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ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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Contents:

	PAGE
The Electrical Outlook	1
The Time for Domestic Advance	2
The Central Electricity Board	2
Transatlantic Telephony	2
Dry Batteries for Radio Purposes (*illus.*)	3
The Design of Extra-High-Pressure Cables, by H. Berry Nixon (*illus.*)	5
A Railway Electrification Scheme (*illus.*)	7
The Electric Market-Place of the Future, by Herbert H. Berry	9
Arc Welding Aided by Hydrogen, by P. L. Roberts	10
Correspondence—	
The "H" Type of Cable	12
Power Supply for Wireless Sets	13
Boiler-house Efficiency	13
Small British Motors	13
An All-Electric House (*illus.*)	13
Business and Industrial Notes	14
Lighting and Power Notes	19
Tramway and Railway Notes	20
Telegraph and Telephone Notes	20
Radio Notes	21
Contract Information	22
Forthcoming Events	23
Notes	23
Our Personal Column	25
Financial Section—	
New Companies Registered	26
Official Returns of Electrical Companies	26
City Notes	26
Stocks and Shares	27
The Foreign Electrical Trade of Denmark	29
New Electrical Devices, Fittings, and Plant (*illus.*)	30
A Capacitance Bridge and New Inductometer (*illus.*)	31
The Physical Society's Exhibition (*illus.*)	32
Heavy-Oil-engine Working Costs (*illus.*)	34
The Co-ordination of Urban Transport, by the Rt. Hon. Lord Ashfield	35
The Electricity (Supply) Act, 1926 (*continued*)	36
The Work of the Electricity Commissioners (*concluded*)	38
Electrical Development in Belgium	39
New Work for Contractors	40

The Electrical Outlook.

THE electrical industry has entered the New Year in the right spirit and with a right determination.

The fact that it has passed practically unharmed through a period in which industrial upheaval has crippled so many other branches of activity would alone justify high hopes as the nation settles down to more normal conditions. But in addition to that fact there are the inherent potentialities of electrical development of every kind, which are always opening out for it a new and ever-brightening prospect.

The right spirit alluded to is the sure and certain confidence that great times are at hand. Electrical men do well to indulge this thought and dwell upon the reasons and the signs in general conversation, though, of course, they will not allow a rosy prospect to lull them into contentment and repose. The determination mentioned is the general will to scheme and plan and labour to bring about that increased electrical turnover which will make the times great. Accelerated electrical development in all departments, bigger production, bigger sales, more employment, and bigger profits—these are things which should be, and we believe will be, witnessed during the year 1927.

For reasons which are better known to our readers than to anybody else, because we have so often alluded to them in recent times, there should be record orders placed for plant, cables, switchgear and apparatus, telephone and wireless equipment, and very large sales of all classes of appliances for domestic and industrial service in the Home Market. Indeed, here there ought to be no looking back for years to come. There are many signs of a revival in our general industries which will call for electrical work and products, and the homes of England are demanding electrical service more than ever before. The improvement in the world position of affairs, too, is leading us into new export possibilities, so that the present satisfactory state of our electrical export trade as evidenced by the statistical returns, should not merely be maintained but substantially advanced.

In short, both at home and abroad there should be plenty to do. The larger orders booked during 1926, including a number of noteworthy ones secured quite recently, are likely to occupy some of the works for many months to come, while the atmosphere is just right for securing much new business in all sections of the electrical and allied industries. Yet there is no room for lack of vigilance in regard to foreign competition. British directors, councillors, and engineers who desire to see British electrical industry grow larger and more prosperous, and who wish to see the unemployment figures fall month by month, should continue to give reasonable preference to British products.

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The Time for Domestic Advance.

THE attention of all who are interested in domestic electrification is directed to the article from the pen of Mr. Herbert H. Berry, published elsewhere in this issue. Everybody is agreed that the time is fully ripe for electricity to stride straightforward in the domestic field. Influences normal and abnormal have combined in recent months to prepare the way—public discussion of electricity supply matters, coal shortage and dearness, and the widespreading activities set in motion under the E.D.A.-E.L.M.A. campaign. In some places great practical results in the shape of business have been achieved both in new connections and in output of appliances. This new business will itself be a powerful force in bringing on to the mains more and more consumers, for every new user will help the electrical educational movement. The campaign wheels will increase their speed of revolution for several months to come; the innumerable circles will do invaluable work carrying the truth in various ways from their centre out to the circumference of their respective areas. But why should a time limit to the campaign be set? Why should it not go on in some form or other? This is surely the moment when such a question should be raised. Therefore, in printing Mr. Berry's views on "The Electric Market-Place of the Future," we invite our readers to discuss the subject both amongst themselves and in the pages of the ELECTRICAL REVIEW. The opinions expressed by the author have our endorsement, as we have on various occasions stressed the need for co-operation of all interests in bringing electrical applications and electrical apparatus effectively before the notice of the public by means of exhibitions, in the form of Electric Houses, electric showrooms, electric shop windows and shops, local and travelling exhibitions, &c., in which efforts all sections of the industry—manufacturers, electricity supply authorities, and installation contractors—would contribute their quota. There is plenty of room for improvement in respect of organisation and selling on the retailing side of the electrical trade. There is wasted effort by some concerns overlapping in their door-to-door sales canvassing; some areas are overworked adding needlessly to selling costs, while others are under-worked. Local individualistic displays are excellent when planned with specialised local knowledge, but they might be more profitably and successfully conducted, so far as the trade is concerned, if dates could be fixed in collaboration with a centralised body. An Electrical Exhibition Committee, comprising delegates from all sections interested, has been set up, with Mr. Berry as chairman. It will operate under the auspices of the E.D.A., and, in our opinion, contains great possibilities for securing impressive electrical demonstration without undue waste of money if only the rank and file will support their leaders. There is much to be done by the raising of the status of electric selling depôts or centres throughout the United Kingdom. The atmosphere and the time are both suitable for co-ordinated effort. We must facilitate the purchase of all electrical contrivances everywhere if we design to assist to our utmost the domestic electrification movement.

The Central Electricity Board.

THE difficulty in finding suitable *personnel* to form the Central Electricity Board, which we have foretold on several occasions, appears to be making itself felt somewhat acutely at headquarters. Rumours are rife in the daily Press regarding overtures alleged to have been made by the Minister of Transport to various prominent men, with what degree of authenticity we do not know; and on the other hand, suggestions have been put forward apparently with the object of affording inspiration to the Minister, whose lot at the moment can hardly be a happy one. The salary said to be offered to the chairman was £10,000 a year. That is equal to the pay of the Lord High Chancellor, and is more than any other Cabinet Minister receives from the State—yet it is by no means comparable with the actual income of such an outstanding man of affairs as the Prime Minister apparently had in mind a year ago; and taxation would reduce it by one-half. As we have said, if the right man is obtained for this post, his motive for accepting the appointment must necessarily be a higher one than the hope of gain, for he will certainly be a loser in a pecuniary sense.

What salaries will be offered to the other seven members of the Board we do not know, but at least they should be equal to those paid to the Electricity Commissioners, which totalled about £15,000 a year when all the five offices were filled (one is still vacant).

Amongst the names that have been mentioned in the daily Press in connection with the formation of the Board are those of Sir Herbert Blain, Major H. Richardson, O.B.E., M.C., Sir Reginald Blair, Sir Philip Dawson, M.P., and Lieut.-Col. Sir Mathew Wilson, D.S.O., M.P. (the last two, of course, being members of Parliament, are ineligible at the moment). All members of the Board must divest themselves of any interests that they may hold in electricity supply undertakings and electrical manufacturing concerns within three months, and must afterwards refrain from acquiring or holding any such interests; these considerations must weigh heavily with many otherwise eligible persons.

Our sympathies are with the Minister of Transport; we look forward with keen interest to the announcement of his solution to this exceedingly difficult problem, and earnestly hope that it may prove to be a happy selection.

Transatlantic Telephony.

THE recent announcement that the Post Office would shortly be in a position to commence a commercial service of wireless telephony across the Atlantic, from subscriber to subscriber, aroused the interest of the public to an exceptional degree—and justly so, for the feat is indeed an astounding achievement. Some months ago we were favoured with an opportunity to participate in a "trial run," when conversation was maintained over a period of several hours between London and New York, the speech being extremely clear and distinct; it then only remained to organise the system on a permanent basis and to make the necessary arrangements for a regular public service, which work has been so expeditiously performed that the service will be inaugurated to-day.

Great credit is due to the wireless branch of the Post Office Engineering Department, which has displayed not only technical ability of a very high order, but also a degree of enterprise which is not usually associated with a State undertaking. The design and construction of the Rugby station—the most powerful in the world, and the first long-distance station to be wholly dependent upon valves for the high-frequency current—was in itself a first-class engineering feat, and it has been worthily followed up by the later developments, which, moreover, are not likely to represent the limit of the Department's ambitions.

To say that ten or twenty years ago the accomplishment of Transatlantic wireless telephony would have been regarded as an idle dream would be an error, for Dr. J. A. Fleming, who invented the thermionic valve in 1904, predicted it in 1907, and repeated his forecast in 1914. Only by the development of his invention has the achievement been made possible, and to him, with his co-workers in this field—many of them of British nationality—a large share of the credit should be given. Like Alexander Graham Bell, he has been privileged to see his work brought to triumphant fruition within his own lifetime. It should also be stated that the original experiments were carried out by the Western Electric Co., Ltd., in conjunction with their associated companies, and were described in the ELECTRICAL REVIEW of January 19th, 1923. Since that date research has proceeded continuously, and great advances have been made; the Western Electric Company has manufactured and installed the bulk of the plant, and continues to collaborate with the Post Office.

Dry Batteries for Radio Purposes.

Some Impressions of a Visit to the Woolwich Works of Siemens Brothers & Co., Ltd.; their methods of manufacture, and the care bestowed upon the assembly and testing of component parts.

ESTABLISHED in 1858, Siemens Brothers & Co., Ltd., has grown to be one of the largest electrical undertakings of its kind, enjoying a world-wide reputation: its Woolwich factories cover an area of 27 acres, and normally employ 6,000 persons.

Large extensions have been carried out at the works, and we were privileged recently to visit the enlarged



Fig. 1.—Principal Dry-battery Assembly Shop: Side Bays just Visible.

battery shops and, in particular, to witness the methods employed by the Company in manufacturing and testing dry-cell primary batteries for wireless purposes. The well-established reputation of Siemens batteries is backed by the fact that primary cells, both dry and wet, have formed an important and successful portion of the Company's manufactures for over 40 years, and the accompanying illustrations will indicate the spaciousness of the modern shops devoted to the production of dry batteries; they are well lighted, heated and ventilated, the arrangement of the electric lamps and fans being visible in fig. 1.

The Company's dry cell (originally known as the "Obach" type) is considered to be one of the most satisfactory on the market, being made in both the square and round forms. The chief component materials are made up as follows.

Retort carbon is ground, sifted, and mixed with tar and certain other ingredients, which permit the electrode to be suitably shaped (rod, plate, &c., according to type of cell) in hydraulic presses. After trimming off the superfluous material, the electrodes are placed in drying ovens and then baked, maybe for several days in the case of the larger sizes, in order to burn out the mixing ingredients; the resistance is, of course, ascertained by means of a Wheatstone bridge method before the carbons are placed in store.

The other electrode is made of sheet zinc, which is cut up to size and pressed and soldered to shape; the canisters thus formed are next tested for mechanical strength, and also by means of compressed air under water to detect leaky specimens, being dried, of course, before amalgamation. Other types are drawn, which process eliminates joints, but necessitates the use of very pure zinc. Another kind of zinc electrode is cast, the mercury amalgam being incorporated in the molten metal; the mixing process is critical on account of the mercury being very volatile. The Company makes a point of amalgamating all dry-cell zinc electrodes, and to prevent the mercury attacking the solder, a bitumen compound is poured down the inside joint and allowed to flow round the bottom.

When a simple element is allowed to generate a current, the chemical action evolves gas, some of which adheres to the electrodes and produces an e.m.f. which opposes that of the cell, diminishing the latter. This polarisation, due to the products of the electrolysis which takes place, may be almost eliminated if the altered condition of the electrolyte, or plates, which causes it is removed as quickly as it is produced; thus the lowering of the e.m.f. due to this cause may be made very slight, or transient, though the e.m.f. is permanently lowered as current is generated by the "exhaustion" of the cell. In practice, only polarisation at the electro-negative pole is of importance, and the polarising ion is generally hydrogen; in order to overcome its action, the two electrodes are separated by a depolarising agent. The latter, in the case of dry batteries, consists of a stiff paste containing manganese peroxide and carbon, some plumbago to reduce its internal resistance, and gum; its exact composition is not disclosed by makers, but is regulated by cost, service requirements, and skill in manufacture.

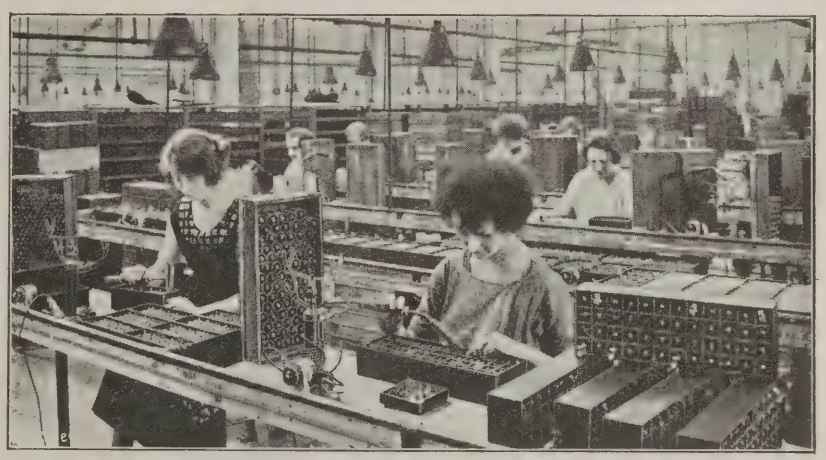


Fig. 2.—Assembly of Standard "RB3" Batteries.

Assembling a dry cell (fig. 1) consists in tamping the

depolariser in a mould round a dummy core, the whole being then placed centrally into the zinc vessel, which also serves as the positive plate of the cell; the inside of the bottom of the vessel is coated with a bituminous compound on which a thick paper disk is laid, thus reducing the possibility of internal short circuiting. The space between the zinc canister and depolariser is filled by pouring in a thin exciting paste consisting of a solution of sal-ammoniac, flour, and plaster-of-paris, the latter causing it to set fairly rapidly. The dummy core is next removed, and the carbon electrode inserted in the centre hole, having been previously fitted with a tinned brass soldering cap, brass screw terminal, or plug socket. A little compound is poured over the top to ensure that no electrolyte will creep across and bridge the electrodes; then the cell is filled up with seed husks, which allow for expansion, and covered with a paper disk through which two small glass ventilating tubes protrude in the case of large cells: the cell is finally sealed with pitch. The above-mentioned precautions are taken to allow a ready means of escape for the gases generated in the cell, and so prevent the outer case "bursting," due to the gradual expansion which seems to accompany the drying of the paste.

At this stage the cells have the appearance indicated in fig. 5, which illustrates the three standard sizes. Each complete cell is now tested individually, first, for e.m.f. and then for p.d. with one ohm resistance in shunt with the voltmeter, which readings enable the internal resistance of the cell to be determined; Siemens voltmeters, having a very small current consumption, are used.

Considerable misapprehension appears to exist regarding the correct method of testing a "high-voltage" dry battery intended for use with radio apparatus. A high-resistance moving-coil voltmeter is, of course, the only suitable instrument for the purpose; the internal resistance of a battery increases with age and use, but it is of relatively little importance in view of the high internal resistance of a thermionic valve, *i.e.*, from 8,000 to 30,000 ohms or more: therefore, a battery having a high internal resistance may nevertheless be still capable of furnishing the maximum current required to operate radio receiving apparatus, provided its overall voltage is sufficiently high. Even a high-grade moving-coil voltmeter with a resistance of at least 100 ohms per volt of scale will take a current of 10 milliamperes at its full-scale reading, and it can accordingly be assumed that if a battery shows a good voltage when indicated by such an instrument, it will give at least the same voltage when delivering current to a radio-receiver.

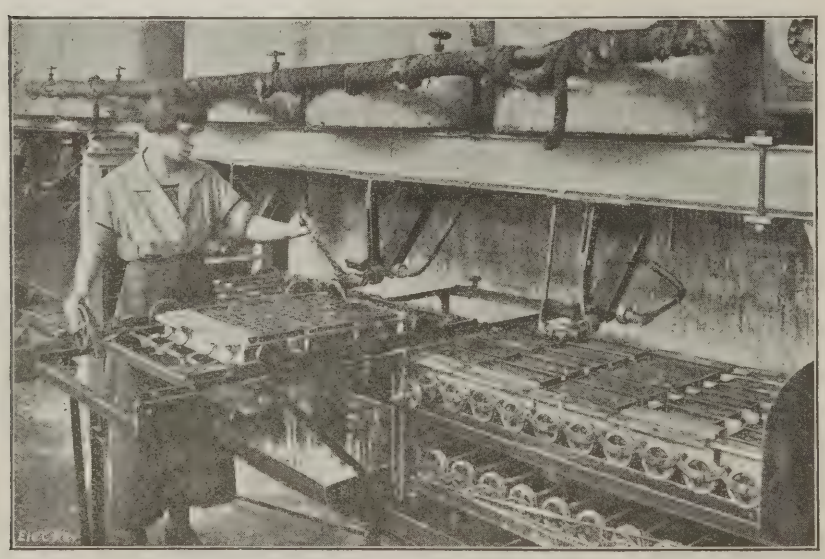


Fig. 4.—Filling Assembled Batteries with Liquid Wax.

Having passed the test successfully, the cells are assembled in the requisite number (according to size of battery) in cardboard boxes, the cells resting on a sheet of corrugated pasteboard at the bottom, and each separated from its neighbours by strips of pasteboard. The terminals and wire cross connectors are soldered on as indicated in fig. 2, which affords a comparison of size between the new (right) and the older smaller standard size to be seen on the left. All soldering operations are carried out with the aid of resin, no liquid fluxes being used, so as to avoid the formation of acids; electric soldering irons are employed.

At this stage the assembled batteries are subjected to further tests, fig. 3, the mechanical strength of the soldered wires being also checked; they are then allowed to stand in racks for several days in order that any incipient defects may have time to mature and reveal themselves in subsequent tests, which are applied before the batteries pass in rotation from the maturing racks to the waxing plant. Liquid paraffin wax is run into the boxes, as shown in fig. 4, the trays of batteries passing on to an endless belt conveyor, which carries them through a duct against a current of cool air, which sets the wax; all cardboard boxes and separators are impregnated with boiling wax to exclude moisture. Every cell is embedded solidly in the wax, and liberally spaced; the previously-mentioned sheet of corrugated paper at the bottom of the containing box assists the wax to penetrate beneath each cell bottom. After

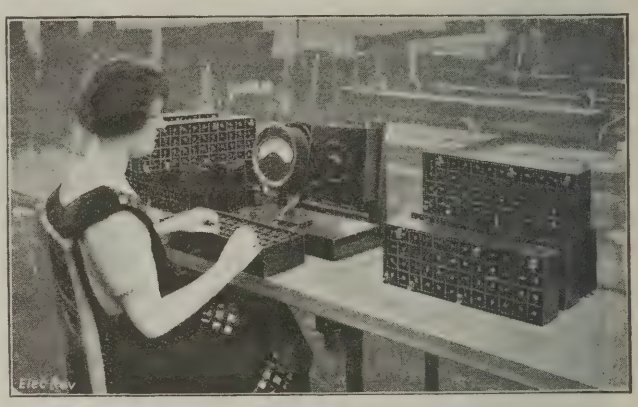


Fig. 3.—Testing Batteries after Assembly.

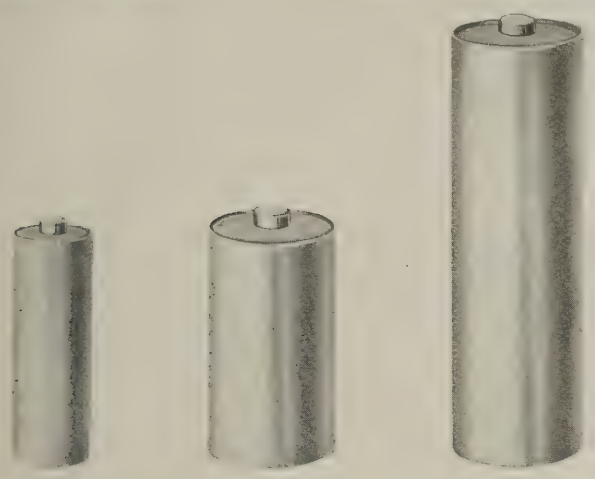
"topping up" to make good the shrinkage of wax, the surface is finished smooth by slightly heating it, and an electrically-heated and driven conveyor machine is being installed to carry out this operation automatically. Labels and printed instructions, at present stuck on to the side or top of the batteries, are to be "floated" under the surface of the wax. After a final test they enter the finished battery stores; on their emerging therefrom, a check test is applied, and each battery is stamped with a code mark to indicate its date of issue to a customer; packing in waterproof paper is facilitated by sealing-band machines.

It is now generally appreciated that a large plate-circuit battery not only assists reception, but is also more economical, notwithstanding its higher initial cost. The "RB3" type of battery consists of 48 cells giving 72 volts and weighing 15 lb., whilst the extra large-capacity pattern shown in fig. 6 is made up of 36 cells connected in series to give a nominal e.m.f. of 50 volts; its weight is 20 lb., maximum discharge rate 20 mA, and dimensions over the lid are $8\frac{3}{4}$ by $5\frac{3}{8}$ by $9\frac{1}{2}$ in. high. Both types are tapped and fitted with dull nickelled spring terminal clips. Thus, three types are now available, their respective maximum economical discharges being: small type, 5 mA; large type, 10 mA; and extra large, 20 mA.

The Company's products include grid-biasing dry batteries, which are now tapped in 1.5-volt steps, a needed convenience. Siemens inert batteries (originally known as the "Dura" type) are made in two 15-volt sizes, weighing 15 oz. and 3 lb. 4 oz. respectively. Their exciting agent is in the form of a powder that remains inert till the addition of clean water changes it into

a paste, thereby giving the cell the characteristics of a dry cell. The special advantage which is claimed for this form of cell is that it will keep, before being charged by the addition of water, for an unlimited time in any climate without deteriorating; it is, therefore, particularly suitable for use in hot climates and in other countries where it is essential to maintain large stocks.

To meet the requirements of those who prefer a wet primary battery for energising the valve-plate circuit, three sizes of Leclanché "sack" cells are made, their discharge rates being 5 mA, 10 mA, and 20 mA at 1.55 volts per cell. Each consists of a circular glass container, a semicircular zinc electrode (negative), and a sack element (positive) enclosing the carbon and depolarising material in fabric instead of a porous-pot,



Weight, oz.	1·25	3	6
Appx. capacity ratio ...	1	3	7·5
Price ratio	1	1·8	2·5

Fig. 5.—Standard Siemens Dry Cells.

which assembly reduces the internal resistance and increases the ampere-hour output. In place of sal-ammoniac crystals, "Siebrolyte" may be dissolved in water to form a viscous electrolyte, which renders the cell practically unspillable; when exhausted, the electrolyte is renewable.

Larger "sack" cells in earthenware jars with a maximum discharge rate of 0.5 A at 1.5 volts are suitable for heating valve filaments, and Siemens low-voltage dry batteries are obtainable for the same purpose; satisfactory service should result when the discharge rate is limited within the normal capability of the battery.

From what has been written, it will be appreciated that the range of dry batteries manufactured by Messrs. Siemens for radio purposes is a comprehensive one. In particular, to those radio enthusiasts who hesitate to use multi-valve receivers on account of the presumed necessity of employing accumulators for energising the valve-plate circuit, the Siemens "Super-Radio" dry battery should appeal strongly. In addition to those mentioned, other types are also made for general purposes, and the care taken in assembling them can only



Fig. 6.—Extra-large "Super-Radio" Battery.

be adequately appreciated by witnessing their manufacture. The testing facilities provided in the factory are very complete, for only by actual measurement after each operation which may tend to alter values can the reliability of the product be maintained.

In conclusion, our thanks are due to Messrs. Siemens Bros. for the loan of the photographs reproduced above no less than for the courtesy with which we were received on the occasion of our visit to their Woolwich works.

The Design of Extra-High-Pressure Cables.

The Permissible Current-Carrying Capacities of High-pressure Cables embodied in Curves for three-core and single-core Cables laid direct in the ground.

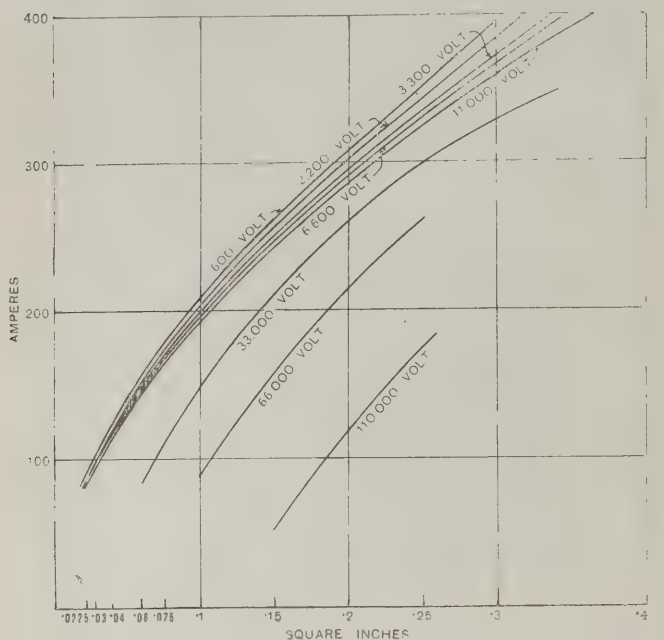
By E. BERRY NIXON, A.M.I.E.E.

THE numerous articles which have been published dealing with what would appear to be the whole of the crucial points connected with cables of low, medium, and high pressures tend to deter one from adding to their number. The only excuse offered for doing so is that this article deals with and gives views upon what has long been a matter of importance to all potential purchasers and manufacturers of super-pressure cables—authentic carrying capacities.

It is not suggested that we are at present "working in the dark," rather is it meant that individual knowledge should be pooled, and from the collective information tables which would be universally appreciated could be constructed; when considering the formation of these, that portion of the cable which is vital, the core, should receive the major thought. Whether this takes the form of one with a rope centre, hollow, or other design at present depends upon individual opinion; the writer's views on this point have often been expressed in this journal.

Either of the former designs is suitable, but preference can be given to that form used with the Brooks oil system and as employed on the 130-kV experimental line of three single-core cables, each 600 metres long, which has been in operation for a considerable time in conjunction with the overhead line of the Societa Interregional, Italy (ELECTRICAL REVIEW, February 26th, 1926, p. 349).

Quite apart from the value of the large amount of copper saved by using this type of core, the advantage of continual impregnation is apparent, and the continued use of solid stranded cores seems all the more strange if we consider impregnation and carrying capacity. The reduction of the ineffective copper, and the distribution of the electrosatic stresses on these large-diameter conductors, would appear to be strong points in favour of the hollow core.



Reduce capacities to 85 per cent. for two cables laid together; 80 per cent., three cables; 72 per cent., four cables.

Fig. 1.—3-core, p.i. Cable : Carrying Capacities.

The following curves indicating the current-carrying capacities of armoured cables laid direct in the ground are wide in their application as they include the lower voltages. Tables for these have already been published,* but the addition of them was made with the view of increasing the usefulness of the curves. The capacities of cables working at 33 and 66 kV are based on

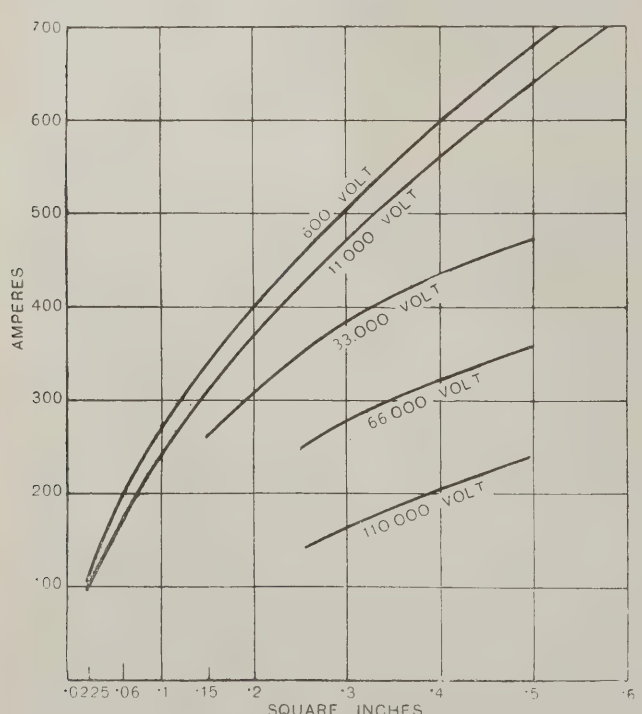


Fig. 2.—Single-core, p.i. Cable Capacities.

experience at these pressures, whereas those at 110 kV are purely theoretical, and in this case it will be realised that some modification of the normal style of a three-core cable would have to be made, possibly in the direction of the S.L. type of cable made by Messrs. W. T. Henley's Telegraph Works Co., Ltd.

* Permissible Current Loading of British Standard Impregnated Paper-Insulated Electric Cables (B.S.S. No. 1-1922) with Explanatory Notes.

Fig. 1 shows the current-carrying capacities for 3-phase, 3-core, cables at 50 periods for pressures up to 110,000 V. We have little or no experience of cable behaviour at this pressure to guide us, but it is fairly safe to decide what would appear to be safe and economical loadings. A cable for a capacity of 100 A at this voltage would, if based on the suggestions already given, consist of one or possibly two layers of core wires, the approximate core diameter being indicated by the sectional area; by this it is meant that the given section fixes the approximate diameter of core, while the amount of effective copper to be left inside this diameter is dependent upon the depth of current penetration.

The next set of curves, fig. 2, giving the current-carrying capacities for single-core cables, provides for three armoured cables being laid direct in the ground

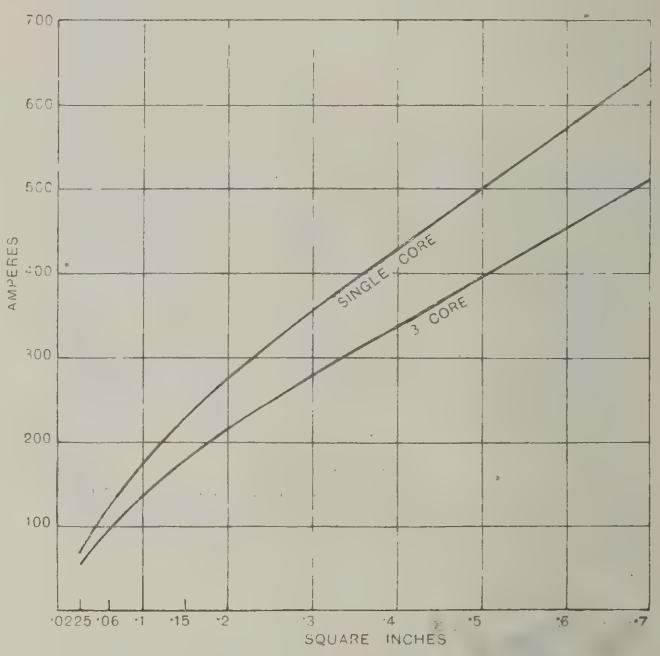


Fig. 3.—Capacities for Varnished-Cambric l.c. Cables.

for the pressures up to 11,000 V, but for the higher voltages they would be unarmoured. The current values suggested for the higher voltages are fairly accurate, and in the case of the 33-kV curve it would be possible to extend it to include cables of larger cross-sectional areas, but for general purposes it is not necessary to do so.

This opportunity is taken for including curves giving the suggested carrying capacities for varnished-cambric insulated and lead-covered cables for internal power station use, fig. 3, and in the case of the single core the basis is for three cables mounted together. It was intended to add curves to cover the higher pressures for this class of cable. but this has been left over until further figures are available.

Tests may prove that the values given in the various curves require some modification, but the curves should prove a useful guide until such time as it is possible to have them corrected. A table of core diameters, giving the actual amount of copper allowed, can be prepared for use with the permissible loading curves.

In conclusion, it is hoped the curves will prove to be of value to many readers and that some benefit will accrue from the above suggestions.

Smoke Abatement.

One of the new laws that became effective on January 1st, which specially affects the inhabitants of large cities, is the Smoke Abatement Act; it does not deal with the domestic chimney, but it increases the penalties for emitting smoke from industrial chimneys. Formerly it was an offence only when such chimneys sent out "black" smoke, but the new law includes white and grey smoke, grit, ash, and soot.

A Railway Electrification Scheme.

Completely Automatic Sub-stations, 33,000 or 12,000 V A.C., 1,500 V D.C. with Remote Control for Supplying the 30-mile line from Capetown to Simonstown of the Capetown Suburban Railway.

THE principal feature of interest in connection with a recent Press visit to the Witton works of the General Electric Co., Ltd., was a demonstration of the working of some of the apparatus which is to be used in connection with the electrification of the Capetown Suburban Railway. The scheme provides for the electrification of the track from Capetown to Simonstown, a distance of about 30 miles, and is believed to be unique in that it is the first occasion on which the equipment for supplying an entire railway line has been automatically operated and remotely controlled.

The power will be supplied from the Salt River power station, Capetown, and transmitted by both overhead and underground cables on a 33,000- and 12,000-V, 3-phase, 50-cycle system to six sub-stations along the track, all of which will be subjected to supervisory control from the generating station. Each "sub" will accommodate one or more pairs of 1,000-kW rotary convertors, each pair in series, for supplying the track at 1,500 V, and the necessary transformers and switchgear for obtaining automatic operation and supervisory control. Fig. 1 shows the outline of the scheme, which will be described in detail as follows:—

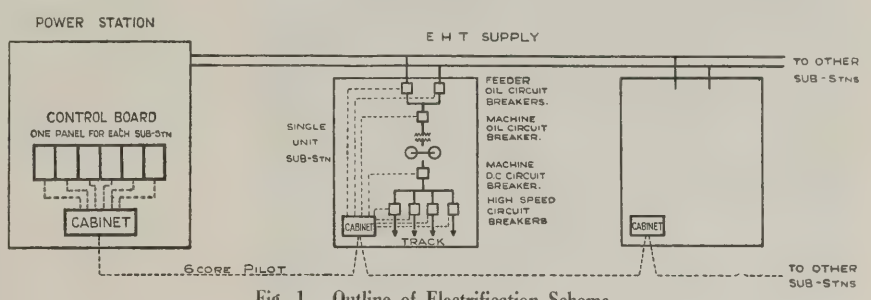


Fig. 1.—Outline of Electrification Scheme.

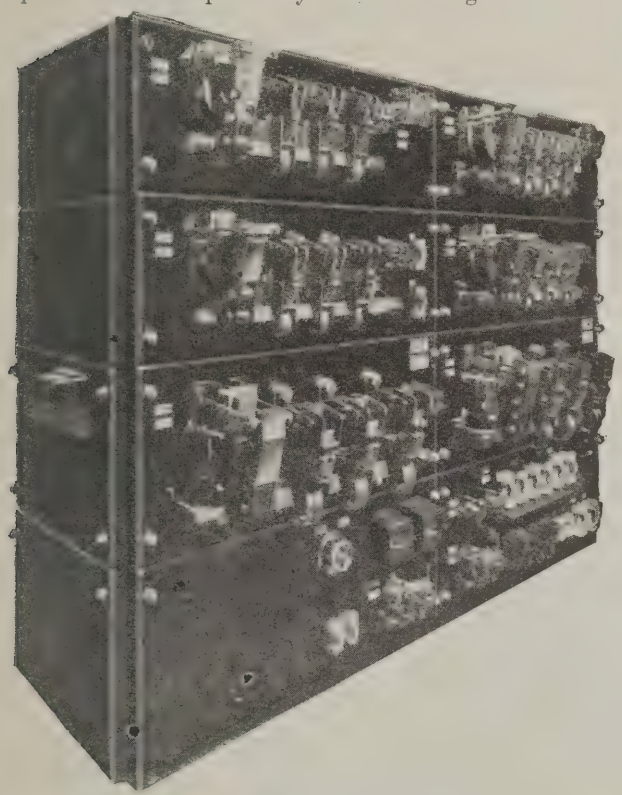


Fig. 2.—Machine Starting Panels.

An oil circuit breaker in each sub-station isolates each e.h.p. feeder cable from the station busbars, while a further oil circuit breaker is installed for disconnecting each pair of rotaries from the bars.

The machine starting equipment consists of two enamelled slate panels, fig. 2, on each of which are mounted three triple-pole contactors for starting, synchronising, and running purposes respectively, in addition to various auxiliary equipment for the machine operations. An interesting feature is a commutator-grinding switch, by means of which, when grinding is in progress, the starting contactors are closed, but the synchronising or running switches held open. The various relays and switching equipment essential to the supervisory and automatic operations at the sub-station end are accommodated on a slate-panel control board, fig. 4. This consists of a l.p. relay panel, a.c. and d.c. machine panels, and a number of outgoing feeder panels. The rotary operations are controlled by apparatus on the relay panel, which also houses an Angold leakage indicator.

On the convertor d.c. panel are the necessary instruments for indicating the load and field currents. Coloured lamps show whether the main d.c. circuit breaker is open or closed. The e.h.p. panel contains intermediate relays for closing the circuit breaker connected between the busbars and the transformer, and also a switch for the local operations. The usual indicating instruments are installed on this panel, and also a link box for testing and a three-phase time-limit overload relay for use with the oil circuit breaker. An auxiliary closing contactor is also provided for the remote control of the air circuit breaker. The feeder panels are similarly equipped.

The actual distribution is effected from a truck-type cubicle board accommodating the necessary incoming and outgoing feeders, designed and equipped in accordance with modern practice. In the incoming truck cubicle is mounted an air-break circuit breaker controlling the d.c. supply. An operating handle is mounted on the front of the truck for the local control of the breaker, referred to later. A butterfly nut handle must be operated before the truck is withdrawn, and should the circuit breaker be closed, the manipulation of this handle will open it automatically before the truck can be moved. The outgoing feeder trucks are similarly equipped, each being provided with a specially designed high-speed circuit breaker. The function of the butterfly nut of the incoming feeder truck is performed on the outgoing apparatus by an ironclad switch suitably mounted on the front of each cubicle.

A sub-station relay cabinet houses the entire equipment necessary to receive the controlling currents sent out from the power station; and, according to their number and sequence, selects the route to the intermediate relay or contactor which operates the desired apparatus. At the power station end the essential apparatus is a dispatcher's control board and a supervisory cabinet. The board has a panel for each sub-station, by means of which a load dispatcher controls the convertors and ascertains whether they are working satisfactorily. The mountings on each panel, fig. 5, are in such a position as to enable the operator to see from a single line diagram of connections the lay-out

of the plant he is controlling, and further, to ascertain immediately the location of any fault that may occur. The two incoming cables are represented at the top, and below these are two two-way control switches for the incoming circuit breakers, and two sets of two signal lamps, red and green, for indicating whether the corresponding oil circuit breaker is open or closed.

The e.h.p. busbars are next represented, and then the operating switch for the machine supply circuit breaker. Below this is shown the rotary-convertor set, and then the d.c. apparatus, with a similar arrangement of indicating lamps for the main d.c. breakers. There are also two white lamps on the panel, one at the top and one at the bottom, for indicating faults on the a.c. or d.c. systems respectively.

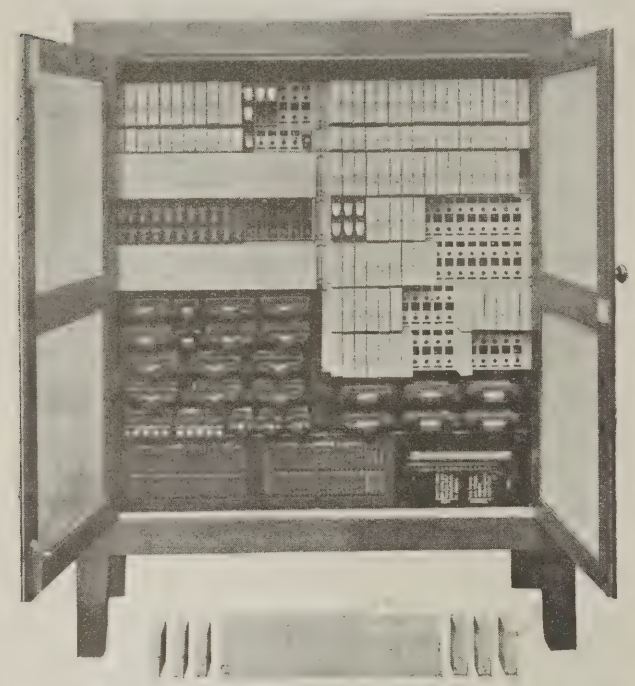


Fig. 3.—Generating-Station Supervisory Cabinet.

The selections of the supervisory remote-control system are arranged wholly by means of relays. A common control or pilot cable runs the whole length of the track, fig. 1, being looped into each sub-station, and is the medium for the supervision of the whole of the sub-station apparatus. Each circuit breaker functions by the simple operation of a single switch, and the selections are achieved by trains of self-generated impulses, the commencement of the impulsing being controlled at the transmitting end and its governing by the correct functioning of the receiving relay equipment. This is operated at 50 V from batteries installed at the power station and sub-stations.

The supervisory cabinet, fig. 3, houses the entire relay equipment for generating and transmitting, in their proper sequence, the impulses, and also the relays required to receive those sent back from the operated circuit breakers, which set up the circuit conditions required to light the signal lamps concerned. The selections of the apparatus and its operation are governed by a series of three trains of impulses. One selects the sub-station, another the group of circuit breakers and the operation to be performed, and a third the required breaker. The first impulse train is received by all the sub-stations, locking out the unwanted ones, and the two subsequent trains of impulses are only received by the selected station. When a circuit breaker has been selected, an indicating signal is sent back to the control station. If this agrees with that sent out from the control station, the operation is allowed to proceed.

The rotary convertors are started by specially designed pony motors and are self synchronising, the synchronising current being limited by means of choking coils inserted between the l.p. side of the power transformers and the machine slip-rings.

After the e.h.p. busbars in the sub-station have been energised, the machine circuit breaker is closed and the rotary-convertor set starts up, synchronises, and parallels with the d.c. bus-bars. The outgoing feeder high-speed circuit breakers are then closed by supervisory control. Where the sub-station has more than one rotary-convertor set, the machines are automatically paralleled when both are required on supply. The attendant at the power station operates the control switch of the rotary-convertor set he wishes to start, and the appropriate intermediate relay is selected and energised by the supervisory gear. The operation of the intermediate relay closes the convertor breaker, and the completion of this operation is indicated by a lamp in the power station, operated by auxiliary contacts on the breaker. The breaker operating transformers are now energised, and an interlock on the breaker completes the circuit which closes the starting contactors, the polarising fields being also switched on to both machines from the sub-station battery. The closing of the starting contactors completes the starting-motor circuit, and the machines run up to speed and build up their field circuits in a similar manner to d.c. generators. When the fields have reached a predetermined value and the machines about 90 per cent. of the synchronous speed, the voltage relay closes, and this in turn closes the synchronising contactors. The full transformer voltage is now connected to the armatures of the rotary-convertor sets and the synchronising chokers in series.

The synchronising relays which are connected across the contacts of one pole of each running contactor become de-energised when the machines are in step and, after a time delay, make contact. As each synchronising relay makes contact, circuits are completed which close the running contactors. When the rotary-convertor set synchronises, an interlock on each running contactor brings the field regulator into operation, and the voltage of the machine settles down to the value determined by the regulator.

When both machines have synchronised and their field relays functioned, the operating circuit for the d.c. breaker is completed and the rotary-convertor set parallels on the d.c. bus-bars. Interlocks on the d.c. circuit breaker then energise the supervisory gear, and the lamp in the power station indicates that the machine is on circuit. When shutting down a rotary-convertor set, after the control switch is set to the " off " position, the supervisory equipment selects and operates the required intermediate relay, which, in turn, completes the circuits for tripping the machine breakers simultaneously, and the remainder of the gear resets ready for the next occasion of starting up.

For testing or other purposes, arrangements are made for the local control of the sub-stations. In such a case

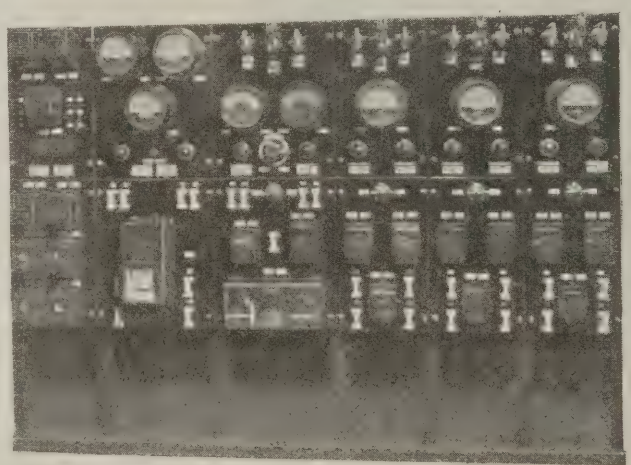


Fig. 4.—Sub-station Control Board.

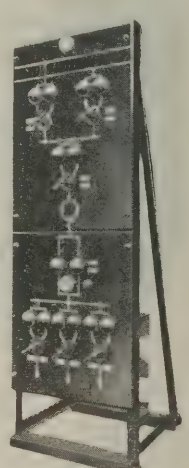


Fig. 5.—Dispatcher's Control Panel.

a "local and distant" controller in the sub-station is switched on to the "local" position, transferring the control to the sub-station control switches.

The machines are fully protected to meet any emergency. A voltage and phase relay prevents the rotary-convertor set from starting up, or shuts it down, when the e.h.p. voltage is low, or a phase is broken or reversed. Inverse time-limit overload and instantaneous earth-leakage relays are installed on the e.h.p. side of the rotaries. Each machine d.c. breaker is fitted with an overload relay having a time lag and a reverse-current relay. To guard against reversed polarity when starting up, polarised fields are fitted to the convertors. These have a 2- or 3-minute rating and are switched on during starting and excited from the battery. Further, should the machine build up with wrong polarity, reverse-polarity relays will shut down and lock out the set. If the set fails to synchronise within a given time, a stalling relay shuts it down and locks it out.

A system of earth-leakage protection, patented by the G.E.C., is used to protect the l.p. windings of the transformers, machine armatures, and the field systems, and will, it is claimed, shut down and lock out the rotaries on the occurrence of a 3 per cent. fault to earth. The machines are further protected against overspeed, unbalanced phase current, overheating, and field failure.

Particular attention has been given to the design of the relays; no oil dash-pots are employed and all the time-relay devices depend on revolving aluminium disks with magnetic braking. The polarity and reverse-current relays are designed to operate across ordinary ammeter shunts, absorbing only 0.075 V at full load.

Fig. 6 shows one of the rotary-convertors included in the contract, and it is interesting to note that the shielding shown is of 5-ply wood. The whole of the apparatus, with the exception of the e.h.p. machine breakers, is being supplied and manufactured by the G.E.C., the supervisory control equipment being made at the Peel-Conner Telephone Works.

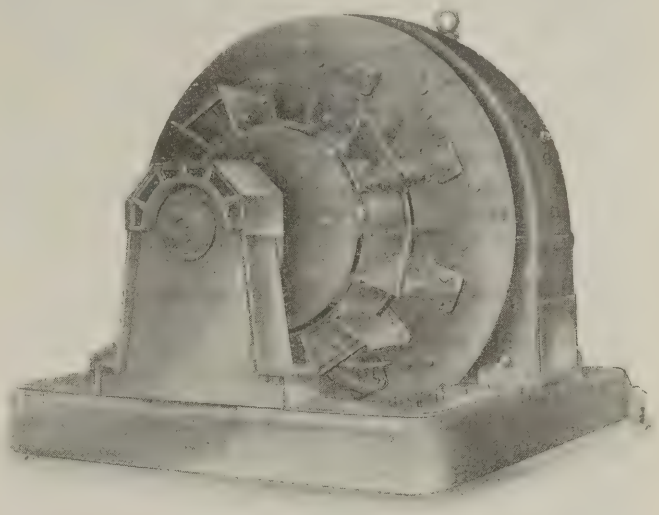


Fig. 6.—Shielded Rotary Convertor, 1,000 kW.

The Electric Market-Place of the Future.

A Scheme for Establishing Centrally Situated Electric Market Places Throughout the United Kingdom.

By HERBERT H. BERRY.

THE year 1927 is full of promise for the Electrical Industry and, in my opinion, will mark a new era in the development of Domestic Electrical Engineering.

Whatever may be said of the merits or de-merits of the Electricity Bill which has become the law of the land, there can be no gainsaying that it will give a steadily increasing impetus to the sale of domestic electrical appliances. Many of the existing domestic anomalies will be removed, and it is to be hoped that it will not be long before the complaint is disposed of that whereas energy for heating and cooking purposes on one side of a road is ¾d. per unit, on the other (virtually) it is 3d. a unit, or 300 per cent. higher, while in outlying districts the discrepancy is even greater.

There is, however, in my opinion likely to be a vastly greater advance, even than the levelling-up of current rates, due to the historical fact that the feud between the Incorporated Municipal Electrical Association and the Electrical Contractors' Association Inc., which has existed for 17 years, is now definitely, and, I believe, permanently ended. Moreover, the incidence of the passage of the Electricity Bill through its successive stages in the Houses of Commons and Lords, during the period of *rapprochement*, has made it possible to get into the Bill a special Trading clause, with certain safeguards, which has not only been agreed by the respective parties to the old dispute, but which also includes among its signatories all the existing Electrical Associations which enjoy beneficial interest.

The situation, as I view it, therefore, will be briefly that the Electricity Act will gradually free a large number of engineers whose attention will be largely diverted to the development of their domestic load, and the consequent improvement in load factor.

It has been stated repeatedly that their avowed object in seeking "selling powers" is for the purpose of increasing the sale of current, and not for the purpose of making profits out of wiring and fittings to the local contractor's detriment. The safeguards introduced into the Bill have that premise in mind, and Advisory Committees will endeavour to stabilise the goodwill which has now been established between the parties.

From January, 1927, onwards, the lately contending parties will be working together for the benefit of the public in general and themselves in particular. I look forward to the time in the immediate future when the following dream will be realised.

My vision is that there shall be created in every city, town and village in the country an Electric House or Electric Market Place centrally situated and built on a "common plan." The standard plans, varying in size according to the population of the town or village, will be approved by a special Committee representing

the interested parties. The Electric Home atmosphere once created, with an adequately equipped Lecture and Demonstration room, what could be more fitting than that the Electrical Development Association should arrange a "Circuit" for lecturers and demonstrators, drawn doubtless, to a large extent from the Manufacturers' and other Associations vitally interested in the economic furtherance of electrical propaganda? Local electrical contractors will co-operate with the resident engineer in an endeavour to crowd the building with their actual and prospective customers. The results will be so far-reaching that the Government estimate as to the increase in current per capita during the next ten years will be found in my humble opinion greatly under-estimated. Herein lies the answer to a sceptical wiring contractor (if such still exists).

Nothing can now prevent an immediate expansion in volume of business, but the rate of progress will be slow without co-ordinate effort. Needless squandering of time and money can be avoided if, instead of an individual and haphazard equipment of showrooms in each separate locality a concerted plan is adopted, using the cumulative experience of those pioneers in electric houses such as Hackney and Croydon, who have already borne the burden and heat of the day, added to the selected skill and knowledge of manufacturers who "deliver the goods," plus the service that can be rendered by the British Electrical Development Association. It is quite conceivable that an architect will readily evolve a series of suitable schemes that will place the Electric House or Electric Market Place of the near future on a pinnacle so conspicuous that Great Britain will soon stand in the forefront as regards commercial domestic electric penetration.

In the meantime and during the period of transition an important development has taken place in another direction. A strong Electrical Exhibition Committee has been established comprising elected delegates from each of the industrial associations and the electrical undertakers.

The business of this Committee (which operates under the sheltering wing of the British Electrical Development Association) is to deal with all matters appertaining to the twelve classes of electrical exhibitions ranging from the world type such as Wembley to the minor local and travelling shows.

Those who are contemplating the holding of electrical exhibitions, of whatever magnitude or class will do well to send their preliminary inquiries or proposals to Mr. J. W. Beauchamp, Director of the British Electrical Development Association, 15 Savoy Street, Strand, W.C.

The Electrical Exhibition Committee of which the writer of this article is Chairman, will welcome constructive suggestions in any shape or form. Every attempt will be made to avoid overlapping of the dates of small shows and attention will be given to the "passing on" from one locality to another in the vicinity.

The existing wasteful methods of exhibition propaganda will be as far as possible curtailed by a process of co-ordination, and it is reasonably felt that with the same capital expenditure as formerly a vastly greater beneficial result will be obtained. Let us, therefore, take heart for the future, and for 1927 in particular.

For the first time in English history we have all the great industrial associations agreed upon a common plan. The loyal co-operation of the individual members to support the policy of their responsible leaders is all that is now needed, and it should be the duty of every member to strive earnestly to that end.

Let it be freely known that a new spirit of camaraderie now exists and that the old political differences are for ever buried with the Old Year.

Arc Welding Aided by Hydrogen.

Important Practical Processes result from Scientific Investigation; the Heat of Association of Atomised Hydrogen is used to intensify the Flame, and a Gas Envelope to prevent Oxidisation.

By P. L. ROBERTS.

TWO new adaptations of the electric arc, as employed for welding metals, have been developed as a result of investigations in pure science in the research laboratories of the General Electric Co. of America,* and recently patented. Both attain the same end by the use of different means, and are equally important in that they produce welds of extremely good mechanical properties; a further common advantage is the high speed of welding which can be attained. The first of these processes is known as "atomic-hydrogen arc welding," and owes its origin to the research work of Mr. R. A. Weiman and Dr. Irving Langmuir. The second process also involves the use of the well-known metallic arc, but in an atmosphere of hydrogen, and was investigated by Mr. P. Alexander partly under the direction of Dr. Elihu Thomson.

Atomic-Hydrogen Arc Welding.

The source of welding heat is not directly the electric arc, but the heat of association of hydrogen atoms. It is well known that hydrogen under atmospheric conditions exists in molecular form; if the temperature of the gas is raised sufficiently, it splits up into atoms (two hydrogen atoms to the molecule) and absorbs an enormous amount of heat during the change; as the temperature falls and the atoms recombine to form molecules, the same large amount of heat is given out. Use is made of this heat of association in the atomic-hydrogen process of welding.

The apparatus consists of two electrodes, preferably made of tungsten, held in two insulated heat-resisting holders, which are included at an angle of 45 deg. to each other, and held in close contact with each other under the action of a spring. The electrodes are separated, for striking the arc, by means of a small finger lever. The current is supplied to the electrode by means of a flexible cable fastened to the end of each. The electrode holders and cables are mounted on an insulated handle. Running through the handle with the cables is the hydrogen supply pipe, at the end of which a small jet is arranged immediately above the point of contact of the electrodes in such a manner as to impinge a jet of hydrogen through the arc. The other end of this pipe is connected to a rubber tube which supplies the gas from a near-by cylinder.

The voltage necessary to strike and maintain an arc in hydrogen is much higher than that needed for one

*See ELEC. REV., April 16th, 1926, p. 627.

in air; the characteristics of the electricity supply are, however, similar to those required for metallic-arc welding. If, then, direct current were used from the mains, a series resistance would be necessary for stability, and a line voltage of 250 V; if a reverse compound-wound generator were used, a lower voltage of approximately 175 V would be sufficient for arc striking. When alternating current is used, reactance in series with the arc and a supply voltage of from 350 to 400 V ensures satisfactory arc striking. The voltage drop across the arc is 80 V, as against 25 V for the metallic arc alone, and from 40 to 60 V for the carbon arc. The requisite current varies from 20 to 70 amps. according to the thickness of the work being welded.

The gas used varies also in proportion to the thickness of the work from 20 to 30 cu. ft. per hour. Tungsten electrodes are used on account of their resistance to disintegration under the intense heat of the arc. Their consumption varies from 3/16 in. to $\frac{3}{8}$ in. for every foot of plate ($\frac{3}{8}$ in. to $\frac{1}{2}$ in. thick) welded.

The *modus operandi* is simple and similar to that of an oxy-acetylene blowpipe. The hydrogen is turned on and the electricity supply switch closed; then the electrodes are separated by means of the lever referred to, so striking the arc. The flame formed by the arc and ignited hydrogen is directed on to the work to be welded, the arc being held about $\frac{1}{2}$ in. from the surface. The stream of hydrogen passing through the arc is heated to such a high temperature that it dissociates into atomic form, absorbing heat from the arc in doing so. Immediately the stream of atomic hydrogen strikes the surface of the metal to be welded, it reassociates to form molecules and the heat absorbed from the arc during the first change is given up to the metallic surface, raising it at once to the melting point.

The apparatus is light and flexible and may be held in the hand, or moved along the joint with the same action as an oxy-acetylene blowpipe. The process has all the advantages of the intense and local heat of the metallic arc, combined with the advantages of the oxy-acetylene source of heat, which is independent of any added metal. Additional metal may be added, as and when required, in the form of a rod of the same composition as the parts being welded. Another point in favour of the process is that metals can be penetrated with the flame to a depth of from $\frac{3}{8}$ in. to $\frac{1}{2}$ in. This obviates the necessity, usual with other processes, of preparing the work by bevelling or veeing for the reception of added weld metal and ensuring proper fusion. For instance, two plates 1 in. thick could be fused together completely by simply butting their edges and welding them on one side and then the other. Thus, considerable economy is effected in preparation alone, apart from the increased speed of welding which such penetration means. No rates of welding for the process are yet available.

The Hydrogen Metallic-Arc Process.

In this process the ordinary metallic arc is used, but surrounded by an envelope of hydrogen to prevent the oxidisation of the weld. The apparatus for accomplishing this consists of a blowpipe, much like the pattern used for oxy-acetylene welding; the metallic electrode is fed through the head of the blowpipe, which is fitted with a gas-tight gland, and out of the other end to the work. Surrounding the electrode guides inside the head is an annular space into which the gas is supplied by means of a side pipe, connected to a length of rubber tube. The open end of the blowpipe is just a small annular orifice for the exit of the gas, through the centre of which the electrode passes, so that it is at all times surrounded by a protecting envelope of gas. The hydrogen side pipe and the pipe through which the electrode passes to the head are shaped to run closely parallel to each other and at right angles to the blowpipe head; an insulated tube over both forms a suitable handle for wielding the blowpipe. The electrode wire passes through a flexible casing like a Bowdon cable, of sufficient length to give wide and free movement; the wire is fed automatically by an electric motor from a large reel. This is obviously the only satisfactory way of supplying electrode material, as the usual short hand-fed electrodes would have to be continually fitted through the gas-tight gland, with the loss of much time. The rate of feed of the electrode is automatically controlled by shunting the feed motor (of the reversing type) across the arc circuit, by which means fluctuations in the arc circuit are made to cause counter fluctuations in the motor circuit.

A modification of the apparatus consists of surrounding the work with a box into which the hydrogen is fed: an ordinary short electrode may then be deposited on to the work through a slot in the top of the box. As an alternative, the gas box may be made small and attached to the electrode holder, so that it moves over the work with the electrode.

The electricity supply required is similar to that for the atomic process. A striking voltage of from 180 to 200 V is necessary, while the voltage drop across the arc varies from 60 to 100 V for arc lengths of from 3/16 in. to $\frac{3}{4}$ in. When alternating current is used, an arc striking voltage of 300 V is necessary. The current required is approximately that needed for ordinary metal-arc welding, *viz.*, from 50 to 250 amps., according to the thickness of the work. The amount of gas employed is approximately 30 cu. ft. per hour at a pressure varying from 5 to 10 lb. per sq. in.

The process, like the atomic flame, has the property of deep penetration into the work being welded. This obviates to a large extent the usual necessity of preparing the work, directly increasing the speed of welding. The average rate of welding $\frac{1}{4}$-in. plates with the metallic arc is 15 ft. per hour (welding from alternate sides), while with the hydrogen metallic-arc 60 ft. has been welded in the same time. The method of operation is similar to that of manipulating the ordinary metallic arc, except that the arc length may be varied within wider limits without detriment to the weld. The gas is turned on and ignited before commencing to weld.

Experiments have been made to determine the suitability of other gases as a protective envelope. Coal gas, nitrogen, and carbon dioxide were tried, but not with such good results as could be obtained in air. It was found that the efficiency of the gas varied directly with the amount of hydrogen it contained. Water gas, containing 50 per cent. of hydrogen (by volume) was found to give good results, with the advantage of being cheap. For the sake of portability, liquids which can be made to produce a large proportion of hydrogen were tried. Methanol, which vaporises at 700 deg. C. to form hydrogen and carbon monoxide, was used with success; one gallon will produce 230 cu. ft. of gas, enough for nearly 8 hours' continuous welding. Ammonia, which consists of 75 per cent. hydrogen and 25 per cent. nitrogen by volume, vaporises into these gases at 600 deg. C.; 50 lb. of ammonia will produce 2,250 cu. ft. of the mixed gases, and the addition of the gas in liquid form to the usual apparatus for arc welding will have little or no effect on its portability.

Particular Features of the Processes.

The properties of the welds produced by both processes are similar, and will therefore be considered together. Owing to the intense heat of the arc, some of the hydrogen used in the second process is atomised, as when done intentionally in the atomic flame. Hydrogen in the atomic state has a very great affinity for oxygen, the result being that no oxygen, or other gas, from the atmosphere can reach the weld so long as there is a stream of hydrogen directed on it. The outer layers of the enveloping gas combine with the oxygen to form water, which passes off as steam. Even metallic oxides, such as rust, previously formed on the material being welded, are reduced to metal. In this way, the hydrogen is not only a preventative of oxidisation, but is an active flux for the metals under treatment. The result is to produce welds of high mechanical properties, the most important of which is remarkable ductility. A characteristic example of the properties of a mild-steel

weld made by the hydrogen metallic-arc is given below with average figures for welds made by the ordinary metallic-arc process:—

Method.	U.T.S. tons/sq. in.	Elastic limit.	Reduction of area per cent.	Elongation per cent.
Metallic arc ...	22.0	—	—	4.0
Hydrogen metallic-arc	25.0	42,000	55.0	36

A metallic-arc weld will usually only bend through an angle of from 20 to 30 deg. before fracture, but repeated tests on hydrogen-welded samples allowed of a bend of 180 deg. being made without fracture. Welded strip-steel has been rolled and drawn without fracture, a further demonstration of ductility. The atomic process is not limited to mild steel; high-speed steels containing vanadium, molybdenum, and cobalt have been welded with success. "Stainless" steels containing as much as 15 per cent. chromium have also been welded satisfactorily, and cast-iron may now be welded by either process with the advantage that such important elements as carbon and silicon are not burnt out. Equally good results have been obtained by the atomic process for welding copper and some of the copper alloys, and even aluminium.

Both processes may be adopted for automatic welding. As already indicated, it is desirable that the electrode in the hydrogen metallic-arc apparatus should be automatically fed at the same rate that it is deposited. Such an arrangement has not been tried with the atomic process, and would in any case be difficult in view of the nature of the apparatus. Either appliance, however, may be mounted on traversing gear over the work, and moved at a uniform rate along the joint, but this arrangement is only economical and even practicable on such work as straight or circular tank seams.

The high rate of welding which may be attained by the use of these processes opens up a very wide field of possible applications, purely on economical grounds. The other great advantage of ductility, equal to that of rolled or drawn metal, at once widens the scope beyond the present applications of the ordinary methods. Such structures as steel building frames, ship's hulls, and boilers suggest themselves as applications. The possibilities are very considerable, and point to a deservedly great future.

Correspondence.

The "H" Type of Cable.

Like Mr. Nisbett, I was amused by the article on Hochstadter's Cable in your issue of December 17th, but apparently for reasons dissimilar to his. I was amused, too, by his letter in the current issue of the REVIEW.

To say that I cannot understand his letter would be to underrate my intelligence, and so I do not say so. But I do say this: That the reasons given for condemning "H" type cable are inadequate. In fact, the whole letter strikes me as an attempt to silence opposition by making a loud noise. So, briefly, I will examine each of his paragraphs.

It may be granted that the screening does not prevent ionisation within the cores; but, by reducing the potential gradients, it reduces the tendency to ionisation. It may also be granted that the difficulty of impregnation is increased, but the increase is so slight that proper manufacture can easily overcome it.

That the withstanding of tangential stresses is within the capabilities of a well-made cable does not prove that a cable without such stresses is not a very desirable thing. In fact, Mr. Nisbett's statement on this point verges on one of those negative arguments far too often used by engineers.

That the Hochstadter cable is more costly to make than the belted type is not proved, for, by the elimination of tangential stresses, less insulation for the same reliability is required in the one case than in the other. In any case, cannot the one be bought at the same price as the other?

I am unable to agree that the screened cable is mechanically weaker than the belted type, because in any 3-core cable subjected to bending, the cores move relatively to each other and to the sheath; and such handling as I have given to Hochstadter cable has deformed the cable no more than similar handling of a belted cable. Further, transforming of the cable from a circular to a triangular section does not necessarily increase the cubic contents. Rather, the reverse is the tendency.

Why is the table of curves so unfair to the belted cable? Whether or not the P.F. tests indicate the quality of the cable matters not at the moment, but as a practical comparison was aimed at, it is to be presumed, although it is not explicitly stated in the article, that the experimental lengths were manufactured of similar paper similarly impregnated, and so the results obtained do throw light on the comparative values of the two methods of construction.

Those results show that there does seem to be reason for the claim that "H" type cable will carry more current than the belted type by reason of its lower dielectric losses. The additional heat conduction due to the thin film of metal round the cores may be quite small, but the increased heat conduction due to the thinner paper walls is considerable.

It would be interesting to read Mr. Nisbett's other points, but if they are not better grounded than those he has brought forward, I, for one, fear that, as in the present case, I shall disagree with him.

C. E. Watson, M.I.E.E.

Matlock Bath, *January 2nd*, 1927.

In your issue of December 31st, Mr. Nisbett pours scorn on the equipotential sheath construction as an old idea which has been tried and found wanting.

It frequently happens in the course of scientific progress that a principle is known for some years before any satisfactory means of applying it practically is developed. A classical instance will serve to illustrate this. Heaviside wrote in 1887: "It is the very essence of good long-distance telephony that inductance should not be negligible." It was not until some thirteen years later that it was first successfully applied to any actual line, and now that the necessary conditions are more fully understood, it is in universal use.

The principle of the equipotential sheath is admittedly not new; the patent dates from 1914. That Mr. Nisbett tried it some years ago and found it of no value does not mean that the principle is wrong, but only that he has apparently failed to find the correct conditions for its use.

What are his objections to it?

1. He says the screened cable is more difficult to dry and impregnate satisfactorily. Perhaps it is, a little, but the difficulty is easily overcome by suitable manufacturing methods, and once they are overcome it is actually easier to maintain uniform quality in output.

2. He says the tangential stresses are within the capabilities of the dielectric strength of a well-made cable. They are, on first manufacture if the impregnation is good, but do not remain so in service. Most breakdowns have been initiated at the point where tangential stress is greatest.

3. He says the three-core cable is unmechanical, and a cable made without a belt will be visibly triangular after handling. That depends on manufacture. Properly made with adequate filling, an "H"-type cable is no more liable to become triangular than any belted type.

4. He says that a power-factor voltage characteristic can be obtained with the belted type, which is as good as that obtained with the "H" type. This is nearly true on first manufacture. It is very far from accurate if the comparative tests are made on cooling after a full-load run sufficient to raise the core temperature to its working maximum. The belted-type cable shows a sharp rise in power factor on cooling after a heat run, *i.e.*, under service conditions. The "H" type shows practically no change. Stable characteristics are vital to permanent service.

5. He deduces that there is no foundation for the claim that the "H"-type cable will carry more current than the belted-type cable by reason of its lower dielectric losses. He is right. It will carry more current, however, although not for that reason. The main reason lies in the smaller dimensions to which it can be made to operate satisfactorily and to a slight extent only to the heat conduction along the sheath.

The equipotential sheath is sound in principle, but it is not the sole requirement of a good cable, and harm is sometimes done by over-enthusiastic advocates who claim too much for it. Although known for many years, its development was retarded by the difficulty of finding a suitable material for the equipotential sheath. That is now obtainable, and coupled with improved materials, satisfactory mechanical construction and methods of impregnation, it offers a satisfactory solution of the high-voltage cable problem.

Standard Telephones & Cables, Ltd.
G. H. NASH, *Chief Engineer.*

London, *January 3rd*, 1927.

I have read with interest the criticisms contained in Mr. G. H. Nisbett's letter (ELECTRICAL REVIEW, December 31st, 1926) relative to an article which appeared in your issue of December 17th, headed "A High-pressure Cable Development."

From Mr. Nisbett's letter of December 31st, and also from his letter to the *Electrical Times* concerning the same subject on December 23rd, one would be almost justified in thinking that the author of these letters was fully convinced in his own mind that the usual type of super-tension cable, which has been employed in the past, is the "ne plus ultra" of cable design, at least for pressures up to 33 kV.

For my own part, I am quite prepared to leave this question to be decided by those engineers who have had extensive experience with 33,000-volt normal-type cables.

The Hochstadter patent was taken out in 1914, but the special metallised paper was not then known. The war naturally delayed further development of the "H"-type cable,

but immediately afterwards American and Continental makers were not slow in taking up the "H"-type cable again, with the result that "H"-type cables for super-tension work have been successfully used for years past, after most exhaustive tests and experiments.

The fact that all the leading cable firms on the Continent, as well as six British firms, are now making the "H"-type cables, tends to prove that the principles on which the "H"-type cable is based are not only electrically, but also commercially, sound.

With reference to all the points raised by Mr. Nisbett, these have been disproved in actual practice, and not merely by factory tests; and as to the "H"-type cable being an unmechanical proposition, this is not correct, as the "H"-type cable may be handled and laid with, comparatively speaking, more ease and safety than the belted type of cable.

Concerning Mr. Nisbett's criticism of the power factor and voltage curves, I would like to remind him that in his letter to the *Electrical Times* he stated that "experience shows that power factor relative to voltage is an unreliable index to the dependability of a cable." Why, then, does Mr. Nisbett go to such length in criticising the various curves as published in the ELECTRICAL REVIEW of December 17th if this point is not of importance?

As a matter of fact, Mr. Nisbett's own explanations and criticisms *re* power factors are not at all clear, and I would say that the differences appertaining to the power factors of the Macintosh cable and the Birmingham Corporation cable are wholly dependent upon the temperatures at which the respective tests were made.

F. Richardson,

Research Department, Enfield Cable Works, Ltd.

Brimsdown, *January 3rd*, 1927.

Power Supply for Wireless Sets.

I note in your issue of December 24th a further letter from Mr. H. Hewlett on this subject.

If one does assume that the h.t. battery is going to receive no proper attention, it appears to me that neither accumulators nor any other type of wet cell would be really satisfactory, and one is reduced to the old-fashioned dry battery. But what I wished to point out in my last letter was that more enlightened views are now largely held, and certainly none of our clients are ever left to get their batteries charged "as best they can," except at their own special request.

With proper arrangements, the only attention needed is (*a*) to put the battery on charge by operating a switch about once a week, and to leave it on until the set is wanted next day, and (*b*) to look at the battery once in four or five months and top it up if necessary.

A more serious matter, however, is the estimate given by Mr. Hewlett as regards current consumption. Modern sets, in which precautions are taken to get something approaching distortionless amplification, invariably demand high currents for the last valve. Our own smallest set, using one ordinary and one power valve, consumes 13 mA, which rises to about 20 mA for the largest set, and I would emphasise that in the present state of our knowledge *it is impossible to get distortionless loud-speaker work with less current*, except by the use of excessively high voltages: in other words, a power of about 3 or 4 watts d.c. supply to the anodes is essential.

For those who are unfortunately compelled to use primary batteries, we invariably specify a capacity of the order of 9,000 milliamp.-hours as the minimum which is likely to be satisfactory: such batteries (which we do not trade in ourselves) cost approximately 25s. per 50-volt unit.

P. K. Turner.

Research Department, Burndept Wireless, Ltd.

Blackheath, *December 29th*, 1926.

Boiler-house Efficiency.

I should be much interested if your readers could tell me of a simple way of obtaining boiler-house efficiency—that is, without going too deeply into chemical and combustion problems. Some time ago articles on this subject appeared in the REVIEW, but although they were excellent, they were not so clear to me as they have have been to more studious readers.

December 24th, 1926. **A. W.**

[Possibly the methods devised by Mr. R. H. Parsons would meet the case. The system was described in the ELECTRICAL REVIEW of February 21st, 1919, and the article, reprinted in pamphlet form ("The Coal Consumption of Power Plants, and Bonuses for Coal Saving") is obtainable from this office.—EDS. ELEC. REV.]

Small British Motors.

We have been trying to obtain a British-made electric motor of one-third h.p., of the repulsion induction type, for single-phase circuit. We have sent out several inquiries, but in the majority of instances the quotations seem to be for motors of American origin.

Can you please give us the names of English firms who are likely to make such a small motor of the type mentioned? We must have one of the repulsion induction type, as the starting torque is approximately 180 per cent. full load.

December 29th, 1926. **Coldair.**

An All-Electric House.

A Harrogate Enterprise.

A RECENT development in the demonstration of domestic electricity is the all-electric house which has been equipped and recently opened for a short period to the public at Harrogate by the Corporation Electricity Department and the local contractors, with the object of demonstrating the latest electrical equipment for lighting, heating, and cooking, and the help, by increased convenience and comfort, which can be rendered to the amenities of domestic life only by electricity. Harrogate is a particularly suitable place for such an enterprise by virtue of its reasonable scale of charges for electrical energy. Lighting and heating can be obtained at 4d. and 1d. per kWh respectively, with the option of a ratable-value tariff.

We have received from Mr. Geo. Wilkinson, M.I.E.E., the chief engineer and manager of the Electricity Department, the following particulars of the apparatus installed. The house is an ordinary middle-class, two-storey dwelling of eight rooms, including a lounge, dining-room, kitchen, and five bedrooms, in addition to the hall and bathroom. Each room is equipped with the appropriate electrical apparatus, which includes fires and lighting fittings in each room, a cooking stove and washer in the kitchen, and an automatically-controlled cylinder water heater in the bathroom. A special feature of the installation is an electric thermal storage plant for heating the dining-room and supplying hot water. The illustration shows the dining-room, in which this is installed; it is in the form of the sideboard, on the right of the illustration, which harmonises with the



Dining Room, Harrogate.

other furniture in the room. The panels are of brown cork, and on the left-hand one is a thermometer showing the temperature of the water. The apparatus holds 50 gallons of water in a rectangular steel tank; the surface of the water is covered with oil to prevent evaporation, and also oxidisation of the tank. Submerged in the tank is a 12-gal. copper cylinder which is fed from a ball-tap cistern overhead, and supplies the kitchen and bathroom. Its contents are heated from the external water which is provided with a 2-kW immersion heater. The water temperature is controlled by a metallic thermostat located in the base. A fan propels air through the heater for warming the room, and is supplied from the lighting circuit, its consumption being about 40 W. A second thermostat controls the room temperature and puts the fan in and out of operation. It is claimed that this thermostat maintains the temperature of the room within a 1 deg. F. variation. Under normal conditions the storage heater is on an alternative circuit to that of the ground-floor heating and cooking; when the circuit is broken at night, indicated by a pilot light, the operation automatically closes on the thermal-storage circuit. Conversely, when the heating and cooking circuit is put on in the morning, the thermal-storage circuit is automatically broken, thus ensuring that no current is taken by the storage apparatus except during bed-time hours. In cases where an abnormal amount of water may be required, provision is made for the apparatus to be supplied from the heating circuit during the day. Electricity for the normal night consumption is supplied at a special low rate, thus rendering the apparatus quite competitive with coal or gas heating.

Electrical Currency.

The *Daily Mirror* reports the following conversation which took place at a garage:—

Customer: "What is the charge for this battery?"

Manager: "One and a half amps."

Customer: "How much is that in English money?"

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

The official campaign report for the fortnight ended January 1st states that two more demonstration homes have been opened—one at Wembley and Potter's Bar and the other at Walsall. The fifth Birmingham demonstration house is to be opened next week. A house was to be opened at Bishop Auckland on Wednesday last; this will be a specially-constructed all-electric house, and will have no chimneys or fireplaces. Doncaster will open a demonstration house on January 10th and, while it is open, it will be advertised by the Corporation in a main-street shop window. House-to-house distribution of cheque-coupons is being carried out, and campaign posters are being freely used in trams and omnibuses and public places, while direction signs are being posted up in various parts of the town. Yet another house in prospect is that at Hull, which is being got ready for opening on January 18th. Two semi-detached houses adjoining the power station at Sheffield are available for inspection by the public. The Wembley demonstration house is floodlighted in a striking manner, the lower red brick portion being illuminated with red light and the upper stucco part with white light. Contractors in the inner London area are being asked, in the course of personal visits by members of the campaign staff, to give greater prominence to the campaign in their windows. The number of electrical shops and showrooms is very small in relation to other trades, so that "100 per cent." support is essential to make an effective show. A successful three-day exhibition was recently held at Greenock; another one is to be held at Falkirk from February 7th to 11th. Exeter reports that £100 has been raised for the promotion of the campaign in that district. No. 6 of "Home Lighting News" was published last week. This contains the January window display suggestion; a list of towns with demonstration houses; appreciations of the campaign from supply authorities, &c.

After certain unavoidable delays, the all-electric demonstration house at Denton, Manchester, was opened on December 31st. The initiative in the matter was taken by an electrical contractor, Mr. Barratt, of Rusholme, who suggested to the Campaign Committee that if a demonstration house would be of use, he would arrange the matter with a local builder who was prepared to lend the property for the purpose, and further, to add to the attraction of the W.O.B. competition, he offered to any person within 20 miles of his premises who won the competition house a first-class radio outfit. Subsequently, with the aid of the builders, Messrs. J. Riley & Son, the house at Denton was equipped, furniture was supplied by Messrs. Philip Hart, Ltd., Manchester, and many leading manufacturers loaned electrical apparatus. After a brief speech by Mr. R. C. Hawkins, the district officer in charge of the campaign, the house was officially opened by Mrs. H. C. Lamb, the wife of the chief electrical engineer of Manchester. Mrs. Lamb is the moving spirit in the Manchester Branch of the Electrical Association of Women, and is assiduously working to further its objects. The Corporation is offering a special rate of 20 per cent. on the pre-war rateable value of the property or its equivalent, and in the case of this type of house the all-in tariff works out at about 12s. 6d. per quarter, plus ¾d. per kWh used. The house is to remain open from 2 p.m. until 8 p.m. until January 29th.

In the South Midlands Area there are indications that the second half of the campaign will be pushed with more vigour and enterprise than before. Two demonstration houses were opened at Walsall on January 1st, by the chairman of the Corporation Electricity Committee (Councillor J. Thickett, who was accompanied by the Mayor (Councillor J. A. Leckie), both of whom emphasised the tremendous advances made by the domestic application of electricity. The houses are well equipped for demonstrations, and they are being extensively advertised. Personal invitations to visit the houses have been sent out to a large number of householders by the local committee.

The Birmingham local committee will open its fifth demonstration house next week. This will be at Erdington, and a point worthy of note in connection with it is that it has been built by an electrical contractor.

The Birmingham Electricity Supply Department has distributed approximately 2,000 competition booklets, a number which is equalled by the Worcestershire, Staffordshire and Shropshire Electric Power Co., which is continuing its series of rural exhibitions in support of the campaign.

The "All-Electric House" at Lochfield Road housing scheme, Paisley, has proved such a success that arrangements have been made for another exhibition in a house of the bungalow type.

British Empire Chambers of Commerce.

The general arrangements for the eleventh congress of the Federation of Chambers of Commerce of the British Empire, which is to be held in Cape Town during the first week of October, 1927, are already well advanced. The Congress will meet under the patronage of the Earl of Athlone, Governor-General of the Union of South Africa, and the delegates will be entertained at a State banquet. A 25-day tour is being arranged by the Association of Chambers of Commerce of South Africa, with the assistance of the Union Government, in order that when the actual business of the Congress has been concluded the delegates may have the opportunity of visiting the principal cities and other points of interest. The president of the Federation, Lord Kylsant, will preside over the Congress sessions; he will be supported by Sir Edward Dawson, chairman of the Council of the Federation.

Frauds on Electrical Companies.

Two Bradford men, Walter Smith and Martin Hewitt, were sentenced to six months' hard labour at Sheffield last week on a series of charges, including one of obtaining by false pretences radio goods, value £33, from the Siemens and English Electric Lamp Co., Ltd., and another of attempting to obtain nine guineas' worth of goods from Metro-Vick Supplies, Ltd. It was stated by the prosecution that the men came to Sheffield at the beginning of December. Hewitt took a room as an office, had bills and an order book printed, and began business, stating that he was an electrical and wireless engineer; Smith acted as his assistant. The latter went to various electrical firms in Sheffield with orders signed "A. Walker," and, if possible, got the goods. Smith signed for the goods in the name of "W. Jones." His real name was not Smith, but Carroll. There was no trace at the office of any electrical business being carried on. Hewitt, giving evidence, said he intended to pay for the goods. He could buy foreign lamps at 8½d. each and sell them at 1s. 6d. If he had had time he would have paid for the goods out of the profits he would have made from the lamps.

Germans to Construct Moscow "Tube."

The Berlin correspondent of *The Times* reports that the arrangements for the construction of an electric underground railway in Moscow by German firms are now understood to be complete. The work is to be undertaken jointly by the Allgemeine Electricitäts Gesellschaft and the Siemens Bau-Union. The cost is estimated at some 200,000,000 marks (£10,000,000). Apparently the difficulties which arose between the municipal authorities of Moscow and the German contractors have been overcome and negotiations have been resumed with the American syndicate which was to have financed the greater part of the undertaking and which recently became restless at the delays and sought to withdraw. It is understood that under the arrangement now reached the Soviet Government, the municipal authorities of Moscow, and the German electrical firms will all have an interest in the railway when completed.

British Exports to Australia.

The Sydney (N.S.W.) correspondent of the *Daily Telegraph* says that the official statistics of foreign trade for the year ended June 30th last show a decline in the proportion of imports provided by Great Britain, including most of the principal manufacturing groups. The machinery group percentage has declined steadily from 62.5 per cent., pre-war average, to 53 per cent. in 1925-26. Compared with the year 1925 the percentage of iron and steel shows a decline of 3 per cent., electrical machinery 2½ per cent., and other machinery 2 per cent.

Australian Tariff Decision.

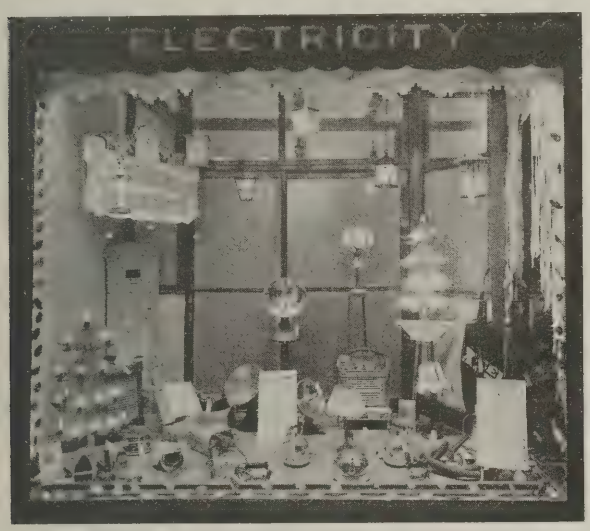
The Australian Tariff Board has decided that alternators and generators of over 75-kW, but less than 500-kW, capacity shall be classed under Item 174 provided security is given that the machines will be used only as generators in plant for the production of electrical energy.

Production Management.

An address on this subject was given by Mr. J. F. Marsden, F.S.S., F.C.W.A., at a recent meeting of the Business Research Association of Great Britain. Mr. Marsden touched upon some of the many considerations which a company or firm has to make before actually embarking upon production, as well as the procedure which should be adopted when production has commenced. In one part of his address he set forth a number of matters which had to be studied when choosing a site for a factory. Some of these were: The proximity of the site to sources of supply of raw materials and to the market for the finished product; labour supply in the district; transport facilities; the accessibility of the plant to workers; the accessibility of fuel or power supply; the availability of water for sanitation, processes, and fire protection; drainage; room for expansion; local taxation, &c. While urging that all the natural light available should be obtained, Mr. Marsden impressed upon the meeting the need for properly-designed artificial lighting.

A Christmas Showroom Window.

The illustration which accompanies this note is a view of the showroom of the Bexley Urban District Council's Electricity Department (engineer: Mr. A. J. Abraham). The



The Bexley Christmas Showroom Window.

appliances shown were put forward as suggestions for Christmas gifts, and both these and the lighting equipment were "Siemens" or "Siemens-Xcel" products.

Spanish Tariff Decision.

The revision of the commercial treaty between Spain and France last August affected Great Britain as the special rates existing before the revision were applicable to British goods. The Spanish Government intended to cancel the concession, but as the result of conversations the special rates are to be continued until April next, when it is Spain's intention to definitely withdraw them.

British Trade with Argentina.

Speaking at the recent annual meeting of the British Chamber of Commerce in the Argentine Republic, Sir Malcolm Robertson, the British Minister, as reported by the *Review of the River Plate*, said that British trade in Argentina appeared to be giving way to that of other countries. There were several reasons for that, but they could all be summed up in the statement that we did not study the market. In these days it was of no use waiting for people to come and buy unless a keen demand had been created by advertising. We had to go out and sell, using the language of the country. The market was worth studying for it was the most important of many similar markets in that part of the world. It was not much use trying to sell first-class goods at high prices when the majority of the people wanted goods of lesser quality and lower price. That did not mean the abandonment of the first-class standard and finish, but the production of lower-grade goods side by side with the others. Among other points which should be emphasised to the Argentine buyer was the fact that Great Britain was Argentina's principal customer. Orders lost meant less work in England which, in turn, meant a lower balance available for Argentine products.

The Sydney Contract Dispute.

We have already recorded that the Commonwealth High Court held that it was *ultra vires* the Australian Shipping Board to undertake a contract for the manufacture of steam and generating plant for the Sydney City Council. Recently the Court delivered its considered judgment in the matter, which was that the activities of the Board were confined by its Act to shipbuilding, owning, and repairing. The Chief Justice said that whatever the position might be in time of war, there was no doubt that the Board had no power to undertake external manufacturing and trading in time of peace.

Radio Apparatus for Australia.

A writer in the January *Broadcaster and Wireless Retailer* draws attention to the fact that out of £6,000,000 worth of radio goods imported into Australia during the last 3¾ years only £700,000 worth came from Great Britain. He proceeds to state reasons for the Australian preference for American apparatus; briefly, these are as follows:—The American manufacturer gives better terms and aims to adapt himself to the Australian traders' requirements; better finish and packing characterise American goods; American models are more up-to-date, perhaps on account of the geographical position of the United States in relation to Australia; and prices are more favourable. Among actual examples quoted are accumulators. While it is agreed that the British types are good, it is held that they are wanting in appearance, and, moreover, are usually in celluloid cases, whereas hard rubber is preferred. Mention is also made of super-heterodyne kits, which are stated to be far heavier than the American patterns, which, in addition, are attractively got up. Two British companies, selling valves and loud speakers respectively, are congratulated upon the methods which they have adopted. The writer says that the Australians do not like the position, but, after all, they look for the best and are willing to pay for it.

Colonial Premier's Visit to Standard Works.

The Hon. J. C. Coates, M.C., Prime Minister of New Zealand, visited the Hendon factory of Standard Telephones and Cables, Ltd., last week, and inspected the new 5-kW broadcasting set recently manufactured there for installation at Wellington, N.Z. The apparatus was actually demonstrated, and Mr. Coates expressed his satisfaction with it. A model exchange, forming part of the new automatic telephone system for London, was also demonstrated, and Mr. Coates was shown many other aspects of the company's activities in the advancement of speech transmission.

German Instrument Companies Amalgamate.

With the title of the Zeiss Ikon Gesellschaft, a new company has been formed in Dresden to acquire and amalgamate the electrical and scientific instrument manufacturing businesses of the Cordessa-Nettel Co., Stuttgart, the C. P. Goerz Optische Anstalt Co., Berlin, and the Ica Co., Dresden.

Social Events.

The office staff and works employés of Messrs. Thorn and Hoddle, Ltd., held their annual dinner at the Old Colony Club, Aldwych, on Wednesday, December 29th, Mr. Albert Hoddle taking the chair. Some eighty members of the male sex were present, the ladies making their own party at the Coliseum. A musical entertainment provided a delightful termination to a very enjoyable evening.

The annual carnival dance of the staff and employés of the Automatic Telephone Manufacturing Co., Ltd., took place at the Grafton Rooms, Liverpool, on December 20th. There was a very good attendance, some 750 dancers taking the floor, and an excellent variety of custumes. Prizes were



Costumes at the A.T.M. Carnival Dance.

awarded to Miss Cairns, Mrs. M. Fisher, Mrs. J. Brown, Miss L. Brown, and Messrs. P. W. Jones, G. Allinson, M. Fisher, and E. Williams. These ladies and gentlemen are seen in the foreground of our illustration. Mr. G. W. Moore (manager of the company), assisted by Mrs. and Miss Moore, acted as judges, and Mrs. Moore presented the prizes.

The annual prize distribution of the St. James' Electric Rifle Club was held on December 23rd. The chairman (Mr. F. J. Walker) was supported by Sir A. B. W. Kennedy, F.R.S., and Messrs. O. M. Andrews and W. E. Rowland. Mrs. Andrews distributed the prizes, which included the "Walker" Cup (Mr. E. B. Powell), and the "Deane" cup and rose bowl (Mr. F. O. Andrews).

The Christmas parties organised by the employés of the Halifax Corporation Tramways and Electricity Departments, for their children, were brought to a close in Christmas week, when there was a gathering of 90 happy children at the fourth of the series. The functions took the form of a good tea, games, dancing, and performances by entertainers, with a visit by Father Christmas to distribute toys.

Midland Bank Maps.

The Midland Bank, Ltd., has just issued a new edition of the maps of its own branches and those of affiliated banks. They are folded and bound in a cover of pocket size. The principal map covers the whole of the United Kingdom, but there are also large-scale maps of Central London and of London and suburbs. The bank has 1,900 branches in England and Wales.

Direction-finder Installations.

The Marconi International Marine Communication Co., Ltd., reports further progress in the installation of Marconi direction-finding apparatus. Ships included in recent orders for equipment are six P. & O. liners, five New Zealand Shipping Co.'s liners, and 11 other vessels. The application of wireless direction finding to cross-Channel boats will obviate to a great extent the delays and uncertainty caused by the dense fogs and currents which are met with.

German Cables for Durban.

The *South African Engineer* says that the Durban Corporation has recently departed from its principle of buying British materials, in the matter of some telephone cables. The South African representative of a Berlin cable maker quoted a net price of £3,273 for material on which the lowest British offer was £1,268 higher. The interesting point emerges that another offer of German origin was but little less than the lowest British tender. "Under the circumstances, it is not surprising that in deciding to accept the lowest German bid, the various committees stipulated that the Corporation should have a representative at the factory to oversee the manufacture of the cable. This will absorb £200 or more of the saving, leaving roughly a difference of £1,000."

Modern Church Lighting.

The illustration herewith is a view of the interior of St. Mark's Church, Sheffield, which has recently been equipped with a modern lighting installation. The fittings and flood-lighting arrangement for the chancel were provided by Metro-Vick Supplies, Ltd. (Sheffield branch). The fittings include ten six-light pentagon fittings and two nine-light octagon (48-in. diameter) fittings, the other lighting being furnished by 36-in. diameter electroliers and single-light



St. Mark's Church, Sheffield.

brackets fitted with 75-W white-sprayed gasfilled lamps. The chancel is floodlighted with "Emvee" reflectors and 100-W gasfilled lamps. "Cosmos" lamps, "Emvee" switches and lampholders, and Glover's v.i.r. cable are used throughout. The contractors who carried out the work were Messrs. Marsh Bros., Fargate, Sheffield.

Italian Tariff Increases.

Under a recent decree certain increases in import duties were put into force on December 19th. Among the articles affected are vacuum cleaners for houses and buildings (portable types), threaded iron and steel tubes, and light-projecting apparatus and machines, with lenses or prisms and parabolic reflectors.

Local Exhibition.

GREENOCK.—An exhibition organised by the Corporation Electricity Department was opened on December 28th by Councillor Lemmon, convener of the Electricity Committee. All the latest electric lighting fittings, fires, and appliances were on view, while cooking demonstrations attracted much attention. Kinema films added to the brightness of the exhibition, which was visited by large numbers of citizens.

Australian Preference for British Goods.

We recently reported that the Commonwealth Government had directed its Tenders Board to give preference to goods made in the United Kingdom if such goods could not be manufactured in Australia. This direction has now been strengthened by a further one that, before foreign goods are considered, articles manufactured partly in the United Kingdom and partly in the Dominions should receive favourable attention.

New South African Tube Company.

A provisional agreement has been arrived at between Stewarts & Lloyds, Ltd., and the Union Steel Corporation (South Africa) for the formation of a company to be known as Stewarts & Lloyds of South Africa, Ltd. This company will undertake the manufacture of tubes at a works to be erected at Vereeniging, the steel for which will be provided by the Union Steel Corporation, and it will also take over the merchant business hitherto carried on by a subsidiary of Stewarts & Lloyds, Ltd.

The Japanese Electrical Industry.

In a recent report on Japanese conditions, the Kobe correspondent of the *Chamber of Commerce Journal* (London) says that force of circumstances has prevented a too radical pursuit of the retrenchment policy, and there have been some big foreign loans for productive enterprises, and this, while increasing indebtedness, has maintained prosperity, without imposing any inconvenient burdens. The electrical companies have been among the chief borrowers, and Japan has now some very big concerns manufacturing electrical machinery and fittings. It is mainly in high-power generation, where speeds are very high and metallurgical considerations are of the first importance, that machinery has to be bought abroad nowadays. The manufacture of power generators is naturally considered a very important matter, and though it has been usual to import all kinds of internal-combustion engines, there are promises of the early taking up of certain varieties of Diesel engines in the big dockyards.

Unemployment.

The total number of persons registered at the Employment Exchanges as wholly unemployed on December 20th was 1,309,700, as compared with 1,410,378 on December 13th, and 1,102,400 on December 21st, 1925.

Shop and Store Lighting.

The first Illumination Design Course of 1927, the twelfth of the series, will commence at the London Lighting Service Bureau on January 24th, when Mr. H. Girdlestone will lecture on "The Lighting of Shops and Stores." The lecture will be illustrated by several full-size windows and specimens of interior lighting.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, January 4th:—Copper (electrolytic) bars, £64, 15s. dec.; ditto ditto sheets, no change; ditto ditto wire rods, £74, 15s. dec.; ditto ditto h.c. wire, 9 5/16d., 1/16d. dec.

Messrs. James & Shakespeare report, January 4th:—No change in the price of copper bars (best selected), sheet and rod; English pig lead, £29 15s., 15s. dec.

Messrs. Edward Till & Co. report, January 4th:—India-rubber, Para fine, 1s. 4¼d., ⅜d. to 1½d. dec.

In their weekly report on the lead position, Messrs. James Forster & Co. stated (January 1st):—"There is little fresh to report. A fair demand from consumers has been experienced this week, but in spite of this prices have sagged. Cable makers are still as slack as ever, and there are no signs yet of any Post Office orders being placed."

Company Law Amendment.

A deputation from the Association of British Chambers of Commerce was recently received by Sir S. Chapman (Permanent Secretary) and Mr. E. R. Eddison (Comptroller of the Companies Department) for the Board of Trade. The object was to suggest amendments to the existing law relating to limited companies which had not been dealt with by the Government Committee which has recently reported upon the subject. Mr. H. Lakin-Smith said that the Committee had suggested the issue of a separate profit and loss account by companies, to be available only at the general meeting; the Association suggested that the facts should be available to all shareholders. Mr. F. P. Robjent dealt with the subject of prospectuses, and said that the Association proposed that fuller information should be given in the case of contracts between the company and vendors and intermediary vendors, to disclose the amount of promoters' profits. Mr. Eddison replied to the points raised, and expressed the Department's unwillingness to impose any restrictive requirements which would only burden the majority of companies which were honest concerns. Sir S. Chapman said that the Bill would probably be based upon the Committee's recommendations, and the Association would have the opportunity of arranging for amendments to be moved during the Committee stage.

For Sale.

Mr. H. J. Shaw will sell by auction on January 12th and following day, at 13, High Holborn, the plant and stock of a wireless condenser manufacturer, the stock of a wireless goods factor, &c. (See our advertisement pages to-day.)

Successful Carol Singing.

As in previous years, the Osram G.E.C. Musical Society's carol-singing party during Christmas week carried out a series of successful "raids" on behalf of the Infants' Hospital, Westminster, the Industrial Orthopædic Society, and St. Hubert's Cripple School, Hammersmith. Various residential districts in Hammersmith, Barnes, Kensington, &c., were visited, resulting in the collection of £36, which has been divided equally between the three institutions mentioned. The party, with a specially illuminated "Osram" delivery van, proved a great attraction, and Mr. E. G. Gant, the conductor, is to be congratulated upon the results.

Failures in 1926.

A summary published by *Stubbs's Weekly Gazette* shows that the total number of failures in the United Kingdom in 1926 was 7,179, as compared with 7,916 in 1925. In England the total number of receiving orders and deeds of arrangement was 6,180, as against 6,768 in 1925; the total liabilities fell from £6,432,782 to £4,686,261, and the total assets from £2,166,553 to £1,972,989.

Important Birmingham Power Station Contract.

We are informed by Mr. R. A. Chattock, City Electrical Engineer, Birmingham, that his Committee has placed a contract with International Combustion, Ltd., for the erection and equipment of a new power station at Hams Hall, at an approximate total cost of £1,435,850. The contract provides that the electrical section, comprising turbo-alternators, condensing plant, and switchgear, shall be let as a sub-contract to the General Electric Co., Ltd., Witton, Birmingham.

Advertising Electric Cooker Hire.

The JACKSON ELECTRIC STOVE CO., LTD., has produced an adhesive stamp depicting one of its cookers and bearing the sentence "Hire Jackson Electric Cookers." These are being provided to electricity supply authorities who use the company's cookers for their hiring schemes.

West Midlands Industrial Council.

The annual meeting of the West Midlands Joint Industrial Council for the Electricity Supply Industry was held last week at Birmingham, and there was a full attendance of representatives from Warwickshire, Worcestershire, and Staffordshire, and from the six trade unions which are affiliated to the Council. Alderman A. G. Ellaway, Birmingham, was elected chairman, and Mr. Dempster, A.E.U., vice-chairman. Mr. E. J. Jennings, of the Birmingham Electric Supply Department, was cordially thanked for his services during the past year, and was re-elected secretary and treasurer.

The Belgian Telephone System.

The telephone question in Belgium now seems to be gradually approaching a solution. Two schemes are under the consideration of the Government. One is to establish a national company similar to the railway company, and the other is to transform the existing undertaking into an autonomous concern. A considerable sum is expected to be expended in developing communication with other countries, and Belgian cable makers have offered to grant credit facilities if they are given consideration in connection with the allocation of the orders for the cables. It is reported that the Ministry of Posts and Telegraphs has placed in Germany part of a large order for cables. The A.E.G. is said to have received orders of the value of 1,006,500 Belgas, and the Felten and Guilleaume Company one of 160,000 Belgas.

Trade Announcements.

Further to the note in our issue of December 24th, the FULLER ACCUMULATOR CO. (1926), LTD., advises us that it has now completed the improvements in the lay-out of the factory, which have greatly increased the manufacturing output, and the company is in a position to deliver from stock all standard types of batteries for wireless work and automobile starting and lighting. Stationary battery deliveries have also improved.

The NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO. has opened showrooms in High Street, Hoddesdon, and an all-electric exhibition flat has also been opened.

MESSRS. ANDERSEN, MEYER & CO., LTD., engineers, contractors, and importers, whose head offices are at Shanghai, have opened London offices at 30, Mincing Lane, E.C., where Mr. S. H. Morden, lately general manager to Messrs. J. Whittall & Co., Ltd., will be in charge.

MR. G. R. ALLEN, radio engineer, of Aldershot, has removed to larger premises at 156, Victoria Road.

THE BEKO LAMP CO., LTD., has removed to 5, Finsbury Square, E.C.2. Phone: "Clerkenwell 7346."

B.K.B. ELECTRIC MOTORS, LTD., has removed to 200, High Holborn, London, W.C.1. Telephone No.: "Museum 4265."

THE NEW PELAPONE ENGINE CO., LTD., are now in occupation of their new factory at Lofthouse Gate, Wakefield.

New Catalogues and Lists.

MESSRS. HOPKINSONS, LTD., Britannia Works, Huddersfield.—List No. 1,880, describing the company's patent "Mac" valves for steam pipes.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The "Osram Bulletin" for December, containing notes and articles on "Osram" lamps, "Magnet" domestic appliances, and "Gecophone" radio apparatus.

INTERNATIONAL COMBUSTION, LTD., Africa House, Kingsway, W.C.2.—A well-produced brochure describing the "Lopulco" pulverised fuel system. Fully illustrated.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2.—Leaflet No. 1,022-3, illustrating and describing Marconi magnetic drum recorders, Types 193 and U.g.4.

THE CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—A mailing card bearing a map indicating the situation of the company's service depôts.

THE CANADIAN PORCELAIN CO., LTD., Hamilton, Ont., Canada.—Catalogue 403, a pocket catalogue containing illustrated details of the company's insulators for indoor and outdoor service. The publication measures only 2¾ in. by 4¾ in. (approx.), and has 91 pages.

THE WALKER ELECTRICAL SERVICE, Annandale Street, Edinburgh.—A folder illustrating and describing the firm's motor and generator repair service.

MESSRS. F. A. WILKINSON & PARTNERS, LTD., Gretton, near Kettering.—An illustrated and priced pamphlet describing the company's wind-dynamo installations. A new type is noted. This embodies a 100-W, 12/14-V generator with a specially-designed switchboard.

THE HART ACCUMULATOR CO., LTD., Stratford, E.15.—January blotter, with a view of Old Heidelberg, advertising "Hart" batteries with non-corrosive terminals.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—January blotter advertising "Elasta" electric lamps.

THE NORMAND ELECTRICAL CO., LTD., 3, North Side, Clapham Common, S.W.4.—An illustrated folder containing details and prices of small geared motors, motor-generators, sirens, and grinders.

THE NATIONAL GAS ENGINE CO., LTD., Ashton-under-Lyne.—Catalogue No. 255, describing in some detail the company's vertical heavy-oil engines. Fully illustrated.

Bankruptcy Proceedings.

N. H. PAYNE, 4, The Triangle, Teignmouth, late of Dawlish, electrical and wireless engineer.—The first meeting of creditors was held recently at the Official Receiver's office, Exeter. The statement of affairs showed ranking liabilities of £798, against net assets of £560, leaving a deficiency of £238. Debtor attributed his failure to having no free capital to enable him to tide over the period of long-term credit which he was obliged to give most of his customers, and to his liabilities being considerably increased by suing creditors. He commenced business at Teignmouth in January, 1925, without capital. Two months ago he borrowed £45 from his father and his brother as surety for a bank overdraft. In September, 1925, he opened a branch at Dawlish under a manager. He estimated the turnover for the whole period of trading at £3,050, with a gross profit of £1,220, against which he placed trade expenses estimated at £1,103. He did not become aware of his position until he filed his petition, and maintained that if creditors had given him time to complete work that he had in hand and in prospect he could have overcome his financial difficulty. The following are creditors:—

	£		£
Agra Engineering Co., Ltd.	27	Bankers	21
British Thomson-Houston Co., Ltd.	28	Metro-Vick Supplies, Ltd.	23
Burris, Fred., & Sons ...	58	Park Wholesale Co., Ltd.	22
Capel, P.	36	Priestley & Ford ...	76
Drake & Gorham Wholesale, Ltd.	22	Payne, H. W. H. ...	45
Falk, Stadelmann and Co., Ltd.	37	Simpson, Baker & Co. ...	42
General Electric Co., Ltd.	63	South Wales Wireless Installation Co., Ltd.	26
Houghton-Butcher (Gt. Britain), Ltd.	60	Siemens & English Electric Lamp Co., Ltd. ...	28
		Sun Electrical Co., Ltd.	38

The public examination was fixed for January 11th, to take place at Exeter.

H. A. MILLS, electrical engineer, &c., 1, Lorne Villas, Old Windsor.—Receiving order made December 21st on debtor's own petition.

J. R. PEET, electrical engineer, "Earsdon," Linden Walk, Prestatyn.—First meeting held December 31st at the Official Receiver's office, St. Peter's Churchyard, The Cross, Chester. Public examination, January 28th, at the Court House, Bangor.

J. R. CHARNOCK, cycle dealer and electrical engineer, 6, Stonegate Road, and Meanwood Road, Meanwood, Leeds.—Last day for proofs for dividend, January 10th. Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds.

H. H. ATKINSON, electrical engineer, 33, Princess Avenue, Old Trafford, Manchester.—First and final dividend of 10s. 1d. in the £, payable at the Official Receiver's office, Byrom Street, Manchester.

D. T. DONOVAN and H. A. LANGLOIS (London Electrical Co.), 119, St. Mary Street, and 124, Queen Street, Cardiff.—First meeting held to-day at 34, Park Place, Cardiff; public examination February 11th, at the Law Courts, Cathays Park, Cardiff.

A. J. CULLUM, motor and electrical engineer, 34, Mount Pleasant, and 8, Church Street, Diss.—First meeting held January 7th, at 9, The Arcade, Ipswich; public examination January 14th, at the Shirehall, Ipswich.

W. H. DICKSON and A. J. SOLOMON (trading as Dickson and Solomon), radio engineers, 13 & 14, Tavistock Street, Devonport.—A meeting of creditors was held at Devonport

on December 31st. The gross liabilities were stated to be £390, and the debtors attributed their failure to the depression in trade and the heavy rental which they had been obliged to pay. The case remains in the hands of the Official Receiver.

Company Liquidations.

CLEAR HOOTERS, LTD., electric horn manufacturers, Birmingham.—A meeting of creditors was held recently, at the Birmingham Chamber of Commerce. Mr. L. J. S. Austin, the liquidator in the voluntary liquidation of the company, submitted a statement of affairs which disclosed liabilities of £6,133 and net assets of £1,126, leaving a deficiency so far as the creditors were concerned of £5,007. The liquidator, on behalf of the directors, submitted a scheme of reconstruction, under which it was proposed that creditors for sums of £30 and upwards should accept 5 per cent. third debentures in a new company in full settlement and discharge of their claims. These would be irredeemable for three years, except at the option of the company, and would be subject to first debentures of £2,200, and to second debentures of £1,000. Creditors whose claims amounted to £5 and upwards to £30 were given the option of either accepting third debentures or a composition of 4s. in the £, payable within two months of the completion of the scheme. Creditors whose claims did not amount to more than £5 were offered the latter alternative. The scheme was accepted, and an advisory committee was appointed consisting of Messrs. J. M. Dunkley (Callender's Cable & Construction Co., Ltd.), H. Harley (Coventry Gauge and Tool Co., Ltd.), and N. R. Nicholls (Birmingham Products, Ltd.).

FARRINGDON ELECTRICAL CO., LTD.—Winding up voluntarily. Liquidator, Mr. A. B. Neil, 22, Queen Street, E.C. A meeting of creditors was held on January 4th, at 22, Queen Street. Particulars of claims to the liquidator by February 28th.

NATIONAL WIRELESS CORPORATION, LTD.—Winding up order made by the High Court on December 21st, 1926.

GWYNNES ENGINEERING CO., LTD.—First meetings of creditors and contributories were held at Carey Street, W.C., on January 5th.

TELE DIS SERVICES (FOUNDERS CO.), LTD.—Liquidator, Mr. G. D. Pepys, Official Receiver, Carey Street, W.C., released December 20th, 1926.

Private Arrangements.

MELROSE & DOW, ironmongers and electrical engineers, Main Street, Callander.—At a recent meeting of creditors it was resolved that Messrs. Galbraith, Glasgow, should prepare trading accounts, a profit and loss account, and a deficiency statement. It was further resolved that, failing the submission of a proposal approved of by the committee of creditors, the debtors' affairs should be realised under a trust deed in favour of Mr. W. B. Galbraith, in the meantime the business to be carried on in the interests of the creditors. A committee representing creditors was appointed to advise in the event of the estates being realised under the trust deed, &c. The statement of affairs as at December 15th showed total liabilities of £2,726 and net assets of £825, leaving a deficiency of £1,901. The following are creditors :—

	£		£
Baxendale & Co., Ltd. ...	33	North British Machine Co., Ltd.	71
Blundell, Spence & Co., Ltd.	20	M. Nairn & Co., Ltd. ...	36
T. Black & Son	27	T. Rowatt & Son ...	44
Cauldon Potteries, Ltd.	20	Remington Arms, Ltd.	24
Crowden & Keeves, Ltd.	39	T. Scott & Co., Ltd. ...	80
Croggon & Co., Ltd. ...	50	Scottish Oil Agency, Ltd.	21
Cathro & Roger, Ltd. ...	24	A. Sharp & Son	24
Falkirk Iron Co., Ltd.	32	Smith & Wellstood, Ltd.	39
Graham & Morton, Ltd.	45	Spence & Gerrard, Ltd.	67
Gardner, John	35	J. Shaw & Sons, Ltd. ...	23
W. Glen & Son	22	Thomson & Williamson, Ltd.	23
General Electric Co., Ltd.	32	Ferrier, James, & Son	21
Jellyman & Sons, Ltd.	24	Macintosh, Hugh ...	53
Lewis, W. & R.	22	Anglo-American Oil Co., Ltd.	38
Martinet, Nicolas ...	27		
W. McGeoch & Co., Ltd.	61		

Dissolutions of Partnership.

MASON & MARSHALL, cycle, motor-cycle and motor-car engineers, electrical engineers, and dealers in wireless sets and accessories, 11, Manor Parade, Stamford Hill, N.—Messrs. C. H. Marshall and C. E. Mason have dissolved partnership. Mr. Mason will continue the business.

J. MANNING & CO., electrical engineers and contractors, 27, Leek Street, Birmingham.—Mr. J. Manning and Mr. L. V. Hamblin have dissolved partnership.

Calendars and Diaries.

We are indebted to a further number of friends in the industry for their compliments and good wishes for 1927.

MESSRS. DAVIDSON & CO., LTD., of Sirocco Engineering Works, Belfast, have issued a card, entitled "Trade Winds," with a coloured view of "The Cutty Sark" in full sail, suggesting a spirit of optimism and a hope that trade in the New Year will eclipse all previous records.

To a card advertising "Elasta" lamps, and issued by POPE'S ELECTRIC LAMP CO., LTD., of 5, Arthur Street, New Oxford Street, London, W.C.2, is affixed a set of monthly 1927 calendar sheets.

MESSRS. DOWNES & DAVIES, Liverpool, have chosen a water-colour reproduction of a pretty girl with rather reproachful eyes as the subject of their 1927 calendar.

The calendar of the DAVENPORT ENGINEERING CO., LTD., Bradford, is a businesslike production bearing a view of some cooling towers and a block of black-upon-red daily slips.

The calendar of Messrs. FRANCIS POLDEN & CO., LTD., Cannon Street, E.C.4, is again equipped with a date-marking device which adds to its usefulness. The company has also sent us, as in previous years, one of its pocket diaries, which is really an excellent production. It has a folding-over leatherette case and four-day pages with ample memoranda space.

Barribal's "Exide Girl" again appears upon the 1927 calendar of the CHLORIDE ELECTRICAL STORAGE CO., LTD.

THE LONDON UNDERGROUND RAILWAYS CO. has sent us an interesting desk calendar, each tear-off sheet providing for one week's memoranda, and bearing a picture representing some notable feature of the railway system, a view in the district which it serves, or a person or incident associated with London or with its famous "Underground."

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2, has sent us a block of daily slips for 1927 to replenish its metal calendar.

We have again received from the KEY ENGINEERING CO., LTD., Trafford Park, Manchester, its pocket calendar, which is a celluloid strip bearing the full 1927 calendar, with English and metric measures on the edges.

MESSRS. W. H. WILLCOX & CO., LTD., have issued a businesslike "date remembrancer" comprising monthly sheets with illustrations of the company's packings, steam fittings, pumps, tools, lubricants, &c.

Bold-figured monthly sheets and illustrations of work carried out by the firm are the main features of a calendar received from the WALKER ELECTRICAL SERVICE, Edinburgh.

The "Orion" pocket diary for 1927 has been received from ORION LAMPS, LTD., 15-17, Eldon Street, E.C.2.

Our desk will be brighter all through the year because of the presence thereon of a metal calendar with ingenious date-changing device, received from Messrs. CRYSELCO, LTD., of Kempston Works, Bedford. Upon the metal case is engraved the impressively uniformed "Col. Chris. Elco," of the "Cryselco Light Brigade."

THE IRON & NICKEL BATTERY CO., LTD., of 17-19, Cockspur Street, London, S.W.1, has prepared for its friends a 10-in. advertising ruler, and will send one to any reader who makes application.

A neat vertically-opening vest-pocket book with squared memorandum pages has been received from the TUNGSRAM ELECTRIC LAMP WORKS, LTD., 72, Oxford Street, W.1.

The architecture of mediæval Chester has again been drawn upon by BROOKHIRST SWITCHGEAR, LTD., for its 1927 desk calendar. The prints are sepia on parchment, and are enclosed in a neat moulded black frame. The business side has been reduced to a minimum, and the beauty of the calendar is thus preserved.

MESSR. B. S. & W. WHITELEY, LTD., of Leeds, have again issued to their friends a wall or desk calendar bearing a block of daily slips with literary quotations.

From the S.E.A. Co., LTD., of Lichfield Street, Hanley, we have received a wall calendar with a picture of three "Kennel Companions" printed in appropriate colours.

Chinese Notes.

An electric power supply company has been organised at Kulangsu, Amoy (Fukien province). It has a capital of $250,000 (national currency).

The Superintendent of Telegraphs in the eastern provinces of Manchuria has closed down a number of telegraph offices which have been rendered superfluous by the growth of telephone communication.

Following upon the increasing of fares by the other Shanghai tramway companies, the Chinese Tramway Co., Nantao, has decided to do the same.

Book Notices.

"The Colliery Managers' Pocket Book, 1927." Pp. 520+cxxvii; illustrated. Edited by J. Vincent Elsden, D.Sc. London: The Colliery Guardian Co., Ltd.—This 58th edition maintains the policy of the work to assist the mining engineer in his daily routine, and the student who aspires to fill a managerial position in his preparation for such duties. The book opens with the usual chapter on Mining Progress during the past year, and includes a summary of the findings and recommendations of the Report of the Royal Commission on the Coal Industry. A valuable feature of the volume is a selection of statistics which are claimed to be completely up-to-date. The staple sections of the book, including Coal and its By-Products, and Electricity in Mines, have been thoroughly revised, while other sections, including winding and haulage, have been re-written by acknowledged experts.

"Marconi's International Register of Telegraphic and Trade Addresses, 1926-7." London: Marconi International Code Co., Ltd. Price 27s. 6d., carriage paid.—The principal change effected in this bulky directory is in the price, which represents a reduction of nearly 50 per cent. The volume contains the names and addresses of over 55,000 of the world's leading manufacturing and trading concerns in alphabetical order. The Classified Trades Section gives exhaustive lists which will be of service to both buyers and sellers. Another

important section is an international list of cable addresses. The Register should prove invaluable to all firms who are interested in overseas trade.

"The Electrical Engineer's Year Book, 1927." Edited by J. H. Johnson, M.I.E.E. (Pp. 508+diary.) London: S. Davis & Co. Price 21s., post free.—This is the nineteenth edition of a work which covers in an admirable manner all phases of electrical engineering—generation, distribution, contracting and manufacturing, as well as selling. The matter has been brought up to date, but the general scheme is similar to that of previous editions.

"Optical Instrument Catalogue." Pp. 336, quarto; fully illustrated, paper covered. London: The Optical Convention. Price 6s. net.—The exhibition to which this catalogue relates was held in connection with the Optical Convention, 1926, and the book is intended as a permanent work of reference to British optical manufactures at the time of the Convention; containing full illustrated descriptions of the instruments and apparatus exhibited by the leading makers in Great Britain, it is indispensable to all users of optical appliances. Descriptions of the experimental and research and historical exhibits at the Convention are also given.

"Proceedings of the Optical Convention." Part I, 512 pages; Part II, 578 pages. Fully illustrated, with plates and figures in the text. Price £3 net.—These two quarto volumes, bound in cloth, contain the full text of the presidential address and of the papers (numbering nearly 100) read at the Convention, together with a report of the discussions and of certain special lectures which were delivered. The publication constitutes a record of progress since the last Convention, in 1912.

From the Cripplegate Institute, Golden Lane, Barbican, E.C.1, we have received a 36-page booklet containing a programme of winter, spring, and summer courses, lectures, entertainments, &c., held at this increasingly popular City institute.

"The *Wireless Trader* Year Book and Diary, 1927" (pp. 215+clxiii). London: The Trader Publishing Co., Ltd. Price 5s. 6d., post free (7s. 6d. overseas).—This is the third edition of this useful wireless directory, and a number of new features are embodied in it. In addition to a great deal of technical and legal matter, the year book contains an ample diary, directories of traders, and proprietary names, and a section devoted to short reviews of books upon radio theory, experiment and construction. A section of particular interest to exporters is that devoted to tariffs imposed by Dominion and foreign Governments upon radio apparatus.

"Science Abstracts" (A. & B.). Vol. XXIX. December 25th, 1926. Part 12. London: E. & F. N. Spon, Ltd. Price 3s. each.

A Siemens-Schuckert Acquisition.

According to the *Financial Times* correspondent at Berlin, the Siemens-Schuckertwerke concern has taken over the National Automobil Gesellschaft, which manufactures automobiles and motor lorries.

Unemployment in France.

According to statistics prepared by the French Minister of Labour the number of French unemployed does not exceed 10,000 in Paris and 30,000 in the departments.—*Reuter* (Paris).

Lighting and Power Notes.

Amesbury.—SCHEME APPROVED.—The Rural District Council has given its consent to an application by the Durrington Electricity Supply Co., Ltd., for an Order to supply electricity in the parishes of Durrington and Bulford.

Aughton (Lancs.).—ELECTRICITY SCHEME.—Mr. G. P. Shallcross, formerly electrical engineer to Birkenhead Corporation, has prepared an electricity scheme, estimated to cost £14,000, for the Parish Council. The Council has decided to approve of the scheme, subject to the requisite number of consumers being obtained, and it will be submitted to a meeting of ratepayers to be held shortly.

Australia.—VICTORIA.—According to the *Electrical Engineer of Australia and New Zealand*, the seventh annual report of the State Electricity Commission, covering operations for the year ended June 30th last, reveals a considerable expansion of the Commission's services and distinct improvements both as regards the technical problems and the financial position of the undertakings. The amount of energy sold during the year was 161,990,327 kWh, as against 101,000,000 kWh in the previous year. The Yallourn power station and the plant at the briquetting factory generated 142,678,586 kWh, while the Newport B power station produced 46,031,164 kWh. The maximum demand on Yallourn was 36,000 kW and that on Newport B was 16,800 kW. A tabulated statement dealing with all generating authorities in the Melbourne metropolitan area shows that the total amount of energy generated for all purposes, including electric railways, was 463,000,000 kWh, as compared with 419,500,000 kWh in the preceding year. The *per capita* consumption of electrical energy was 503 kWh, as against 489 kWh and, excluding railway traction, the respective *per capita* consumptions were 335 kWh and 314 kWh. The total loss on the whole of the operations during the year was £262,000. The total revenue from the electric supply operations was £713,252, and the expenditure, including interest, amounted to £937,931, making a loss of £224,679. The loss on electric supply last year was £240,944. The briquetting operations resulted in a loss of £36,257, as compared with £39,925 last year.

Bolton.—INCREASED CHARGE REMOVED.—Increased electricity charges imposed by the Electricity Committee three months ago through the high cost of coal are to be removed.

Brazil.—SAO PAULO.—The Sao Paulo Power Co. has completed its new hydro-electric station at Cubatao. The two turbo-generators of this new plant are each of 40,000 h.p., and are said to be the largest yet constructed of this type. It was expected that the plant installed at the end of 1926 to meet the demand for electricity in Sao Paulo would have a capacity of 228,000 h.p.

Chesterfield. — LOANS. — The Electricity Committee is to apply for sanction to the following loans:—£48,700 for mains and services; £1,075 for the provision of transformer sub-stations; £12,000 for further hired wiring installations; £10,000 for meters; and £8,240 to cover amounts already spent on mains, services, meters, &c.

PROGRESS OF SUPPLY.—The Engineer (Mr. D. H. Davies) has reported to the Committee that applications for supply are being received in such large numbers that at the present rate all the available householders in the town would be taking a supply in the next five years.

PRICE REDUCTIONS.—Despite the coal dispute, the charges for lighting and large power purposes were reduced by 10 per cent., in March and July last, respectively.

Continental.—CZECHO-SLOVAKIA.—According to *Commerce Reports*, plans for the electrification of eastern Czecho-Slovakia were recently formulated in Kosice. The manager of the electrical works at Presov has suggested the erection of a central hydro-electric station on the banks of the Poprad river, where there is a fall of 65 metres, which could develop 6,000 h.p. The projected station will be the first plant of the proposed system to be known as the Eastern Slovak Electric Power Works. The Government will finance a part of the work, and the interested municipalities will contribute large sums, in accordance with the electrification law. The central power station will supply electricity to Presov and by way of Kezmarok to Levoca. On completion of this station an electric railroad will be constructed from Podelin to Luboteny in order to connect this part of the Poprad valley with the Slovak railway system.

SWEDEN.—The Stockholm correspondent of *The Times Trade and Engineering Supplement* reports that at the State hydro-electric works at Lilla Edet and Norrforsen, near Umea, 60,000 additional h.p. is now available, while works have been commenced near Hammersfors which will produce another 27,000 h.p. The total amount at present available is estimated at 1,400,000 h.p., as compared with 885,000 ten years ago.

Dundee.—EFFECT OF COAL STRIKE.—It was reported at a recent meeting of the Corporation Electricity Committee that the loss sustained by the Department as a result of the coal strike was £24,000. An effort is to be made to avoid a continuance of the 10 per cent. increase in price by resorting to the reserve funds.

East Anglia.—ELECTRICITY BILL.—The East Anglian Electric Supply Co. has deposited a Bill for next session, under which statutory power is sought to supply electricity within an area comprising the whole of the counties of Norfolk, Suffolk, and a large part of Essex. The company, which is already supplying electricity in these counties, is to submit to the Commissioners proposals for the development of the supply. These proposals are to be carried into effect within the time prescribed by the Commissioners, but if within three years from the passing of the Act the company has not, in the opinion of the Electricity Commissioners, substantially commenced its works for the purpose of carrying out its powers, the Minister of Transport may order the powers to cease as to the whole or any part of the area of supply.

Eastbourne.—NEW RING MAIN.—The Electricity Committee has approved an estimate of £22,834 for the proposed new ring main.

Japan.—KOBE.—*Eastern Engineering* states that the Municipal Electric Bureau's application for sanction to extend its steam power plant for generating electricity has been rejected by the Communications Department on the score that the Bureau's present plant, capable of generating 26,000 kW, is sufficient in view of the supply of hydro-electric power of 15,000 kW by the Ujikawa Electric Power Co. The Communications Department does not encourage the increase of steam power from the point of view of national economics, preferring that hydro-electric power be obtained.

Lyme Regis.—LOAN.—The Town Council is to obtain sanction to a loan of £16,065 for electricity purposes.

Newark-on-Trent. — CONSULTING ENGINEER. — The Town Council has appointed Mr. R. W. Willis as consulting engineer for the electricity undertaking at a retaining fee of 100 guineas per annum, plus expenses.

Northern Ireland.—Co. ANTRIM.—Fearing that the proposed electrical schemes in the county would be detrimental to the inland fisheries of the River Bann, the Coleraine Board of Fishery Conservators has appointed a deputation to place its views before the Bann Drainage Advisory Committee.

Price Increases.—Owing to the higher cost of coal, increases in the charges for electricity have been made or recommended in the following districts:—

HAMILTON.—An increase of 5 per cent.

RADCLIFFE.—An increase of 10 per cent.

Rawtenstall.—NEW PLANT.—The Corporation is to install an additional 6,000-kW turbo-generator at its generating station. The new plant will enable it to double its present output of electricity.

Rugby.—WIRING OF SMALL HOUSES.—The Urban District Council has adopted a scheme, submitted by the Electric Lighting Committee, for the wiring of its houses on the deferred payment system.

St. Helens (Isle of Wight).—STREET LIGHTING.—The Urban District Council has sealed a three-years' contract with the Isle of Wight Electric Light and Power Co., Ltd., for public lighting.

South-East Lancashire Electricity Advisory Board.—NEW STATION AT KEARSLEY.—In connection with the proposal of the Lancashire Electric Power Co. to erect a new power station at Kearsley, the Engineering Advisory Committee has received replies from Manchester, Oldham, and Salford Corporations to its inquiry as to whether they would be willing to extend their stations in order to meet the demands of the company, and if so, the terms upon which they would give such a supply. As no terms have been quoted by the three Corporations for bulk supplies as alternatives to the company's proposal, the Board has resolved that it is in the interests of the district that the proposal of the company for the erection of a new station at Kearsley should be carried out and that the Board be recommended to approve it.

MACCLESFIELD.—The Committee has received intimation that the Electricity Commissioners have sanctioned the installation of a 400-kW d.c. oil-driven set at the power station of the Electricity Company of Macclesfield, Ltd.

CHAPEL-EN-LE-FRITH AND DISTRICT.—The Engineering Advisory Committee has recommended the Board to support the application of the Power Development Co., Ltd., for a Special Order authorising it to supply electricity in the above area.

WIGAN.—The Committee has also recommended the Board to support the application of Wigan Corporation for a Fringe Order to supply electricity to the works of the Haigh Dyeing Co., Ltd., Haigh, subject to the approval of the Lancashire Electric Power Co. and Wigan Rural District Council.

The minutes of the proceedings of the Engineering Advisory Committee have been approved by the Board.

Staveley.—ELECTRICAL DEVELOPMENT.—The development of the h.p. electrical system of the Staveley Coal and Iron Co., which serves not only that company's works and collieries, but several Derbyshire villages and a part of Chesterfield, has necessitated the installation of a second very large gas engine at that company's Derbyshire works generating station. It is intended in due course to erect a third engine of this type at the Devonshire works.

Stirling.—ELECTRICITY SUPPLY.—Application is to be made by the Town Council to the Scottish Midlands Electricity Supply Co., Ltd., for its terms for supplying electricity to supplement the supply generated at the power station.

LOAN SANCTIONED.—Sanction has been received to a loan of £2,050 for mains and services.

Tring.—INAUGURATION OF SUPPLY.—An electricity supply for the district was recently formally inaugurated by the vice-chairman of the Urban District Council. The supply is obtained from Aylesbury Corporation.

York.—NEW BOILER PLANT.—The city electrical engineer has reported upon the question of raising the boiler steam pressure, and the Electricity Committee has recommended to the Corporation that three boilers and an economiser be removed, and one 36,000-lb. and one 18,000-lb. boilers with chimney, feed pumps, economisers, steam piping, &c., be installed, which would increase the boiler steam capacity by 54,000 lb., or 3,850 kW, making a total of nearly 13,000 kW. The estimated cost of the scheme is as follows:—Removing old boilers and economisers, fitting new boilers, chimney, &c., £19,500; reloading and adjusting existing boiler safety valves, £80; fitting new nozzles to the two 3,500-kW turbines, £500.

PRICE REDUCTION.—The committee has decided to reduce the charge for electricity by ¼d. per kWh as from the December quarter meter readings.

Wolverton.—ELECTRICITY SUPPLY.—At a recent meeting of the Urban District Council, the clerk reported that in reply to an inquiry made to the Northampton Electric Light Co. as to the price of electricity, he had received a reply from the company to the effect that when the overhead mains had been constructed and sufficient consumers were connected to wipe out the present loss in giving a supply to Wolverton, the price of electricity would be considered. It was decided to ask the Ministry of Transport to withhold consent to the erection of overhead cables until the Council received a satisfactory answer as to the cost of electricity.

Tramway and Railway Notes.

Australia.—ADELAIDE.—The report of the Municipal Tramway Trust (manager: Mr. W. G. T. Goodman) for the year ended July 31st last shows a total income of £629,394, as compared with £609,202 in the preceding year. Working expenses amounted to £446,791, as against £443,081, leaving a gross profit of £182,603 (£166,121). After deducting capital charges, there was a net deficit of £62,304, as compared with a deficit of £67,457. There was also a loss on the Port Adelaide tramway and motor-'bus systems, making a total deficit for the year of £89,958. The number of passengers carried increased from 59,663,457 to 62,562,249, and the car miles run from 6,860,256 to 7,021,400. During the year the power station at Port Adelaide, which supplies the energy for the tramways, was extended by the addition of a 10,000-kW turbo-alternator.

Continental.—ITALY.—Work is about to be commenced on the electrification of the railway between Chiasso, on the Italian-Swiss frontier, Milan and Voghera. Good progress has been made with the electrification of the railway between Florence and Bologna, and electric trains are about to be put in operation between Bologna and Pistoja. The necessary electricity is to be supplied from two hydro-electric stations in Tuscany.

Glasgow.—SUPPLY FOR TRAMWAY.—Hitherto the supply of electricity for the Corporation tramway has been drawn from the Tramway Department's own station at Pinkston, but consideration is now being given to a proposal for taking the necessary supply from the new Corporation station at Dalmarnock, thus bringing about a unification of control throughout the city.

Japan.—RAILWAY ELECTRIFICATION.—The scheme for electrifying the railways of Japan is receiving renewed attention. According to *Eastern Engineering*, under the present programme, the electrification of the line between Numadzu and Akashi, a distance of 378 miles, is to be carried out at the estimated cost of y. 7,777,000 in five years, from the next fiscal year, but it is now considered that the money appropriated for the purpose is hardly sufficient. As, on the other hand, it is out of the question for expenditure to be increased, in view of the dwindling railway revenue in recent years, the view is finding support that the proposed work should either be abandoned or postponed. As regards the Chuo line, it is proposed that electrification between Tokyo and Hachioji be completed by the end of the fiscal year 1928-29, while the electrification work on the line between Hachioji and Kofu is also to be started either during the next fiscal year or on the completion of the electrification of the line between Tokyo and Hachioji. So far as the electrification of lines in the suburban districts of big cities is concerned, work will proceed according to programme.

London.—SLOANE SQUARE STATION.—Sloane Square station will be the first District Railway station to be equipped with an escalator for its own traffic. All other stations which have escalators connect with deep-level tubes. The new escalator is to be an ascending one from the westbound platform to the street level, with an intermediate landing for eastbound passengers, and its construction forms part of a general scheme of reconstruction at this important station. The other improvements include the complete rebuilding of the booking hall and entrance to the station, and the installation of two booking booths which will take the place of the existing "hole-in-the-wall" method of booking. The new station will resemble closely the new Morden line stations, and will include a scheme of floodlighting.

HIGHGATE TUBE STATION.—To enable the traffic to be dealt with more expeditiously, the four lifts at Highgate tube station are to be superseded by comb-type escalators. Work will begin shortly, and it is hoped that the improvements will be complete by next summer. When the escalators are installed, the lifts will be dismantled and the space they occupy devoted to the formation of a larger booking hall, which will facilitate a freer movement of traffic entering and leaving the station. Passimeter booking booths will replace the existing booking office. The escalator will maintain a continuous service throughout the day and be able to deal with 20,000 passengers an hour.

Manchester.—NEW TIME-KEEPING DEVICE.—The Corporation has adopted a new time-keeping device, operated from the car platform, which will obviate delay caused by conductors leaving the cars and waiting for the correct time before "clocking" at roadside time boxes. The new device has been introduced in order to lessen the number of accidents to conductors when leaving their cars to "clock on."

Wharfedale.—RAILWAY ELECTRIFICATION.—The proposal of the clerk of the Ilkley Urban District Council for the electrification of the railways from Leeds and Bradford into Wharfedale has received the support of the Guiseley Urban District Council, the Menston and Poole Parish Councils, and the Wharfedale Rural District Council, who are to petition the L.M. & S. Railway and L.N.E. Railway Companies to carry out the electrification of the lines.

Telegraph and Telephone Notes.

Austria.—LONG-DISTANCE TELEPHONY.—The first trunk cable between Vienna and Passau, on the German frontier, has been completed, and was to be opened to the public on January 4th, says *The Times*. The authorities will now immediately proceed to lay cables successively to the Italian, Jugo-Slav, and Hungarian frontiers. The cost, which has been estimated at £2,100,000, is being met out of the international loan granted to Austria under the guarantee of the League of Nations.

Central America.—RADIO-TELEGRAPHY.—The radio stations presented by the Government of Mexico to Guatemala and El Salvador have been completed and put into public service. They deal with ordinary messages, night and special Press service, and day and night letters. The neighbouring States of Honduras and Costa Rica have been brought into radio communication range.—*Reuter's Trade Service* (Guatemala City).

Spain.—AUTOMATIC TELEPHONY.—We are informed by Standard Telephones & Cables, Ltd., London, that King Alfonso, together with leading citizens, participated in the establishment of a new European long-distance telephone record on December 29th, when a conversation was carried on over a circuit of 3,800 kilometres long, as a feature of the inauguration of "Standard" rotary automatic telephone service throughout Madrid. The record was established in a demonstration of the lines of the nation-wide system that has been built in the last eighteen months by the Compania Telefonica Nacional de España and, although the distance covered was equal to that from Madrid to Moscow, the circuit did not extend beyond Spanish territory. It did, however, cross the Straits of Gibraltar by submarine cable, uniting the continents of Europe and Africa; sixteen stations responded to the roll-call over the circuit, which event was preliminary to the formal opening by King Alfonso of the new Madrid local telephone system, completely installed in fourteen months by the Compania Nacional. The change in service was accomplished simultaneously throughout the capital, and Madrid is second in the series of nineteen cities in which the company will convert the telephone service to rotary automatic within the coming three years.

Sweden.—TELEPHONE DEVELOPMENTS.—The Director-General of the Swedish Telegraph Board stated in a recent interview that a third telephone cable between Sweden and Germany would be laid this year, 1927, not only to meet the steadily increasing communication between Sweden and Germany, but also for an extension of telephone traffic to England, in which very great interest is shown, and perhaps later on to France and Italy. The planned telephone cable to Finland will not be laid yet, no allowance having been made in the Finnish Budget for this purpose. Among other features will be the continued erection of automatic telephone stations at Stockholm, the extension of the telephone cable northwards to Upsala and Gaefle, and an increased use of the Stockholm-Gothenburg cable.—*Reuter's Trade Service* (Stockholm).

INVENTIONS.—Two Karlskrona inventors, Consul K. Vogel and engineer J. G. Larsson, have succeeded in constructing apparatus which may be coupled to the telephone and registers communications to the subscriber during his absence. The inventors emphasise the fact that their apparatus is not a variation of existing "parlograph" systems.—*Reuter's Trade Service* (Stockholm).

The Telephone Service.—NEW EXCHANGE.—A new public telephone exchange for Camberley is to be opened on January 11th. The switchboard, which is located in a new building in Park Street, was made and installed by Siemens Bros. & Co., Ltd., and is of the latest pattern common-battery type with accommodation for 780 subscribers, which can be increased to over 1,000 as required. The new exchange will provide Camberley subscribers with automatic "calling" and "ring-off" signals in place of the existing old style "turn-the-handle" system, which is rapidly being superseded throughout the country.

Radio Notes.

Argentina.—NEW RADIO STATION.—A contract has been concluded for an additional radio-broadcasting station in the Colon Opera House, Buenos Aires, at an estimated expenditure of 100,000 dollars (£20,000). The station, which is to be built by a United States company, is to be in operation by May, 1927, in time for the next opera season.—*Reuter's Trade Service* (Buenos Aires).

Loud-Speakers Banned.—EASTBOURNE.—Another by-law affecting the use of broadcasting loud-speakers has come into force in England. The Eastbourne Watch Committee has been informed by the Home Office that such a by-law will be sanctioned, says the *Morning Post*, in the following form:

"No person shall in any street or public place, or in any place which adjoins any street or public place, and to which the public are admitted, operate, or cause or suffer to be operated, any wireless loud-speaker or gramophone in such a manner as to cause annoyance to, or disturbance of, residents or passengers. Any person offending against the foregoing by-law shall be liable to a penalty not exceeding £5."

Reading has already a by-law of this kind, and other towns are likely to follow suit if users do not exercise a little more discretion. In the main these by-laws affect the proprietors of wireless shops who make a practice of fixing a loud-speaker outside their premises with the object of attracting purchasers.

FRANCE.—The new year commenced with the issue of a police order for the suppression of loud-speakers used for advertising and other purposes in the streets of Paris. They have long been threatened by the police.

France.—STATE CONTROL.—Wireless-telephony in France is to be placed on a legal basis, according to a proposal made by the Minister of Commerce which has been unanimously approved by the Cabinet. Broadcasting becomes the prerogative of the State, which will assume possession of all transmitting stations in five years' time. Meanwhile broadcasting will be State-controlled by a mixed committee of Government officials, authors, musicians, and lecturers, who will supervise operation, which will be carried out by authorised private enterprise. During the transition period the State will receive a percentage of the advertisement receipts.—*Reuter* (Paris).

High-power Stations.—REGIONAL PLAN.—It is reported that the scheme for the erection of new regional higher-power broadcast stations for Great Britain and for the provision of alternative programmes has been agreed to by the Postmaster-General in its broad outline. The main idea is for a certain number of high-power stations to be erected, some in parts of the country at present without a station, says the *Daily Mail;* they will number five or six, and will have a power of 10-15 kilowatts, and there will also be other stations with the same power as that of London. It is expected that part of the scheme will be ready for inauguration at the end of this year.

India.—STATION SITE.—The Indian Radio Telegraph Co., Ltd., has accepted the terms offered by the Improvement Trust for the lease of land in the Cossipore-Chitpore open space for the location of a broadcasting station.

Japan.—NEW STATION.—An order is said to have been placed for a 600-kW station, which will be ready in 1928. It is to be entirely the property of the Japanese Wireless Telegraph Co., an official concern enjoying the support of Parliament.

Licences.—BIRMINGHAM'S RECORD.—A campaign against "pirates" is being conducted by Post Office officials in the Birmingham district, and it was explained during the hearing of summonses that the possession of apparatus which was not assembled, or the erection of an aerial only, did not relieve the owner of the obligation to take out a licence. The number of licences now issued in the city is approximately 100,000, and the proportion of licence-holders to the population is probably higher in Birmingham than in any other centre.

Sweden.—INTERFERENCE ELIMINATOR.—An invention to prevent interference between broadcasting stations issuing the same programme on the same wave-length has been made by the broadcasting expert of the Swedish Telegraph Office (engineer, S. Lemoine).—*Reuter's Trade Service* (Stockholm).

United States.—CONTROL URGED.—In a recent address, according to *World Radio*, Major-General J. G. Harbord, president of the Radio Corporation of America, said that under the present developments there were only 89 wavelengths available within the United States, or approximately one-tenth the number of stations now in operation or projected in the immediate future. The National Radio Co-ordinating Committee had urged Congress to deal with the radio problem, saying that further delay would jeopardise a national industry involving $600,000,000 a year and disappoint 20,000,000 persons. The Co-ordinating Committee urged emergency legislation, necessary because broadcasting stations were increasing at the rate of one a day. The Committee urged prompt passage of a permanent control law, and endorsed the principle of the White Bill for control by a Federal Radio Commission and the United States Department of Commerce.

"ATMOSPHERICS."—In addressing a gathering of 1,500 scientists from all parts of the world at Philadelphia, Dr. Michael Pupin made the startling announcement that "atmospherics" and the fading nuisances so well known to wireless enthusiasts were "messages" from the sun and the planets. According to the *Daily Telegraph*, Dr. Pupin made it quite clear that he used the word "message" in a symbolic sense, and meant merely the electrical attraction between the earth and the planets as demonstrated by the periodical swing of great earth currents, the tidal flux of electricity through submarine cables, and objectionable noises in wireless instruments. These phenomena would in time be interpreted.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Ampthill.—January 12th. U.D.C. Electric light installation, public lavatories, depôt stores, and fire station; Mr. F. W. Walker, surveyor, 105, Dunstable Street.

Army Contracts.—Manufacturers who are not already on any War Office list of tenderers, and who wish to tender for Army requirements of cables, electrical stores, scientific instruments, &c., should apply to the Director of Army Contracts, Caxton House (West), Tothill Street, Westminster, S.W., for Form I, on which formal application for inclusion on the list of tenderers may be made. (See this issue.)

Australia.—MELBOURNE.—February 28th. City Council. Two 2,500-kW motor-convertors and accessories, or two 2,500-kW rotary convertors, with transformers and accessories. (B.X. 3124.)*

Argentina.—BUENOS AIRES.—February 24th. Department of Navigation and Ports. Three 10-ton electric shunting locomotives (Diesel type). (A.X. 4016.)*

Askern (near Doncaster).—January 18th. Electric light installation at Sutton Road new school. Education Department, West Riding County Hall, Wakefield.

Barking Town.—Electricity Committee. 1,000-kW motor-convertor.

Barnes.—February 8th. Electricity Department. One 1,000-kW rotary or motor convertor with transformer, l.p. switchgear and connections. (See this issue.)

Belgium.—Municipal authorities of Schaerbeek. 11,500 metres of h.p. and l.p. armoured cable and 1,500 electricity meters.

Bootle.—January 18th. Corporation. Electrician's work required in erection of 16 lock-up shops, with 16 flats above, Bailey Drive. Particulars from Borough Engineer, Town Hall.

Bradford.—January 11th. Corporation. Electric lighting installations at housing schemes, No. 3, Bradford Moor (12 combined shops and houses); No. 9, Bierley (16 combined shops and houses); and No. 11, Swain House (594 houses). City Architect, Town Hall, Bradford.

Burnley.—January 27th. Tramways and Omnibus Department. General stores for 12 months. Schedules from the General Manager, Queensgate Depôt, Burnley.

Canada.—GREAT FALLS.—January 17th. Manitoba Power Co., Ltd. Three 7,000-kVA single-phase oil-insulated indoor-type transformers for Lac du Bonnet, Manitoba. (B.X. 3118.)*

Doneraile (Co. Cork). — Cork County Sanatorium. Supply of electrical fittings and installation of electric bells, &c., at the Sanatorium. Mr. C. J. Murphy, secretary to the Committee of Management, Courthouse, Cork.

Ecuador.—QUITO.—Municipal Council. 3,000-h.p. hydro-electric plant for which water power with a fall of 42 metres is available, to be owned and worked by the city authorities. A second installation of similar capacity, for the port and city of Guayaquil, is also contemplated.

Falcarragh (Co. Donegal).—Installation of an electric lighting plant. Mr. A. J. O'Doherty, secretary, Falcarragh.

Haverfordwest.—January 15th. Water Department. One vertical treble plunger pump (16,000 galls. per hour capacity) and one 50-b.h.p. (approx.) semi-Diesel oil engine. Particulars from the Water Engineer.

India.—India Store Department. January 25th. Overhead electric travelling cranes (two 60 tons, four 25 tons, two 120 tons, three 8 tons, one 5 tons). Specifications (5s.) from 15, Belvedere Road, Lambeth, S.E.

Liverpool.—January 19th. Electricity Supply Department. 250,000 tons best quality steam slack during the 12 months to March 31st, 1928. City Electrical Engineer.
January 27th. Electricity Supply Department. Twelve months' supply materials, including cables and accessories, insulated cables, meters, lamps, &c. (See this issue.)

London.—LONDON COUNTY COUNCIL.—January 10th. Electrical installation at the Frankham Street, Deptford, S.E., elementary school (approx. 153 points). (December 31st.)
STEPNEY.—January 18th. Board of Guardians. Electric goods lift at the St. George's-in-the-East Hospital. (December 31st.)

Manchester. — January 11th. Tramways Committee. Electrolytic and cadmium copper trolley wire. Particulars from the General Manager and Chief Engineer.

Newport (Mon.).—February 5th. Electricity Department. Two water-tube boilers, steam and feed-water piping, economisers, air heaters, induced- and forced-draught plant, steel stack and grit catcher, coal and ash conveyors, extension of boiler house, including structural steelwork and foundations. (See this issue.)

New Zealand.—DUNEDIN.—February 19th. City Corporation Gas Department. One motor-generator with control board and accessories. (B.X. 3095.)*

Romford.—January 10th. Board of Guardians. Intercommunicating telephone installation. (December 31st.)

Salford.—January 8th. City Council. Electrical wiring of premises, 143 and 147, Regent Street. Specifications from Medical Officer of Health, 143, Regent Road.

South Africa. — PRETORIA. — February 3rd. Municipal Council. E.h.p. cable and accessories, switches and cut-outs. (B.X. 3097.)*
JOHANNESBURG.—January 20th. Municipal Council. Supply of electric lamps. (B.X. 3112.)*

Stoke-on-Trent.—February 8th. Stoke and Wolstanton Union. Alterations and additions to the central-heating and hot-water services at the London Road Institution. The work includes large calorifiers, two electric generating sets, pumps, &c. Specification from Mr. T. Wood, clerk to the Guardians, Union Offices, Stoke-on-Trent.
February 9th. Electricity Department. Steam and water piping, valves, &c., constructional steel work, platforms, crane gantries, &c. (See this issue.)

Torquay.—Electricity Department. Railway siding and coal-handling scheme for Newton Abbot power station. Construction of elevated railway siding upon reinforced concrete gantry; one rotary wagon tipper; one railway wagon weighbridge with weighhouse; electric capstan and fair leads; coal-conveying plant; one 1,000-ton concrete storage bunker. Forms of tender, Mr. H. F. G. Woods, Electricity Offices, Upton Valley, Torquay.

Uruguay.—MONTEVIDEO.—February 18th. State Electricity Works. 65,000 kg. unvarnished black iron wire and 10,000 kg. g.i. wire. (A.X. 4019.)*
February 11th. 37,500 electric filament lamps. (B.X. 3117.)*
February 15th. 55,500 iron pieces (angles, ties, bolts, &c.) for overhead lines. (A.X. 4018.)*

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birmingham.—Electric Supply Department. Particulars are given in our "Business Notes" of an important contract (£1,435,850) awarded to International Combustion, Ltd., for a new power station.

Brentwood.—Essex Education Committee. Accepted:—
Installing electric lighting at the County High School for Girls (£675).—A. Goodwin & Co.

Erith.—Urban Council. Accepted:—
Stock cable (£418).—Callender's Cable & Construction Co., Ltd.

Hebden Bridge.—
Electrical wiring, &c., at Council houses.—J. Harrison and Co., Halifax.

London.—BOOTH STEAMSHIP CO.
12 months' supply of electric lamps.—Siemens & English Electric Lamp Co., Ltd.
ADMIRALTY.
Accumulators.—Edison Swan Electric Co., Ltd.
LONDON & NORTH-EASTERN RAILWAY CO.
Railway-carriage lighting.—Edison Swan Electric Co., Ltd.

Salford.—Health Committee. Accepted:—
Wireless receiving apparatus for the Ladywell Sanatorium (£138).—Marconiphone Co., Ltd.

Education Committee. Accepted:—
Alterations to the electric lighting installation at the Royal Technical College.—County Electrical Co., Ltd.
Installing electric lighting at the Trafford Road Council School (£125).—Taylor & Son.

Tramways Committee.
Sand-drying plant (£500 approx.).—Pneulec Co., Ltd.
Two Morris travelling electric hoist blocks (£207).—Herbert Morris, Ltd.

Electricity Committee.
9,000 yd. l.p. and 450 yd. e.h.p. cable (£2,740).—H. V. Nederlandsche Kabelfabriek, Delft, Holland.

Southend-on-Sea.—Town Council. Accepted:—
Five top covers for tramcars (£1,625).—Brush Electrical Engineering Co.
3-ton electric crane (£1,190).—Smith & Co.

Windermere.—Urban Council. Accepted:—
Laying cables for the Oldfield housing scheme (£325).—Windermere and District Electricity Supply Co., Ltd.
Supplying and installing wires (£168).—J. K. Thornborough & Co.

Worcester.—Infirmary Committee. Accepted:—
Installing a telephone system in the infirmary.—British Telephone Supply Co.

York.—Works Committee. Recommended:—
Electric wiring at Foss Islands depôt (£80).—H. Hetherington.

Forthcoming Events.

Edinburgh Electrical Society.—Friday, January 7th. Royal Scottish Society of Art, 117, George Street. 8 p.m. Social and dance.

Junior Institution of Engineers.—Friday, January 7th. 39, Victoria Street, S.W. 7.30 p.m. "Distortion in Heat-treated Case-hardened Carbon Steels." Mr. P. J. Haler.
Friday, January 14th. 7.30 p.m. "The Thermionic Valve and its Characteristics." Mr. R. L. Kirlew.

Institution of Fuel Economy Engineers.—Friday, January 7th. Royal Society of Arts, Adelphi, W.C. 6 p.m. "Utilisation of Low-grade Fuels for Steam Generation." Mr. W. F. Goodrich.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, January 8th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Collieries and Public Supply." Mr. T. S. Thomas.

(Western Sub-Branch).—Saturday, January 8th. 60, Wind Street, Swansea. Informal discussion on "Chief Electrical Inspector's Report, 1925-1926." Mr. J. A. B. Horsley, Electrical Inspector of Mines, will reply to the discussion.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, January 10th. London. 7 p.m. "Some Notes on the Earthing of Metal Objects other than Conductors, and General Remarks on the Earthing of Electrical Circuits." Mr. S. W. Melsom.

(Mersey and North Wales (Liverpool) Centre).—Monday, January 10th. Liverpool University. 7.30 p.m. Faraday Lecture, "What is Electricity?" Prof. W. M. Thornton.

(North-Eastern Centre).—Monday, January 10th. Armstrong College, Newcastle-on-Tyne. 7 p.m. Ordinary meeting.

(North-Midland Centre).—Tuesday, January 11th. Hotel Metropole, Leeds. 7 p.m. "The Design of City Distribution Systems." Messrs. J. R. Beard and T. G. N. Haldane.

(North-Western Centre).—Tuesday, January 11th. Engineers' Club, Manchester. 7 p.m. Ordinary meeting.

(Western Centre).—Monday, January 10th. Royal Hotel, Bristol. 5.30 p.m. Reception 6 p.m. Annual dinner and visit of the President.

(Scottish Centre).—Tuesday, January 11th. North British Station Hotel, Edinburgh. 7 p.m. "The Applications of Electricity to Agriculture." Mr. R. B. Matthews.

(Dundee Sub-Centre).—Thursday, January 13th. University College. 7.30 p.m. "Government Scheme of the Electricity (Supply) Bill." Mr. D. H. Bishop.

(South-Midland Centre).—Friday, January 7th. Engineering and Scientific Club, Queen Street, Wolverhampton. 7 p.m. "Electrical Research." Mr. W. Wilson.

Nottingham Society of Engineers.—Monday, January 10th. "Electricity in the Home." Mr. G. S. Haydon.

Electrical Power Engineers' Association (Glasgow Section). Tuesday, January 11th. Reid's Restaurant, Gordon Street, Glasgow. 7.30 p.m. "Boiler Rings." Mr. J. A. Cogan.

(Manchester Section).—Thursday, January 13th. Geographical Hall, Manchester. 7 p.m. "Metering of Three-phase Supplies." Mr. O. Howarth.

Institute of Marine Engineers.—Tuesday, January 11th. The Minories. 6.30 p.m. "Progress in the Development and Practical Application of Heat-resisting and Non-corroding Steel." Sir R. A. Hadfield, Bart., F.R.S.

Röntgen Society.—Tuesday, January 11th. 32, Welbeck Street, W. 8.15 p.m. Ordinary scientific meeting.

Illuminating Engineering Society.—Tuesday, January 11th. Lighting Service Bureau, 15, Savoy Street, W.C. 6.30 p.m. "Flood Lighting." Messrs. W. J. Jones, H. Lingard, and T. Catten.

Electrical Society of Glasgow.—Tuesday, January 11th. 30, Gordon Street, Glasgow. 7.30 p.m. "A Survey of the Conditions of Trading in the Electrical Industry." Mr. A. Ramsay.

Institution of Civil Engineers.—Tuesday, January 11th. London. 6 p.m. "The Economics of Power Production and Utilisation at Collieries." Prof. D. Hay.

Royal Society of Arts.—Wednesday, January 12th. John Street, Adelphi, W.C. 3 p.m. "The Story of a Wireless Valve." (Juvenile Lecture.) Prof. C. R. Darling.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, January 14th. Literary and Philosophical Society, Newcastle-upon-Tyne. 6 p.m. "Progress in Economy of Turbine Machinery on Land and Sea." Sir Chas. A. Parsons and Mr. R. J. Walker.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

VEXTEX candle lamps.

Notes.

Wattmeter Calculations.

With reference to the article under the above title which appeared on p. 1064 of our issue of December 31st, it should be stated that the work described therein was carried out in the Research Department of Burndept Wireless, Ltd., and was published with their permission.

Royal Scholarships and Free Studentships.

The Board of Education has awarded Royal Scholarships to, amongst others, E. E. Wilkins and G. W. Dimmick, electrical fitter apprentices, and J. L. Howard, electrical engineer apprentice, and a Free Studentship to W. T. Pratt, electrical fitter apprentice—all at H.M. Dockyard.

Lectures.

THE POLYTECHNIC.—A course of four lectures, entitled "Sidelights on Broadcasting," is to be given by Capt. Jack Frost, M.I.R.E. (late of the B.B.C.), on Friday evenings, commencing on January 21st, at the Regent Street Polytechnic, London. The lectures will be popular in character, fully illustrated with lantern slides, and include demonstrations. The fee for the course is 5s.

LONDON COUNTY COUNCIL.—HACKNEY INSTITUTE, E.—A course of lectures on Electrical Power Control and Measurement will be given in the Institute on Wednesday evenings, commencing January 12th. Full particulars of the course may be had on application to the principal.

Appointments Vacant.

Temporary shift charge engineer for the Leigh Corporation Electricity Department. Electrical engineer (£350) for the Borough of Newark Electricity Department. Two charge engineers (400 taels per month) for the Shanghai Municipal Electricity Department. (See our advertisement pages to-day.)

Swiss Railway Electrification Economies.

In an article upon the Swiss Federal Railways, *Commerce Reports* states that considerable economy has been effected by electrification. A table is included which shows the actual costs of operating the electrified system in 1924, and compares the costs of steam working; this is reproduced below:

Operating item.	Electric. fr.	Steam. fr.
Cost of driving *personnel*	4,587,000	6,553,000
Cost of *personnel* at depôts ...	705,000	1,210,000
Surplus expenses for *personnel* on trains and for cleaning the cars, with steam traction	—	870,000
Cost of upkeep of locomotives and motor-coaches	3,082,000	4,150,000
Cost of greasing material	101,000	132,000
Surplus cost for upkeep of cars and wagons, with steam traction ...	—	50,000
Total	8,475,000	12,965,000

It is seen that the savings from these items alone reach nearly 4,500,000 Swiss francs, or approximately 35 per cent. of the cost under steam traction. Thus, with the electrification programme completed in 1929, the economy effected by the reduced cost for these items and for coal will ensure a very appreciable cut in the Swiss budget.

Fourth Conference on Large Extra-High-Pressure Systems.

This conference will be held in Paris from June 23rd to July 2nd, 1927. The Council of the Institution of Electrical Engineers will shortly nominate those who will attend the conference as the official delegates of the Institution, but, in addition, any members of the Institution can attend the conference as unofficial delegates. The latter should send their names, together with a remittance of £2, to the Secretary of the Institution, who will obtain the necessary membership cards.

University of London.

In connection with the celebration of the centenary of the University College, University of London, an appeal is being made for £500,000, one half of which is required to provide increased endowment for improving the salaries of the staff, and the other half is wanted for extensions and reconstructions to the present buildings, including a new block for chemical engineering. Sir Gregory Foster, Provost of University College, recently outlined the future programme of the University and its history to representatives of the Press. In 1831, when the first calendar of University College was issued, it had two faculties—Arts and Laws, and Medicine. The total staff numbered 30 and the number of departments 33. In 1926 there were five faculties—Arts, Laws, Science, Engineering, and Medical Science. There were 75 departments and 254 members on the academic staff. To-day the students of the college number 3,200, as compared with 420 in 1831. Engineering was introduced into the University in 1835, when a lectureship in civil engineering was established. Later, the chairs of civil, mechanical, electrical, and municipal engineering were established in the order given. One of the features of the progress made in University College is the co-operation which now exists between the departments, particularly between the engineering and science departments.

Accident.

Two men were severely burned by molten lead on December 30th as the result of an explosion at the Belvedere works of Callender's Cable & Construction Co., Ltd.

Wireless Telegraphy Commission.

This Commission was appointed in 1920 to decide upon the plant most suitable for carrying out the scheme of Imperial communication recommended by the Imperial Wireless Telegraphy Committee. A first report was submitted to the Cabinet on December 5th, 1921, and the second report (Cmd. 2781; Stationery Office, price 2d.) describes the proceedings of the Commission afterwards, the decision of the Cabinet in 1923 to go on with the construction of a powerful station in England, and the arrangement come to in 1924 between the Postmaster-General and Marconi's Co. for the construction of "beam" stations for telegraphy between England and Canada, with possible extensions giving similar communication with Australia, South Africa, and India. In each of these countries, the report says, the work on corresponding stations is well advanced. With regard to the Rugby station, the site was chosen to accommodate 16 masts, each 820 ft. high, but for economy it was decided to erect only 12 masts in the first instance. The power plant installed is capable of converting about 1,800 kW into suitable form for use in the wireless plant. The high-frequency generator consists of two exciting units in duplicate and a main amplifier of five similar panels, each containing eighteen valves and capable of giving a high-frequency output of 180 kilowatts at a frequency of 16,000 cycles per second. By using three panels a total output capacity of about 500 kilowatts is available for use on the whole aerial, leaving two panels in reserve. Alternatively, the two sections of the aerial, each working with two power panels, can deal with about 300 kilowatts and 200 kilowatts respectively, leaving one power panel in reserve. Up to the date of the report (July 7th, 1926) the smaller section of the aerial had been reserved for use with an experimental telephony transmitter, and good and reliable two-way conversation across the Atlantic to New York had been obtained repeatedly for many hours of the day.

The telegraphy installation had only been worked on the eight-mast aerial with about two-thirds power; even so, the signals had been heard all over the globe. A summary of the reports on the signals received at different distant places is appended to the report. The lay-out was designed to provide for the simultaneous use of two transmitters during the most favourable atmospheric periods. Experiments on the main telegraph transmitter and the transatlantic telephony transmitter will determine whether simultaneous operation is feasible. In addition, further installations are in contemplation, namely, short-wave and medium-wave plant, utilising the existing masts for supporting the additional aerials.

(The complete aerials, supported on 12 masts, have since been employed; the use of the north and south aerials combined in parallel has resulted in the normal working current being increased from 550 to 740 amperes. The present limiting condition with regard to the power output is the voltage on the aerial system, the normal working value of which is 156,000 V. With masts earthed, an aerial current of 810 A has been obtained.—EDS. ELEC. REV.)

B.E.S.A. Publication.

The British Engineering Standards Association has just issued a specification for flameproof enclosures for electrical apparatus and machinery (for use in mines and other places where an explosive atmosphere may be encountered) and of tests for such enclosures. The specification defines the tests which the flameproof enclosure must withstand, and the definition has received acceptance in several parts of the world. The test clauses have been associated with conditions which aim at securing that the certificates of compliance with the flameproof test should be issued only when the apparatus conforms to British Standard Specifications, where these exist, and the request has been made that more complete specifications for control gear than those now existing should be prepared. In this connection it is of interest to note that committees acting conjointly under the Electrical and Colliery Sections of the B.E.S.A. are preparing specifications for mining motors, switchgear and controllers for use in mines which make use of the tests given in this publication in order to ensure the flameproof properties of the gear. Copies of this new specification may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, S.W.1, price 2s. 2d., post free.

Fatality.

Thomas Hester, a ganger, recently employed on the construction of the new Albert Bridge over the Thames between Old Windsor and Datchet, pierced a temporary cable used in the construction of the bridge, and received a fatal electric shock. At the inquest, on December 29th, it was stated that rats and birds had scraped the earth away from the adjoining bank and covered the cable, which was usually laid above the ground.

Electric Telpherage.

In a publication under the above title, by G. W. Grossmith, M.C., issued by the Technical Section of the Association of Engineering and Shipbuilding Draughtsmen, the general design of electric telpher systems is considered, and typical selected examples are dealt with in detail. The advantages claimed for the telpher over other conveyor systems are, generally, that it has a comparatively small proportion of working parts, with consequent low maintenance costs, and that it is only in motion when there is useful work to be done. Calculations are given for obtaining the h.p. of the travelling motor, and the angle of bogie swivel, in addition to the necessary constructional dimensions for the various types of plant. The importance of obtaining correct balance for the bogies is stressed and the limits of accuracy for the different systems are defined. The top-rail and bottom-flange systems are briefly described and compared, and the designs for a 60-ft. span lattice girder and ordinary and open trestles are dealt with in detail. An interesting feature of the book is a description of the all-wheel-drive coal-handling plant installed at the Nechells power station of the Birmingham Corporation Electricity Department. Copies of the publication may be obtained from the Association Secretary, 96, St. George's Square, London, S.W.1, price 2s. each.

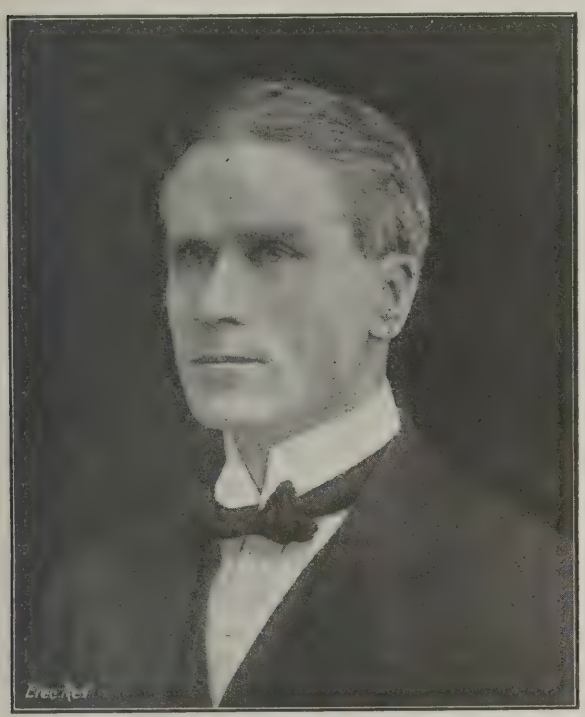
Incorporated Municipal Electrical Association.

ANNUAL CONVENTION.—The preliminary programme for the annual convention of the I.M.E.A. has now been issued. It will be held at Buxton, from May 30th to June 4th; on Tuesday, May 31st, the convention will be opened by the Mayor of Buxton, and Mr. R. W. L. Phillips, M.I.E.E., engineer and manager of the Bedford Corporation Electricity Department, will read his presidential address, which will be followed by a paper and discussion. In the afternoon the exhibition of electrical apparatus will be visited, the Mayor will entertain the visitors at tea in the Pavilion, Buxton Gardens, and in the evening the president will hold a reception. Papers and business meetings will occupy the following mornings, and visits to places of interest will be arranged for the afternoons, as usual. The annual dinner will take place on Thursday evening, June 2nd. Communications should be sent to the Secretary, Electric House, 38, High Street, Croydon.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

New Year Honours.—We offer our congratulations to two gentlemen well-known in the electrical world upon their inclusion in the List of New Year Honours. Mr. Duncan Watson, M.I.E.E., whose connection with the electrical contracting and manufacturing trades began very many years ago, and continues to-day as Duncan Watson & Co., and whose services rendered to Marylebone as chairman of the Borough Council Electricity Committee and subsequently as Mayor, stand out prominently in his career, has since late in 1925 been filling the important office of first chairman of the London and Home Counties Joint Electricity Authority. May Sir Duncan Watson live long to enjoy the honour of knighthood now conferred upon him. Mr. John Charles Walsham Reith, upon whom His Majesty also confers the honour of knighthood, is well known as managing director of the British Broadcasting Company, whose success during the pioneering years of the greatest and most rapidly developing undertaking ever known is fully recognised by electrical men.



Hana.] [*London.*

Sir Duncan Watson, M.I.E.E.

At Bangor borough electricity works, last week, Mr. C. H. GOODWIN, assistant electrical engineer of the city, was presented with a gold watch, subscribed for by the electricity works staff. The presentation was made by Mr. John Jones, the oldest workman, who was himself subsequently presented with an armchair. Mr. Price White, the borough gas and electrical engineer, presided.

Mr. W. E. C. LAMPERT, who was recently appointed assistant electrical engineer at Devonport Dockyard, was married at Plymouth, on December 29th, to Miss Lilian Glanfield.

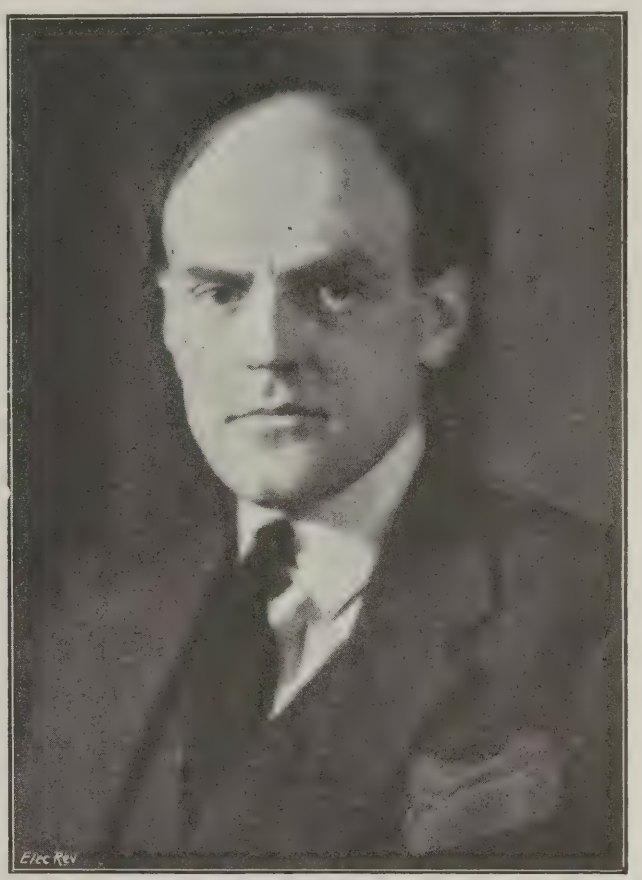
MR. STANLEY HODGKIN, joint managing director of the Pulsometer Engineering Co., Ltd., of Reading, on completing 50 years' association with the firm, has been presented by the senior members of the staff with a gold watch and a framed address. The presentation was made at a complimentary dinner at Mr. Hodgkin's residence, Old Southcote Lodge, Reading, when as guests of Mrs. Hodgkin a number of members of the staff were present. Mr. C. E. Hodgkin, who has been associated with his brother in the control of the business for 25 years, testified to his brother's qualities.

The Maidstone Town Council has appointed Mr. D. MACBEAN as constructional engineer and draughtsman for the electricity works extension.

Modern Transport states that Mr. J. DALRYMPLE has been asked to act as tramway adviser to the Johannesburg Municipality, and he has decided to proceed to South Africa when his investigations in South America are completed. As a farewell gift, the staff and employés of the Glasgow Corporation Tramway Department have presented Mr. Dalrymple with a cabinet and bookcase, and a dressing case for Mrs. Dalrymple.

We are informed that MR. WILLIAM WHITE has joined the Buenos Aires telephone organisation as chief installer, and not as chief engineer as stated in our issue of December 24th, p. 1045.

It is announced that Mr. E. R. PEACOCK has resigned his position as chairman of the Mexican Light and Power Co., Ltd., and the Mexico Tramways Co. on account of the pressure of other business; he will remain a director and continue to act as chairman of the Bondholders' Committee. He is succeeded by Mr. Millar Lash, K.C., legal adviser and vice-president of the companies. Mr. R. C. Brown has resigned the position of president of the two companies, remaining as vice-president, and is succeeded by Mr. G. R. G. Conway, managing director in Mexico, who will undertake the duties of both offices.



Sir John Reith.

Mr. WILFRED F. SANDS, of the Wolverhampton Corporation electricity staff, has been appointed assistant manager of the Electrical Distribution, Ltd., North Wales, and will be stationed at Llandudno Junction.

MR. D. ALAN STEVENSON, of the firm of D. & C. Stevenson, Edinburgh, has been appointed lighthouse engineer to the Government of India to advise on the reorganisation of the Indian lighthouse service, and to advise generally on the lighting of the coasts of India, Burma, and the Persian Gulf. Mr. Stevenson has sailed for India, and will be some months engaged there in advising the Government.

Mr. S. J. GODDARD, vice-president of the Western Union Telegraph Co.; Rear-Admiral C. P. R. COODE, C.B., D.S.O., general manager of the European Division; Mr. R. D. PAULIN, European traffic manager; and Mr. H. K. KINGSBURY, assistant general manager, went to Penzance to be guests of honour at the 33rd annual dinner and smoking concert of the local staff of the company on Saturday last. The dinner took place in the room in which the event was inaugurated on January 1st, 1888, and 31 diners sat down under the chairmanship of the superintendent of the Penzance station, Mr. T. O'Donoghue.

Science reports that Dr. W. D. COOLIDGE, assistant director of the research laboratory of the General Electric Company (America), has been awarded the Edison medal for 1926, by the American Institute of Electrical Engineers, "for the origination of ductile tungsten and the fundamental improvement of the X-ray tube."

Mr. W. VINCENT WAITE, M.I.Mech.E., A.M.I.E.E., has resigned his position of London manager to Messrs. Clayton Wagons, Ltd., and Messrs. Clayton & Shuttleworth, Ltd., and asks that communications be sent to his temporary address:—Room 75, Empire House, 175, Piccadilly, W.1.

Obituary.—M. GASTON SCIAMA.—The death occurred on November 24th last of M. Gaston Sciama, the general director of the Maison Breguet, of Paris, France. The deceased, who had been associated with the firm since 1884, was an ex-president of the Société Internationale des Electriciens.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

H. Lewis, Ltd.—Private company. Registered December 28th. Capital £2,000 in £1 shares (1,000 7½ per cent. cumulative preference and 1,000 ordinary). Objects: To acquire the business of an electrical and mechanical engineer, &c., now carried on by H. Lewis at Wisbech, Cambs., as "H. Lewis." The permanent directors are:—H. Lewis, 5, North Street, Old Market, Wisbech; Mrs. Margaret G. Lewis, 5, North Street, Old Market, Wisbech. Qualification, £100 shares. Solicitors: Ollard & Ollard, Wisbech.

Continental Hydro-Electric Co., Ltd.—Private company. Registered December 28th. Capital, £20,000 in £1 shares. Objects: To seek for, prospect and test means and facilities in all parts of the world for the generation, utilisation, manufacture, distribution and supply of light, heat, sound, power and energy by the utilisation of rivers, watersheds, seas and water supplies and any other natural or other resources, to dispatch and supply commissioners, investigators, experts and agents, to carry out any works deemed expedient, to carry on the business of suppliers of electricity, &c. The provisional directors are:—B. C. Pearson, 47, Parliament Street, S.W., director of public companies; C. S. Gulbenkiau, 27, Quai d'Orsay, Paris, director of public companies. No qualification required. Solicitor: H. Davey, 47, Parliament Street, S.W.1.

J. R. Jennens, Ltd.—Private company. Registered December 28th. Capital £500 in £1 shares. Objects: To carry on the business of wireless apparatus manufacturers and dealers, &c. The first directors are:—J. R. Jennens, 51, Earlsbury Gardens, Handsworth, Birmingham; F. Stickley, 138, Winson Green Road, Birmingham; F. G. Layland, 42, Kentish Road, Handsworth; J. H. Jennens, 226, Boldmere Road, Wylde Green, Birmingham, manufacturer. Qualification, 50 shares. Solicitor: R. E. Parr, 83, Colmore Row. Registered office: 13, Jennens Row, Birmingham.

Elliott's Electrical Construction Co., Ltd.—Private company. Registered December 23rd. Capital, £1,000 in £1 shares. Objects: To acquire the business of an electrical contractor and engineer now carried on by A. J. Elliott at Coronation Buildings, High Street, Gateshead. The directors are:—A. J. Elliott, 113, Biddlestone Road, Heaton, Newcastle-on-Tyne; J. E. Stephenson, Highcliff, Windsor Crescent, Whitley Bay. Secretary: J. E. Stephenson. Registered office: Coronation Buildings, 136, High Street, Gateshead.

Solidite and Synthetic Mouldings, Ltd.—Private company. Registered December 24th. Capital, £20,000 in £1 shares. Objects:—To adopt an agreement with J. A. Swain and to carry on the business of manufacturers of and dealers in the preparations known as "solidite," and all improvements therein, and all goods to which solidite may be applicable, manufacturers of and dealers in india-rubber, vulcanite, ebonite, fibres, tires, chemicals and drugs, glassblowers, &c. The subscribers (each with one share) are:—L. R. Shaw, 4, Broad Street Place, E.C., accountant; B. Reynolds, 22, Dalmeny Avenue, N.7, accountant. First directors:—Sir C. S. Forbes, Bart., 25, Holland Park, W.11; T. E. Slaughter and A. J. Swain. Qualification, £1. Solicitors: Hoale, Smith & Field, 4, Broad Street Place, E.C.2.

Reliance Trading Co. (Liverpool), Ltd.—Private company. Registered December 24th. Capital £100 in £1 shares. Objects: To carry on the business of electrical, mechanical, marine engineering, aeronautical and general agents, manufacturers of and dealers in electrical plant and appliances, and wireless plant and accessories, &c. The subscribers (each with one share) are:—S. A. Romain, 31, Brompton Avenue, Liverpool, manufacturers' agent; P. Bredsni, 26, Montague Street, Liverpool, meat salesman. The first directors are to be appointed by the subscribers. Qualification, 25 fully-paid shares. Remuneration as fixed by the company. Secretary: S. R. Ashcroft, 36, Kirkdale Vale, Liverpool.

Husbands, Hart & Warburton, Ltd.—Private company. Registered January 3rd. Capital, £3,000 in £1 shares. Objects:—To acquire the business of electrical engineers or otherwise, carried on as "Husbands, Hart & Warburton," at City Road Mills, Derby, and elsewhere. The permanent directors are:—J. Husbands, 15, Chestnut Avenue; H. H. Hart, The Cottage, Alfreton Road; G. F. Warburton, Belper Road, all of Derby. Qualification, 25 shares. Solicitor: W. H. M. Marsden, 42, Full Street, Derby.

Foster-Boynton & Co., Ltd.—Private company. Registered January 1st. Capital, £300 in £1 shares. Objects:—To carry on the business of manufacturers of, or dealers in radio, cycles, and component parts thereof, &c. The directors are:—D. W. Foster, 1108, Stratford Road, Hall Green, Birmingham; H. Boynton, 4, Woodstock Road, Moseley, Birmingham. Qualification, 1 share. Registered office: 70, Lombard Street, Birmingham.

Maitland & Co. (Manchester), Ltd.—Private company. Registered January 3rd. Capital, £3,000 in £1 shares. Objects:—To acquire the business of an electrician, electrical engineer and contractor carried on by J. W. Maitland at 29, Princess Street, Manchester, as "Maitland & Co.," and to carry on the same and the business of armature winders, manufacturers of, and dealers in radio and other apparatus, &c. The subscribers (each with one share) are:—J. W. Maitland, 29, Princess Street, Manchester, electrical engineer; A. W. Maitland, Silver Street, Bury, solicitor. J. W. Maitland is permanent governing director, subject to holding a third of the issued capital, with power to appoint other directors. Qualification, after termination of original management, £100. Remuneration, after termination of original management, as fixed by the company. Solicitor: P. S. Howarth, Silver Street, Bury.

Official Returns of Electrical Companies.

Bastian Electric Co., Ltd.—H. G. Ash, of Finsbury Court, Finsbury Pavement, E.C.2, ceased to act as receiver or manager on December 15th, 1926.

Goswell Engineering Co., Ltd.—Debenture dated December 13th, 1926, to secure £300, charged on the company's undertaking and property, present and future. Holder: A. P. Barry, The Old Court House, Limpsfield.

General Radio Co., Ltd.—Satisfaction in full on November 18th, 1926, of debentures, second series dated June 2nd, 1925, securing £1,500.

J. H. Nott & Sons, Ltd.—Mortgage on Wessex Works, Frome, with machinery, &c., dated December 14th, 1926, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

Townson & Chadwick, Ltd.—E. Price, of Daisey Hill, Adlington, late of Cross Street, Manchester, ceased to act as receiver on November 26th, 1926.

Finston Manufacturing Co., Ltd.—Issue on November 23rd, 1926, of £500 debentures, part of a series already registered.

V. Badman, Ltd.—Debenture dated November 30th, 1926, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: V. Badman, 88, Western Road, Southall.

Ebonite Container Co., Ltd.—Satisfaction in full on November 10th, 1926, of charge dated January 20th, 1925, securing £1,500.

Grierson, Ltd.—Capital, £10,000 in 6,000 ordinary and 4,000 preference shares of £1 each. Return dated November 30th, 1926. 2,501 ordinary shares taken up. £2,501 paid. Mortgages and charges, nil.

Frinton-on-Sea and District Electric Light and Power Co., Ltd.—Capital, £10,000 in 7,300 preference and 2,700 ordinary shares of £1 each. Return dated November 16th, 1926. All shares taken up. £10,000 paid. Mortgages and charges, £4,000.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—Capital, £50,005 in 5 preference shares of £1 each and 100,000 ordinary shares of 10s. each. Return dated July 16th, 1926. 100,000 ordinary shares taken up. £3 10s. paid. £49,996 10s. considered as paid. Mortgages and charges, £111,235.

Electro-Mechanical Brake Co., Ltd.—Capital, £30,000 in 2,500 preference and 27,500 ordinary shares of £1 each. Return dated November 29th, 1926. 1,500 preference and 26,500 ordinary shares taken up. £21,965 paid on 1,500 preference and 20,645 ordinary shares. £6,035 considered as paid on 6,035 ordinary shares. Mortgages and charges, £7,500.

City Notes.

Edison Swan Electric Co., Ltd.

The annual meeting was held on December 29th. Mr. W. Shearer (chairman) presided, and in moving the adoption of the report (*vide* our last issue, p. 1086), said that as he and the majority of his colleagues had only been directors for some two or three months it would not be possible for him to present any elaborate or detailed review of the affairs of the company. They were fortunate in still having with them two of the old directors, Mr. C. H. Cox and Mr. E. A. Gimingham. Commenting on the balance sheet, he said that the item of patents, goodwill, &c., had been reduced during the year by £59,504, and the figure stood at £86,000 less than in 1923. Investments had increased during the year by reason of the shares which they had taken in the Edison Swan Cables, Ltd. They now held the whole of the ordinary shares in that company, and since they had become actively identified with the management of that concern considerable progress had been made. The output had been speeded up, the selling organisation had been improved, and they had taken over the principal selling agency. The works were now running at their full capacity, and considerable extensions were in contemplation. They looked upon that business as a sound acquisition, and one which had excellent prospects. Stocks, which included work in progress, amounted in the aggregate to £227,075. The reserve account was £50,000 more than at the corresponding date last year, and now stood at £130,000. The profits shown were not quite so favourable as those of the preceding year, which was an exceptionally good one. Having regard to the fact that the general strike occurred in the period covered by the accounts and that the last two months of the year's trading was affected by the coal dispute, he did not think the shareholders had any cause to be dissatisfied with the figures. As to the prospects for the current year, the labour disputes which continued for five months of the period had naturally had a detrimental effect upon the business, but he was pleased to tell them that since the termination of the coal trouble sales had increased very satisfactorily, and it was to be hoped that the improvement would be maintained notwithstanding the attenuated demand which would probably be experienced for some time. In conclusion, he paid a tribute to the work of the late board, who, he said, had had a very heavy task to perform during the last three years. In particular their thanks were due to the late chairman, Mr. C. F. Spencer. They had been endeavouring to induce him to rejoin the board and take up his old position again as chairman, and he (the chairman) was hopeful that he would do so at an early date. The report was adopted.

Low Temperature Carbonisation, Ltd.

The annual meeting was held on December 31st, Sir Arthur Wheeler, Bt. (chairman), presiding. In his address the chairman referred to the reorganisation which had taken place during the year, and said that the board comprised, in addition to himself, Messrs. W. H. Behrens, H. Langham-Reed, F. R. Wade, and R. P. Wilson. The new working capital provided by the issue of prior lien debenture stock was £135,000 net. The reconstruction of the Barnsley works was in progress; 160 retorts with a carbonising capacity of 250 tons per day were being erected, and within a few months it should be proved whether the profits anticipated could be realised in actual working practice. One battery of retorts should be in commission by the middle of March, and by the end of May the company hoped to be turning out between 400 and 500 tons of "coalite" and other by-products per week. He had every confidence in the future of the company and the "Parker" process, and claimed that the amount of rich gas which could be produced by the system would have an enormous influence upon the cost of generation of electric power. In conclusion, the chairman said that the company's year ended on July 31st next, and they hoped to issue a report and accounts early in the autumn.

Telephone Co. of Pernambuco, Ltd.

This week the company issued for information only a statement of its capitalisation and objects. The company has a share capital of £200,000, of which £100,000 has been issued. The vendor of the telephone business in Pernambuco received £10,000 in cash and 7,000 ordinary shares of £1 each. Under an agreement made in 1914 with the Pernambuco Tramways and Power Co., Ltd., that company agreed to take up 54,990 7 per cent. cumulative preference shares of £1 each, and in consideration of this the company was allotted 25,000 ordinary shares of £1 each as commission. The authorised debenture capital amounts to £200,000, and of this £150,000 has been issued to the Pernambuco Tramways & Power Co., Ltd., which has received as consideration 13,000 fully-paid ordinary shares.

North Metropolitan Electric Power Supply Co.

The company has decided to redeem the £250,000 8 per cent. cumulative preference stock on July 1st, 1927. It is intended to make an issue of other stock or shares into which he holders of the 8 per cent. stock will be able to exchange their holdings.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Compania de Electricidad de la Provincia de Buenos Aires, Ltd.—131,250 ordinary shares of £2 each, fully paid, Nos. 1 to 131,250.

The undermentioned have been ordered to be officially quoted:—

Compania de Electricidad de la Provincia de Buenos Aires.—131,250 ordinary shares of £2 each, fully paid, Nos. 1 to 131,250.

United River Plate Telephone Co.—152,000 ordinary shares of £5 each, fully paid, Nos. 912,001 to 1,064,000.

Japanese Electric Bond and Share Co.

The American Press reported last week that a company had been formed with the above title, representing Japanese, American, and English interests. The initial capital will be 10 million yen, of which 25 per cent. will be paid up immediately. The parties concerned in the matter are the Tokyo Electric Light Co., the Toho Electric Power Co., the Tokyo Marine and Fire Insurance Co., the Yasuda Holding Co., the Mitsui interests, the Guaranty Co. of New York, the International General Electric Co., the Electric Bond and Share Co., Lazard Bros. & Co. (London and New York), Sale & Co., and the Whitehall Trust.

Yorkshire Electric Power Co.

The company has deposited at the Private Bill Office of the House of Commons a Bill enabling it to increase its authorised capital by £2,000,000 by the creation of new ordinary or preference shares. It is also sought to increase the company's borrowing powers up to one-half of the issued capital.

Simms Motor Units, Ltd.

The directors have contradicted a report, circulated last week, that an offer had been made to purchase the company's shares at prices far in excess of those ruling in the market.

French Companies.

The *Société des Exploitations Electriques* reports net profits of 2,042,000 fr.; the dividend is at the rate of 17 fr. per share.

The *Société Alsacienne et Lorraine d'Electricité* reports net profits of 2,906,000 fr. for 1925-26, as against 2,809,000 fr. in the previous year. A dividend of 8½ per cent. has been declared.

Greenwood & Batley, Ltd.

An interim dividend of 2½ per cent. has been declared, as in 1922.

Quebec Railway, Light, Heat and Power Co.

A dividend of $1 per common share has been declared.

Stocks and Shares.

MONDAY EVENING.

THE New Year in the Stock Exchange markets opened with a cheerfulness that amounted to something akin to buoyancy in the case of investment stocks. The cause is traceable to the offer by the Government of a new issue of 4 per cent. consolidated stock at what seems to be the relatively high price of 85, such sinking-fund provisions being attached to the loan as render the latter likely to prove generally popular. The immediate effect was to strengthen quotations for existing securities of the gilt-edged order, and this served to impart a strong tone to investment prices in most of the markets. The London Power debenture, for instance, has strengthened to 2 premium, stock still being on offer at 97¼ free of stamp and fee, and carrying a three-months' interest payment due on April 1st. The return is the modest one of £5 2s. 6d. per cent. on the money, but the security is irreproachable, and it is stocks which have a character of this description that are in active demand.

During the first week of the New Year it is customary for Stock Exchange prices to exhibit a good deal of strength, owing to the fact that people feel more hopeful on the turning-over of a new leaf, besides feeling themselves released from the necessity of building up big balances at the banks. Later on in the spring there comes into operation the effect of sales made for the purpose of providing money wherewith to meet income tax demands, added to which there arise uncertainties in regard to the Budget. At the moment, however, pointers suggest cheaper money in the near future, and, as already mentioned, markets in most parts of the Stock Exchange are

cheerful, with business amongst investment stocks exhibiting noticeable activity.

The amount of new capital raised in London during 1926 was 230¾ million pounds, as compared with 232 millions in the previous year. Electric light, power and telegraph companies took £13,667,800 last year, against rather under eight millions in the previous twelve months the final quarter of the year 1926 calling for more money than the rest of the nine months put together. The new issues were taken in most cases with readiness, and in all such instances as those where sound security was offered at a reasonable price, subscription lists were closed in advance of the advertised time.

The New Year has started with indications that more capital will be required before long by some of the electricity supply companies. The East Anglian Electric Supply Company has a Bill to come before Parliament in the next session, the object of which is to extend the supply of electricity within Norfolk, Suffolk, and a large part of Essex. The Yorkshire Electric Power Company's Bill deposited in the House of Commons, proposes to empower the company to raise additional capital to the extent of two million pounds by the issue of ordinary or preference shares. Borrowing powers are also sought to the extent of one-half of the capital raised. The Bognor Gas Light and Coke Company is altering its name to the Bognor Gas & Electricity Company, and Parliament is being asked to grant permission for the company to supply electricity in West Sussex.

Last year's experience showed that, in spite of the demands for new capital, these had little apparent influence upon prices of existing stocks and shares. With the new issues made by manufacturing companies, the fact of the new shares being offered at what are called bonus prices assisted in the rises that occurred in this section. It is expected that several of the electricity supply companies, now that their finances are established upon a firm forty years' basis, will take an early opportunity for spending fresh capital, though the manner in which this will be raised is at present in doubt. It is impossible to imagine that a new authority such as that created by the London Electricity Acts will fail to follow in the familiar footsteps of other similar bodies in the matter of raising money.

Metropolitan Electrics are quoted ex rights, and so are Brompton ordinary, the prices being 26s. and 25s., respectively. No changes have occurred in the list of ordinary shares since the old year. Notting Hill preference at 10 ex dividend have recovered the distribution.

The surprising developments whereby telephonic communication has been established with New York, and the expectation that this will be extended to Australia very shortly, have failed to energise the price of Marconi shares, which remains dull at 13s. 9d. The auditors' investigations are known to be practically complete, and the report should be out before these notes appear. The company has notified that the statements concerning Australian beam service tests are unauthorised, but add that the preliminary tests, so far carried out, have been highly successful.

The cable market at a whole is quiet, with a slight improvement in Globe ordinary to 18⅝. The company has declared its usual quarterly dividends of 3s., less tax, on the preference, and 5s. net on the ordinary shares. The Chili Telephone Company announces an interim dividend of 6 per cent. tax free, payable January 15th, the same rate as that of a year ago, and the price remains unchanged at 6¾.

In the manufacturing group, there has been a trifling setback in Johnson & Phillips to 58s. 9d. On the other hand, Metropolitan-Vickers ordinary rose 3s. 9d. to 26s. 3d., upon announcement of some excellent contracts which the company has secured. Edison Swan continue dull, the price going back to 10s. in consequence of the contraction of £17,000 shown in the profit for the year ended June, 1926. Callenders are 1/16th off at 3⅜; Henleys fell ⅛ to 4¼. The interest recently aroused in the market has subsided to some extent, but prices continue firm as a whole, and there is a steady demand for General Electrics and others of this character. Babcock and Wilcox are better, a fairly general improvement taking place at the opening of the year in the shares of iron, coal and kindred companies. Hopefulness is the pervading note in most of the speeches and messages made by the principal industrialists, and it is felt that justification exists for this, in view of the conclusion of the coal stoppage and the knowledge that business is returning to the country's main arteries of commerce.

The Home Railway market has benefited with the rest. Rises have occurred in Metropolitans, in Districts, and in Underground Electric shares. At the extreme close of last year, an all-round recovery took place in the stocks of the steam railways, but these improvements have not been held in their entirety. The Southern and several of the other railways have in contemplation big schemes of extension, which will involve, it is known, the expenditure of substantial sums upon electrical equipment.

In the foreign group, Brazilian Tractions are better at 108½ and Anglo-Argentine Tramways preference shares, quoted ex dividend, retain the improvements that they secured at the end of last year. A good deal of hesitation is felt in connection with Mexicans. British Columbia Electric stocks met with support, in spite of the slight reduction in the dividend on the preferred. Rubber shares are better, on the whole, thanks to the impression that the price of the raw material will improve if the exportable allowance is again reduced—and there are prospects of such a step being taken—from the beginning of next month.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1924.	1925.	Price Jan. 3 1927.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	14	14	60/6	—	4 12 7
Brompton Ordinary	1	10	10	25/-xr	—	5 12 0
Charing Cross Ordinary	1	15	15	25/-xr	—	5 12 0
do. do. 4½ Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	25/-	—	5 12 0
City of London	1	15	15	2⅛	—	... ...
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/-	—	5 14 4
County of London	1	15	15	26/-xr	—	... ...
do. do. 6% Pref.	1	6	6	22 6xd	—	5 6 8
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	30/6	—	6 11 2
Kensington Ordinary	1	15	15	24/-	—	5 16 8
Lancs. Light and Power	1	7½	7½	24/-	—	6 2 5
London Electric	1	10	10	24/-xr	—	5 17 8
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	26/-xr	—	5 7 8
do. 4½% Pref.	1	4½	4½	17/-xd	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 8
Newcastle-on-Tyne Ordinary ...	1	7	7	21/3	—	6 11 9
do. 5% Pref. ...	1	5	5	17/-xr	—	5 14 8
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10xd	+½	6 0 0
North Met. Elec. 6% Pref. ...	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	24/-	—	5 16 8
South London	1	15	15	24/6-xr	—	6 3 0
South Metropolitan Pref.	1	7	7	1¼	—	6 3 0
Urban Ordinary	1	4	7	1⅛	—	5 17 11
do. 6 % Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	24/6	—	5 14 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	64½	+1½	7 15 0
do. District	,,	3½	3½	58	+½	6 0 8
Underground Electric	£1	Nil	Nil	12/6	+6d.	Nil
do. do. Income ...	Bonds	6	6	103	—	*5 17 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 18 10
do. Def.	,,	1½	1½	25	—	6 0 0
Automatic Telephone	1	8	10	2⅛	—	8 14 4
Chili Telephone	5	5	6	6¾	—	4 7 4
Cuba Sub. Ord.	10	5	5	7	—	7 5 6
Eastern Extension	10	10	10	17⅞	—	*5 11 4
Eastern Tel. Ord.	Stock	10	10	17⅞	—	*5 12 1
Globe Tel. and T. Ord.	10	10	10	18⅝xd	+⅛	*5 7 5
do. do. Pref.	10	6	6	11xd	—	5 9 1
Great Northern Tel.	10	22	20	27	—	7 8 2
Indo-European	25	8½	10	47½	—	*5 5 10
Marconi	1	10	Nil	⅛	—	... ...
Marconi-Marine	1	10	7½	1⅜	—	6 13 4
Oriental Telephone Ord.	1	12	12	2⅞	—	*4 18 4
United R. Plate Tel.	5	8	8	7⅞	—	*5 2 3
Western Telegraph	10	10	10	17¼	—	*5 16 0

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	2⅞xd	—	9 11 4
do. do. 2nd Pref. ...	5	6	6	2 13/16xd	—	10 13 4
do. do. 5% Deb. ...	Stock	5	5	66½	—	7 12 8
British Electric Traction Ord. ...	,,	7	8	144½	—	5 10 9
do. do. 6% Pref. ...	,,	6	6	109	—	5 10 1
Brazil Traction	100	4	5	108½	+2½	4 12 2
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	88½	—	5 14 3
do. do. Preferred ...	,,	96/-	136/9	117½xd	—	*5 6 8
do. do. Deferred ...	,,	129/5	8	146½xd	—	*5 9 3
do. do. Deb. ...	,,	4½	4½	79½	—	5 8 3
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	7/-	+6d.	Nil
London United Tram. Deb. ...	Stock	4	4	42½xd	+1½	9 8 4
Mexico Trams, 5% Bonds	—	5	5	63½	—	8 0 0
Mexican Light Common	100	Nil	Nil	8½	—	Nil
do. Pref.	100	Nil	Nil	7⅝	—	Nil
do. 1st Bonds	—	5	5	64½	—	7 15 0
Yorkshire (West Riding)	1	5	—	12/6	—	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	18	52/6	—	4 19 1
British Aluminium Ord.	1	5	10	48/-	—	4 3 4
British Elec. Transformer Pref. ...	1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	1	15	15	67/6	—	4 9 0
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	8⅜	—⅛	4 9 0
do. 6½% Pref.... ...	1	6½	6½	23/9xd	+6d.	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	£/-	10	10	10/-xd	-1/-	4 0 0
do. 5% Deb.	Stock	5	5	84xd	—	5 19 1
Electric Construction	1	10	10	31/3	—	6 8 0
Enfield Cable Pref.	1	7½	7½	1¼xd	+1/32	6 6 4
English Electric	1	5	Nil	15/-	—	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	22/6	—	5 15 7
do. Ord.	1	5	7½	31/-	—	4 16 9
Henley	1	16	20	4¼xd	—⅛	4 14 1
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1 1/16	—	*4 14 1
Johnson & Phillips	1	10	17½	2 1/16	—1/16	5 19 1
Met.-Vickers Ord.	1	8	8	26/3	+3/16	6 2 0
do. Pref.	2	8	8	2 3/16	—	6 18 4
Siemens Ord.	1	7½	7½	1¼	—	5 0 0
Telegraph Construction	12	20	10	29½	—	*4 1 4

*Dividends paid free of Income Tax.

The Foreign Electrical Trade of Denmark.

The Last Two Years' Imports and Exports Compared.

THE following table shows Denmark's imports and exports of electrical machinery and apparatus in 1924 and 1925, indicating the principal countries of origin or destination. A note of increases and decreases is also given. Denmark is, on the whole, still more of an importer than an exporter of these goods. She does a very large and growing oversea business in batteries and cells. Imports of machinery declined, while exports of dynamos and motors advanced in 1925, and exceeded the total imports in that class. It will be noticed that although exports of electric wire and cable show fair increases, they are still considerably below the value of imports, which in 1925 marked a very large advance on 1924. Material for lighting installations (switches, fuses, &c.) is still imported in greater quantity than it is exported.

Imports.

	1924. Kr. (1,000).	1925. Kr. (1,000).	Inc. or dec. Kr. (1,000).
Electric cables—			
Total	536	1,506	+ 970
From Germany	400	1,148	+ 748
,, Holland	51	347	+ 296
,, Switzerland	60	(a)	—
Insulated wire—			
Total	1,380	1,904	+ 524
From Germany	553	1,124	+ 571
,, Sweden	100	115	+ 15
,, Holland	416	346	− 70
,, Belgium	126	71	− 55
,, United Kingdom	68	65	− 3
,, United States	61	112	+ 51
Accumulators and plates—			
Total	972	1,135	+ 163
From United States	143	322	+ 179
,, Germany	91	682	+ 591
,, United Kingdom	37	94	+ 57
Installation material (switches, lamp holders, fuses, &c.)—			
Total	1,127	1,518	+ 391
From Germany	968	1,231	+ 263
,, United Kingdom	46	130	+ 84
,, Sweden	57	55	− 2
,, United States	32	46	+ 14
Dynamo lighting sets, ignition magnetos, &c.—			
Total	(a)	595	—
From Germany	(a)	386	—
,, United States	(a)	193	—
Batteries and cells—			
Total	685	870	+ 185
From Germany	460	538	+ 78
,, United States	138	263	+ 125
,, United Kingdom	60	38	− 22
Radio apparatus—			
Total	(a)	3,300	—
From Germany	(a)	1,600	—
,, United Kingdom	(a)	722	—
,, Holland	(a)	473	—
Electrical machinery and apparatus not elsewhere specified—			
Total	1,911	497	−1,414
From Germany	914	297	− 617
,, United Kingdom	334	49	− 285
,, Sweden	382	19	− 363
,, United States	87	94	+ 7
Dynamos, generators, motors, transformers, stators, armatures, rotors, &c.—			
Total	3,816(b)	2,669	−1,147
From Germany	1,500	1,359	− 141
,, United Kingdom	859	518	− 341
,, Sweden	824	146	− 678
,, United States	500	463	− 37
Telephone apparatus—			
Total	396	125	− 271
From Sweden	199	32	− 167
,, Germany	132	66	− 66
,, United Kingdom	39	9	− 30
Electrical measuring instruments—			
Total	827	539	− 288
From Germany	698	491	− 207
,, United Kingdom	62	(a)	—
Other electrical instruments—			
Total (mainly from Germany)	22	49	+ 27

(a) Not separately distinguished.
(b) Vacuum cleaners included in 1924.

Exports.

	1924. Kr. (1,000).	1925. Kr. (1,000).	Inc. or dec. Kr. (1,000).
Electric cables—			
Total	841	1,051	+ 210
To British South Africa	151	312	+ 161
,, Poland	176	270	+ 94
,, Norway	140	120	− 20
,, Sweden	83	141	+ 58
Insulated wire—			
Total	259	297	+ 38
To Holland	72	105	+ 33
,, Belgium	87	67	− 20
Motors and dynamos—			
Total	2,413	2,737	+ 324
To Sweden	228	507	+ 279
,, Great Britain	410	367	− 43
,, Norway	253	277	+ 24
,, France	32	247	+ 215
,, Italy	23	237	+ 214
,, Argentina	83	130	+ 47
,, China	288	188	− 100
,, Asia Minor and Syria	—	110	+ 110
,, Spain	367	67	− 300
Telephone apparatus—			
Total	45	49	+ 4
To Holland	23	—	− 23
Electrical measuring instruments—			
Total	100	61	− 39
To China	39	33	− 6
,, Great Britain	10	10	—
Installation material (switches, lampholders, &c.)—			
Total	1,192	900	− 292
To Sweden	380	322	− 58
,, Belgium	107	128	+ 21
,, Great Britain	43	64	+ 21
,, China	51	65	+ 14
,, Norway	51	70	+ 19
Batteries and cells (including flash-lamps)—			
Total	5,147	6,389	+1,242
To Great Britain	1,293	1,971	+ 678
,, Norway	350	529	+ 179
,, Sweden	724	1,097	+ 373
,, Finland	407	402	− 5
,, Holland	165	176	+ 11
,, Belgium	502	357	− 145
,, Spain	327	535	+ 208
,, Argentina	291	143	− 148
,, British South Africa	167	166	− 1
,, Australia	356	519	+ 163
Electrical machinery and apparatus, not elsewhere specified—			
Total	849	643	− 206
To Great Britain	122	98	− 24
,, Sweden	226	94	− 132
,, Holland	55	97	+ 42
,, China	36	89	+ 53
,, Japan	41	57	+ 16
,, Finland	39	49	+ 10
,, Russia	149	21	− 128
Wireless apparatus—			
Total	(a)	510	—
To Sweden	(a)	218	—
,, Greenland	(a)	118	—
,, Iceland	(a)	59	—
Electrical porcelain goods—			
Total	272	433	+ 161
To Spain	—	114	+ 114
,, Belgium	57	94	+ 37
,, Russia	—	69	+ 69
,, Great Britain	57	62	+ 5
,, Switzerland	86	—	− 86

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

New Mining Switchgear.

A recent production of MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, London, S.E.7, is a new design of mining switchgear of the draw-out pattern, for 300-A loading at 3,300 V. It is made in units arranged for connecting up in switchboard form, and compensation is provided in each bus-bar chamber for any unevenness in the floor levels of adjacent units. The apparatus consists mainly of two parts, the bus-bar chamber and an oil circuit breaker. The former is arranged as a switchboard when a number of units are employed, and as a cable-sealing chamber when only a single unit is used. The oil circuit breaker is equipped with rollers which run on rails to allow the breaker to be withdrawn. Its travel is limited, but it may be lifted from the rails for repairs. The trips are adjusted by a simple device on the top of the breaker, so that it is not necessary to remove the oil tank or main covers to alter the trip settings. Safety interlocking is provided throughout the apparatus, and the usual instruments and automatic features are included. Fig. 1 shows a unit

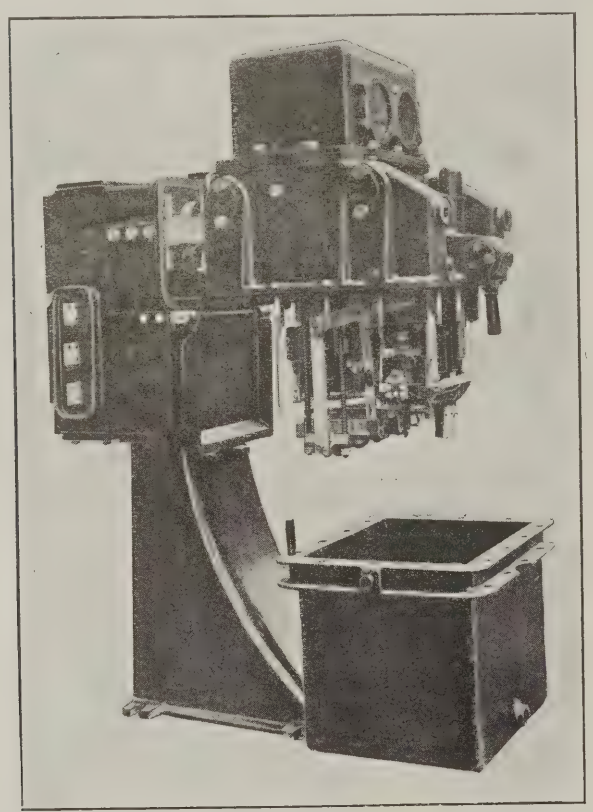


Fig. 1.—Mining Switchgear Unit.

with the breaker withdrawn and the tank removed. Series overload coils with a time-limit attachments can be fitted for any capacity up to the maximum scheduled rating, and self-setting low-voltage releases, or earth leakage trips, may also be provided.

A Motorless Refrigerator.

To assist in meeting the demand for a small refrigerating plant large enough to be of practical use and simple enough to be easily worked by unskilled labour, the PULSOMETER ENGINEERING CO., LTD., Nine Elms Iron Works, Reading, has developed a motorless apparatus, the "Pulsometer" refrigerator, fig. 2. It requires only a small amount of power for heating which can be provided electrically. As there are no moving parts, the equipment has the advantage of being, it is claimed, absolutely silent. The only refrigerating medium is securely confined in the machine, and is claimed to never need replenishing. The only attention required is with regard to the heating and the circulating water; the control of the former is arranged automatically, and the heating circuit is "on" for about 1¾ hours per day. The plant consists merely of a sealed system of containers and pipes, allowing no escape of its contents. The safe is thoroughly heat insulated, and its inside walls are water and damp proof. The apparatus is simple to install, the only requirements being suitable housing, and water and electric connections.

The cooling is effected by the expansion of a certain chemical vapour, dissolved in water, which readily leaves the water on the application of heat, and after it has done its work of cooling is condensed and re-dissolved in the water. On leaving the solution the vapour passes gradually into the special arrangement of pipes fixed inside the safe. When the heating is cut off and the circulation diverted, the cooling period starts. The refrigerant, which has been driven from the boiler into the evaporator in liquid form, then turns into gas and absorbs heat from the cabinet, returning slowly to

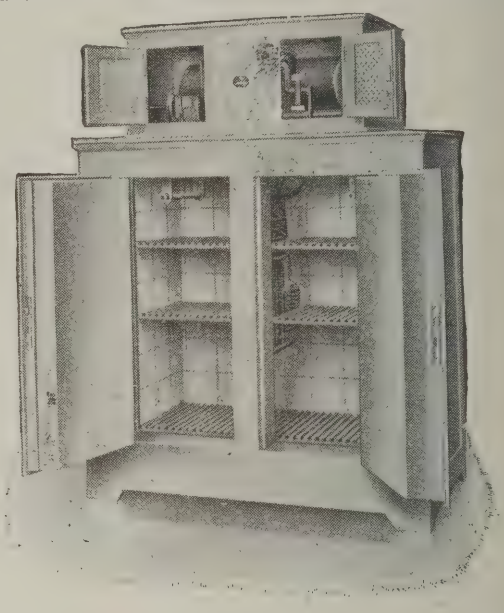


Fig. 2.—"Pulsometer" Refrigerator.

the boiler where it becomes once more absorbed in the original solution. The process of evaporation is gradual, and consequently the cooling continues for a considerable time. Where the advantages of electric heating are denied, other forms of heating can be arranged for.

A Short Rope Drive.

What should prove of interest to the textile industries is a new system of rope drive, the Texrope, introduced by MESSRS. FRANK WIGGLESWORTH & CO., LTD., Shipley, Yorks., which is claimed to permit unusually short distances between the drive centres. It consists essentially of driving and driven sheaves both V-grooved for a number of Texropes. These are of a specially designed material which acts as a cushioning medium. They are wedge-shaped and stretch slightly so as to pull into the grooves gradually when starting. They do not touch the

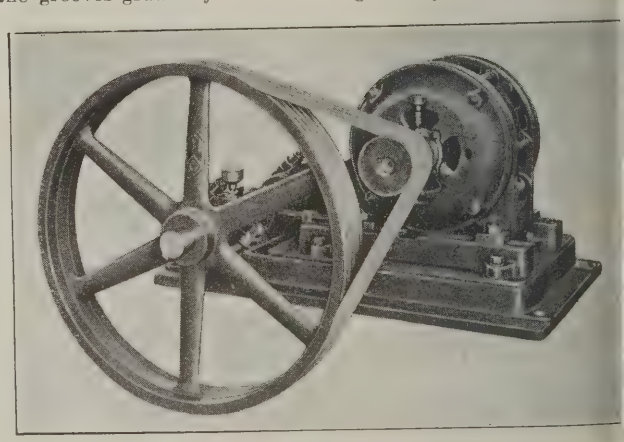


Fig. 3.—A "Texrope" Drive.

bottom of the grooves, being of trapezoidal cross section, so that at high speed no air is trapped to reduce the grip and driving power. These driving mediums are constructed as endless "belts," and are claimed to be more efficient than the ordinary V-belt. Another advantage claimed for this drive is that no lubrication is required, an important feature for drives in such places as food factories. There appears to be no limit to the shortness between the drive centres provided the minimum arc of contact on either sheave is not less than 120 deg. This will no doubt prove a desirable qualification in those cases where direct electric drive is not advisable. Fig. 3 shows a typical Texrope drive.

A Capacitance Bridge and New Inductometer.

A Simple, Self-contained Instrument of Wide Range with a Novel Scale System.

(Abstract of Paper read before the PHYSICAL SOCIETY OF LONDON.)

FOR the accurate measurement of capacitance, Mr. Albert Campbell introduced in 1907 Heydweiller's modification of Carey Foster's method, using as standard a mutual inductometer calibrated against a mutual inductance calculated from its dimensions. This method still holds its place as one of the best for precision measurements of capacitance and power factor, but it requires a rather large set of resistances if a wide range of values is to be dealt with. For tests which do not require the highest accuracy Mr. Campbell has designed a simple self-contained bridge which affords a quick and convenient means of measuring capacitance over a long range, also indicating the power factor with fair accuracy except in extreme cases, and he recently described it in a short paper before the PHYSICAL SOCIETY.

The method consists in placing an unknown condenser C in parallel with a known non-inductive resistance P, and reading the effective self-inductance and resistance of the combination by means of a bridge containing a mutual inductometer; C is obtained directly by multiplying the reading L of the inductometer by $1/P^2$, which factor is conveniently chosen to be some power of 10, so making the scale read the capacitance practically directly. The method has been designed for the convenient determination of capacitance, and treats power factor only as a secondary consideration. If P is not non-inductive, its self-inductance l can be kept so small that corrections are unnecessary in general.

The present model is arranged, as in fig. 1, with equal ratio arms (R=S), P and Q being equal resistances in the other arms, which also include H and K, the two sections of the secondary winding of the mutual inductometer, which are made identical in resistance and self-inductance. The inductometer scale is marked to read L directly, usually extending from −10 to +105 microhenries; the resistances P and Q can be simultaneously altered by a step-switch, giving a series of values, 3.162, 10, 31.62, 100, 316.2 and 1,000 ohms, which give scale ranges of 100$\mu\mu$F, 1,000$\mu\mu$F . . . up to 10 microfarads. Two fixed steps on the inductometer carry each range to three times the above, giving a total range from

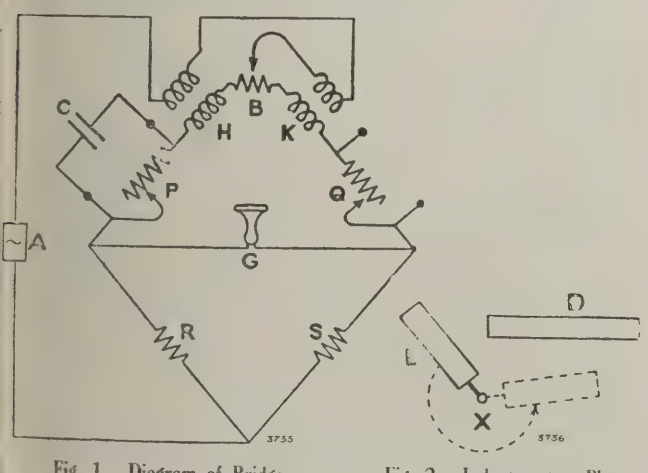


Fig. 1.—Diagram of Bridge.

Fig. 2.—Inductometer, Plan Diagram.

(say) 1$\mu\mu$F to 30μF. The rheostat B has its scale marked to read directly changes in P or Q and can be shunted so as to increase the accuracy of reading tenfold. To make a measurement, the range-setting switch is turned to give the desired range, and a balance (in the telephone or vibration galvanometer G) is obtained by setting B and a small zero-setting L-dial, the main L-dial reading zero. The condenser C is then put across P, and a new balance obtained by altering B and the main inductometer. Then the multiplied inductometer reading gives C, and the change in the rheostat reading gives $(P-P')$, and hence the power factor. Two condensers not very unequal can be compared by putting the larger across P and the smaller across Q.

The instrument, which is made by the Cambridge Instrument Co., is illustrated in fig. 3, and its accuracy of measurement has been greatly increased by the use of a new type of mutual inductometer designed by the author, the scale of

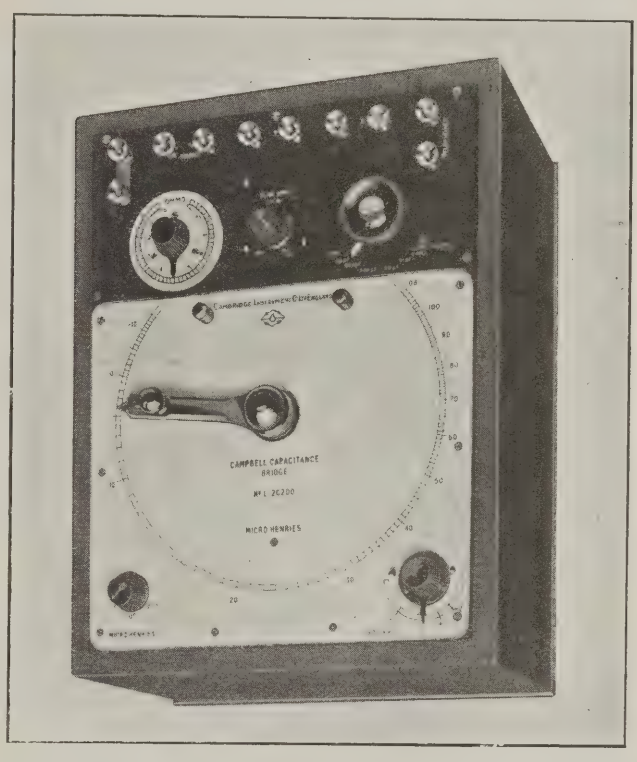


Fig. 3.—Campbell Capacitance Bridge.

which embodies two improvements:—(1) Its angular extent is very great, being about 260 deg., older types giving only about 160 deg. (2) The scale gradually opens out towards the zero, in such a way that over the greater part of the range the percentage accuracy of reading is nearly constant; a slight intentional opening towards the top prevents the divisions being too close there, the minimum length being 1.8 mm. per division.

The importance of constant percentage accuracy of reading does not seem to have been realised by many instrument makers and users, and it is very often difficult to attain. The equation for a scale of constant percentage accuracy is $M=\alpha\epsilon^{\theta}$, where M is the mutual inductance at angular reading θ, ϵ the base of natural logarithms, and α a constant; but such a scale could never get down to zero until $\theta=-\infty$. Therefore, a practical scale is closed in gradually at the lower end so as to reach zero and negative values. In the present instance, the ideal scale has been attained by constructing the inductometer as shown in plan in fig. 2, where the fixed and moving circuits are the vertical coils D and E respectively, E being mounted on a vertical axle X, carrying the pointer.

Except at the beginning of the very lowest range, the accuracy of reading of the capacitance bridge is within 2 parts in 1,000 throughout. With the two highest ranges (or for very large power factors) correction is sometimes required; for example, with a frequency of 800 cycles per second for C=1μF., the correction is about 2 in 1,000, and for C=30μF it becomes quite excessive. This difficulty with very large condensers can be avoided by making the tests at a lower frequency, such as 100 cycles per second. In conclusion, it may be remarked that the system of shunting used in the bridge involves considerable loss of sensitivity, but this disadvantage appears to be well outweighed by the convenience and ease of working of the instrument.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

THIS eagerly-looked-forward-to show was held as usual at the Imperial College of Science and Technology, South Kensington (January 4th, 5th and 6th). It was the seventeenth of the series of annual exhibitions arranged by the Physical Society of London, and the Optical Society, to indicate the year's developments in the design and manufacture of electrical, optical, and other physical apparatus, being accordingly hailed as one of the chief scientific events of the season.

The Councils of both Societies decided to again include this year, in addition to the well-established trade section in which some 74 exhibitors participated, a research and experimental section similar to that successfully initiated in 1926. The groups in this section comprised: (*a*) Exhibits illustrating the results of recent physical research and improvements in laboratory practice; (*b*) effective lecture experiments; and (*c*) repetitions of famous historical experiments, for which accommodation had been provided in rooms distinct from those devoted to the trade exhibits, and a section of the catalogue had been allotted for their description. In group (*a*) there were this season 19 exhibitors; in group (*b*), 11; and in group (c), two. The total was, therefore, 116, which figure is an indication of the size of the display.

Three discourses were delivered, one during each evening: Prof. E. N. da C. Andrade lectured on "Light and Electricity, as it might have been given in 1709," with the apparatus of the time. "Progress in Electrical Instrument Design and Construction" was the subject chosen by Dr. C. V. Drysdale; and Mr. John L. Baird spoke on "Television."

We commence below brief descriptions of some of the newer apparatus of an electrical nature which was exhibited in the trade section.

Eversheds & Vignoles, Ltd.

Chief amongst the new instruments and improved devices shown by this Company was the Midworth distant repeater, an electrically-operated system which enables movements as different in character as the motion of a sluice gate, lever arm, or instrument pointer, to be shown at any distance and at any number of points; it can also be used for the distant control of any power-driven apparatus, and any number of repeating instruments, either indicating, recording, integrating, or controlling can be used. The actual transmission is of an angular motion, and normally the repeating instruments also show a corresponding angular deflection. Where a movement in a straight line is to be repeated, it is therefore converted into angular motion; if, however, it is desired to repeat the original movement exactly, appropriate arrangements can be made at the repeating station.

The operation of the system imposes no load on the apparatus of which the movements or indications are to be indicated or recorded, a valuable feature where the readings of a delicate instrument have to be transmitted to a distance. It does not operate on the step-by-step principle, and the repeating instruments cannot get out of step with the transmitter, whilst for transmitting information by means of indicating or recording instruments, it requires two conductors only between transmitter and repeating instruments.

The apparatus automatically compensates for variations in the supply voltage and for changes in the resistance of the repeater circuit; the line connecting transmitter and repeating instruments may therefore be of any length desired, and the number of repeating instruments used may be varied at will without affecting the accuracy of the system. In the event of line breakage, the apparatus returns automatically to normal working without loss of accuracy when the break is repaired. The repeating instruments are milliammeters, which are inexpensive.

The principle underlying the system is the regulation, by the originating movement, of an electrical current which passes through the controlling and repeating instruments in series; below the main index, and mounted in axial alignment with it, is the pointer of the electrical control instrument, which floats between two contacts borne on the main index; when the latter moves in response to the originating movement with which it is connected, one of the contacts which it carries touches the pointer of the control instrument and completes the circuit of one of two field coils of the control motor. The field coil being energised, closes a switch in the armature circuit of the control motor, at the same time releasing a brake which normally prevents the armature from revolving; the armature then turns worm gearing which moves the contactor arm over the control rheostat (see fig. 1); the direction in which the arm is moved depends on which field coil has been energised. As the arm moves over the rheostat, the current passing through the repeater and control instrument circuit is altered until the pointer of the control instrument reaches a position at which it floats freely between the contacts carried by the main index, when the field-coil circuit is broken, the motor is switched off, and the armature is stopped instantaneously by the releasing of the brake. The control mechanism operates therefore to bring the current through the control instrument to such a value that its

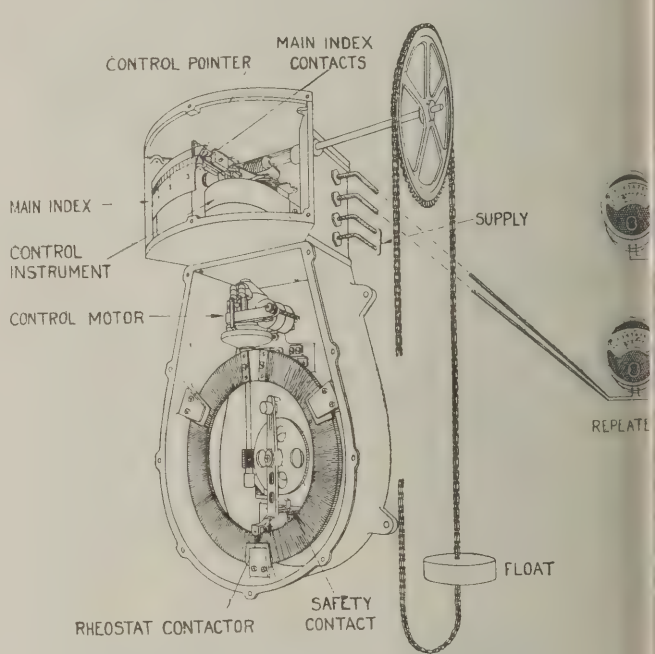


Fig. 1.—Midworth Distant Repeater.

angular deflection corresponds with that of the main index and as the control and repeating instruments are in series the pointers of the repeaters will follow wherever the main index may be moved.

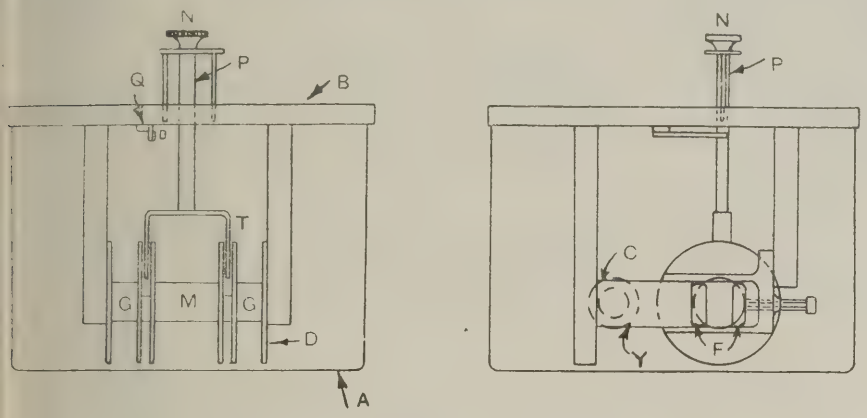
As the mechanism tends always to bring the system to a state of balance with the pointer of the control instrument and the main index in alignment and the motor at rest, it is evident that when equilibrium is attained there can be no load on the main index; hence the system can be used for repeating the indications of delicate instruments at a distance. Should the voltage of the repeater circuit vary, the current will fall and the control pointer will touch one of the contacts on the main index; the motor will rotate the rheostat contactor in the direction necessary to restore the current through the repeater circuit to its correct value until the pointer once more floats freely. Changes in the resistance are similarly compensated for, so the number of repeating instruments can be varied at will. In the event of a break in the line, the control motor will try to make up for the insertion of resistance of infinite value, and will rotate the rheostat until a safety contact is touched, when the system is closed down. The circuit through the other field coil, that which causes the motor to turn the contactor arm so as to reduce the current, is, however, left ready so that when the line is restored, the motor immediately starts, and the reading returns to its correct value.

Should the rheostat, or contactor, become corroded, the arm will oscillate until the dirt has been removed. The cor

tacts of the main index carry only the small current necessary to energise the field coils; they are therefore not subject to sparking or to rapid wear. The full line voltage is always across these contacts, and they are thus not susceptible to imperfect contact. All contacts are readily detachable, and the rheostat can be easily removed without undoing any wire. The motor is of simple design, and the power consumption for the entire installation is from 10 to 12 watts only. The system as at present designed works on direct current, and its varied possible applications indicate its wide range of usefulness.

Cambridge Instrument Co., Ltd.

Amongst a number of new instruments shown was the useful and simple Campbell capacitance bridge, which is described fully on page 31 in this issue. Another piece of apparatus was the Hughes permeameter for accurately determining the magnetisation curve and hysteresis loop of bars of magnetic material. The complete outfit consists of a bridge, resistance



Figs. 2 and 3.—A Simple Hughes Permeameter.

and switch unit, ballistic galvanometer, resistance box, and a multi-range ammeter. The main magnetising coil is so arranged that H equals 100 times the current in amperes, and it is designed to carry up to 4 A in air, or up to 10 A in oil; values of H from 1 to 1,000 c.g.s. units may be measured with tolerable accuracy. The bridge (figs. 2 and 3) consists of an aluminium tank A with an ebonite lid B supporting the yokes Y and the compensating and magnetising windings C M; the specimen is passed through the brass spool D and clamped across the two yokes by F. The spool D has a slot on each side of the magnetising winding to allow the test yoke T to approach the specimen. Two guard windings G maintain an even distribution of flux in the specimen, and provision is made so that the test yoke may be reversed in order to test for complete demagnetisation of the test yoke. A switch is arranged to automatically short circuit the resistance in the galvanometer circuit when testing for magnetic balance. The arrangement enables the windings of the specimen to be immersed in oil when working at the higher values of the magnetising force, by filling the aluminium case with oil. This simple form of apparatus enables commercial bar specimens of magnetic material to be tested by standard methods with a precision equal to that of the ring method, without necessitating the provision of a perfect magnetic joint at the ends of the specimen, and without winding any special coils on the specimen other than the search coil. The range of the apparatus may be readily extended to the measurement of permeability, and the determination of the hysteresis loop at high values of the magnetising force. The precision of the results obtained is such that for any but abnormally low values of H, the errors do not exceed 1 or 2 per cent., while for higher values of H (up to 1,000 c.g.s. units) the accuracy is proportionately increased.

An improved form of thermionic voltmeter is similar to the original model developed by Mr. E. B. Moullin, but is a multi-range pattern suitable for a wider range of measurement.

A simple form of thread recorder (fig. 4) for use with base metal thermo-couples is expected to have a large sale. It possesses the essential features of the standard Cambridge thread recorders, but can only be supplied as a single-point instrument and in one of the following ranges:—0 to 600 deg. C., or 0 to 800 deg. C. for use with iron-constantan thermo-couples, and 0 to 1,000 deg. C., or 0 to 1,200 deg. C. for use with "Titan" thermo-couples. The galvanometer is a robust pivoted-coil instrument and the record is traced on a 25-hour chart with a record space 95 millimetres wide; the mechanism is enclosed in a metal case.

A continuous film micro-indicator, which was made for the London & North-Eastern Railway, was shown by courtesy of the chief mechanical engineer. It is a modified form of the indicator designed by Mr. W. G. Collins, by which diagrams are obtained from high-speed engines by means of a stylus acting upon the surface of a celluloid disk; the continuous-film instrument has been designed primarily for use on locomotives, and the controlling switchgear may be fixed in any suitable position to enable the records to be obtained from a distance.

A new illuminated indicator has been designed to meet the demand for a large-dial instrument which can be easily read from a considerable distance, and the first model has been developed for use with CO_2 meters. One of these indicators is mounted on each boiler and connected to a katharometer in the ordinary way: the movement of the pointer is controlled from a galvanometer, which forms a separate unit, and is common to all the indicators (up to six) in an installation, being connected to each in turn through a master switch. The apparatus can be linked to an ordinary multi-point thread recorder installed in any convenient position. The indicator has a 13-in. dial with large figures, and contains no delicate mechanism; the scale is graduated in CO_2 percentage, the standard range being 0 to 18 per cent. A circular area on the portion of the scale to which the pointer is directed at any moment is illuminated by white light, while the pointer itself is illuminated by green light, if the percentage of the CO_2 is increasing, and by red light if it is decreasing. The operation may be briefly described as follows:—A pendulum contact-maker continually makes and breaks an electric circuit, and thus operates two electro-magnets: one operates the master switch, while the other operates a chopper-bar mechanism, which depresses the galvanometer pointer at regular intervals on to one of the two contacts, depending upon the direction of its deflection; by its rotation the master switch connects each CO_2 meter in turn (for a definite period) to the corresponding indicator and to the galvanometer. When there is a change in the CO_2 percentage in a flue, the galvanometer pointer will be deflected and, when it is depressed by the chopper bar, it will close an electric circuit which energises one of two electromagnetically-operated pawl and ratchet mechanisms in the indicator, and thus rotates the indicator pointer in the corresponding direction. As the pointer rotates, a contact arm is moved over a circular rheostat and so rebalances the Wheatstone bridge circuit. When the illuminated pointer moves up and down the scale, a green or red screen is automatically introduced into the path of the light which illuminates the pointer.

Marconiphone Co., Ltd.

Units for supplying high plate voltage for radio receivers and amplifiers from d.c. or a.c. mains were on view. They are designed to work on 100 to 120 or 200 to 250-volt mains, giving outputs at 120, 80, and 40 volts, so that any supply and any receiver may be suited. The U.5 full-wave rectifying valve is used in the a.c. unit, which has an output of 50 mA. The d.c. unit has a switching arrangement for reversing the smoothing circuit in cases where the positive main is earthed. This feature is not generally provided, and is a point worthy of note, as the efficiency of the smoothing effect may otherwise be seriously affected.

A new 2-volt power valve, the DEP.215, consumes only 0.15 ampere at 2 volts, and has the remarkably high

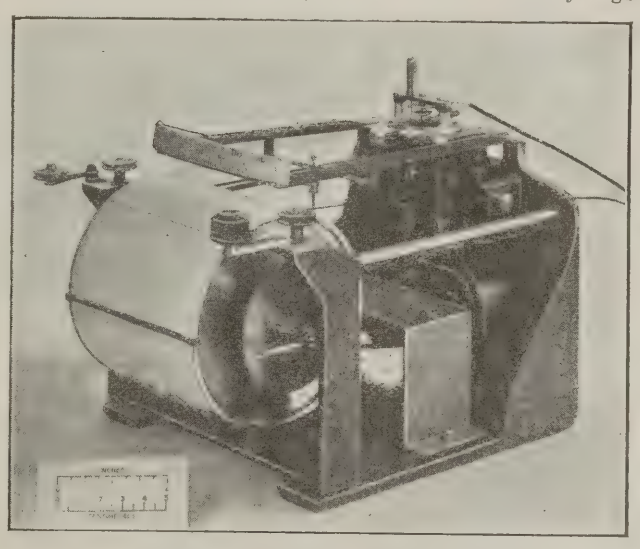


Fig. 4.—A "Cambridge" Thread Recorder.

mutual conductance of at least 1,000 micromhos. The amplification factor is 6.25, and the impedance is given as 6,250 ohms, but is generally below this figure. The maximum output is therefore very high, being 126 milliwatts of undistorted energy, at 120 volts h.p. The efficiency, expressed in microhms per watt of filament consumption, is 3,330.

The new supersonic transformer, with a natural wavelength of 6,500 metres, is worth attention. It is of the open iron-core type designed to give as sharp a cut-off as possible consistent with good amplification over a band of 5,000 cycles on either side of the fundamental frequency, with a step-up of about three and a half. The result is that reproduction is excellent, no filter is required, and two intermediate frequency stages are sufficient for all practical purposes.

(To be continued.)

Heavy-Oil-Engine Working Costs.

Diesel Engine Users' Association's Report for the Year 1925-26.—*Abstract.*

THE report of the General Committee of the Diesel Engine Users' Association on the working costs of Diesel engine and other heavy-oil-engine installations for 1925-26 has been published. In view of the interest which is being taken at present in the working costs of prime movers for the generation of electricity throughout the country, the figures and graphical representation of the results (fig. 1) which accompany the report are receiving particular attention. It should, of course, be noted that the average cost is obtained from undertakings in the majority of which the conditions of working are by no means favourable to securing the best results, and that the average figures do not represent the results obtainable when operating under reasonably favourable conditions. In some of the undertakings the heavy-oil-engine plant is only used as a stand-by, and in a large number of cases the annual plant load factor is less than 15 per cent.

In presenting the report, the Committee explains that the list of stations has been maintained practically intact and average figures over a period of four consecutive years' working are now available in many cases. Where plant has been run very little during the past year owing to the advent of bulk supplies of electricity, engineers in some cases have failed to send reports of their oil-engine working costs, under the impression that in such circumstances their figures would be of little interest; but the very reverse of this is true, as the Committee aims at collecting information under as great a variety of working conditions as possible.

Among the 46 undertakings listed (37 Home and 9 overseas) six new engines, varying in size from 250 to 1,125 b.h.p., were installed during the year, the average size having been 750 b.h.p.; the average size of engine installed during the previous year was 500 b.h.p.; the tendency to adopt larger engines therefore continues. There has naturally been an increase in the average plant capacity per station, and it is satisfactory to note that the average cost of repairs and maintenance per kilowatt installed is steadily falling in consequence. The average engine cost per unit generated among the home stations improved from 0.806d. to 0.799d., notwithstanding a slightly increased price for fuel oil and a slightly less favourable running-plant load factor. Among the overseas stations the corresponding figure increased from 0.746d. to 0.753d., the rise having corresponded exactly with the higher price paid for fuel oil; in this case also there was a slight diminution in the running-plant load factor.

Engine Costs.—Taking the 51 home stations, the average engine cost per unit generated in the year was 0.799d., see Table I.

TABLE I.—*Engine Cost per Unit Generated.*

	Pence.	Percentage of Total Engine Cost.
Fuel	0.387	48.40
Lubricating oil	0.057	7.13
Water (including treatment) ...	0.011	1.38
Stores	0.007	0.88
Wages (running staff)	0.200	25.10
Repairs and maintenance	0.137	17.11
	0.799	100.00

Output.—The total output reported upon has increased by 8,800,000 units, equivalent to 17.2 per cent. of the previous year's output.

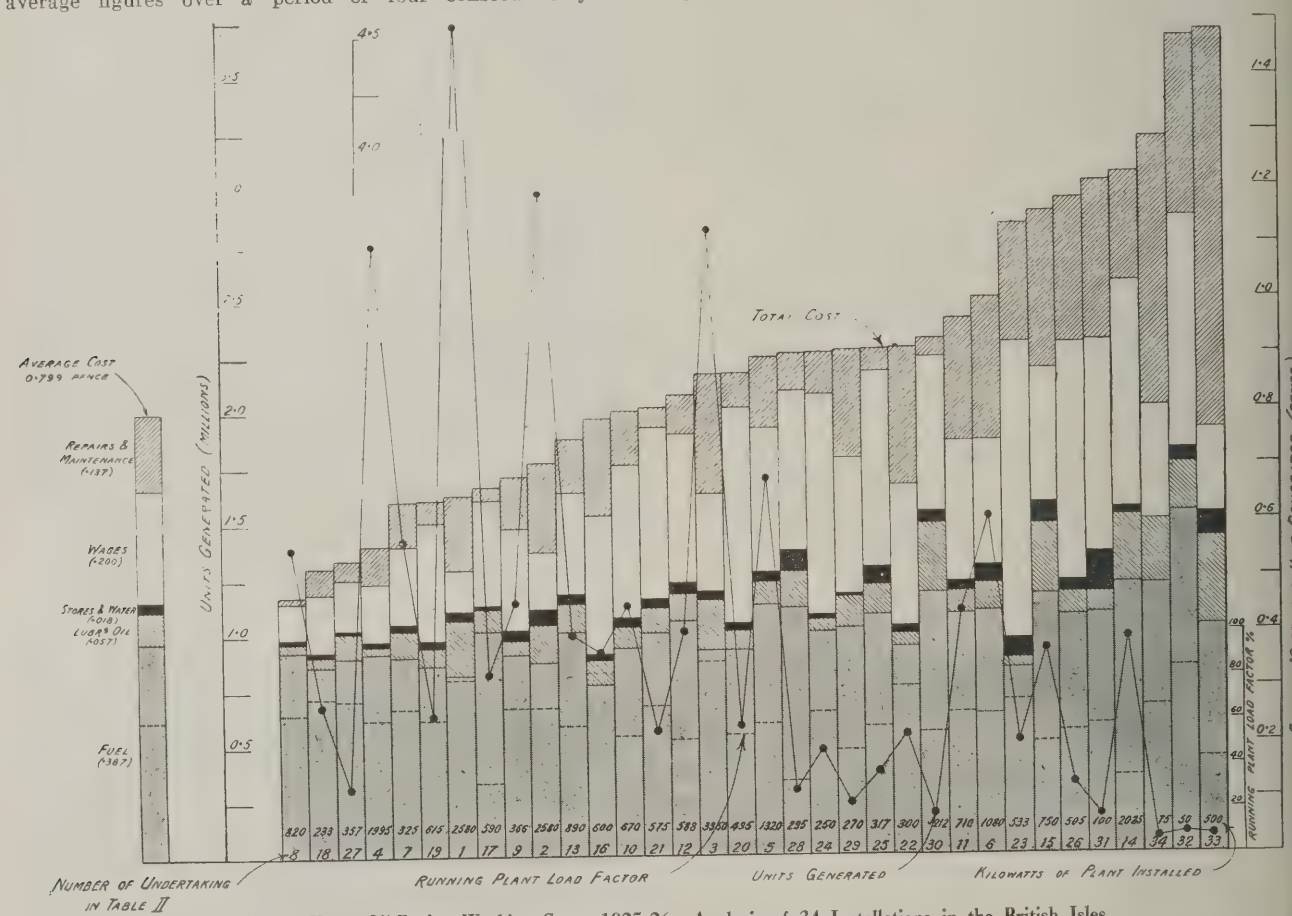


Fig. 1.—Heavy-Oil-Engine Working Costs, 1925-26; Analysis of 34 Installations in the British Isles.

Plant Installed.—The increase in plant installed during th year among the stations listed was 3,100 kW. The increase average plant capacity per station [Home 788 kW (703 kV previous year), overseas 1,510 kW (1,270); total engine capa city, Home 29,141 kW (25,363), overseas 13,550 kW (10,193) has a bearing on the reduction in the repairs and maintenanc cost per kilowatt installed and per unit generated.

Thermal Efficiency and Fuel Consumption.—Taking th average gross calorific value of the fuel oil used at 19,50 B.th.u. per lb., the overall thermal efficiency of the 46 station employing 177 engines (varying in size from 1,125 to 60 b.h.p run at an average running-plant load factor of 60.1 per cen was 24.15 per cent. This is a slightly better result, and at slightly lower running-plant load factor, than was obtaine in the previous year. The average fuel consumption per un generated, 0.725 lb., is about 7.8 per cent. above the corr sponding value on the standard curve; the excess recorded i the previous year was 9.1 per cent., while for 1923-24 th excess consumption was 10 per cent. Twenty-one undertakin returned fuel consumptions which fall on or below a lir drawn at 5 per cent. above the reference curve; the be results in this respect were obtained by the Chiswick Ele tricity Supply Corporation, the Maidenhead Corporation, Bir dale District Electric Supply Co., the Buxton Corporation, th Alderley and Wilmslow Electric Supply Co., the Bognor G

and Electric Co., the Electric Supply Corporation (Hitchin station), the Cookham and District Electricity Corporation, and the Kastoorchand Mills Co. (Bombay, India). These undertakings scored fuel consumptions below the reference curve, which several of them have done consistently during the last three years; from the last-mentioned fact arises the request for information to be supplied in future as to the brand of fuel oil used, and in view of the foregoing there seems to be no reason for altering the standard of reference.

Lubrication.—The average consumption of lubricating oil per unit generated, 0.00154 gallon, shows an improvement of about 9.4 per cent. The average improvement among the Home stations was about 4.5 per cent., and overseas 16 per cent.; the Home stations' average improvement does not reflect the economies which have been effected by a majority of the stations owing to the heavy consumptions of the Charing Cross and Southend undertakings, which bulk largely in the total lubricating oil used (accounting for 25,800 out of a total of 553,800 gallons). As a matter of fact, very much better results than formerly have been obtained by many Home stations; the average consumption of 33 of them was 0.00114 gallon per unit generated, at an average running-plant load factor of 57.8 per cent; this figure approaches fairly nearly to the working standard curve. A large number of stations have adopted centrifugal machines for oil cleaning with beneficial results.

Maintenance.—The average maintenance cost per unit generated, 0.137d. for Home stations, and 0.116d. overseas, shows a further substantial reduction in comparison with the corresponding figures for previous years, although a slight fall in the respective annual plant load factors has been recorded. Among the Home stations listed 127 engines (varying from 50 to 1,125 b.h.p.), and among the overseas stations 50 engines (varying from 100 to 1,050 b.h.p.) were in use during the year. The development of new types of engines of larger capacity than formerly usual necessitates the gradual solution of special problems in design, and a temporary set-back with regard to this item of working cost might have been experienced, but many examples of the newer engines have given such favourable service that there is no doubt that a definite advance in oil-engine development has been made. Maintenance costs which have been collected during the last four years are being scrutinised along new lines, and the Committee would welcome a free discussion and suggestions on this matter from the members. It is felt that the investigation into this item of cost has been really useful so far as it has gone, but a great deal of work and a combined effort on the part of all members is necessary for carrying it to complete success.

The Co-ordination of Urban Transport.*

The Desirability of Unified Management and Common Financial Interest.

By the Rt. Hon. LORD ASHFIELD,

(Chairman and Managing Director of Underground Electric Railways of London, and other Companies.)

URBAN transport is a complex subject. The means of travel required to conduct it satisfactorily are many and varied; the volume of traffic to be dealt with continually outstrips the capacity of the services provided, and the margin between receipts and expenses is always narrow in relation to the demands made upon it by reason of the large capital costs involved.

The underlying principles which may govern the operation of such undertakings are three, contrasted and opposed, namely, competition, co-ordination, and monopoly. "Laisser faire" and competition are but two aspects of the unrestricted freedom which the earliest economists deemed essential to the public welfare. The doctrine of the other extreme, of socialism as the negation of competition, found its dominant utterance later; out of evolution, however, the idea of co-ordination started, but there is still the same lip service by large sections of the community, the notion that competition alone is essential and beneficial and advantageous.

In 1860 the urban passenger movement in Greater London, using purely local means of transport, amounted to 40 millions of passengers. Twenty years later it had multiplied six-fold, and twenty years later still (in 1900) twenty-fold; it continued to advance with ever-accelerating speed, for in 1925 it amounted to 3,225 millions of passengers, or an accumulative increase of 8,000 per cent.; by 1930 it will be within reach of 10,000 per cent. Greater New York affords an almost parallel series of results, and one of the most illuminating comments on this record is that in a modern metropolis it is impossible to catch up with the demand for transport, because every addition to the means of transport creates fresh traffic and, therefore, fresh congestion. There is much truth in this which points, not to competition between the means of transport, but rather to competition between the users of the service of transport, a quite novel aspect of the blessed process. Apart from this radical change in the scale or magnitude of the problem, there has been the revolution wrought by electricity and the counter-revolution of the internal-combustion engine. It is time the new problems were approached as new problems, and not merely as overgrown old ones.

Transport consists in public service. The service may be measured statistically in seat-miles; the use of the service may be measured in passenger-miles: if the seat-miles are not used by passengers and so converted into passenger-miles, they are lost. The provision of service must be distinguished from the provision of commodities: if commodities are not sold one day, unless they are perishable, they may be sold the next; but service, once provided, is wasted unless it is used. The whole service must be paid for out of the proceeds of the part which is used, and a substantial proportion of the total service provided is wasted in any event by the operating conditions occasioned by the variable flow of the traffic. Whether railways, or tramways, or motor-omnibuses are considered, in Greater London the average use which is made of the facilities provided barely exceeds 33 per cent. In the cities of America it will not be greater; it may easily be worse. Only by unified management of all the means of transport and their co-ordination into a general system can such unavoidable waste as there is be reduced to the minimum compatible with adequate and efficient service to the public; but transport is not a simple service: express railways are required to connect outer suburbs with the centre; ordinary railways with high-speed stopping trains are required to connect the inner suburbs with the centre; the streets are filled with motor-cars and omnibuses; to cope with heavy short-distance traffic, street railways or tramways are needed upon which units of two or three coupled cars may rapidly clear away the in-flow and out-flow from factories, stores, and offices. The demands for service are varied, and the means of transport must become equally varied to meet the demands. Competition of one kind of service with another grows up which needs regulation and control, for the economic or profit-earning capacity of the different kinds of service is unequal.

In Greater London the average speed of the underground trains is 18 miles per hour, including stops, or 24 miles per hour where a limited number of stops only is made; of the tramways, the average speed is 9.6 miles per hour, but of the motor-omnibuses in the built-up areas it is only 8.6 miles per hour.

Average receipts per passenger upon the underground railways are 2.8d., upon the omnibuses 1.8d., and upon the tramways slightly less than 1.45d.; but the average cost of carrying a passenger upon the underground railways is 2.1d., upon the omnibuses 1.6d., and upon the tramways 1.3d., so that the margins (net receipts) are respectively 0.7d., 0.2d., and 0.15d. per passenger. Their relative net earning capacities (if the railways are taken as 100) are 29 in the case of the omnibuses and 21 in the case of the tramways, and the capital investment involved in the provision of these several forms of transport represents, per passenger carried in the year, 34d. in the case of the underground railways, 5d. in the case of tramways, and 1.4d. in the case of motor-omnibuses. Then, if the net receipts per passenger are brought into relation to the capital expenditure per passenger, it will be found that (motor-omnibuses being taken as 100) the economic capacity of the tramways is only 21, and of the underground railways (on account of their enormous capital expenditure) only 15.

Yet all these means of transport are necessary to a complete scheme of facilities. Under competition, free and unrestrained, the motor-omnibus must develop at the expense of tramway and railway, but this cannot be contemplated,

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so once more co-ordination must take the place of competition, and, added to unified management, there must be common financial interest which will permit of the strong aiding the weak, so that all may continue to expand and improve as may be necessary to give the public satisfaction. No form of transport dare confine itself to catering for one class, if by catering for several classes it could secure more passengers in the aggregate; tramways and omnibuses both seek the short-distance passenger and, in the main, give equivalent services at equivalent prices; railways cease to develop express services in favour of stopping services because they secure better loadings. In effect, competition is destroying the effectiveness of the transport facilities provided.

Developments since 1860 have proved that competition is no longer applicable to urban transport, but is the only alternative monopoly in one or another of its forms? It is suggested that co-ordination is a golden mean.

Those who manage and control joint stock companies have built up a technique of management which they must observe conscientiously. Undertakings now stand or fall by good management, and the weakness of the present economic situation is the absence of a sufficient supply of good managers. Finally, and may be most important than all else, publicity has entered into management. What is done in the office is shouted in the Press. The basis of prosperity in urban transport is not a few passengers at high fares, but many passengers at low fares.

What is meant by co-ordination? There is no one answer to such a question; each city must work out its own. It does not necessarily involve all transport agencies being in one ownership, or all transport agencies being under one management for the routine discharge of their operations, but there must be the power and authority to ensure that the operations of all the transport agencies are knit together into a systematic whole, to readjust the financial positions of conflicting agencies, to ensure that (whatever their ability to earn may be) all receive according to their needs, if their service is required. In some cities an independent board may be set up for the purpose, as in Boston; in others the transport agencies may be amalgamated and managed as one, under private auspices, as in Cleveland; in other cities a judicial body may decide between conflicting parties, and a semblance of direct competition remain, as in New York. In all cities the people have the right to exercise control, subject to the observance of certain principles. First, that those who control shall not be interested in one transport agency more than in another; secondly, that the transport agencies as a whole shall be self-supporting, or if that is not to be the case because cheap transport is held in such esteem as to warrant a tax or impost on the community in some other shape, such as a charge on landed estates, a rate on property, or a levy on industry at large, then a definite policy of subsidy out of such other resources shall be defined; thirdly, that those who invest their money in urban transport shall be entitled to a reasonable and proper return upon their capital. If, however, those who are engaged in the provision of urban transport are neglectful, or dilatory, or unreasonable, then the door should be opened and fresh agencies invited to take a share. Co-ordination is conditional protection depending upon deserts. The case for co-ordination has, since the war of 1914-1918, been reinforced by the tendency of events in almost all the great cities of the world. In Paris, Berlin, and New York there is a combination of public ownership with private operation. In Cleveland the celebrated plan of "service at cost" was instituted in 1910, and, with minor modifications, has been copied in many cities. This was a pioneer adventure in management on modern lines, and laid down a basis under which private ownership and public interests could be harmonised and the advantage of individual effort and skill placed at the disposal of the public and shareholders. The root plan is an agreement between the municipality and the transport undertakings which guarantees to the latter financial security in return for the best service possible, having regard to the economic conditions under which the transport facilities must be operated. The plan has been tested for years and still shows scarcely a flaw. Wherever search may be made, the tendency is always the same, yet London lags behind. However, a business influence is spreading, and it is hoped to establish common management of all transport undertakings in Greater London.

The Electricity (Supply) Act, 1926.

A Summary of its Provisions.

(*Continued from page* 1098.)

9.—(1) The Board may require any authorised undertakers or the owners of any selected station to amend or alter the frequency employed in their undertaking or station, if and so far as such amendment or alteration is required to effect the standardisation of frequency provided by a scheme, or to effect such standardisation of frequency as the Board, with the approval of the Electricity Commissioners, may think expedient, subject to the payment of any expenses incurred in carrying such requirements into effect (including the cost of altering or replacing plant belonging to consumers), and the Board shall, if required, advance free of interest such sums as may be necessary.

(2) The payment of any such expenses and the making of such advances shall be purposes for which the Board may borrow.

(3) The Board shall be entitled to be repaid by the Electricity Commissioners in each year the sums required to meet the interest and sinking fund charges in respect of money so borrowed.

(4) Any question regarding expenses shall, in default of agreement, be determined by the Electricity Commissioners or at the option of the authorised undertakers or owners be referred to arbitration.

(5) A railway company shall not be required to alter the frequency employed by them except by an Order made in accordance with the Railways Act, 1921.

10.—(1) As soon as the Board, as respects any area or part of an area, notify that they are in a position to supply electricity, they shall be under an obligation to supply it to any authorised undertakers in that area demanding such a supply.

Provided that the Board shall not supply electricity directly to authorised undertakers situated in the area of supply of a power company without the consent of the company unless the undertakers have an absolute right of veto on any right of the power company to supply electricity within the area of supply of those undertakers; or unless the power company are unable or unwilling to supply electricity to such authorised undertakers on reasonable terms and conditions, to be determined in case of dispute by the Electricity Commissioners.

(2) Where it appears to the Board that the outlay incurred in providing the transmission lines required would entail unreasonable expense, the Commissioners may authorise the Board to impose such terms and conditions as the Commissioners may think fit, on the giving of the supply.

(3) Where any authorised undertakers owning a generating station, not being a selected station, demand a supply of electricity, they shall take the whole quantity of electricity required for their undertaking, directly or indirectly, from the Board.

Provided that—

(*a*) The Board shall not impose such a condition unless satisfied that the cost per unit to the undertakers will for a period of not less than seven years be less than the cost at which electricity is then being produced at the generating station of the undertakers, and in determining such cost no account shall be taken of capital charges in respect of capital expended on the station; and

(*b*) Where the authorised undertakers feel aggrieved they may appeal to the Electricity Commissioners, who shall if so requested by the undertakers, refer that question to arbitration;

(*c*) Where the Board impose such a condition they shall take over the obligations of any such undertakers to receive supplies of electricity in bulk.

11.—(1) Subject to the provisions of this Act as to the sale of electricity to the owners of selected stations, the price to be charged by the Board for electricity supplied directly by them to authorised undertakers shall be in accordance with such tariff as may be fixed by the Board from time to time and the tariff shall be fixed so that over a term of years to be approved by the Electricity Commissioners the receipts on income account shall be sufficient to cover the expenditure on income account, including interest and sinking fund charges, with such margin as the Electricity Commissioners may allow.

(2) The tariff shall be so framed as to include as part of the charge and show separately—

(*a*) A fixed kilowatt charges component;

(*b*) A running charges component:

in accordance with such principles as may be approved by the Electricity Commissioners:

Provided that an order of the Electricity Commissioners under this subsection shall not come into force until it has been laid before each House of Parliament for thirty days.

(3) The tariff fixed under this section may be different for different areas.

12.—Where any authorised undertakers take a supply of electricity from the Board, the price charged by them for the supply of electricity in bulk to other authorised undertakers, or to a railway company, shall be on the same terms as those on which the undertakers receive the supply from the Board, together with charges in respect of any transmission line used for the purpose.

13.—Where the owners of a selected station, who take a supply of electricity from the Board, prove to the satisfaction of the Electricity Commissioners that the cost of taking that supply in any year exceeds the cost which they would have incurred, had this Act not been passed, in themselves generating the like quantity of electricity, then the charges by the Board to those undertakers shall be so adjusted that the amount charged in that year does not exceed the cost which, in the opinion of the Electricity Commissioners, the undertakers would have incurred.

14.—(1) Where the Board notify any authorised undertakers owing a generating station, not being a selected station, that the Board are in a position to supply them with such quantity of electricity as they would require if the station were closed, and undertake to give such a supply for a period of not less than seven years on specified terms, and are satisfied that the cost of the supply on those terms is below the then prevailing cost of generating electricity at the station, and those undertakers refuse to take such supply from the Board, then, if the Electricity Commissioners are satisfied as respects the next subsequent year that the cost of production of electricity at the station substantially exceeded the cost they would have incurred had they purchased the like quantity of electricity from the Board, the Commissioners may by order require the undertakers to take a supply of electricity in bulk from the Board and shut down the generating station as such.

(2) If any question arises under this section as to the cost of production it shall, if the undertakers so require, be referred to arbitration.

(3) In calculating for the purposes of this section the cost of production of electricity generated by the authorised undertakers, no account shall be taken of capital charges in respect of capital expended on the generating station.

(4) For the purposes of this section, any authorised undertakers owning a generating station (not being a selected station) shall, on being so required by the Electricity Commissioners, furnish them with a statement showing the cost of production of electricity at that station.

15.—Section sixteen of the Electricity (Supply) Act, 1919, as amended by section twenty-one of the Electricity (Supply) Act, 1922, shall, with the necessary adaptations, apply to any officer or servant of any authorised undertakers affected by the closing (permanent or temporary) or restrictions imposed by the Board or by or under a scheme on the working or use of or the acquisition of a generating station, or the acquisition of a main transmission line or any part thereof, under or in consequence of this Act, as set out in the Fourth Schedule to this Act.

16.—(1) Where under this Act the Board are authorised or required to enter into arrangements with authorised undertakers for any purpose it shall be lawful for the undertakers to enter into and carry out such arrangements.

(2) The carrying out of such arrangements shall be a purpose for which authorised undertakers, being a local authority or a joint electricity authority, may borrow.

(3) Where the carrying out of any such arrangement by authorised undertakers, being a company, involves capital expenditure, and the company cannot raise the necessary capital without the authority of an Act of Parliament, the company may submit to the High Court (or in Scotland the Court of Session), a scheme providing for increasing its loan or share capital; and if the scheme is approved by the Court, then the additional capital shall rank *pari passu* with the existing capital, or with the consent of the shareholders, before it.

17.—(1) Where a generating station, or a main transmission line acquired under this Act, is in the course of construction, extension, or repair, the rights and liabilities of the former owners thereof under contract shall be transferred to the acquiring authority.

(2) Plant which forms an essential part of the distribution system of the former owners of the generating station shall remain the property of such owners.

18.—(1) Where the consent of the Minister of Transport or the Electricity Commissioners would be necessary under the Electricity (Supply) Acts, nothing in this Act shall remove the necessity of obtaining such consent.

(2) Where an application is made by any authorised undertakers to the Minister of Transport or the Electricity Commissioners for their consent, the Minister or Commissioners shall have regard to the provisions of this Act and the effect of any scheme thereunder.

Subsidiary Provisions as to the Board.

19.—(1) The Board shall be deemed to be authorised undertakers within the meaning of the Electricity (Supply) Acts:

Provided that sections two and three of the Electric Lighting Act, 1888 (which relate to the purchase of undertakings by local authorities) shall not apply to the undertaking of the Board.

(2) Before any regulations come into force they shall be laid before Parliament for not less than thirty days.

(3) The Board shall not supply electricity directly to persons not being authorised undertakers, except that—

(*a*) They may supply the owners of selected stations, not being authorised undertakers;

(*b*) With the consent of the Electricity Commissioners, they may supply electricity to any company, body, or person requiring a supply for power purposes in any area not forming part of the area of supply of any authorised undertakers, and such supply may be used for lighting premises in which the power is utilised.

20.—(1) The Board may acquire land or any rights in or over land by agreement, or may be authorised to acquire land or any such right compulsorily, for the purpose of any of their powers and duties under this Act (including the construction of main transmission lines) like local authority undertakers under the Electricity (Supply) Acts; and the Board shall be deemed to be a public authority for the purposes of the Acquisition of Land (Assessment of Compensation) Act, 1919.

(2) Nothing in this section shall authorise the compulsory acquisition by the Board of land or rights over land held by the owners or lessees of any railway, canal, inland navigation, dock, or harbour for the purposes of their undertaking otherwise than in accordance with the provisions of the Electricity (Supply) Acts, 1919 and 1922.

21.—The Board may, by agreement, use any main transmission lines for such time and upon such terms as may be agreed.

22.—(1) The Board and any local authority, company, or person producing electricity by water power, waste heat, or otherwise, may enter into arrangements for the purchase by the Board of surplus electricity, and the Board may be authorised by order of the Electricity Commissioners to exercise such powers as may be necessary for the purpose of conveying the electricity so purchased.

(2) The provisions of sub-section (2) of section fifteen of the Electricity (Supply) Act, 1919, shall apply to the Board as to a joint electricity authority.

23.—(1) The Board shall annually make to the Minister of Transport a report of their proceedings under this Act during the preceding year, and such report shall be laid before Parliament.

(2) The Board shall furnish to the Electricity Commissioners such statistics and returns as they may require.

Financial Provisions.

24.—All sums received by the Board shall be paid into a separate fund, out of which the salaries, fees, and allowances of the members of the Board and the salaries, remuneration, pensions and gratuities of the secretary, officers, and servants of the Board, and all expenses incurred by the Board, shall be paid, including repayment to the Electricity Commissioners of any expenses incurred by them in the preparation of schemes under this Act, and payment to the Minister of Transport of any expenses and liabilities incurred by him before the commencement of this Act preliminary to the preparation of such schemes, with interest at the rate of 5 per cent. per annum.

25.—(1) For the purposes hereinafter mentioned the Board may, with the consent of the Electricity Commissioners, and subject to regulations to be made by the Minister of Transport with the approval of the Treasury, borrow money, and the regulations may empower the Board to borrow temporarily and to make arrangements with bankers, and may apply enactments relating to borrowing by local authorities.

(2) Such powers of borrowing may be exercised for—

(*a*) The construction or acquisition of main transmission lines, generating stations, and other works;

(*b*) Any other payment or any permanent work, the cost of which ought, in the opinion of the Electricity Commissioners, to be spread over a term of years;

(*c*) The provision of working capital;

(*d*) Any other purpose authorised under this Act.

(3) Any money borrowed under this section, and the interest thereon, may be charged on the undertaking and all the revenues of the Board, and shall be repaid within such period not exceeding sixty years as the Electricity Commissioners may determine.

(4) The maximum amount which may be borrowed by the Board under this section shall be thirty-three and a half million pounds, and the Board shall not have power to borrow any sums in excess of that amount, otherwise than for the purpose of paying off loans previously raised, unless authorised to do so by a special order under section twenty-six of the Electricity (Supply) Act, 1919.

(5) It shall be lawful for any annual provision for the repayment of borrowed money, to be suspended whilst the expenditure out of such moneys remains unremunerative, subject to such conditions as the Electricity Commissioners, after consultation with the Treasury, may determine:

Provided that such suspension shall not be for a longer period than five years from the commencement of the financial year next after that in which such expenditure is incurred.

(*To be concluded.*)

The Work of the Electricity Commissioners.

Report for the Year 1925-26. *(Abstract).*

(*Concluded from page* 1096.)

Consents to Subscriptions to Associations.

The Commissioners issued 24 consents in respect of the payment of subscriptions to and/or expenses of attendance at meetings of Associations, and authorised contributions to the expenses of District Joint Industrial Councils.

The British Electrical Development Association made an appeal for increased support, the suggested scale of contributions being at the rate of 20s. per thousand pounds of gross revenue of the electricity undertaking. The Commissioners approved in principle of the new scale, and were prepared to give their consent to the payment of contributions on that basis.

The attention of the Commissioners was drawn to the position of the British Electrical and Allied Industries Research Association Incorporated, the work of which was mainly financed by a contribution from the British Electrical and Allied Manufacturers' Association, and by an equal contribution from the Department of Scientific and Industrial Research; and to the possibility that the financial grant from the Department in question might cease. The work of the Research Association had already proved an asset of considerable value to the electricity supply industry, and the Commissioners informed the Incorporated Municipal Electrical Association that they were prepared to sanction the payment of reasonable subscriptions in that connection. The Commissioners also addressed communications to other representative Associations of the electricity supply industry with the view of enlisting their active support for the work of the Research Association.

Returns and Statistics.

In June, 1926, the Commissioners published a Statistical Return which embodied detailed engineering particulars for the three years 1920-3, and financial particulars for the two years 1921-23 in respect of all authorised electricity undertakings in Great Britain. Progress was made with the preparation of a second Return containing similar particulars for the two years 1923-25 [issued in November, 1926].

During the year the Commissioners received the usual monthly returns of fuel consumption, units generated, &c., in respect of the generating stations (numbering 483) belonging to authorised undertakers in Great Britain, 78 generating stations owned by railway and tramway authorities, and 23 stations owned by non-statutory undertakings.

Transfer of Undertakings.

Under the provisions of 11 Orders, the Commissioners approved of deeds transferring certain undertakings. The transfer of other authorised undertakings also took place during the year. The Corporation of Barnsley acquired part of the undertaking of the Electrical Distribution of Yorkshire, Ltd., and the Corporation of Scarborough acquired the undertaking of the Scarborough Electric Supply Co., Ltd.

By Section 13 of the Act of 1919, it is provided that where any right to purchase the whole or any part of the undertaking of an authorised distributor is vested in a local authority and becomes exercisable before the date of the constitution of a Joint Electricity Authority for the district, the right shall not be exercised without the consent of the Commissioners. During the year the Commissioners received intimations from local authorities in such areas that they had given formal notice of their intention to purchase the electricity undertakings. The legal aspects of the matter were considered, and the Commissioners were advised that their consent under the Section was necessary before the rights of purchase could be exercised; that in the absence of prior consent a formal notice of intention to purchase was not valid; and that a notice given in the absence of prior consent could not be validated by the subsequent issue of a consent under the Section. The local authorities concerned were notified accordingly.

During the year, the Commissioners issued four consents to the exercise by local authorities of their rights of purchase.

Appointment of Electric Inspectors.

During the year, the Commissioners appointed Electric Inspectors for the purposes of the undermentioned Order and Act, and prescribed the fees to be paid for services rendered: (1) Bromley (Kent) Electric Lighting Order, 1891, inspector, Dr. A. Russell; (2) Sheffield Corporation Act, 1918, inspector, Mr. A. E. Moore.

Advisory Committee on Domestic Supplies of Electricity.

In April, 1925, the Commissioners appointed an Advisory Committee to consider what steps could be taken to bring about an increased consumption of electricity for domestic purposes, and also the possibility of simplification and greater uniformity in tariffs and methods of charge adaptable for the object in view. At an early stage of its investigations, the Advisory Committee arrived at certain interim conclusions which were submitted to the Commissioners. Certain of the suggestions put forward by the Committee had already formed the subject of representations made by the Commissioners to the Minister of Transport.

[The Advisory Committee reported in July, 1926, and the Report has been published.]

Charges for Electricity.

The general tendency towards lowering the charges for electricity throughout the country was again reflected in the applications made to the Minister of Transport for Orders authorising a revision of maximum prices. In two cases, the authorised undertakers concerned were taking steps to establish electricity undertakings under Orders obtained in 1914 and 1915 respectively, and it was represented that the maximum prices originally prescribed by the Orders were not sufficient under post-war conditions to ensure a reasonable return on the expenditure incurred. The Commissioners recommended the Minister to grant the desired Orders. In addition, six applications, affecting 10 authorised undertakings, were made for a downward revision of maximum prices; in three cases the Commissioners recommended the Minister to grant Orders, the undertakers having agreed to reductions. In two other cases, where the rights of local authorities to take over the undertakings were approaching maturity, the Commissioners recommended that consideration of the applications should be deferred. In the case of the Twickenham and Teddington Electric Supply Co., Ltd., a joint application was made by all the local authorities concerned. The application formed the subject of a public inquiry, in the course of which the company indicated that the undertaking had reached a stage of development at which it would be prepared to apply the whole of any savings in the cost of working to the reduction of prices to consumers. After consideration of the evidence, the Commissioners recommended the Minister to grant Orders authorising a new maximum price of 9d. per unit and minimum quarterly charges on the usual basis, subject to the company furnishing a definite undertaking on the basis indicated.

Overhead Lines.

There was a substantial increase in the number of applications for consent to the erection of overhead lines, 194 applications being dealt with during the year, as compared with 162 applications during the preceding year. In 84 cases the applications were from local authority undertakers, in 51 cases from electric power companies, and in 59 cases from other company undertakers. The Commissioners were able, in the majority of the cases, to recommend the Minister of Transport to give his consent. In certain cases, however, objection was taken by the local authority to the placing of lines overhead, and the applications in question were referred to the Minister. At March 31st the Minister had given his consent in respect of 189 of the applications, the remaining cases still being under consideration.

During the past two or three years, undertakers have found it necessary in a number of instances to make application for an amending consent to permit of minor deviations from the line of route prescribed in a prior consent. Upon a review of the cases concerned, it appeared to be inexpedient that additional formalities should be invoked where the deviations were of a minor character. After consultation with the Postmaster-General, the Commissioners accordingly recommended the Minister to adopt, in appropriate cases, a modified form of consent, in respect of overhead lines over country of an open character in urban and rural areas, giving power to the undertakers to make minor deviations within certain defined limits if found necessary during the erection of the line. The Minister has since given his consent in the modified form when so advised by the Commissioners. A lateral deviation, even within the defined limit, which would involve the placing of any portion of the line within the district of a local authority other than the one concerned with the original application, would involve a further consent.

Wayleaves.

The Commissioners dealt with 24 applications for consent to wayleaves. In five cases the parties concerned arrived at a settlement. In seventeen cases the Minister of Transport caused local inquiries to be held.

With regard to fifteen cases in which the Minister gave his consent, the wayleave rentals prescribed are given in the Report; examples are as follows:—1s. for each 100 yards of cable laid underground; 1s. for each single pole; 2s. for each double pole; and 6d. for each stay. Where the poles impeded arable farming, 4s. or 5s. was fixed, and 2s. or 2s. 6d. for each pole which impeded the mowing of grass.

Revocation of Powers.

During the year the Commissioners had under review the circumstances in which statutory powers to supply electricity had not been brought into operation. They recommended the Minister of Transport to revoke the Tenby Corporation Electric Lighting Order, 1915; and to defer the question of revoking the Electricity Special Order. An application was made by the Corporation of Gravesend for the revocation of the powers of the Kent Electric Power Company, and the West Kent Electric Company, Ltd., in respect of certain parishes in the Rural Districts of Dartford and Strood. An application was also made by the Urban District Council of Shoreham-by-Sea for the revocation of the powers of the Shoreham and District Electric Lighting and Power Company, Ltd. In each case the Commissioners recommended the Minister not to accede to the application.

Abstraction of Water.

In the case of the application made by the North Metropolitan Electric Power Supply Company for an Order to authorise the abstraction of water from the King George Reservoir of the Metropolitan Water Board, proceedings took place in the High Court, and judgment was given to the effect that the reservoir was "a river, stream, canal, inland navigation or other source" within the meaning of Section 15 (1) of the Act of 1919. The application of the company was under consideration by the Minister at March 31st.

Borrowing Power Regulations.

The Electricity (Supply) Act, 1922, empowers Joint Electricity Authorities to borrow money for purposes specified therein, subject to regulations to be made by the Minister of Transport with the approval of the Treasury. At March 31st the regulations drafted by the Commissioners were under consideration [subsequently issued on August 30th, 1926].

Compensation for Loss of Office, &c.

An arrangement for mutual assistance was entered into by the Corporation of Portsmouth and the Fareham Urban District Council, and approved by the Commissioners. The Council ceased to generate electricity, and arising from the closing down of its generating station, claims for compensation were preferred by four employés. The total amount of the compensation awarded by the Referee was £565 10s.

The Grays Thurrock Urban District Council entered into an agreement for a bulk supply from the County of London Electric Supply Co., Ltd. The Council ceased to generate electricity, and, arising from the closing down of its generating station, claims for compensation were preferred by three employés. The Referee awarded a total sum of £123.

Organisation of the Electricity Commission.

The Commissioners received notice in the early part of the year that it would not be possible for them to continue the tenancy of offices in Gwydyr House. They decided to take the offices formerly occupied by the Metropolitan Water Board at Savoy Court, Strand, and entered into occupation on May 25th, 1925.

During the year the Commissioners found it necessary to make certain additional appointments to their staff to enable the increasing volume of work to be effectively dealt with. On March 31st, 1926, the staff of the Commission numbered 60 in all, and consisted of 30 established officers and 30 unestablished and temporary officers, inclusive of typists and messengers.

At the beginning of the financial year the Commissioners estimated the net cost of administration for the year at £54,700; after allowing for a reduction of £1,700 in the working balance, the total amount to be apportioned among authorised undertakers was £53,000. The certified returns submitted to the Commissioners showed that 4,997,963,253 units were sold by authorised undertakers in Great Britain during the year ended December 31st, 1924. The apportionments in June, 1925, the contributions by the electricity supply industry towards the expenses of the Commissioners for 1925-26 thus involving a payment by each authorised undertaker concerned amounting to about 2.54d. per 1,000 units sold.

The actual excess of expenditure over receipts was £44,098, and the working balance was increased by £8,901. The expenditure included £3,731 for a further report on the standardisation of frequency, and the work of Advisory Committees.

Returns submitted to the Commissioners showed that the "units of electricity sold" by all authorised undertakers during the year ended December 31st, 1925, amounted to 5,515,345,364, an increase of over 10 per cent. as compared with the preceding year; the estimate of expenses for the year 1926-27 approved by the Minister of Transport amounted to £51,000, and apportionments involving a payment of 2.23d. per 1,000 units "sold" were made on authorised undertakers in July, 1926.

The Commissioners record with regret the resignation, on June 30th, 1925, of their colleague, Mr. Archibald Page, from the office of Electricity Commissioner after more than five years of service in that capacity, to take up an appointment with the County of London Electric Supply Co., Ltd. Consequent upon this resignation, the Minister of Transport appointed Mr. S. L. Pearce, C.B.E., consulting and chief engineer and general manager of the Manchester Corporation Electricity Department, to the office of Electricity Commissioner.

Attached to the Report are 17 appendices, containing reports relating to eight Districts, details of consents to extensions of plant and to main transmission lines, lists of Special Orders applied for and made, and particulars of loans sanctioned, systems of supply, non-statutory undertakings, fringe orders, proceedings under the Trade Facilities Acts, and the Electricity Fund Account.

Electrical Development in Belgium.

THE Belgian National Commission on Production, which has just issued its final report, deals at length with the situation of the coal industry, the fuel problem and the economies to be realised, and the production and distribution of electricity. At the outset it is pointed out that the distribution of electricity permits of the concentration of production in large stations, the capital costs of which are low, and allows, moreover, of the use of coal which is otherwise unsaleable, and of the low-quality gas yielded by coke ovens and blast furnaces.

An example of what ought to be done, it is said, is afforded by the industrialists in the region of Liége, whose generating stations are interconnected and interchange the available energy, saving in this manner 60,000 tons of coal per annum. Similar organisations are in the course of being realised or are projected elsewhere. The interconnection of such networks will constitute further progress. But in order to allow of this parallel working of the generating stations throughout the country, it is necessary for the voltages and frequencies to be standardised and for the construction of main transmission lines to be undertaken.

Under the circumstances the Commission, addressing itself both to the public authorities and to industrialists, has reached the following conclusions:—(1) That the supply of cheap electrical energy is a matter of national interest; (2) That the economical production of electricity requires the maximum utilisation of energy obtained from by-products, the use of generating units of high power, the rational use of engines of different kinds, and the smallest installation of reserve plant which is not fully utilised; (3) That the organisation of groups of large stations, uniting the industrial stations fed by blast-furnace gas, coke-oven gas, and refuse fuel, at the same time as the central stations consume coal, is capable of ensuring the achievement of these objects and of bringing about a minimum consumption of fuel and a maximum of reliability; (4) That the results obtained in this sense by the Union des Centrales Electriques grouping the several generating stations in the basin of Liége, fully confirm the theoretical calculations which it is possible to make on this subject; (5) That various schemes have recently been prepared with a view to utilising sources of hydraulic energy; (6) That the general organisation of the production of electricity in Belgium, based upon the creation or development on a more or less extended scale of large central stations, as well as the running of the generating plant in parallel, would permit of the reduction of the annual consumption of fuel, as well as of the cost of labour, by at least 50 per cent. of their present amount for the whole of the generating stations. The Commission consequently recommends the development of efforts in these directions.

Concerning the utilisation of waterfalls, the Commission states that Belgium is not well provided with natural waterpower. It is not even certain that it would be possible to create artificial waterfalls with a good yield by the construction of dams so as to form reservoirs in the valleys situated in the Ardennes, or to harness the rivers. But if hydraulic installations considered exclusively as sources of electrical energy are not economical, they would be able to become so if they were utilised not only for the production of energy, but also for regulating the discharge of rivers and diminishing the effects of inundations, remedying the pollution of rivers, feeding the navigation canals, ensuring the navigability of rivers, and placing water at the disposal of industrial regions. Taking these matters into consideration and bearing in mind that projects have been prepared for the construction of large barrages in the Ardennes and for the regulation of certain watercourses, the Commission suggests that the Government should cause a general study to be made from the technical, economic, and financial standpoints of a part of the schemes for barrage reservoirs proposed for the Ardennes on the one hand, and the schemes for the organisation of the Meuse between Liége and Vise on the other.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

ABERDEEN.—1,000 houses, for Corporation; city architect.

ALLOA.—Motor engineering works; Wilson & Carmichael, solicitors.

AUCKLAND (NEW ZEALAND).—Development of a civic centre in Queen Street: Art Gallery, Town Hall Annexe, and other buildings, first instalment (£630,000), subsequent developments, £383,000; the City Council.

AUSTRALIA (MELBOURNE).—Installation of pneumatic tube service for the Commonwealth Postmaster-General. Supply Officer, Australia House, Strand, W.C.

AUSTRALIA (SYDNEY).—Rebuilding premises, for Messrs. Metters, stove and windmill makers (£135,000).

AYLESBURY.—Additional 60 houses, for the R.D.C.; surveyor.

AYR.—Ultra-violet treatment to be introduced at Heathfield Hospital; medical superintendent.

BAKEWELL.—Electric light installation, Haddon Joint Hospital; Charles Flint, architect, The Quadrant, Buxton.

BANDON (Co. CORK).—Cottage hospital for South Cork County Board of Public Assistance; D. Egan, secretary, County Home, Douglas Road, Cork.

BATLEY.—Extensions to Providence Street schools (£12,100), for the borough E.C.; the clerk.

BILLINGHAM.—Houses, for the U.D.C.; builders, J. G. Porteous, Ltd., Middlesbrough (52), T. Sweeting, Middlesbrough (52), J. McCreton, Ltd., North Ormesby (56), and G. Fordy, Stockton-on-Tees (56).

BIRKENSHAW (YORKSHIRE).—Elementary school; West Riding Education Department, County Hall, Wakefield.

BOMBAY.—Market, Dador Colony; municipal commissioner.

BO'NESS.—Extensions for Seaforth hosiery factory; J. Taylor, architect.

BRADFORD.—186 houses for Corporation, at Eccleshill No. 6 estate; city architect, Town Hall, Bradford (Jan. 11th). 340 houses for Corporation, at Wyke; city architect, Town Hall. Extensions to the Northbrook Brewery, for J. Hey & Co., Ltd.; W. Illingworth, architect, Sunbridge Road.

BRETBY.—Extensions to Bretby Hall tuberculosis institution and administrative quarters, for Derbyshire C.C.; Mr. Widdows, county architect, Derby.

CAMBRIDGE.—Ward, Fulbourn Mental Hospital; A. Paul Macalister, architect, 20, St. Andrew's Street.

CAPE TOWN.—Market extensions (£50,000); municipal engineer.

CREWE.—Additional housing scheme (150), for the T.C.; E. G. Timbrell, architect, Municipal Buildings.

CROYDON.—Additional 50 houses, Coulsdon, for the T.C.; Borough Engineer.

DAGENHAM.—School, March Green (£8,315), for Essex E.C.; J. Stuart, county architect, Springfield Old Court, Chelmsford.

DUMFRIES.—Water supply scheme (£101,345), for the Dumfries and Maxwelltown Water Commission; the clerk.

DUNDEE.—U.F. Church; Rev. J. Robbie, clerk of Presbytery. Western Esplanade extension (£70,000), extension of Dudhope Terrace (£10,000); city engineer. School for education authority in Perth Road; the clerk.

EASTLEIGH (HANTS.).—Houses (56), Stanley Road, for T. W. White, 111, Nutbeem Road.

GLASGOW.—53 houses at Netherlea (electric light); Mitchell and Sons, builders. 112 houses, Shettleston; housing director. 192 houses, Germiston; Brown, Fraser & Co. 2,000 Corporation houses at Carntyne; Director of Housing, City Chambers. 182 houses at Kelvinside; Mactaggart & Mickel, Ltd., 65, Bath Street. Scottish National Commercial College (£100,000); clerk, education authority. Kinema, Springburn; B. Frutin, 164, Argyll Street. Additions and alterations to Stobhill General Hospital, clerk, Parish Council.

GRAVESEND.—Schools, Whitehill Road (£10,840), for the E.C.; Friday & Sons, builders, Erith.

GRIMSBY.—Maternity home, Nunsthorpe; Steele & Goddard. 60 houses, Nunsthorpe; borough engineer.

GUILDFORD.—'Bus garage; L.G.O.C.

HEMSWORTH (YORKS.).—Housing scheme (40), Grove Lane, for the U.D.C.; surveyor.

HORBURY (YORKS.).—Blanket mills, Coxley Valley, Middlestown, for Messrs. Clayton.

HOVE.—100 houses, Knoll Housing Estate, Old Shoreham Road; borough architect.

KILMARNOCK.—Additional housing scheme (210), for the T.C.; borough surveyor.

LEICESTER.—Extensions to the Municipal College of Technology (£50,000).

LEITH.—Secondary school; clerk, Education Authority, Edinburgh. Public library; city architect, Edinburgh.

LONDON (BARKING E.).—160 houses, Cecil Estate; C. Gray. Electricity offices and showrooms, Ripple Road, for the U.D.C.; council architect.

(BARKING TOWN, E.).—32 houses, River Road; County of London Electric Supply Co., Ltd.

(E.C.).—Block of offices, St. Mary Axe; W. D. Caroe, architect, 3, St. College Street, S.W.1.

(MUSWELL HILL, N.).—Bank, shop and flats, Broadway; E. Maufe, 3, Raymond Buildings, W.C.1.

(CRICKLEWOOD, N.W.).—Factory, Oxgate Lane; E. Brown and Son, Ltd.

(HAMPSTEAD, N.W.).—Extensions, Westfield College for Women Students, Kidderpore Avenue; Thompson and Walford, architects, Leadenhall Street, E.C.

(REGENT'S PARK, N.W.).—Additions to Bedford College for Women; Sir J. W. Simpson and M. Ayrton, architects, 3, Verulam Buildings, Gray's Inn, W.C.

(WILLESDEN, N.W.).—1,400 houses, Walles Hill; Costain and Sons, Ltd.

(BRIXTON, S.W.3).—Stores, corner of Brixton Road and Stockwell Road, for Bon Marché, Ltd.; H. P. Wyatt, architect, 465, Brixton Road, S.W.

(CLAPHAM COMMON, S.W.).—Enlargement and rebuilding senior school, for the Governors, Royal Masonic Institute for Girls; A. B. Brown, Freemasons' Hall, Great Queen Street, W.C.2.

(LEICESTER SQUARE, W.).—Drapery emporium, corner of Leicester Square and Wardour Street; Whinney, Son and Austen Hall, 8, Old Jewry, E.C.

(PARK LANE, W.).—Block of flats on Grosvenor House site; Wimperis, Simpson & Guthrie, 61, South Molton Street, W.1.

(RED LION SQUARE, W.C.).—Premises to be called Conway Hall, for the South Place Ethical Society, South Place Institute, Moorgate, E.C.2.

MAIDSTONE.—Houses (118), for the T.C.; Corben & Sons, builders.

MALDON.—50 houses, Cross Road and Mundon Road, borough engineer.

MANCHESTER.—Rebuilding Winter Gardens Kinema, Peter Street; proprietors. Block of offices, 40, Cannon Street (£200,000); proprietors.

MIDDLESBROUGH.—Additional 100 houses, for the T.C.; borough surveyor.

RHYL.—Central school; Flintshire Education Committee.

RUGBY.—Additional 32 houses, for the R.D.C.; surveyor.

RUTHERGLEN.—Church, hall and offices at Burnside; convener, Home Mission Committee, Glasgow Presbytery.

SALFORD.—Schools, Tootal Drive, Weaste, for the borough E.C.; the clerk.

SHEFFIELD.—Development of Wey Manor Estate, New Haw (3,600 houses); G. Longden & Son.

SHIPLEY (YORKS.).—68 houses, Albert Road estate; H. Dawson, architect, Council Offices, Somerset House.

SITTINGBOURNE.—Stores (£7,936), for the Co-operative Society; E. Bishop & Sons, Ltd., builders.

SOUTHEND-ON-SEA.—Intermediate school (£24,500), for the borough E.C.; the clerk.

SOUTHERN RAILWAY.—£8,000,000 extension scheme (Southampton Docks extension, £3,000,000; new stations at Eastbourne and Epsom; cleaning sheds at Victoria, &c.).

STOCKBRIDGE (YORKS.).—School; Education Department, West Riding County Hall, Wakefield.

SWANSCOMBE (KENT).—Housing scheme (48), Milton Road site, for the U.D.C.; surveyor.

TONBRIDGE.—Public hall kinema, for Mr. Beaden.

TORQUAY.—Reinstatement of "Courtlands," Chelston, for F. Dobson, C.C. (£4,000).

UPMINSTER (ESSEX).—Roman Catholic Church and schools (£7,000); Rev. Father M. J. Healy.

WALLINGFORD.—Hospital (£8,500), for the committee; the secretary.

WALSALL.—182 houses; Richards, Smith & Co., Ltd.

WALTHAM ABBEY (HERTS.).—Development of Hayes Hill estate, with 250 houses; Bristow & Co., architects.

WATH-UPON-DEARNE.—Secondary schools (£11,050), for West Riding E.C. director of education, County Hall, Wakefield.

YORK.—42 Corporation houses, Tang Hall Estate, No. 2; F. W. Spurr, city engineer, Guildhall (January 17th).

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Contents:

	PAGE
Materials for the Electrical Industry	41
The Location of Power Stations	42
The Electricity (Supply) Act Reviewed	43
The Brightness of Illuminating Glassware	43
Extra-high-pressure at Bradford	43
"Creda" Heating and Cooking Appliances (*illus.*)	44
River Water—or Cooling Towers? by J. N. Waite (*illus.*)	46
Copper, Lead and Rubber Prices (*illus.*)	49
The Signs of Trade Revival	50
Transatlantic Radio-Telephony (*illus.*)	51
The Electricity (Supply) Act, 1926	52
Legal	53
Business and Industrial Notes	54
Lighting and Power Notes	60
Tramway and Railway Notes	61
Telegraph and Telephone Notes	62
Radio Notes	62
Contract Information	63
Forthcoming Events	64
Notes	65
Institution Notes	65
Our Personal Column	66
Financial Section—	
New Companies Registered	66
Official Returns of Electrical Companies	67
City Notes	67
Stocks and Shares	67
Minor African Markets	69
The Physical Society's Exhibition (*illus.*)	70
The British Industries Fair	72
New Electrical Devices, Fittings, and Plant (*illus.*)	73
Electric Railway Track Equipment, by Arthur R. Cooper (*illus.*)	74
The Electricity (Supply) Act, 1926 (*concluded*)	76
Correspondence—	
The "H" Type of Cable	78
Electric Ovens	79
The Necessity for Higher Voltages	79
New Work for Contractors	80

Materials for the Electrical Industry.

ALTHOUGH the consumption of copper during the year 1926 was on a very large scale, the market was not a very satisfactory one as regards prices. Standard copper at the end of 1925 was about £59 12s. 6d. per ton, whilst the value at the end of last month was only about £56 2s. 6d. In the same period "electro" dropped from £66 to £63 15s.

It was a matter of surprise to many that values should have shown such poor response to an excellent demand, but it has to be remembered that in recent years improved methods of metallurgy have resulted in a cheapening of the cost of output and, indeed, have made possible the working of ores which previously would not have been an economic proposition. However, with a view to stabilising prices, producers in America arranged an organisation entitled Copper Exporters Incorporated, to handle all sales of metal for overseas countries, the United States market being excluded. The association is not confined to American interests, although there is still a certain production which does not come within its scope. Naturally those interested in the metal apprehended a rise in price, and on the eve of the start of the new concern, substantial buying was done by both consumers and dealers, the latter being anxious to secure supplies in view of the expressed intention of the Incorporated Exporters to confine sales to the consuming industries so far as practicable. The result was that trading subsequently underwent a lull and, indeed, the new selling organisation experienced keen competition on the part of dealers. This resulted in anxiety on the part of American producers to secure orders in their own country, the combined effect of these two circumstances resulting in still lower prices. It has to be borne in mind, however, that as the quantities of copper in dealers' hands are limited, and as the stocks of metal which they purchased just prior to the formation of Copper Exporters, Inc., become reduced, the chance of that concern having a greater control over the market is increased.

Whilst there are hopes of improved consumption in Europe in the coming year, the prospects in regard to the United States are a little indefinite as yet, but what

one has to remember is that the price has had a fair fall, and is now at a reasonable level, and with the chance already indicated of the Copper Exporters securing greater control over the market, values should respond to any change for the better in general conditions.

The lead market was disturbed during the year by the incidence of the coal strike. In addition, however, the early part of the year saw the market in a weakening condition owing to the arrival of large supplies from Australia, where stocks had accumulated owing to a shipping strike at the close of 1925. As a result, supplies of the metal in this country have been ample, and whilst Continental consumption was good at one period, the rate of activity on the Continent has declined latterly, resulting in the bulk of the supply being diverted to the United Kingdom. The general result is that a surplus has accumulated here, but as the bulk of this is held in warehouses which do not furnish a return of their stocks, it is impossible to estimate what the total supplies here may be. In any case, however, they seem to be held in strong hands and are not pressed for sale. During last year prices dropped from about £35 10s. to £28 15s., and although a rather better sentiment is expressed, based on the belief that the arrivals here during the first month or two of the year may be on a slightly smaller scale, that the existing stocks will probably be carefully nursed, and that there are fair prospects of a revival in the rate of consumption, the market has nevertheless shown further weakness.

Spelter also saw a decline in values during 1926, prices coming down from about £38 12s. 6d. at the end of 1925 to £32 15s. at the end of last month. Consumption here was interfered with by the coal strike, but while the stoppage at our mines continued, a high rate of consumption was maintained on the Continent. Latterly, however, the rate of industrial activity on the Continent seems to have eased, whilst the consumption in this country has not increased to the extent anticipated. No doubt, however, this is partly on account of slack conditions in galvanised sheets, and a broadening in the demand on the part of galvanisers is to be expected when the inquiry for sheets shows signs of increasing. An important event was the dissolution of the German syndicate of spelter producers. Hitherto the leading smelters in that country had been acting in concert in selling their output, and the news of the break-up of the syndicate naturally had a somewhat depressing effect on the London market. So far, however, no selling pressure has developed on the part of the various concerns which formed component parts of the syndicate, producing interests in that country apparently preferring to hold their metal in the hope of a rally in the market. There is now talk of some further syndicate being formed, but nothing concrete has developed as yet so far as is known. In view of the change in conditions in Germany, it is difficult at present to take a definite view of the outlook. At around present levels, however, the metal market seems fairly moderately priced.

During the first seven months of 1926 rubber quotations fell fairly steadily, following the 1925 boom. However, for the greater part of the year the exportable quota from Malaya and Ceylon was 100 per cent., and with consumption in America considerably below expectations, stocks accumulated in London and in the United States, and rose to the extent of fully 60,000 tons during the year. The restriction scheme was considerably amended at the end of October, and the question of unused coupons was dealt with. The outlook for 1927 is very uncertain, for consumption in the United States, which in 1926 fell far below the estimates, is still most difficult to forecast. Motor-car production at the moment has fallen off, and although a good demand is anticipated in the spring, this may not materialise. Moreover, the powerful "Pool" recently formed in the United States may be strong enough to influence the course of the market. More rapid increase or curtailment of exports is now provided by the restriction scheme according to the price level, and with the reassessment of estates as yet uncompleted, estimates of output are most difficult. Generally speaking, it is anticipated that 1927 will see a larger consumption of rubber and with an impending reduction in the exportable quota to 70 per cent. of standard at the end of January, prices should be maintained at a reasonable level, in spite of the stocks held in London and America. Much, however, depends on whether consumers delay purchasing and so cause a further reduction in the exportable quota at the end of April.

The Location of Power Stations.

The lines on which electricity supply is developed to meet the electrical needs of a country are influenced very materially by the conditions obtaining in the particular country. What has proved to be an economic proposition in one country—or even in one district of a country—is not in itself a guarantee that similar methods will yield the best economic results elsewhere. Local conditions must always be taken into consideration. This country is fortunate and unique in that most of its electrical load centres are situated on, or closely adjacent to, coalfields. The fact is not always given its due weight when the electrical requirements of the country as a whole are under consideration, although it is really the dominating factor of the whole electricity supply situation. The moral of the old adage that "It does not pay to carry coals to Newcastle" is surely applicable to the problem of this country's electricity supply, for the source of electrical energy, in this country, is coal, and most of the main load centres have their own coalfields.

Other conditions being equal, the obvious location of a power station is at the centre of gravity of the load supplied therefrom, for thus capital and running costs of distribution are kept to the minimum value. From a distribution point of view this is the ideal location, and as the capital cost of distribution is usually more than half the total cost of an undertaking, and the ratio is tending to increase, it follows that before extra cost is incurred in distribution due to locating the station far away from its load centre, the gain due to decreased generation cost should outweigh the increased distribution cost. A school of thought has arisen in the electricity supply world which takes it for granted that the only right policy for generation is to concentrate it in relatively few stations on riverside sites. We have never agreed that that is the only possible policy, for in our opinion, if it were carried out in its entirety, the enhanced distribution costs would far outweigh the gains in generation costs. There are cases where the riverside capital station represents the optimum economic solution, but on the other hand, there are other cases where such a choice could not be justified.

There are many factors affecting the economic location of power stations. The values of some of the factors vary with every case, but the values of certain of the factors are capable of being determined for general application. In this issue we publish an article entitled "River Water—or Cooling Towers?" by Mr. J. N. Waite, M.I.E.E., in which the author examines the effect of using river water for condensing purposes on thermal efficiency, as compared with cooling towers; to this article we would direct special attention, as being a very timely and authoritative pronouncement on this important factor.

A study of the article shows quite clearly that the author, who has had a very extended experience of both classes of station, and has studied the subject exhaustively by actual tests under normal working conditions, holds no brief for either the riverside station or the cooling-tower station, but is solely concerned with arriving at a reasonably accurate estimate of the inherent thermal gain accruing from the use of river water for condensing purposes. The article examines the question in a judicial manner, giving the basic data, and the logical conclusions to be derived therefrom.

The results arrived at, as given in Table III, provide material for serious thought, for the inherent thermal gain due to the use of river water for condensing purposes is considerably smaller than has been generally accepted. It is obvious that the thermal gain alone is not sufficient to pay for locating a power station far from its load centre.

The recent decision of the Liverpool Corporation undertaking, with the approval of the Electricity Commissioners, to extend Lister Drive Station, which uses cooling towers, instead of building a new power station on a riverside site, caused considerable surprise in the supply world, and provoked some criticism. In this case, the cost of a riverside site and of the civil engineering work in connection therewith was the deciding factor. The results shown in the article by Mr. Waite give further support to the view that the decision arrived at was the correct one. The Liverpool undertaking is to be congratulated on thinking for itself and refusing to be led by fashion.

The fact that such undertakings as those at Birmingham, Sheffield, Bradford, and a number of others have pursued the course of locating their power stations as near to the load centres as possible and using cooling towers, in preference to going a long distance afield to obtain sites where river water is available, taken in conjunction with the generating costs of those undertakings, is reasonably satisfactory proof that capital stations can be erected and operated to give economic results without the use of river water for condensing purposes. For every given case there is an economic limit distance from the load centre. In this country, with its many coalfields, the economic distance limit must be relatively small in many cases.

We commend the article to the serious attention of supply engineers as being a lucid and well-reasoned examination of an important factor in the location of power stations.

The Electricity (Supply) Act Reviewed.

THE complete and final text of the Act was issued last week, and to-day we conclude a summary of its provisions; we also begin a critical review of its contents, mainly from the legal standpoint, written at our request by Mr. W. S. Kennedy, who is intimately acquainted with its provisions and, moreover, is a staunch advocate of the Government scheme. Whilst we opposed the Bill during its passage through Parliament, we accept the Act as a fact, and shall endeavour to look on the bright side and direct attention to its good points.

We strongly recommend all managers of electricity supply undertakings to obtain copies of the Act *in extenso*. Many of its provisions, it is clear, relate to the future and will have no direct bearing on the work of the industry for some years to come, but, on the other hand, a close examination of the clauses reveals a number of useful amendments to the previously existing Acts, from 1882 to 1922, which can be availed of at once. The outstanding clause which is of the most immediate importance is, of course, Section 48, "Sale of Fittings," which grants to all local authority undertakers the selling rights which they have so long sought to obtain, subject to agreed safeguards. We hope that no time will be lost in carrying this Section into effect, whilst the E.D.A.-E.L.M.A. campaign is in full swing, and that it will serve as a flywheel to carry on the good work of domestic electrification when the campaign itself has ended. There should be plenty of work for contractors in 1927.

Another useful Section is No. 34, "Power to lop Trees and Hedges," which will facilitate the erection of overhead lines in rural districts, though its provisions are sadly cumbersome, and may lead to tedious delay. Section 42, "Methods of Charge," will hasten the adoption of the two-part tariff which we have so long advocated; that system is fully endorsed by Sections 11 and 51 and the Seventh Schedule, which explicitly prescribe the division of the cost of production and of the price charged for bulk supply under two heads—the fixed kilowatt charges component and the running charges component.

Other amendments of immediate interest will be found in the Schedules by those who take the pains to compare them with the Acts and Schedules to which they refer; moreover, in some respects they are mandatory. The Fifth Schedule restricts the allocation of the net surplus in aid of the local rate in any year to a maximum of 1½ per cent. of the outstanding debt, and after March 31st, 1930, forbids any such allocation unless the reserve fund has been adequately built up. The statutory notice in respect of service lines is reduced from one month to seven days.

Lastly, the Fourth Schedule is of importance to members of the staffs of electricity supply undertakings who fear that the operation of the Act may prove detrimental to their interests.

The Brightness of Illuminating Glassware.

THE Fourth Technical Paper issued by the Illumination Research Committee on the brightness of glassware describes researches made at the request of the British Engineering Standards Association. Eighteen different types of hemispheres and bowls were examined, five being of pot opal, nine of cased opal glass, and the remainder of alabaster ware. In general, 300-watt lamps were used in the 16-in. diameter glassware, 200-watt lamps in the 12-in and 100-watt lamps in smaller sizes. The conditions thus agreed with usual practice, and it is interesting to observe that the brightnesses recorded are by no means excessive. The average brightness of the glassware is frequently below 1 candle per sq. in., and in only one case (a translucent sphere) did the brightness of any portion of the luminous surface exceed 2 candles per sq. in. The average brightness of the white sky has been commonly assumed as the brightness of objects that can be comfortably contemplated without glare; authorities have accordingly recommended that fittings within the direct range of view should preferably not exceed 3 candles per sq. in. in brightness. It would seem, therefore, that the consumer who utilises good modern diffusing glassware with gasfilled lamps is not likely to go far wrong; and that good modern opal and alabaster bowls in general afford ample protection against the glare from filaments. Another feature pointed out in the report is the even distribution of brightness over the surfaces of the bowls tested In all but four cases the variation in brightness per inch of surface was within 10 per cent. The Department of Scientific and Industrial Research has again done good service in presenting data on this subject.

Extra-High-Pressure at Bradford.

WE have received particulars of a notable departure from the conventional power-station practice which has been put in hand by the Corporation of Bradford, on the advice of the City Electrical Engineer, Mr. Thomas Roles, M.I.E.E. In brief, Mr. Roles has decided to install a boiler to work at 1,100 lb. gauge pressure, with an evaporation capacity of some 90,000 lb. per hour, the temperature of the steam being 800 deg. F.; this boiler will supply steam to a 2,500-kW turbine, which will exhaust directly into the main steam range of the Valley Road power station. It is anticipated that this combination will result in a saving of 12 per cent. of coal, and the proportions of the plant are such that the output of the alternator driven by this turbine, together with the electrical output derived from the steam handed over to the low-pressure plant, will cover the estimated future base load of the station.

The contract has been entrusted to the English Electric Co., Ltd., which has been conducting experiments on the use of high-pressure steam at its Rugby works for many years with successful results. The boiler will be made for that company by Messrs. Babcock & Wilcox.

We congratulate Mr. Roles and the contractors on their enterprise, which will be watched with interest.

"Creda" Heating and Cooking Appliances.

A recent visit to the New Factory of Credenda Conduits Co., Ltd., near Birmingham, showed how the standardised mass production of domestic electrical apparatus is facilitated by well-laid-out modern plant.

HAVING built up its business on quality rather than the production of cheap lines, the Credenda Conduit Co., Ltd., deserves the well-merited success of its enterprising policy of quantity production of domestic electric heating and cooking apparatus, which has brought its reward by permitting of the introduction of material improvements without involving increased manufacturing costs.



Fig. 1.—A General View of the Sheet-Metal Press Shop.

Commencing with the manufacture of conduit and associated fittings in the City of Birmingham about 1900, the production of electric heating and cooking appliances was later embarked upon in the original Scholefield Street premises, the business being eventually transferred to the Star Works at Aston, and in 1913 the concern became a limited liability company. In 1917 the Heating Department was lodged in separate premises in Avenue Road, where it grew at an embarrassing rate, due largely to the introduction of a new series of cookers, and the lack of extension facilities made a move imperative. A 5½-acre site was accordingly obtained at Oldbury, and the new factory commenced production in May, 1926; notwithstanding the generous allowance of space, however, present indications are that further bays will probably have to be added to certain shops in the near future. The new factory is laid out on modern lines, with north lights, adequate electric light, and central-heating plant: the accompanying illustrations convey some idea of the spaciousness of the principal shops, and it is worthy of note that the showroom and drawing and administrative offices are heated electrically throughout. Electricity is purchased from the Shropshire, Worcestershire, and Staffordshire Electric Power Co., at 5,500 volts, 3 phase, 25 cycles, and transformed in the works sub-station to 400 volts, some of the power being converted to d.c. for welding, electro-plating, and testing purposes.

From the rough stores sheet metal and rough castings, large stocks of which are maintained, are issued to the press and machine shops respectively; the former (fig. 1) is fully equipped with guillotines, both hand and power presses, and a battery of electric spot welders. A part of the well-equipped machine shop is shown in fig. 2; all tools are made on the premises, a large number often being required for the production of one article. The same shop also accommodates the lathes used for spinning copper kettles, a fascinating

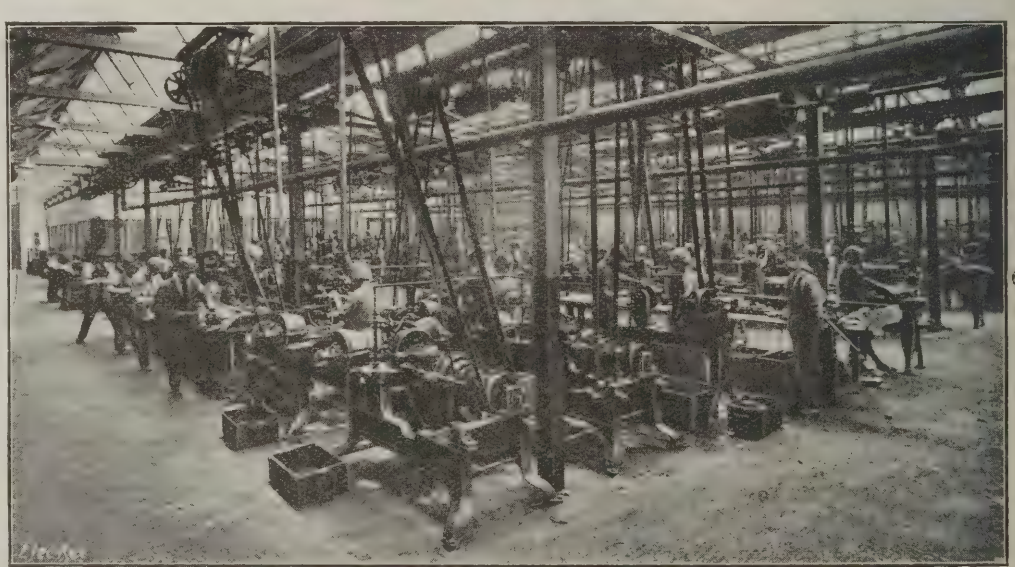


Fig. 2.—A Corner of the Extensive Machine-Tool Bay.

operation to watch. The majority of heating elements are wound by high-speed machines, but it is found desirable in some cases to hand-wind them; to allow for expansion and contraction, as the wire is wound it is passed through crimping rollers. The operatives work in gangs under section leaders, which facilitates the addition or withdrawal of sections as occasion demands. It will be noticed from fig. 3 that the larger cookers are assembled on platforms, while benches are provided in the case of the smaller appliances, their respective heights being so chosen as to prevent back strain and fatigue; the system in vogue is "one man one job," the aim of the management being quantity production, and the assembly process follows through from the finished components stores at one end of the shops to the test section and packing bay at the other end, which is adjacent to and on a level with the main road to facilitate dispatch. The test benches are fitted with conveniently arranged bus-bars, and besides the usual tests, all apparatus is "flashed": large cookers at 2,000 volts, and kettles, irons, and the smaller appliances at 1,000 V. The products of the works are finished in varied styles: a polishing shop, fitted with a system of exhaust fans to protect the workers from dust, is kept busy, and also a large electro-plating section. Extra-heavy-quality copper, nickel, and silver plating is employed, besides oxidised and antique finishes. A feature of the lacquering shop is the electrically-heated hot plates and cupboards for drying, warming and hot lacquering. Steel is "blued" in an oven; the first coats of enamel are applied by dipping and the final coats by spraying. Cookers of several sizes are made, perhaps the most popular model being that illustrated in fig. 4. All heating elements are 3-heat controlled, including the grill, and are of the plug-in variety and easily removable. The oven interior can be withdrawn in one piece for cleaning; it is heated from the sides and bottom, and loaded to 2,000 watts, but the bus-bar arrangement facilitates the addition of extra elements at any time. The grill is loaded to 1,500 watts, as are each of the two boiling plates, of the open pattern, arranged so that spilt liquids cannot harm them. Domestic grills and boiling and warming plates are also manufactured: also a "swing-gate" toaster, so named because the bread holder on each side is hinged to enable the bread to be reversed. The range of irons includes one specially useful when travelling; it is fitted with a special element connector to make it adjustable for any pressure between 100 and 250 volts. The Company's kettles can be provided with a protective device in the form of a tiny fuse, which is melted by excessive heat, and so releases a quick-break switch mechanism located in the false bottom, thus protecting the kettle in the event of its boiling dry.



Fig. 3.—Part of the Main Assembly Department; Large Electric Cookers.

Electric fires, including the bowl and imitation coal varieties, are manufactured in numerous styles and finishes. One of the most graceful in appearance is illustrated in fig. 6; an improved guard is now fitted and a cool, fall-down handle at the back, in addition to the cast ornamental one at the top. Influenced by its hard-wearing qualities, the "Crater" fire bar is fitted to the majority of the Company's fires, a different winding being available for every 10 volts. It is made of tough fireclay with a steel back to prevent breakage; the heavy-resistance spirals are easily renewable, no anchor wires or clips being necessary.

In recent years considerable progress has been made in the manufacture of standardised electric heating and cooking appliances, instead of special types and features, which in the past retarded the introduction of mass methods of production.

The Company's range of manufactures includes electric heating and cooking appliances for hotel and industrial uses, but space considerations do not permit of their description; neither did we have time to inspect the tube mills and conduit fittings department at the Aston Works. Our thanks are due to Mr. P. W. Davis, the managing director, and Mr. F. G. Nesbitt, the sales manager, for their courtesy in showing us over the works, and giving us information which filled our visit with interest.

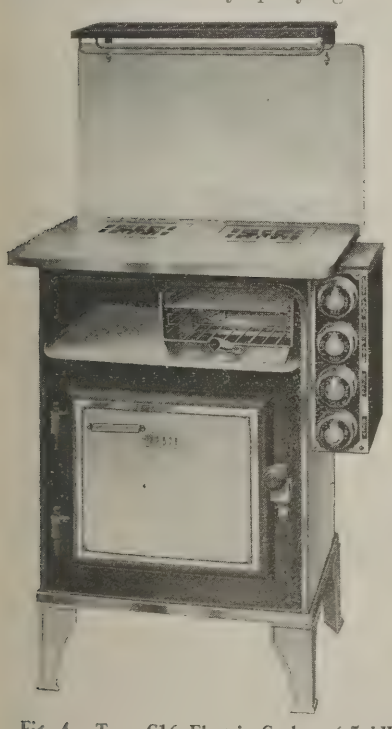


Fig. 4.—Type C16 Electric Cooker, 6·5 kW.

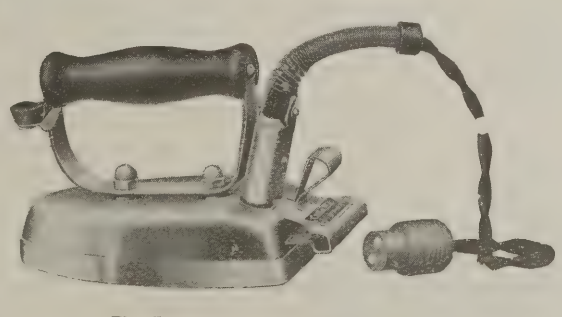


Fig. 5.—A "Creda" Domestic Iron.



Fig. 6.—The "Graceful" Electric Fire.

River Water— or Cooling Towers?

The theoretical gain of thermal efficiency due to the use of river water at 50° F., as compared with water artificially cooled to 75° F., for condensing, is partly neutralised by the difficulty of dealing efficiently with the immense volume of steam at a pressure near 1 inch of mercury (absolute); instead of 10 per cent. the net gain in practice is about 4 or 5 per cent.

By J. N. WAITE, M.I.E.E.

IN view of the obvious trend of legislation regarding electricity supply, the present appears to be a particularly opportune time to review the effect of some of the salient factors affecting the economic location of generating stations. The object of this article is to consider the effect of using river water for condensing purposes on the coal consumption of power stations, compared with the use of cooling towers. This factor, of course, is only one out of many that govern the choice of site, but as it is the one which affects thermal efficiency, which at present seems to be looked upon as a universal panacea for all the more or less mythical ills that the electricity supply industry is deemed to be suffering from, it would appear desirable to attempt to delimit the effect of this factor first. In engineering, as in other walks of life, fashions arise, have their day, and decline. At the present time the leading fashion for power stations is the so-called super-power station, situated where a plentiful natural supply of water is available for condensing purposes. There is no doubt that a power station situated where river or sea water is available for condensing purposes will be able to achieve a higher thermal efficiency than a station using cooling towers, assuming equally efficient plant and operation in both cases. There is also no doubt that, in the majority of cases, the capital costs of a riverside station will be less than for a cooling-tower station. This last statement has a very necessary qualification, for it is conceivable that the exigencies of a riverside site might involve such relatively high costs for foundations, river works, &c., that the advantages of river water might be nullified.

It must always be borne in mind that it is the total cost of energy delivered to the consumers that is the criterion of economic power supply, and not merely the cost of generation. The ultra-efficient power station located at a great distance from its load centre may involve a higher total cost for energy delivered to the consumers than would be the case with a less efficient station located nearer to the load centre. It is obviously useless to reduce generating costs if the gain is to be outweighed by increase in transmission and other costs. For all given cases there is an economic distance limit to power transmission. Beyond this limit, in this country, it is cheaper to carry coal than to transmit electrical energy.

The problem of economic electricity supply in this country is not going to be solved solely by the creation of a relatively few large-sized super efficient riverside power stations. Most supply engineers will agree that there are too many small power stations operating now, but at the same time there is a solid body of opinion that the influential supporters of the large-size riverside station fashion, in their enthusiasm for the fashion, are proposing to go much further than is warranted at the present time by the economic facts. Doubtless the necessary antidote will be forthcoming before all the proposals take concrete shape. Before any great changes take place, it should be shown beyond reasonable doubt that not only will the yield be greater than the cost, but also that the ultimate gain will be greater than could be achieved by any other method or scheme.

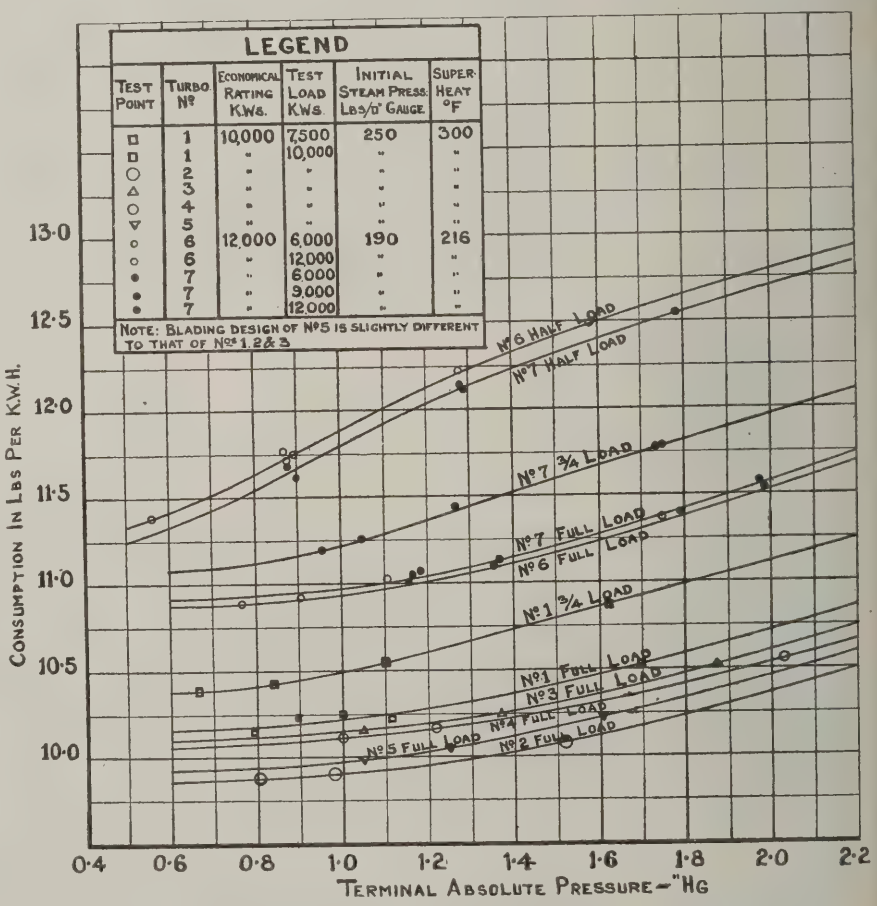


Fig. 1.

So far as the writer is aware, no detailed examination of this important question has been published. Many engineers hold definite opinions on this subject, but the majority of the opinions that have been seen or heard by the writer do not coincide with the ascertainable facts. It has been, and still is, often stated that by using river water for condensing purposes instead of cooling towers, the resultant gain is 10 per cent. or over on the coal consumption. The value assigned is far too high, as will appear later. The probable reason for this absurdly high value being assigned to the gain is that it has been calculated on the theoretical increase in adiabatic heat drop with decreased terminal pressure —or higher vacuum—and also to over-estimation of the difference in the vacua realisable under the two sets of conditions.

In well-designed commercial turbines, at full load, the actual gain due to decreased terminal pressure closely follows the theoretical down to about 1.6 inches Hg. absolute (28.4 in. Hg. vacuum). Below this pressure the rate of actual gain rapidly falls away, although the theoretical gain increases. This is illustrated in fig. 1, which gives the test results of seven large-sized modern turbines, all of which are of the two-cylinder type, having double-flow, low-pressure cylinders, which design enables efficient results to be obtained at the l.p. end, and represents about the best result to be expected at the present time. With turbines having a restricted low-pressure blade area, the falling-off will commence higher up the scale of pressure. It will be noted from fig. 1 that at half load the actual gain follows the theoretical much further down the pressure scale than is the case for full load, which is to be expected; but this does not affect the present investigation, for turbines are normally operated at their full economical load.

Before the advent of feed heating by turbine bleeding, there was a very appreciable debit against the gain due to decreased terminal pressure, from the fact that low terminal pressure could only be achieved in conjunction with a low condensate temperature, with the result that the total heat per lb. of steam to the turbine increased with decreased terminal pressure. This debit is practically negatived when bleeding for feed heating is employed, but should be taken into account when bleeding is not used.

Effect of River Water on Coal Consumption.

To arrive at an estimate of the effect of using river water for condensing purposes on coal consumption, the following data are necessary:—

(1) The average temperature of river water.
(2) The average atmospheric temperature.
(3) Cooling tower performance.
(4) Condenser performance.
(5) Actual value of terminal pressure on turbines.

All the foregoing are variables, but from a practical point of view no serious difficulty exists in arriving at representative values from which the effect of using river water on coal consumption can be deduced. Actual cases will probably have different values from those taken as the basis here, but it is contended that the variations met with in practice will not materially alter the main conclusion arrived at.

River water temperature will vary somewhat between different rivers, and also between different places on the same river, mainly according to whether close to the sea or remote therefrom. From records available it would appear that the average temperature of river water is round about 50 deg. F., probably slightly higher. In what follows, the average temperature of river water is taken as 50 deg. F. With this value, full justice will be done to the results from a riverside station.

Official meteorological records from a station in the Midlands give the average of daily *maximum* atmospheric temperatures over a period of 31 years as: dry bulb, 53.5 deg. F.; wet bulb, 49.5 deg. F. These values are the averages of maximum daily temperatures, so that the true average temperature will be appreciably lower. In what follows, the average atmospheric wet-bulb temperature is taken as 45 deg. F., and the average atmospheric humidity as 80 deg. These values do not in any way favour cooling towers.

The real criterion of cooling-tower performance is: how near to the atmospheric temperature can the circulating-water temperature be reduced? The most suitable atmospheric temperature for this purpose is that of the wet bulb, for this takes account of humidity. Cooling-tower performance is affected by design, loading rate, degree of cooling, situation, atmospheric temperature, and humidity. For the purpose in view, the performance required is that corresponding to what can be obtained from a modern well-designed cooling tower when operating at a normal loading rate and doing a normal degree of cooling, with the atmospheric temperature assigned. From a fairly extensive knowledge of cooling-tower performance, and a knowledge of what cooling-tower manufacturers are prepared to guarantee to-day, the writer would assign a value of 75 deg. F. to the temperature of re-cooled water leaving a cooling tower with an atmospheric wet-bulb tempearture of 45 deg. F., and with normal loading and degree of cooling, as representing a good average performance. Therefore, for cooling-tower stations the average circulating inlet-water temperature will be taken as 75 deg. F., as against an average circulating inlet-water temperature of 50 deg. F. for riverside stations.

Condenser performance varies with design, with the efficacy of the air extraction, with the velocity of the circulating water through the tubes, with the loading rate, with the ratio of water to steam, with the state of the tube surfaces, and with the temperature of the inlet circulating water. For the purpose in view, with the exception of the last, all these variables can be neglected, the performance required being the absolute pressure that can be produced with a modern condensing plant under normal conditions of loading and circulating-water quantity, with inlet temperatures of 50 deg. F. and 75 deg. F. respectively. From a fairly wide experience of condenser testing, the writer would assign the respective values to be:—

With 50 deg. F. inlet temperature, 0.9 in. Hg. abs.

With 75 deg. F. inlet temperature, 1.7 in. Hg. abs.

These values can be realised with modern commercial condensing plant, but as the ratio of circulating-water quantity to steam quantity is usually somewhat less with cooling towers than with river water, it is proposed to assign a value of 1.8 in. Hg. absolute as the average condenser absolute pressure in cooling-tower stations. Hence the assigned values for average absolute pressure for the two cases are:—

Average terminal pressure for river-side station, 0.9 in. Hg. abs.

Average terminal pressure for cooling-tower station, 1.8 in. Hg. abs.

The actual influence of terminal pressure on turbine steam consumption varies with design, with the initial steam conditions, and with the degree of terminal pressure. These variations do not affect the comparison to be made, for what is required is the best value that can be realised by a modern turbine over the assigned range of terminal pressure (1.8 to 0.9 in. Hg.). Before considering what is the actual gain to be realised, it may be advantageous to show the theoretical gain due to decreased terminal pressure over the assigned range. This is shown by Table I for a range of initial pressure with constant initial superheat. The result would not be materially affected if a constant initial top temperature were taken instead of constant initial superheat.

TABLE I.

Increase of Adiabatic Heat Drop due to Decreasing Terminal Pressure from 1.8 in. Hg. to 0.9 in. Hg. abs.
Initial Superheat Constant at 250 deg. F.

Initial steam pressure, lb. per sq. in. gauge	250	350	450
	Adiabatic heat. Drop in B.th.u./lb.		
Terminal pressure, 1.8 in. Hg. abs.	422.6	447.0	465.6
Terminal pressure, 0.9 in. Hg. abs.	456.8	480.7	498.8
Increase in heat drop	34.2	33.7	33.2
Theoretical decrease in steam consumption	8.1%	7.5%	7.1%

From Table I it will be noted that the gain due to decreased terminal pressure gets less as the initial pressure increases, ranging from 7.1 per cent. with 150 lb. initial pressure to 8.1 per cent. with 250 lb. pressure, so that if the value assigned to the actual gain is based upon turbine tests at relatively low initial pressure (as will be the case), it represents the best that can be expected.

Actual Gain Less than Theoretical.

As stated earlier, the actual gain for the assigned decrement of terminal pressure is considerably less than the theoretical gain; the reason for this is fairly well known, and may be briefly outlined as follows:—

The efficiency ratio of turbine blading varies with ratio of blade speed to steam speed. With other conditions constant, the volume of steam presented to the last stages of a turbine varies inversely with the terminal pressure (approximately); hence, the steam volume increases at the last stages as the terminal pressure is decreased, and unless the blade area at the exhaust end is increased to that necessary to maintain the maximum efficiency ratio, this ratio will decrease, and the actual gain will be less than the theoretical. With the low terminal pressures obtainable with modern condensing plant using relatively cold river water for circulating purposes, it is not commercially possible to provide a sufficiently large blade area at the turbine exhaust end to utilise efficiently the immense volume of steam presented at low absolute pressure. Therefore, after a certain degree of absolute pressure has been reached, the actual gain gets progressively smaller for each equal decrement of pressure, although the theoretical gain gets progressively larger. The actual degree at which this falling-off commences is a matter of design.

Very few test data are available on the actual influence of terminal pressure on turbine steam consumption. The writer has taken an active interest in this detail point for many years, and in pursuance of that interest has determined the actual value on a fairly large number of turbines of various designs and sizes. The difference between the actual value found and the manufacturers' estimate of it has been very striking indeed on occasions. It is admittedly difficult to determine accurately small differences by measuring large quantities, especially when several variables exist, as is the case with turbo-alternator tests, but given the necessary equipment and experience, it can be done. A number of such tests are given in fig. 1. These are the best results obtained by the writer, who has obtained many others giving much lower results.

The test results in fig. 1 show that the highest gain realised at full load by reducing the terminal pressure from 1.8 in. Hg. to 0.9 in. Hg. was just over 4 per cent. This was with an initial steam pressure of 190 lb. per sq. in. gauge, so that the actual gain is rather less than half the theoretical gain in steam consumption. It may be emphasised that the only value of terminal pressure considered is that pertaining to economic full load, for that will be the load at which turbines will—or at any rate should—operate for the major portion of their running hours. As will be seen from fig. 1, the value of terminal pressure, within the limits under consideration, is considerably higher at half load, showing that although the particular turbine was designed for 0.9 in. Hg. at full load, and was provided with a double-flow low-pressure cylinder, the last stages were over-run at full load and the designed vacuum.

As stated earlier, on a straight turbine, there is a debit against the gain due to decreased terminal pressure in the form of decrease of heat in the condensate. This can be best illustrated by a simple example. From fig. 1 a gain of steam consumption of 4.1 per cent. may be expected by reducing the terminal pressure from 1.8 in. Hg. to 0.9 in. Hg. absolute. On a modern condensing plant the temperature of the condensate leaving the condenser will be about 3 deg. F. lower than the temperature corresponding to the absolute pressure at the top of the condenser, when the plant is giving a good performance. The following Table II shows the thermal gain for a straight turbine—without feed heating by bleeding—for a representative case.

At the present time the practice of feed heating by bleeding is practically standard for all new plant, and then the loss of heat to the condensate due to lower terminal pressure can be made good by bleeding at low pressure, with practically no effect on the steam consumption. This apparent anomaly is due to the last stages of a turbine being normally over-run. Withdrawing a portion of the steam from the last stages has the effect of increasing the efficiency ratio of the last stages, utilising the steam that passes at a higher efficiency, and so causing the effect of bleeding at low pressure to have practically no effect on the turbine

TABLE II.—TURBINE THERMAL GAIN DUE TO DECREASING TERMINAL PRESSURE FROM 1·8" HG. to 0·9" HG. ABS.

Decrease in steam consumption = 4·1%.

Initial steam.			Terminal press: "Hg. abs.	Condensate tempre. °F.	Total heat to turbine B.t.u. per lb.	Steam consumption lb. per kWh.	Heat consumption B.t.u./kWh.	Thermal gain %
Press: Lb. p. sq. in. abs.	Superheat. °F.	Total heat per lb. from 32° F. B.t.u. per lb.						
250	250	1340	1·8	95	1277	10·70	13664	2·5
250	250	1340	0·9	73	1299	10·26	13328	

steam consumption. Hence this debit is to all intents and purposes negatived in modern plant, and need not be considered in the comparison being made, but it was considered advisable to point it out, as cases might arise where it was applicable.

Conclusion.

The result of the foregoing examination of what is the inherent thermal gain to be expected from the use of river water for circulating purposes, as compared with cooling towers, is that the maximum thermal gain, assuming full economical load on turbines, is of the order of 4.0 per cent. The gain will vary with the average load on the turbines. In most cases the actual average load would probably be somewhat lower than the full economical rated load. The following Table III gives the thermal gain corresponding to given average loads.

TABLE III.

Maximum thermal gain from the use of river water for condenser circulating water, compared with the use of cooling towers.

Data: Average atmospheric temperature (wet bulb) 45° F.
Average temperature of re-cooled water leaving cooling towers ... ... 75° F.
Average temperature of river water ... ... 50° F.
Average absolute pressure with:—
Inlet water temperature of 75° F. ... ... 1.8" Hg.
Inlet water temperature of 50° F. ... ... 0.9" Hg.
Value of terminal pressure deduced from fig. 1.

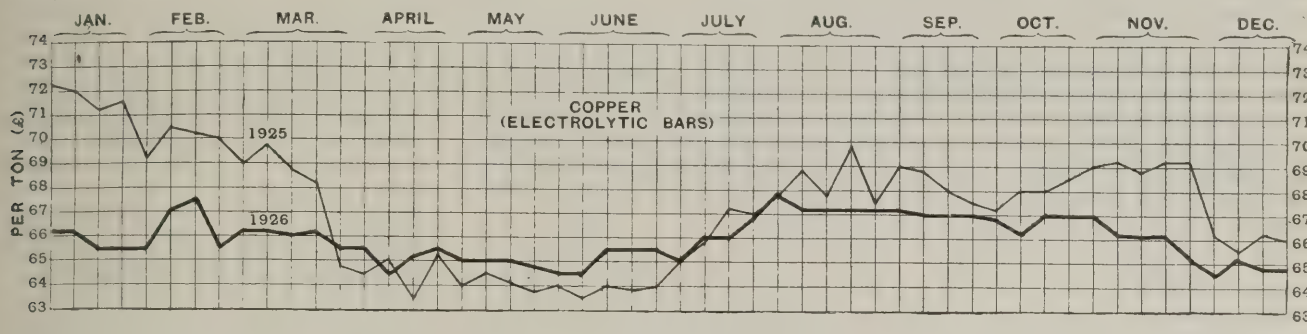
Average turbine load as fraction of full economical load.	Maximum thermal gain from the use of river water. %
1/1	4.0
7/8	4.8
3/4	5.6
5/8	6.4
1/2	7.1

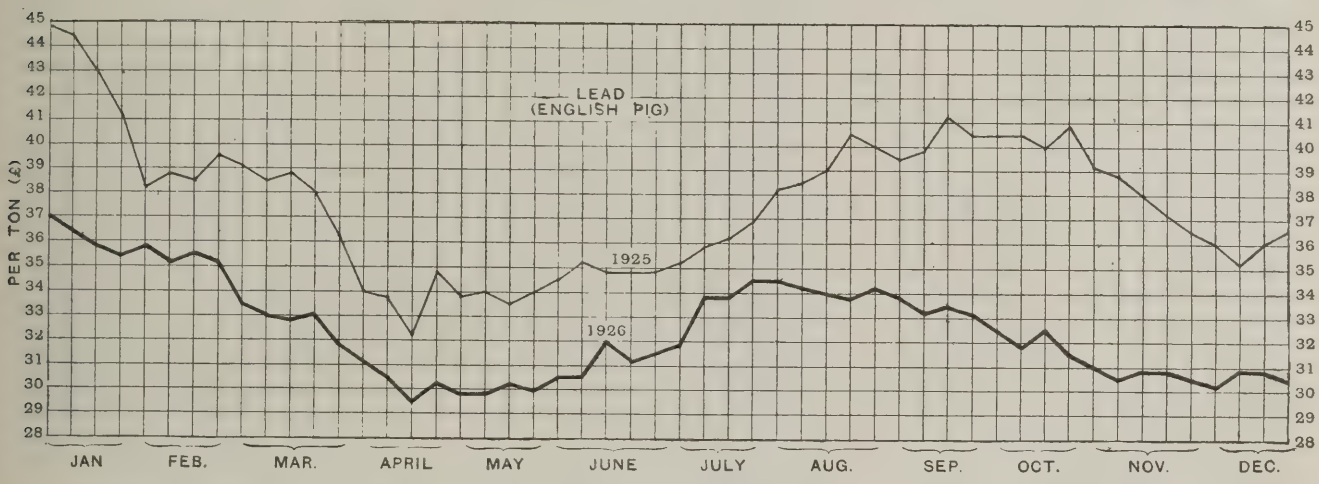
In view of the many variables involved, the examination has been made on broad lines, confined to the main essentials, and deals solely with the effect on thermal efficiency. It is contended that the result presented in Table III is substantially accurate, although it is at variance wtih many opinions on the subject. Special pleading leading to revision of values of the basic data either one way or the other could only alter the data within quite small limits, and the effect on the result would be negligible with the turbines available at the present time.

Copper, Lead and Rubber Prices.

The Past Two Years' Movements Compared.

THE curves showing the course of copper, lead, and rubber prices during 1926 which we publish in accordance with our usual practice, indicate greater stability and, generally speaking, lower levels than in 1925.

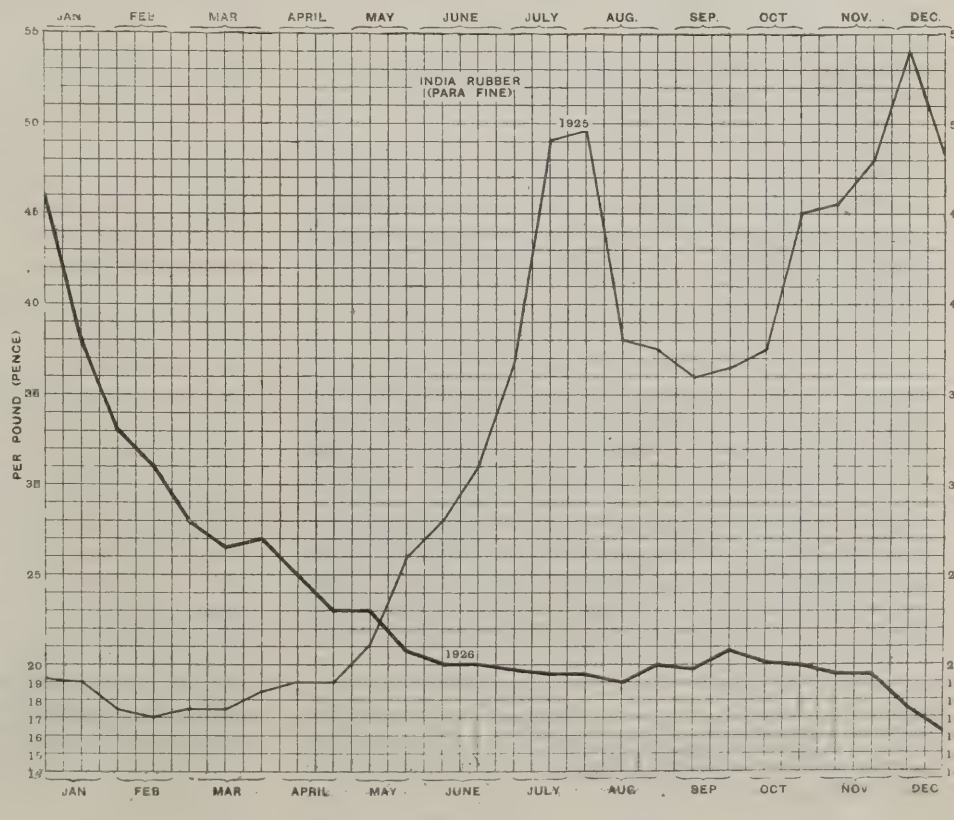




In the case of copper, the opening price was £6 lower than in 1925, and this feature continued until the end of March, when for three months the curve remained above that of the previous year. From August onward the 1926 prices continued lower in a gently-falling curve, and the end of the year found copper 25s. below the 1925 closing prices. Whereas in 1925 the price of electrolytic bars fluctuated between £63 10s. and £72 5s., last year the upper and lower levels were £67 15s. and £64 10s.

The 1926 lead prices were below those of 1925 throughout the whole of the year, and the general tendency was for the fall to continue. At no time did the price approach within £2 of the corresponding price of 1925, and in October there was a difference of £9 5s. The closing figure was well below the opening price.

In the first few months of the year rubber prices fell swiftly from the giddy heights attained in the preceding year, and during the whole period fell to just over a third of the opening price, with a tendency to fall still further. At one point in 1925 rubber reached the price of 4s. 6d.; at the end of 1926 it stood at 1s. 4¼d. Those whose business it is to buy rubber for manufacturing purposes will be thankful that rubber prices have lost their resiliency however much that quality is desirable in the material itself.



The Signs of Trade Revival.

Justified Optimism Manifesting Itself in all Sections of British Industry.

ALL branches of British industry appear to be agreed that 1927 is a year of great promise, and that it will mark an emergence from the slough of despond in which many of them rested during 1926. How much of this optimism is due to a feeling that things could not be much worse than they were last year, and how much to real, visible signs of improvement, it is difficult to say, but there are unquestionably many favourable indications. From all directions gleams of brightness are beginning to penetrate the industrial gloom, and many of them are very substantial gleams taking the shape of firm orders. Some of these orders have been carried over from last year, unfulfilled on account of the troubles of the year, but there are also many new ones.

There appears to be a dawning realisation that industrial disputes bring no lasting benefit to any party involved, but rather loss to the industry itself and to many others besides, eventually harming the nation as a whole. Frank discussion and a will to peace accomplish far more and lead further towards settled conditions without which no industry can hope to prosper. There are several shining examples of industries which have settled all their differences for many years by peaceful means, and consequently find themselves in a healthier state than others which have resorted to strikes and lock-outs.

With regard to the export position, which is a most important matter to many industries, there also appears to be ground for qualified optimism. While there are no indications of a lowering of the tariff walls which outsiders find so hard to scale, relief can be expected in the currency position which for some years has militated against British traders in foreign markets. In the countries of most of our competitors, the currency has appreciated and has been stabilised at a reasonable level. Unhappily, the restlessness of China, Russia, and Mexico are still features in the situation. This has a twofold advantage to the British trader. He not only finds it possible to compete on more level terms with the "stabilised" competitor in a third country, but it gives him a better chance in the "stabilised" country itself.

Another factor in improvement is efficient production. The growing consumption of electricity is an indication of a tendency in the right direction, and if the hopes of the Government from the Electricity (Supply) Act are realised, a further inducement to change over to electricity should be given to manufacturers who have not yet taken that step. Reports from some centres show that the industrial load lags behind.

Now to turn to concrete examples upon which the hopes of industry are based. We will first deal with the engineering industry, which was one of the most badly hit by the coal dispute. At no time during the year did unemployment in the industry fall below 10 per cent., and for five months it was well above 16 per cent. Being unable to obtain iron and steel in adequate quantities for over half of the past year, the heavy engineering section was especially affected. Now that the iron and steel industry is commencing to function in a normal way, this branch is bound to reap the benefit. Many of the larger companies report that they have sufficient orders in hand to keep them going for long periods without taking new ones. A representative body, the British Engineers' Association, says:—"It is only to be expected that the resumption of something approaching the normal output of coal, and of consequential activity in our basic industries in the execution of an accumulation of orders, placed either before or during the coal stoppage, will induce an all-round revival of trade. References have been made in the Press to a prospective boom, but it is to be hoped that there will be no such undesirable phenomenon, with its inevitable reactions. What is wanted now is steady progress, built up stage by stage on solid foundations, and all concerned in the restoration of real prosperity will discourage excessive optimism and the financing of too speculative enterprises, more especially if it be directed towards any increase in our already excessive productive capacity."

The revival of other industries will also have its effect upon the engineering industry. Textile authorities say that the world stocks are lower at present than they have been for many years past, and there must inevitably spring up a demand for cotton and woollen goods. In what may be anticipation of this revival, several large orders have been placed for textile machinery, and the outlook in that branch of engineering is said to be brighter than it has been for the last two or three years. The shipbuilding industry, which has been in a wretched state for a long time, is also looking up. Apart from the execution of held-up orders, work will be provided by a number of contracts received towards the close of last year. Here again the improvement will react upon the engineering industry, as the depression has already reacted.

During 1926 the electrical industry was looked upon as the "one bright spot," and all indications augur an intenser brightness during the coming year. Last year, in the face of the general strike and the coal dispute, the British electrical industry managed to increase its exports to a marked extent. This shows that without such restrictions it is capable of holding its own and more in the world's markets. Quite apart from foreign business, however, the electrical industry is assured of a prosperous year. Already we have learned of orders valued at millions of pounds being placed by customers in this country. The most important of these are the £1,460,000 contract awarded by the Birmingham Corporation to International Combustion, Ltd., for the construction of a new power station, in which the General Electric Co., Ltd., is a large participant; the electrification contract placed with the Metropolitan-Vickers Electrical Co., Ltd., by the Southern Railway Co., valued at over £600,000; and a very large cable order (over £100,000) given by the same company to Messrs. Johnson & Phillips, Ltd. In addition, there are numerous orders of a smaller nature for machinery and plant. This activity is bound to be reflected in the other electrical branches, and we look for increasing loads on the country's power stations brought along by the wiring and contracting industry. The organisers of the "Wiring the Homes of Britain" Campaign already report increased business in many districts, but the effect of six months' propaganda will continue to show itself for a long time to come.

One sign that our manufacturers intend to do their utmost to secure all the trade that is available is the increasing interest shown in the British Industries Fair. This year the display will surpass all previous fairs, both in magnitude and in its representative character. The electrical industry in particular is making an excellent effort, and we are convinced that it will not be in vain; its moral and psychological effects upon foreign buyers will not be the least of its advantages.

Transatlantic Radio-telephony.

The Inauguration of a Unique Service between London and New York with the Aid of British-made Apparatus is an Epoch-making Event.

A TRANSATLANTIC radio-telephone service between London (England) and New York (America) was formally inaugurated on January 7th, an achievement which reflects the greatest credit on all concerned, but it is perhaps not generally realised that the high-power transmitter used at the Rugby station (England) is almost entirely a British product.

By far the greater part of the work, *e.g.*, the power amplifier, the control table, &c., was carried out in London at the works of Standard Telephones and Cables, Ltd., in co-operation with the Engineering Department of the British Post Office. The power amplifiers used are capable of giving an amplication of the order of 500,000,000 times, with very great purity, by means of a relatively small number of water-cooled valves. Thirty-four valves are used, fig. 1, and thirty of them working in parallel constitute the final stage that handles the actual output of the transmitter. One thousand gallons of water per hour is required for cooling the valves in each of the two units into which the amplifier is divided; the water flows through 160 ft. of 2-in. hose so as to maintain the insulation of the valves, which are designed to operate with 10,000 volts on their plates, and these were also manufactured for the British Post Office at the New Southgate works of Standard Telephones and Cables, Ltd.

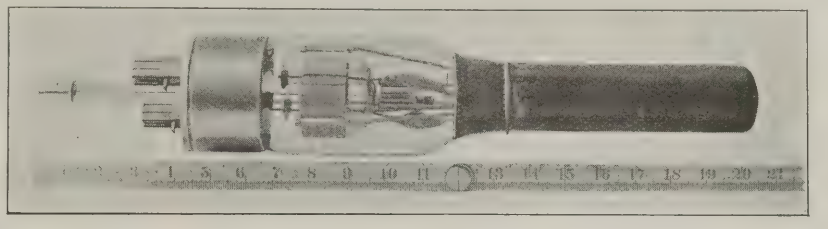


Fig. 1.—A 10-kW Water-Cooled Valve used at Rugby.

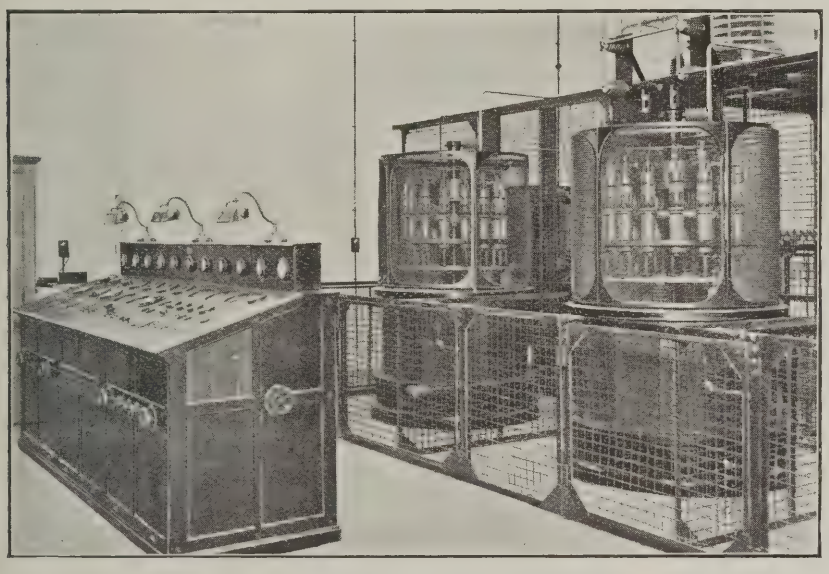


Fig. 2.—The Control Desk and Amplifier at Rugby.

Another extremely interesting part of the equipment is the control table, fig. 2, which is so placed in the station that from it the whole of the more important equipment can readily be seen. It carries all the controls for operating the equipment, and they are so grouped that the operator can follow and check the performance of the transmitter at each stage; for this purpose no less than 33 recording instruments are provided. The control table also carries devices for safeguarding the operating personnel, and others for protecting the valves, which are very costly owing to their intricate design and difficult manufacture. In the event of anything abnormal occurring in the apparatus, or of a person approaching dangerously near the high-voltage plant, the station is instantly shut down and an alarm given; the exact nature of the fault in such cases is indicated by lamps which light up on the control table.

Although the Rugby station is at present working satisfactorily, development work is still being carried on, and several ways of effecting immediate improvement are apparent to the Post Office engineers, who are negotiating with Standard Telephones and Cables, Ltd., for the manufacture of the necessary additional apparatus.

Messages are accepted in the usual way at the London Trunk Exchange, whence they go by land line to Rugby, then by wireless across the Atlantic Ocean to the Houlton receiving plant, and then by land line to New York; the return circuit is from New York to the Rocky Point transmitter, then to the Wroughton receiver (England) and finally to London. At the Trunk Exchange an operator controls the volume of sound emitted by the subscriber, so as to maintain it at the required standard. The American Telephone and Telegraph Co. co-operated in establishing the service.

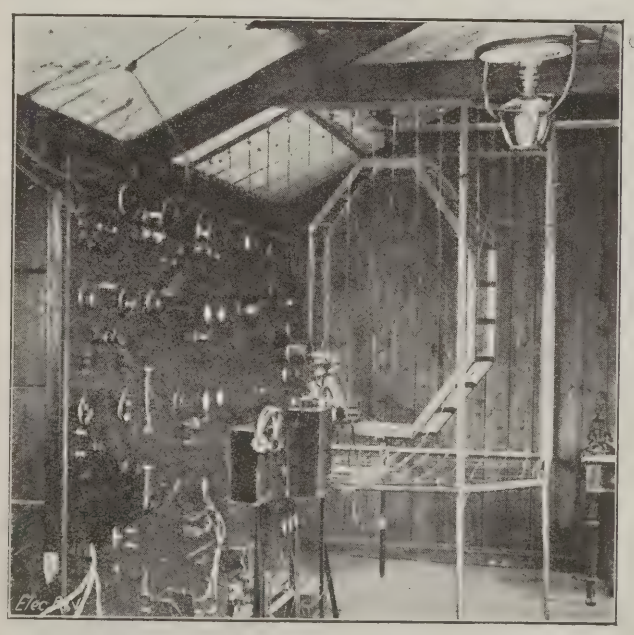


Fig. 3.—Receiving Apparatus at Wroughton, near Swindon.

The Electricity (Supply) Act, 1926.

An Explanatory Analysis of Provisions of the New Act, and a Critical Review of the Measure from the Legal Point of View.

By W. S. KENNEDY, Barrister-at-Law.

THE new Electricity Act may be considered from several points of view, and has been severely criticised from all. The political and social implications of the Act, though extremely important and, in the writer's opinion, likely to be of benefit to the country, are outside the scope of this article. With the technical aspect of any scheme which may be evolved under the Act, the writer is hardly competent to deal; his aim is to endeavour only to analyse the provisions of the Act and translate them, where necessary, into language more easily understood by the non-legal mind than the somewhat cumbrous phraseology necessarily employed by those whose object it is to provide for all possible contingencies.

The Act, as is well known, is based on the report of Lord Weir's Committee, and it is a legitimate surmise that the scheme which the Commissioners are to submit to the new Board will follow generally that which is outlined in the report. But it is important to note that the Act does not adopt the report, and indeed differs from it in important particulars; and, further, that the Act does not contain or give legal sanction to any of the technical details of that document. It is premature to criticise a scheme which has not yet been published, and must be subjected to a searching examination by impartial tribunals before it can become effective. We are here concerned only with the administrative frame and machinery which was recommended by the Weir Report, amended in the Bill as introduced, and further altered in Parliament to become the present Act.

The end to which this machinery is established is the development and cheapening of the supply of electrical energy in the country by co-ordination of generation, interconnection of supply systems, and, to such degree as is necessary, standardisation of frequency. With this end and, generally speaking, with the means suggested for its achievement, no one is likely to quarrel. It is, in effect, a development and wider application of the general principles put before the Commissioners during the London Inquiry in 1921. A scheme on those lines proved to be impossible because certain of the supply authorities were unwilling to allow the control of their generating stations to pass in any degree out of their own hands, and the Commissioners had no powers of compulsion. It will be remembered that such powers were given in the original Bill of 1919, but struck out in its passage through Parliament. They are restored in another form in the present Act, and are, in the writer's opinion, a regrettable necessity. If agreement could have been reached between the divergent interests represented before the Commissioners in the various inquiries they have held, compulsory powers would probably have been unnecessary. As it is, it may be hoped that their existence will make their use improbable.

The Act consists of 52 sections and seven schedules. It is divided into seven parts, dealing with the following matters: Sections 1-3, Constitution and general powers of the Board; Sections 4-19, Provisions as to scheme; Sections 20-25, Subsidiary provisions as to Board; Sections 26-30, Financial provisions; Sections 31-35, Miscellaneous; Sections 36-50, Amendments of earlier Acts; and Section 51, Interpretation. It is convenient to deal with these groups separately, although a certain amount of overlapping is inevitable.

1. The Board.

The first thing perhaps to note is that the Board, which has very large powers, is not a Government Department. In some ways the Commissioners, who are part of the Ministry of Transport, have been deprived of authority which has been given to the Board. This fact should at least give pause to those who, in delight or disgust, proclaim the Act to be a socialistic measure. The second important point is that the Board will not be a technical body. The Minister of Transport, before appointing the members, is to consult not only representatives of the electrical industry, but those of local government, commerce, industry (whatever this may mean—presumably any business which is not included under other heads), transport, agriculture, and labour. The minister is not bound to accept suggestions made to him by these bodies, but the Government's intention is obviously that the Board should not be composed of electrical experts. It will be comparable rather to the Board which has charge of broadcasting, if the comparison be not derogatory, than to the Commissioners. The Chairman and some other members are to devote their whole time to the work, but apparently the majority of the Board will act as directors and simply attend regular meetings. From the fact that three, out of the eight, constitutes a quorum, we may if so inclined deduce that possibly half the Board will be whole-time members. They are to be paid such salaries as the Minister may determine, and the enormous figures suggested in some daily papers exist only in the sub-editorial imagination. No member of the House of Commons may be a member of the Board—a very wise provision—and presumably the Board will be answerable for its proceedings to the whole House and not, except where the Act expressly provides, to the Minister of Transport. An opportunity is given to the House to discuss the Board's work when its annual report is laid before Parliament (Section. 25).

The general duty of the Board is to supply electricity to authorised undertakers, but not to generate itself, save in very exceptional cases. The Board will not become a competitor of existing undertakers. There are in Section 2 important provisions as to the Board's power of delegation. Any powers which the Board thinks may be more conveniently exercised locally may be delegated to authorised undertakers, except that the Board may not delegate its powers with regard to selected stations. This provision is of special interest to London, for it allays the fear which has been expressed that the Board might select the most efficient of the companies' stations and hand the management of them over to the J.E.A.—a course which would not be consistent with the spirit of the London and Home Counties Order. The Board must also retain in its own hands the power of fixing tariffs.

2. Provisions as to Scheme.

The scheme—or schemes—for development and reorganisation are to be prepared by the Commissioners and submitted to the Board as soon as possible. It is common knowledge that work on certain areas is already well advanced, but it is premature to criticise schemes which have not yet been published. The Weir Committee's Report gave certain figures, but these cannot

be taken as the Commissioners' final word, for much detailed investigation has been carried out since its publication. The Act itself contains no figures, but lays down the general lines which the Commissioners are to follow. The scheme is to relate to a definite area—there is no reason to suppose that the country is to be dealt with in one scheme as a whole, though general interconnection is certainly ultimately desirable. For that area the Commissioners select certain existing stations as being suitable—with possible alterations and extensions either immediate or future—for supply in the area generally. They are also to indicate what new stations should be built to provide for future developments; these are also known as selected stations. It is from these selected stations that eventually the whole supply will be given. A scheme is further to provide for the interconnection of selected stations, which is obviously necessary for economical working and for the interconnection of the system in the area with the system in any other area (presumably this means a contiguous area) where a scheme is in operation or may come into force.

(*To be continued.*)

Legal.

Colassi v. Smith.

IN the Mayor's and City of London Court, before Mr. Registrar Dell, on January 4th, a claim was made by Mr. W. L. Colassi, Fenchurch Street, E.C., against Mr. A. C. Smith, Fulham, for £3 7s. 6d., the value of wireless goods supplied as samples. The plaintiff said that in response to an advertisement which he inserted for a traveller to sell loud speakers, the defendant called and was given a sample, as well as batteries and valves, for the purpose of securing business. No business came, and he (plaintiff) wrote to the defendant asking for the return of the samples, but received no reply. The defendant admitted that he was in the wrong in not returning the samples, but he was willing to do so. He had carried the samples for a month without any remuneration. The plaintiff, in answer to the Registrar, said that there was no arrangement for defendant to have anything on account of expenses. The Registrar made an order for the return of the samples, and judgment was given for the plaintiff accordingly, with costs.

The Transporter Co. v. Johnson.

IN the Mayor's and City of London Court, last week, the plaintiffs, of Cannon Street, E.C.4, claimed £1 8s. 2d. from Mr. R. F. Johnson, Luton, for freight and charges. It was stated that a consignment of batteries was sent from Berlin to the defendant. Upon delivery, the batteries were found to be damaged; the defendant accordingly sold them for what they would fetch and remitted the proceeds to the plaintiffs. Defendant corroborated this, and said that the plaintiffs should have deducted their costs from the amount sent them before passing it on to Berlin. Mr. Registrar DELL considered that the plaintiffs had not proved their claim, and struck the case out of the list.

Heren v. Babcock & Wilcox, Ltd.

BEFORE Judge Shewell Cooper, in the Mayor's and City of London Court, on January 3rd, Mr. C. C. Heren, Plaistow, sued the defendant company for £468 in respect of damages under the Employers' Liability Act, 1880. In his evidence the plaintiff said that he was an acetylene operator and was employed at the Islington power station in the dismantling of a boiler. While working there some piping fell and struck his head; he sustained a compound fracture and septic scalp wounds, and was in hospital for nearly a fortnight. Since the accident he had suffered from severe headaches, and claimed that he was permanently incapacitated from following his employment. He admitted in cross-examination that he knew there was a possibility that the piping would fall. Evidence was given that it was the usual practice in dismantling boilers to support any parts which might fall. The foreman in charge of the work said that the piping did not actually fall; it merely turned in a bracket which supported it.

Judge SHEWELL COOPER absolved the foreman from all blame, and said that the methods adopted by the defendants were perfectly satisfactory. The plaintiff also knew of the risk which attached to the position in which he was working. The claim must therefore be dismissed with costs. Considering the matter under the Workmen's Compensation Act, his Honour said that from the medical evidence he was satisfied that the plaintiff was totally incapacitated from work since the date of the accident and at present. He therefore awarded him 30s. a week, and gave instructions that £10 of the amount due should be deducted towards the payment of the defendants' costs in the action. Leave was given to the defendants to make any application that they thought desirable.

The Sale of Batteries on Closing Day.

AN interesting case recently came before the magistrates at Grimsby when a local trader was summoned under the Shops Closing Order for selling radio batteries on closing day. The defence submitted was that the renewal of exhausted batteries represented a repair of the set and consequently was a public service. The case was therefore dismissed.

Rating Appeal by Aberdeen Corporation.

IN the Valuation Appeal Court, Edinburgh, on January 7th, before Lords Hunter, Sands, and Morison, counsel were heard in an appeal by the Electricity Department of the Corporation of Aberdeen against the decision of the Valuation Committee of the city entering the value of the undertaking for the year 1926-27 at £68,185. Counsel stated that he was supported by the other Scottish municipalities with similar undertakings. The appellants objected on the ground that deduction had not been allowed in respect of sinking fund and interest on capital expenditure on buildings and plant before they were completed and became revenue-producing subjects. They claimed that sums of £6,971 and 419 should have been deducted.

The Assessor maintained that the expenditure of which deduction was claimed was an application of net revenue and not a valid charge against revenue. An annual sum properly raised by the appellants by means of charges made under their statutory powers could not be excluded from computation for purposes of the revenue principle merely because the present owners chose to spend that portion of their revenue in a particular way. In the event of the deduction being allowed, the Assessor submitted that the calculation for fixing the annual value should be three years instead of five years. The Court reserved judgment.

Sentence.

AT Bow Street Police Court, on January 7th, Willoughby L. Brooks, accountant, was found guilty of stealing money from his employers, the Tudor Accumulator Co., Ltd., and was sentenced to six months' imprisonment in the second division.

Manslaughter Charge Against a Colliery Company.

AT the Bridgend Police Court on January 10th, Messrs. Cory Bros. & Co., Ltd., and three of their electrical engineers were summoned upon a charge of manslaughter. It was alleged that the defendants had set or caused to be set a man-trap, *viz.*, an electrified fence, by which a youth named Brynmor Edward John was killed in August last. The secretary of the defendant company appeared and entered a plea of "not guilty."

Mr. ARTEMUS JONES, for the prosecution (undertaken by the brother of the deceased youth through the South Wales Miners' Federation), stated that the company was troubled by the theft of coal, and to put a stop to it a fence was erected, consisting of three copper wires supported by insulators on pit props. Between certain hours the fence was electrified, and notices were erected warning trespassers of the fact. On the day he met his death, John and some companions were chasing a rat with a dog, and got through the fence unscathed. While they were on the colliery premises a whistle was blown, and upon his return through the fence John received an electric shock and collapsed. The pressure was stated to be 110 V.

The brother of the deceased said that John was in good health at the time, and he did not know of deaths from heart failure in the family. A number of witnesses deposed that they heard the whistle, and a shopkeeper repeated a conversation which he heard between two of the engineers who were charged with the company, in which they mentioned the erection of the fence. Sir E. MARSHALL HALL, K.C., for the defence, suggested that there was no foundation for the statement, but witness maintained that it was true. Medical evidence was given that death was due to shock; the witness could not state whether or not there was a bruise on the dead youth's skull. Sir E. Marshall Hall suggested that the pressure on the fence was only 60 V and asked witness if he had known of any previous death from a shock at that pressure. The witness said that he had not.

The hearing was adjourned until January 11th, when Sir Bernard Spilsbury was called as a witness for the prosecution. He said that death was caused by heart failure due to the passage of an electric current. Death from such a low voltage was rare, but the conditions were apparently favourable. The defendants were committed for trial, bail being allowed.

Theft of Electricity.

AT the Dukinfield Police Court last week penalties amounting to £8 10s. were imposed upon Charles Burton, a motor engineer, who was found guilty of fraudulently abstracting electricity from the mains of the Stalybridge and Hyde Joint Electricity Board. It was stated that the supply had been cut off from the defendant's premises owing to the non-payment of an account. The seal of the meter had been broken and a connection made.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

The official report for the week ended January 8th, states that new electric demonstration houses were opened at Denton (Manchester), Bishop Auckland, Doncaster, Bradford and West Bridgford (Nottingham). The Bradford house was organised by Mr. H. Wilson, a local electrical contractor. It has been decided to open the Denton house on Sunday afternoons. Campaign "revival" meetings have been held in several places in response to the organisers' call for increased efforts. Great activity is reported from Cardiff, where more successful houses have been run. Arrangements have been made for a large model to be displayed for a week in the window of one of the principal stores. During the week sandwichmen will distribute cheque-coupons. Works meetings are being held in the Lancashire area and other areas are urged to follow this example. The opening of the Aberdeen house has been deferred until the end of January. The first of Glasgow's three houses is to be opened next week; 100,000 descriptive leaflets have been printed for distribution, and a local advertising campaign is being launched. Exhibitions in lieu of houses are being run at Dewsbury, Dudley, Hagley, Halesowen and Wolverhampton. An exhibition is to be held



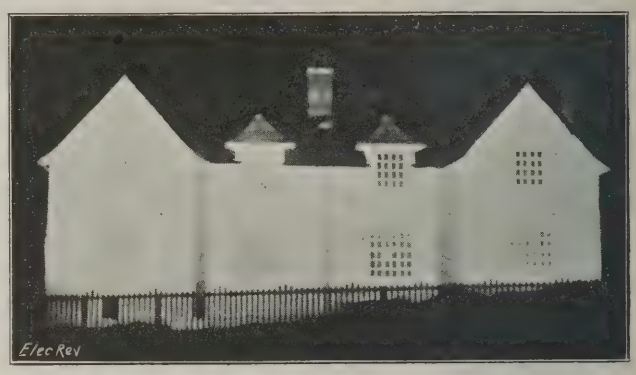
Campaign Display at the Greenock Exhibition.

at Falkirk from February 7th to 11th, and exhibits have been arranged by five manufacturers and five local contractors. Immediately after this exhibition another will be held at Dumfries.

We have already reported that the Greenock Corporation recently held an electrical exhibition. This was designed to convey an excellent idea of the many domestic uses of electricity. Two of the principal sections were a nicely-furnished sitting room and a kitchen. In the latter apartment demonstrations of electric cooking were given by a capable operator and half-hour film programmes were presented at intervals. A special display was arranged to draw attention to the campaign and this is illustrated herewith.

In our last issue we reported the opening of the demonstration house at Denton, Manchester. From the illustration of the building, which is reproduced herewith, it will be seen that the house is similar to many thousands in this country, and can be taken as a fair example of the type of dwelling to which supply authorities and contractors should pay particular attention. Such houses form the backbone of the domestic load.

The Dundee demonstration house which was open to the public from November 20th to December 18th, is depicted herewith. The Dundee circle reports that the premises were visited by about 5,300 persons and 500 competition booklets were distributed. The house was designed for educational purposes primarily and no great efforts were made to effect direct sales or to secure new consumers.



The Dundee Electric House.

With the object of reviving interest in the campaign a mass meeting of supply engineers and chairmen of local Electricity Committees was held at the Lighting Service Bureau, Manchester, on January 6th. The meeting, which was rather poorly attended, was presided over by Mr. P. P. Wheelwright, Blackburn, the chairman of the North-Western Campaign Committee, and the principal speaker was Mr. W. E. Bush (E.L.M.A.). After a few preliminary remarks, Mr. Bush said that although 106 local circles had been formed, only one of them, *viz.*, that at Liverpool, was in the North-Western area. The circles were the main inspiration of the campaign and the Central Committee had hoped that as the national adver-



The All-Electric Home at Denton, Manchester.

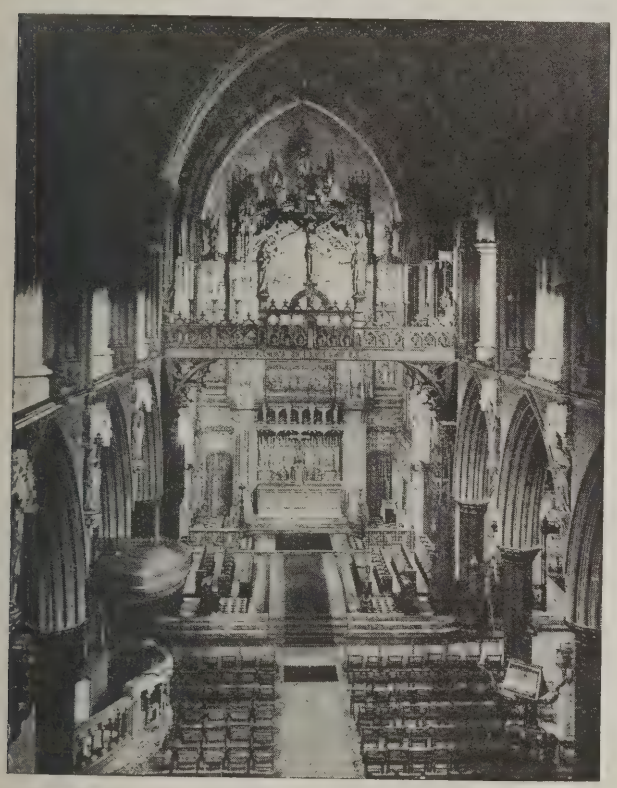
tising campaign was reduced in intensity, so would the circle activities increase and the matter become more and more localised. The circles in various parts of the country had done really beneficial work, but in nothing more perhaps than in bringing the various sections of the trade together. One of the most pleasing features was the determination of most of the circles not to disband at the end of the campaign but to keep together ready for future work. In booklets the

North-Western area had not done so badly; out of 800,000 issued, the area had taken 116,000, but the committee did not think the total sufficient, and it had decided that as from February 12th, the trade should be asked to circulate the booklets direct to the public. A proportion of the extra cost would be borne by the National Committee.

In a subsequent discussion Mr. H. C. Lamb, the Manchester City Electrical Engineer, said that a circle was being formed to include Manchester, Salford and Stretford and a feeling of co-operation had been established amongst all parties. Complaints were made by other speakers as to the lack of interest shown by contractors and in some particular cases by their local Associations who had been invited to discuss the matter but had done nothing further. The apathy, and to some extent suspicion, of the public was referred to, and in one case quoted, out of 14,000 circulars sent out, not more than 200 applications for booklets had been received. The advantages derived from a well-got-up campaign window display were extolled by Mr. Wheelwright.

A Flood-lighted Church.

The accompanying picture is a view of the interior of St. Cuthbert's Church, Philbeach Gardens, S.W.5, and was taken solely by the light from a new installation carried out by Mr. W. J. Adams, 205, Tolling Road, Hammersmith. Ten "Gecoray" floodlight projectors, each equipped with 200-W "White Osram" gasfilled lamps, illuminate the nave, being fixed at clerestory level about 40 ft. from the floor. The chancel, reredos, and Lady Chapel are similarly illuminated. The aisle is lighted by ten smaller units, in which 100-W lamps are employed. All the projectors point towards the chancel, and thus there is no glare in the eyes of the congregation. Each unit is separately plugged. Readings taken on a horizontal plane 2 ft. 6 in. above floor level gave the following average intensities of illumination:—Nave, 3 ft.-candles; chancel, 5.5 ft.-candles; and aisles, 2.5 ft.-candles. The General Electric Co., Ltd., prepared the scheme in collaboration with Mr. S. T. Puzey, P.A.S.I.



St. Cuthbert's Church, S.W.

Hungarian Electrical Contracts.

According to Hungarian Press reports, the Hungarian Ministry of Commerce has invited the interested branches of industry to bring forward competitive offers for the construction of a great electric power station. Two offers were received, one from the English "Talbot" group and another from a Swiss and Hungarian group. The offer of the "Talbot" group includes, besides the supply of electricity for all the needs of Budapest, the electrification of the State Railways. It is proposed to erect a great super-power station in the coal fields of Tata in agreement with the Hungarian General Coal Mining Co., Ltd. The group is represented to have come to an agreement with Ganz & Co. concerning the supply of electric locomotives.—*Reuter.*

Telephone Manufacturing in Spain.

The National Telephone Company of Spain intends to enlarge its plant so as to be able not only to supply the needs of the Spanish telephone system, but also to export telephone material to South America.—*Reuter's Trade Service* (Madrid).

New Tricity Restaurant.

On Monday last Mr. A. F. Berry presided over a luncheon attended by a large number of representatives of the newspaper and technical Press, held at the new Tricity Restaurant in the Strand, at the corner of Savoy Street. This is an all-electric restaurant of the first class, which has now taken the place of the original Tricity House restaurant which has rendered such excellent electrical propaganda and publicity service during the past fourteen years. Mr. Berry described the objects of the new restaurant, which was duly formally opened. We shall deal fully with the matter in our next issue.

A New Public Clock.

A large turret clock has recently been made and erected by Messrs. Gent & Co., Ltd., Leicester, in the water tower of Messrs. Terry & Co.'s chocolate factory at York. A peculiar feature of the installation is that a large water tank occupies the space immediately behind the dial openings, there being only a few inches between the inside wall and the tank, as it occupies the space which should, in the ordinary way, be available for the usual mechanism and the radial connecting rods for the four dials which are each 8 ft. in diameter and arranged for internal illumination. The problem, therefore, was to drive the hands of the clock from a mechanism fixed many feet below the tank and 16 ft. below the dials. The difficulty was surmounted by designing special gear which could be fixed from the front of the dials through detachable portions thereof, and by providing a mechanical connection with the waiting-train movement fixed below the tank by means of four lengths of ordinary bicycle chain. In order to illuminate the dials internally, the electric lamps have had to be lowered from the top of the tank to the desired positions behind the dials, there being no other means of access. In the same circuit as the large clock, there are a number of wall clocks distributed throughout the works, as well as a system of "start" and "cease work" sound signals. The whole is controlled from the same prime transmitter or master clock, so uniform time is shown throughout. The clock is depicted in the accompanying illustration.



A Turret Clock at York.

Russia Pays for Machinery.

The *Financial Times* says that orders received from Russia enabled some of the leading textile machinery concerns to run practically full time for a good part of last year. Our exports of this class of machinery to Russia during the first eleven months of the year aggregated 12,672 tons, as compared with 1,661 tons during the corresponding period of 1925. It is expected that further contracts will be negotiated within the next few weeks. Careful inquiries show that in every instance the Russians have honoured their financial obligations with great promptitude.

Calendars and Diaries.

We again have to acknowledge and reciprocate the season's greetings from a number of our friends, and thank them for calendars, &c., which we have received from them.

Messrs. James Armstrong & Co., of Manchester, ask us to state that their supply of diaries has been exhausted, and they regret their inability to meet all requests.

From the B.E.N. Patents, Ltd., 96-98, Victoria Street, London, S.W.1, we have received a desk pad calendar with ample space for daily memoranda.

A New Year greeting card has been sent to all its domestic consumers (about 12,000) by the ELECTRICAL DISTRIBUTION OF YORKSHIRE, LTD. This depicts in warm colours an "all-electric" sitting-room; explains a number of common electrical terms; and gives details of the various tasks which a unit of electricity will perform.

From the COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD., we have received the usual telephone wall-card. The picture extols the virtues of the electric motor.

A pocket diary ("Cromwell" series), containing an insurance coupon, useful general information, &c., has come to hand from the LONDON MAGNETO REPAIRING & WINDING CO., LTD., of 78, Hampstead Road, London, N.W.1.

MESSRS. MATHER BROS., 36, Farringdon Street, E.C.4, have retained the usual style for their calendar, *i.e.*, large monthly sheets with a date-marking device.

From MESSRS. MAWDSLEYS, LTD., of Dursley, Glos., we have received a wall calendar with unobtrusive monthly slips below a charming coloured view "In Sunny Algeria."

The SHROPSHIRE, WORCESTERSHIRE & STAFFORDSHIRE ELECTRIC POWER CO. has sent us a large wall calendar in which the business note is very inconspicuous. The subject is a lady in eighteenth-century costume, and both the subject and the treatment are admirable.

Once again the DUSSEK BITUMEN CO., LTD., of Bromley-by-Bow, has prepared a handsome pocket case and diary, with ample engagement and memoranda spaces and insurance coupon.

MESSRS. WM. SANDERS & CO., of Falcon Electrical Works, Wednesbury, have sent us a telephone scribbling pad on a metal base.

MR. S. BAXTER, 102, Greyhound Road, W.6, has sent us a businesslike wall calendar with plainly-printed monthly sheets.

Trade Announcements.

The business lately carried on under the style of Coughlan and Tyrrell, Ltd., has been purchased by TRELLEBORG EBONITE WORKS, LTD., from the liquidator, Mr. A. T. Keene, and will be carried on by them.

MESSRS. SANTON, LTD., have removed from 34, Bridge Street, to 149-150, Dock Street, Newport, Mon.

The offices of MESSRS. A. W. BEUTELL, LTD., have been removed to the company's works at Christopher Place, Chalton Street, Euston Road, N.W.1.

MESSRS. THOMAS BROADBENT & SONS, LTD., have now opened an office of their own at 65, Bath Street, Glasgow, under the management of Mr. Eden Field. (Telephone: Douglas 2459; telegrams: "Broadbent, Glasgow.")

Mr. J. SCRIVENER, who has been associated with the sale of vacuum cleaners for many years, has formed a new company, VOLTA, LTD., to sell "Volta" suction cleaners and other labour-saving devices, exclusively to the trade. Offices and showrooms have been taken at Kern House, 36-38, Kingsway, W.C.2 (telephone: Holborn 0188 and 0189), to which address all communications for Mr. Scrivener should be sent.

The Cardiff address of the MACINTOSH CABLE CO., LTD., has been changed to 98, St. Mary's Street. Telephone No.: "Cardiff 2224."

New Catalogues and Lists.

MESSRS. LANDIS & GYR, LTD., Elgee Works, Windmill Road, Hampton Hill.—An illustrated pamphlet dealing with the company's instrument transformers.

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—January calendar-blotter advertising the "No. 554" electric fire, which is of an ornamental pattern.

MESSRS. L. MCMICHAEL, LTD., Wexham Road, Slough.—A pictorial blotter advertising the company's "Unimic" and "Dimic" coils.

THE CREDENDA CONDUITS CO., LTD., Oldbury, Birmingham.—An abridged price list of "Credenda" conduits, fittings, cables and flexibles.

MESSRS. G. COHEN, SONS & CO., LTD., 600, Commercial Road, E.14.—A catalogue of power plant for disposal, including coal-handling plant, pumps, boilers, generating sets, motors, &c.

The NEW PELAPONE ENGINE CO., LTD., 41, Baker Street, W.1.—Leaflet No. 156, an illustrated pamphlet dealing with the new "Pelapone Simplex" range of country-house electric lighting sets.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—A well-illustrated brochure describing in detail the "Samson" 1927 model chain coal-cutting machine for electrical or pneumatic operation.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38 and 39, Upper Thames Street, E.C.4.—Monthly price sheet (January) containing illustrations and prices of electrical appliances, accessories and materials.

THE BRITANNIA MANUFACTURING CO., LTD., 22-26, Britannia Street, City Road, N.1.—An illustrated pamphlet dealing with electric cranes, hoists and winches; and a postcard advertising second-hand motors and dynamos.

MESSRS. DORMAN & SMITH, LTD., Ordsal Electrical Works, Salford.—Catalogue No. 100, a 230-page publication in strong binding containing illustrations and prices of fuse-gear of all kinds, battery switchboards, motor controllers, switchgear, cable-jointing equipment, industrial lighting fittings, &c.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—Publication No. 802, an attractively-produced brochure upon automatic sub-stations, giving fully-illustrated particulars.

MESSRS. FREDK. J. GORDON & CO., LTD., 92, Charlotte Street, W.1.—A priced and illustrated catalogue of battery-charging equipment, including motor-generators, switchboards, lead moulds, and all kinds of tools.

HOPKINSON INDUCTION MOTORS, Willesden Lane, North Acton, W.3.—January stock list of a.c. motors, ranging in size from 0.5 to 30 h.p.

Bankruptcy Proceedings.

R. L. BROCK, electrical engineer, trading as R. L. Brock and Co., Bedford Row, Plymouth.—The public examination of this debtor took place at the Plymouth Bankruptcy Court on January 4th. The statement of affairs showed liabilities estimated at £1,723, and assets of £355, leaving a deficiency of £1,368. Debtor stated that he started business in 1919 with £120, which he received as an Army gratuity. This venture cost him about £300. When the "boom" in the wireless trade came he took a wireless expert into partnership. In 1925 the partnership was dissolved, and matters went so unfavourably that he had to sell his premises, and the bulk of the proceeds went to the first mortgagee. His failure was contributed to by the fact that much of the work undertaken by the firm had been under-estimated, and that, owing to incompetent workmen, some of it had to be done over again. The Official Receiver questioned him regarding an apprentice, from whom he obtained a £50 premium for a three-year indenture shortly before his bankruptcy. Debtor said that he acted in good faith; he had suffered from lack of capital ever since he had been in business. The examination was adjourned until February 18th.

A. A. WATMOUGH, carrying on business in co-partnership with W. Hurworth (Hurworth, Watmough & Co.) as electrical engineers, 41, Town Street, Horsforth, and 1, Back James Street, Harrogate.—Supplemental dividend of 2s. 1½d. in the £, payable January 20th, at the Official Receiver's office, 24, Lower Bond Street, Leeds.

G. TURNER (Radio Supply Co.), electrician and wireless dealer), 34, Mesnes Street, Wigan.—Last day for proofs for dividend January 22nd. Trustee, Mr. E. D. Symond, Official Receiver, 11, Dale Street, Liverpool.

Company Liquidations.

KENYON & TORRANCE, LTD., electrical and automobile engineers, Manchester.—A meeting of creditors was held last week, at the offices of Messrs. Whittaker & Provis, C.A., Mount Street, Manchester, when it was reported that the liabilities were £336 and the net assets £103, leaving a deficiency of £233. The issued capital of the company was £202, making a total deficiency of £435. In addition to the liabilities shown in the statement there were cash claims for £1,128, representing money advanced to the directors and their friends, but those claims were being withdrawn. The business had been closed down. The company was formed in February, 1924, and since its inception there had been a gross profit of £1,589, but after allowing for all the expenses there had been a net loss. A resolution was passed confirming the voluntary liquidation of the company with Mr. G. Whittaker as liquidator.

MINING REQUIREMENTS CO., LTD., Wombwell, near Barnsley.—A meeting of creditors was held recently, at the Law Society's Rooms, Sheffield, when a statement of affairs was presented which showed ranking liabilities of £1,313, all of which were due to the trade. The net assets were £819, leaving a deficiency of £494. It appeared that there was uncalled capital to the extent of 10s. a share on 1,200 shares. A resolution was passed confirming the voluntary liquidation of the company, with Mr. T. C. Parkin, 36, Bank Street, Sheffield, as liquidator, whilst a committee was also appointed consisting of the representatives of the British Thomson-Houston Co., Ltd., Callender's Cable and Construction Co., Ltd., and the Hallamshire Electric Co., Ltd. The following are creditors:—

	£		£
Angus, Geo., & Co., Ltd.	57	Henley's (W. T.) Telegraph Works Co., Ltd.	23
British Thomson-Houston Co., Ltd.	200	Metro-Vick Supplies, Ltd.	94
Callender's Cable and Construction Co., Ltd.	59	Middlesbrough Steel Tube and Conduit Co., Ltd.	20
Earle, G. & T. (1925), Ltd.	40	Peck, J. H., & Co., Ltd.	155
Edison Swan Electric Co., Ltd.	66	Premier Accumulator Co., Ltd.	55
Electrical Components, Ltd.	69	Saxonia Electrical Wire Co., Ltd.	55
Electrical Conduits, Ltd.	35	Walsall Hardware Manufacturing Co., Ltd. ...	48
General Electric Co., Ltd.	47	Warren Bros	26
Hallamshire Electric Co., Ltd.	103	Webber, J. M., & Co., Ltd.	55

KNIVETOWN ELECTRIC WIRE CO., LTD.—Winding up voluntarily. Liquidator, Mr. S. W. Tubbs, 24, Basinghall Street, E.C.—A meeting of creditors was held at the Institute of Chartered Accountants, Moorgate Place, E.C., on January 10th.

Capital Issues in 1926.

Statistics compiled by the Midland Bank show that new issues of capital totalling £253,266,414 were made during last year as compared with £219,986,630 in 1925. Of this, electric light and power issues accounted for £11,523,092, as against £7,242,534; telegraph and telephone issues for £1,220,890, against £2,136,000; and tramway and omnibus issues for £2,355,152, as compared with £409,916 in 1925.

Social Events.

For their annual pantomime which they give to audiences largely composed of poor children of the city, the children of employés of the Birmingham Electric Supply Department this year chose "Dick Whittington," the chief performance of which was given on January 3rd, at the Temperance Hall, Birmingham. The Lord Mayor of Birmingham, Alderman A. H. James, and Mr. R. A. Chattock, the city electrical engineer, were present, and both warmly commended Mr. Joseph H. Fletcher, who directed the performance, and those who assisted him. Excellent electrical effects were provided by the Department's engineers.

On New Year's Day the football team of the Walsall Hardware Manufacturing Co., Ltd., had the pleasure of beating the M.E.M. team by two goals to *nil* after a hardly fought game. After the match, the rival teams, with representatives of the management of the two companies, dined together. A return match is to be played.

The A.T.M. Orchestral Society, numbering 35 performers, in conjunction with the Barnabas Singers, a talented vocal quartette party, gave a concert at Picton Hall, Liverpool, on December 23rd in aid of the local Goodfellow Fund. In the course of the evening Mr. G. W. Moore, general manager of the Automatic Telephone Manufacturing Co., Ltd., formally presented a conductor's baton to Mr. C. Brandreth as a mark of appreciation of his efforts in raising the orchestra to such a commendable pitch of efficiency.

On January 1st, the G.E.C. Sports Club put four football elevens into the field, two matches being won and two lost. The first eleven played Parkside and won by 9 to 2; the second played Selfridge's and won by 5 to 1; the third played British Petroleum and lost by 0 to 6; and the fourth played Clesco and lost by 1 to 6. Preston, of the first eleven, scored seven goals against Parkside.

On January 5th the Electric Art Shades, of Kelvedon, Essex, gave their annual dance at the Parish Hall to their employés numbering nearly 200. Mr. H. A. Chard, the sales manager, acted as M.C.

Last week the Dewsbury Corporation tramways football and billiards teams, and their supporters, entertained the corresponding teams and supporters of the Halifax Corporation tramways. In the afternoon a football match in the Yorkshire Tramways League competition was won by Dewsbury by four goals to three. After tea there was a billiards match, Dewsbury again winning. The remainder of the evening was devoted to a social and concert.

On January 7th, Mr. and Mrs. R. E. Robson entertained the employés of Messrs. Robson & Coleman, Newcastle, and their friends, at their annual whist drive, supper and dance. About 120 people took part and spent a very enjoyable evening. Music for dancing was provided by Mr. J. B. Anderson's orchestra. At the close of the evening, Mr. Robson presented Mrs. Meikle, caretaker of the firm's premises, with an armchair and a gift of money, in appreciation of her 50 years' service.

The Edinburgh Electrical Society held its annual whist drive and dance in the Albyn Rooms last week, when a representative gathering of the electrical trade of Edinburgh was present. Whist prizes were given by the leading electrical manufacturers and suppliers. Special lighting effects were arranged, and a thoroughly enjoyable evening was spent.

Book Notices.

MESSRS. BRUNTONS, Musselburgh, have issued a small book, intended for the use of the shop foreman, defining the various uses of wire rope slings for the hoisting of heavy machines and structures. Special consideration is given to the application of slings with reference to the inclination of the sling and the safe load limits.

"Stresses in Space Frames," by Wilfred W. Padfield. Pp. 35; illustrated. Issued by the Association of Engineering and Shipbuilding Draughtsmen. Price 2s.—This book treats on the work of simplifying the methods of finding the stresses in three-dimensional constructions.

"High Vacua," by G. W. C. Kaye. Pp. xi+175; figs. 91. London: Longmans, Green & Co., Ltd. Price 10s. 6d. net.

Miscellaneous Publications of the U.S.A. Bureau of Standards. No. 75, June, 1926, "Annual Report of the Director of the Bureau of Standards" for the year ended June 30th, 1926. Price 5 cents.

"Edison: The Man and His Work," by G. S. Bryan. Pp. xi+350; illustrated. London: A. A. Knopf. Price 18s.

Scientific Papers of the U.S.A. Bureau of Standards. No. 536, Vol. 21, "A Portable Radio Direction Finder" for from 90 to 7,700 kilocycles. Price 10 cents.

Unemployment.

There was an increase of 41,260 in the unemployment total during the week ended December 24th. At that date the total was 1,351,000, as compared with 1,309,740 on December 20th.

Free Gifts with Vacuum Cleaners.

During January MESSRS. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, W.C.2, are carrying on an intensive campaign for the sale of "Universal" vacuum cleaners. As an inducement they are giving *gratis* an electric iron, a curling iron, a toaster or a table stove to every purchaser of a vacuum cleaner. Some attractive publicity matter, illustrating both the principal appliance and the free gifts, is being sent to retailers by Messrs. Hawkins. Free home demonstrations and "easy terms" are offered.

Recent Contracts.

Besides the Birmingham contract mentioned below, INTERNATIONAL COMBUSTION, LTD., has recently secured other important work. The company is the main contractor for the 12,000-kW hydro-electric station which is to be erected at Perak, Malaya. The Anglo-Persian Oil Co. has awarded the company a contract for the extension of the boiler-house at the Abadan Refineries, Persia, and a large steel works in the North of England has ordered "Raymond" pulverising and transporting equipment from the company for the firing of a continuous billet-reheating furnace.

As reported in our "Contracts Closed" section to-day, the Liverpool Corporation has awarded a contract for a 25,000-kW turbo-generator set to the METROPOLITAN-VICKERS ELECTRICAL CO., LTD. This is for the new Lister Drive No. 3 power station, and will be the second unit of the same size supplied for this station by the Metropolitan-Vickers Co. The station is designed to accommodate five such sets. The contract includes the supply of the necessary condensing plant and auxiliary apparatus. The new set is expected to be ready for service by the latter part of the year.

The PULSOMETER ENGINEERING CO., LTD., has received an important order for pumping plant to be installed at one of the pumping stations of the London & North-Eastern Railway at Hull. It covers four double-unit turbine centrifugal pumps, two rated at 800 g.p.m. and two at 600 g.p.m., against a head of 1,960 ft.; and two return water pumps to deliver 3,000 g.p.m. against a head of 44 ft. All these pumps are to be electrically driven, and the plant will be operated by air-break automatic control gear.

The Birmingham Power Station Contract.

We reported in our last issue that the Birmingham Electric Supply Committee had awarded a contract valued at £1,450,000 to INTERNATIONAL COMBUSTION, LTD., for the erection of a new power station at Hams Hall. The company sends us the following additional information. The station is one of the new capital power stations under the Government's electricity scheme. The civil engineering work covers the preparation of site, levelling, piling, mass concrete foundations, steel framed buildings for switch house, turbine house and boiler house; it also covers workmen's dwellings, reservoirs, railway sidings, locomotive sheds and levelling of the coal storage site, and this, together with the cooling towers and coal and ash handling plants, has been sub-contracted to the Mitchell Conveyor and Transporter Co., Ltd. The two turbo-alternators, each of 30,000-kW capacity, the two house generators of 1,500-kW capacity, also all switchgear, transformers and motor generators, as well as the condensing equipment, will be supplied by the GENERAL ELECTRIC CO., LTD., to whom the whole of this section has been sub-contracted The General Electric Co. has already supplied five large generating sets to the Corporation. In the boiler house, five of the largest water-tube boilers yet constructed in this country are to be installed, each having an evaporative capacity of 200,000 lb. per hour. The working pressure of the boilers will be 375 lb. per sq. in., and they will be operated with "Lopulco" pulverised fuel firing equipment. The water-cooled furnaces will form an important feature of the steam generating equipment, and air heating by means of the "Usco" plate type air preheater will be used throughout. The ultimate capacity of Hams Hall will be 210,000 kW. The whole of the specifications were prepared by Mr. R. A. Chattock, city electrical engineer.

Liverpool to Join the B.E.A.I.R.A.

Subject to the consent of the Electricity Commissioners, the Liverpool Corporation has accepted associate membership of the British Electrical and Allied Industries Research Association, at a subscription of £100 per annum.

For Sale.

Messrs. Edwards, Son & Bigwood will sell by auction on February 2nd, by direction of the Electric and Ordnance Accessories Co., Ltd., the freehold manufacturing premises, "Blic Works," Cheston Road, Aston, Birmingham. (See our advertisement pages to-day.)

Proposed Electricity Showrooms at Leeds.

On January 5th a recommendation by the Leeds Electricity Committee for the establishment of showrooms came before the City Council. The proposal was opposed by the Conservative members on the ground that it was undesirable that the Council should compete with its ratepayers. Liberal and Labour members supported the recommendation and it was carried by 38 votes to 26.

Indian Electrical Imports.

An official return just to hand shows that the imports of electrical equipment into India during October last attained a value of 3,700,000 rupees, as compared with 1,853,000 rupees in the corresponding month of 1925.

German Rubber-Selling Combine.

The Fulda Rubber Works Co., of Fulda, and the Deka Pneumatic Co., of Berlin, a subsidiary of the German Cable Works Co., have combined their sales organisations.—*Financial Times.*

Commercial Secretary at Hungary.

The *Board of Trade Journal* announces that Mr. H. N. Sturrock, formerly Commercial Secretary at Berlin, has been appointed Commercial Secretary at Budapest, in succession to Mr. F. H. Duke, C.B.E., who resigned recently. Mr. Sturrock will assume his duties on or about February 1st.

London Electricity Supply Changes.

Mr. F. J. Walker, general manager and secretary of the Central Electric Supply Co., Ltd., has issued a notice to the effect that, in accordance with the agreement scheduled to the London Electricity (No. 2) Act, 1925, the generating station of the company at Grove Road, has been transferred to the London Power Co., Ltd., of 6, Eccleston Place, London, S.W. The Central Company will discharge liabilities for goods supplied to December 31st, 1926, on contracts placed by them.

Chinese Notes.

A concession to install and operate electric lighting and tramways in Harbin was granted to a Chinese syndicate in 1919. This syndicate formed the Harbin Electric Light and Tramways Co. with an authorised capital of $10,000,000. Later the Government acquired an interest in the company. The concession called for a 10,000-kW generating plant and 22 miles of tramways. The first part of the programme, consisting of the erection of the power station and the laying of 8½ miles of tramways, is now in hand, a contract for $2,520,000 having been awarded to the Siemens China Co. Consignments of machinery have already arrived in Harbin. The company has applied for an extension of the term of the concession, and also for the extension of its working scope, 22 miles of tramways being considered too short for successful working. A prospectus recently issued by the company states that an annual profit of $2,700,000 gold roubles is anticipated.

Electric irrigation is being employed in parts of China. The Foochow Electricity Supply Co. recently installed special electrically-driven pumps for the purpose capable of delivering 525,000 gal. of water per hour. The pumps can be used either for pumping water to the fields or extracting it from them. The benefit derived by the owners of upland fields using electric irrigation apparatus in the Changchow (Kiangsu) district during a recent drought has led to large sales of such apparatus. The Cheng Kwa Electric Power Co. has been unable to meet the demand fully.

Hungary's Foreign Electrical Trade.

During the first six months of 1926 Hungary imported electrical equipment valued at approximately £174,000, and exported similar goods to the value of £313,000. The corresponding figures for the first half of the previous year were £93,000 and £232,000.

Electrical Employés Help Hospitals.

The employés of Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne, contributed through their Hospitals and Charities Committee during the year 1926 the sum of £969. Out of this total, £275 went to the Newcastle R.V. Infirmary, £275 to the Hebburn Infirmary, £75 to the Newcastle Eye Infirmary, £85 to the Employés' Benevolent Association, and smaller amounts to a large number of other deserving institutions and funds.

Increased Australian Copper Consumption.

The Australian Tariff Board recently considered an application for a bounty in connection with copper mining. The manager of an Australian electrolytic copper refining and smelting company gave evidence in support of the claim, and said that the proportion of his company's production consumed in Australia had increased to a remarkable extent in the past few years. In 1914, when the production was 16,401 tons, the proportion sold in Australia was 5.27 per cent. Last year the company produced 11,090 tons, and no less than 86.42 per cent. of this was taken by Australian industries. It was claimed that the production of copper in the Commonwealth had saved Australian firms very large sums of money, and should be encouraged. For some time past the cost of the production of copper in Australia generally had been higher than that of the finished product owing to the fall in the price brought about by increased world production. The Board later heard an application from Australian manufacturers for the imposition of increased import duties upon copper products and alloys of copper. This was opposed by the Australian representative of Elliott's Metal Co., Ltd., Birmingham, on behalf of the Australian Association of British Manufacturers.

Jackson Cooker Contracts.

It is interesting to record that figures recently received by the Jackson Electric Stove Co., Ltd., show that in eight towns alone there is an aggregate of 8,000 of its electric cookers installed on hire. The company has received orders from the Manchester Corporation Electricity Department for 680 cookers since the commencement of the yearly contract last September, and there are now 2,300 Jackson cookers on hire on the Manchester mains. The company has also received a contract for the supply of cookers, during one year, to the Dublin Corporation Electricity Department.

Proposed Buenos Aires Subways.

Major O. Sumner, O.B.E., has sent us a letter upon this matter, in which he states that the scheme for the construction of subways in Buenos Aires, with which he is associated, has not been rejected, as had been reported. The project is said to have strong Argentine support and to be suspended on account of one or two articles of the concession being *ultra vires* the Municipality. Major Sumner emphasises that it is the intention of his group, if the concession is granted, to place orders for equipment in England.

The Brazilian Radio Market.

Owing to adverse economic conditions, radio equipment is not selling well in Brazil at present. Importers are not only curtailing orders, but in some instances countermanding them. Complaint is made of the large amount of obsolete material still being offered at so heavy a discount as seriously to interfere with the importation of up-to-date apparatus.—*Reuter's Trade Service* (Rio de Janeiro).

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections can be entered against any of the proposed marks within one month from the dates mentioned:—

December 29th, 1926.—Roc. No. 472,446. Class 8. Instruments and apparatus and parts and accessories thereof for use in connection with radio-telephonic and telegraphic receiving and transmitting sets. Jurassia, Société Fabrique de Machines Parlantes, Ste. Croix, Switzerland. (British representatives: Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

January 5th, 1927.—Central (lettering and design). No. 472,481. Class 6. Hand-propelled electric vacuum cleaning machines for domestic use. C.C.A. (Central Cables & Accessories), Ltd., 83, Queen Street, E.C.4.

Sterling. No. 473,157. Class 8. Telephones and radio-telephone and signalling apparatus. Sterling Telephone and Electric Co., Ltd., Marconi House, Strand, W.C.2.

Ansil. No. 473,827. Class 8. Radio-telephonic and telegraphic instruments and apparatus. N. Garnett, 482, Bury New Road, Kersal Bar, Manchester.

Colvern. No. 475,344. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy. Collinson's Precision Screw Co., Ltd., Macdonald Road, Walthamstow, E.17.

Premier. No. 468,285. Class 18. Electric welding plant. Premier Electric Welding Co., Ltd., Harrow Manorway, Abbey Wood, S.E.2.

Lamp Manufacture in Belgium.

The Société Belge de la Lampe Philips recently acquired works at Lemnis, Belgium, where electric lamps are now being manufactured for the Belgian market.

Tradesmen Using the Royal Arms.

The *London Gazette* for January 4th contains lists of tradesmen in London and elsewhere who hold appointments to Royalty with authority to use the Royal Arms.

Electrical Development in Singapore.

United States trade officials at Singapore report remarkable electrical progress during the past five years. The municipal power plant has been steadily extended, and the public demand has kept pace with the development. One of the largest stations in the Far East is to be erected by the Municipality, and this will provide a cheaper supply, which, in turn, will create a large demand for consuming devices. Since the introduction of electricity has been comparatively slow the market has not actively developed. It is considered that a progressive sales campaign for the marketing of electrical goods would produce excellent results.

Chinese Electrical Machinery Imports.

According to *Commerce Reports* the imports of electric power station machinery into Shanghai during the first half of last year were valued at 97,501 Haikwan taels, as compared with 178,220 taels in the first six months of 1925. The corresponding figures for imports into Dairen were 176,032 taels and 179,472 taels respectively.

European Copper Sales Agreement.

In order to deal with the situation resulting from the international agreements in the copper markets, a group comprising the Anaconda Copper Mines, the Société Minière Calumet, the Hecla and the United Verde Companies on the one hand, and the Union Minière du Haut Katanga and the Société Générale Métallurgique de Hoboken, on the other, have decided that their sales in Europe shall be entrusted to the same firms.—*Reuter* (Brussels).

Proposed Scottish Textile Machinery Exhibition.

The manager of the Textile and Industrial Exhibitions, Ltd., Manchester, has applied for the use of a portion of Kelvin Hall, Glasgow, for about three weeks in November next for the purpose of holding an exhibition of textile machinery, &c.; the application has been remitted to a committee.

United States Electrical Exports.

The official statistics of exports from the United States during October last give a total for the electrical section of $8,035,710, as compared with $7,512,642 in October, 1925, an increase of $523,068. The battery class showed the greatest increase—83 per cent. in the case of primary batteries and 36 per cent. in storage batteries. In general the lighter classes showed important gains, while the heavier apparatus registered losses. The export value of a.c. generators fell from $193,961 to $17,004, and d.c. generators also showed a substantial decline. Self-contained lighting outfits rose from 331, valued at $93,996 in October, 1925, to 538 ($153,414) in October last. Other large advances were made by electric lamps, telegraph and telephone apparatus, railway motors, and electric locomotives. Radio apparatus showed a fall from $1,317,846 to $1,108,442, but October, 1925, was a record month in this direction.

British Participation in International Steel Trust.

The Berlin correspondent of *The Times* says:—"According to information received here, the representative body of the British steel industry has announced its readiness in principle to join the International Steel Trust. It is stated that British representatives are to be invited to attend the meeting of the trust, which has been provisionally fixed for the first week in February. The *Börsen Courier* states that for some time the principal difficulty has not been one of willingness on the part of the British steel industry to join the trust, but arises out of a difference of opinion as to what should be the British quota. The total originally demanded by the British industry lay between ten and twelve million tons, while the amount the trust would be prepared to concede is less than nine million tons."

Salford and a Dutch Cable Tender.

In our "Contracts Closed" section last week we mentioned that the Salford Electricity Committee had recommended the acceptance of a Dutch tender for cable. At its last week's meeting the City Council adopted the recommendation by 28 votes to 7. During a discussion of the matter it was stated that the tender was 36 per cent. below the lowest British offer. Members who opposed the acceptance of the tender said that British manufacturers had to bear higher national and local burdens, which increased their costs. The chairman of the Electricity Committee quoted information prepared by the International Labour Bureau showing that Dutch manufacturers paid high wages and sustained heavy social burdens. Another councillor said that by means of rings the British cable-making companies were stifling competition and paying "enormous" dividends.

American Capital for Brazil.

The Rio correspondent of *The Times* states that American industrial enterprise is making considerable investments of capital in Brazil. The General Electric Company has announced a $28,000,000 investment project relating to Brazilian public utilities, and states that it has already purchased for 94,000 contos (£2,350,000) the Companhia Brasileira de Energia Elettrica, in the State of Rio, and other concerns in the Guinle interests. The General Electric Company's activities are stated to be due to a desire to control these and other enterprises for the purpose of selling material manufactured by the parent company, but opinion in Brazil does not doubt that its pretensions are more ambitious. The zones of the service companies purchased are only of secondary importance, and sweeping reforms and Government concessions will probably be necessary before the venture can be profitable.

Unemployment in Germany.

The official figures of unemployment in Germany show that at December 15th there were 1,464,000 people in receipt of relief, as compared with 1,369,000 on December 1st.

Threatened Strike Averted at Poplar.

Last week the members of the Electrical Trades Union employed in the erection of the new municipal generating station at Poplar threatened to cease work, alleging that the contractors were not observing the agreed conditions. It was announced later that the contractors had agreed to the men's demands, thus averting a cessation of work.

Timber Trade Report.

Our timber trade correspondent reports that the softwood market is steady with a firm tendency. Stocks in London docks are of slightly smaller volume than those of a year ago, which were large, but with the general improvement in trade which is anticipated, the demand is expected to show considerable expansion between now and May next, when navigation is resumed at North European ports. Sales to date for next season's delivery constitute a record for European wood exporters, and show clearly the confidence amongst operators in the British Isles and on the Continent that considerable progress will be made in industry this year, which will cause large quantities of timber to be taken into consumption. In the British Isles especially there is expected to be a good demand for house-building work. All the hardwoods, especially mahogany and teak, are strong in value, with stocks in first hands light, and little expected to come forward during the next few months. American woods are in good supply, but shippers' quotations have risen, restricting early future transactions with this country. This in itself tends to keep the spot market for American lumber firm whilst stocks are ample. The revival expected early in the furniture and cabinet trades, however, will do much to bring stocks to a lower level, which will be all to the benefit of the spot selling market.

Proposed Increase of Railway Rates.

The report of the Railway Rates Tribunal was issued last week. So far as goods traffic is concerned, the result of the Tribunal's decisions will be a slight increase in charges in most cases. Apart from this, the railway companies have decided to institute an increase of about 6½ per cent. in goods traffic charges at an early date on account of their grave financial position. This increase follows upon reductions made voluntarily by the companies in the hope of increasing traffic, a policy which was justified by an increase, but one that was unremunerative.

Peruvian Duty Increased.

As from January 1st the basic import duty on electric lighting fixtures imported into Peru has been increased by one-half.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.		Price Jan. 11th.	Fortnight's inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4¼d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£13 10s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3¼d. to 3½d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ...	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots...	per ton.	£107 to £112	...
b ,, Wire	per lb.	1/6 to 2/-	...
b ,, Sheet	,,	1/3 to 2.9	...
p Babbitt's Metal and Anti-friction Metal—			...
Grade I	per ton net.	£262	£1 dec.
Grade II	,, ,,	£184	£2 dec.
Grade III...	,, ,,	£98	£1 dec.
c Brass (rolled metal 2" to 12" basis)	per lb.	9⅝d.	...
c ,, Tubes (solid drawn) ...	,,	1/0 to 1/0½d.	...
c ,, Wire, basis	,,	10⅛d.	...
c Copper Tubes (solid drawn) ...	,,	1/1	...
c ,, Bars (best selected) ...	per ton.	£92	...
c ,, Sheet	,,	£92	...
c ,, Rod	,,	£92	...
d ,, (Electrolytic) Bars ...	,,	£62 10s.	45s. dec.
d ,, ,, Sheets ...	,,	£144 10s.	...
d ,, ,, Wire Rods	,,	£74 15s.	...
d ,, ,, H.C. Wire	per lb.	9⅜d.	¼d. dec.
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
n German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	8/-	...
h India-rubber, Para fine	,,	1/4¾	¼d. to ⅜d. dec.
i Iron Pig (Cleveland No. 3.) ...	per ton.	122/6	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£29	30s. dec.
g Mercury	per bot.	£17 to £17 17s. 6d.	...
e Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large ...	,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2⁹	...
p ,, ,, wire...	,,	1/3¾	¼d. dec.
o Platinum	per oz.	£23	...
d Silicium Bronze Wire	per lb.	10¼d.	...
r Steel, Magnet, in bars	,,	7½d.	...
n Tin, Block (English)	per ton.	£297 to £297 10s.	10s. to 2's. inc.
n ,, Wire, Nos. 1 to 16	per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Reporting on the lead position on January 8th, Messrs. James Forster & Co. stated:—"At the moment there seems nothing for it but still lower prices, but it must be borne in mind that lead at £27 per ton is no encouragement, but rather a deterrent to production. The trade prospect, particularly in the electrical industry, is much brighter than it has been for several months past, and the lower price for lead will undoubtedly stimulate consumption of the metal. We look for temporarily lower prices followed by a sharp recovery which, assisted by better trade, will probably be maintained throughout the year."

New French Company.

La Caisse Bearnaise Auxiliare d'Electrification is the name of a new undertaking which has lately been formed at Pau with a capital of six million francs to finance syndicates organised for the distribution of electricity in the Lower Pyrenees.

A French Lighting Service Bureau.

The French Society for the Improvement of Lighting has opened a demonstration salon at 134, Boulevard Haussmann, Paris, where the public are being invited to inspect the latest developments in electric lighting equipment.

German Capital Issues in 1926.

As in the previous year, little activity took place in 1926 in the direction of new capital issues in the electrical and gas industries in Germany, which are grouped together for this purpose. The number of applications for increases of capital was 20 in each year, but the amount offered for subscription rose from £1,295,000 in 1925 to £2,064,000 last year. The number of new joint stock companies formed declined from 10 in 1925 to four last year, but the capital offered increased from £159,000 to £465,000.

Selling Appliances at Manchester.

At last week's meeting of the Manchester City Council, the Electricity Committee submitted a report by the chief engineer and manager (Mr. H. C. Lamb) upon the question of the sale of apparatus from the St. Ann Street showrooms. Mr. Lamb said that it would only be possible in the existing premises to carry this out on a small scale. A stock of the more-frequently required appliances could be maintained and others could be ordered direct from the manufacturers. He suggested that a hire-purchase scheme should be adopted for radiators and wash boilers. The following articles could be sold:—Cooking apparatus, water heaters, radiators, irons, kettles, wash boilers, suction cleaners, fans, and other small motor-driven domestic appliances. It was estimated that within a year or two a revenue of £10,000 a year would be derived from this business.

A member of the Council moved an amendment deleting the matter from the Committee's minutes as it "opened the door to extreme Socialism." The amendment was rejected and the report agreed to.

Lighting and Power Notes.

Aire and Calder District.—The Electricity Act.—At Bradford Town Hall, on January 5th, a private meeting was held of representatives of the Conference of Local Authorities in connection with the West Riding (Aire and Calder) Electricity District. Alderman Wilfred Turner, chairman of the Bradford Corporation Electricity Committee, presided. Discussion was on the situation created by the passing of the Electricity (Supply) Act, 1926, and the meeting decided that the conference should remain in existence. A special committee was appointed to consider what steps should be taken to afford assistance to the authorities concerned in carrying the provisions of the new Act into effect.

Barrhead (Renfrewshire).—Street Lighting.—A committee of the Town Council is to consider the question of lighting the streets by electricity instead of gas.

Barrow.—Loan.—The borough electrical engineer has submitted a report to the Corporation on sub-station extensions, and has recommended that application be made for sanction to a loan of £14,560 with a view to providing for the increased load at North and South Vickerstown, and for future extensions at the Abbey and locomotive works sub-stations. The Council has approved the recommendation.

Bath.—Loan.—The Town Council has applied for sanction to a loan of £15,178 for mains and services.

Beckenham.—Electricity Charges.—The Urban District Council has adopted the following scale of charges for electricity consumed by the tenants of the Shortlands houses:—Five-roomed houses, a fixed weekly charge of 1s. 6d.; four-roomed houses, 1s. 4d.; three-roomed houses, 1s. 3d.; all energy consumed is to be charged at 2d. per kWh or, if a cooker is installed, 1½d. per kWh.

Bristol.—Electricity Supply.—To meet the demand for electricity in the East district the Electricity Committee has decided to lay two additional cables at a cost of £31,000.

Bury.—Electricity Extensions.—Proposals by the Electricity Committee for extensions at the power station, estimated to cost £116,540, have been approved by the General Purposes Committee. The scheme provides for the immediate installation of a new boiler, mechanical stoker, &c., at an estimated cost of £17,450, and also for the replacement of obsolete plant, at an outlay, for the first section, of £99,000. In the latter, provision is made for two 60,000-lb. boilers and a 10,000-kW turbo-alternator.

Canada.—Hydro-Electric Development.—The Department of the Interior has issued a bulletin confirming the estimate made twelve months ago that new hydro-electric installations during 1926 would exceed 250,000 h.p. New installations during the year totalled 266,000 h.p., bringing the total for the installations in Canada to 4,556,000 h.p. The new installations represent a direct capital investment exceeding $25,000,000, irrespective of the further capital required in the application of power to industrial purposes. New installations initiated but not completed during the year will add a further 1,700,000 h.p.—*Reuter's Trade Service* (Ottawa).

Chelmsford.—Price Reduction.—The Electric Supply Corporation, Ltd., has decided to reduce its charges for the supply of electricity for power and heating purposes so that the maximum charge shall not exceed 2½d. per kWh.

Continental. — Switzerland. — The Bundner Kraftwerke Gesellschaft has recently put in operation a new hydro-electric power station, known as the Klosters, which utilises the water power of Lake Davos. The initial plant has a capacity of 10,000 h.p., but the buildings have been so constructed that the capacity may eventually be extended to 30,000 h.p. The Klosters plant is being worked in parallel with the Kublis station, the electricity generated being transmitted to the distribution system of the North-East Switzerland Power Co., and the municipal authorities of Zurich.

Luxemburg.—A Bill which has recently been placed before the Luxemburg Parliament relative to the general electrification of the Grand Duchy includes the scheme submitted by the Société des Centrales Electriques des Flandres, of Brussels. The Government has been in negotiation with the Belgian company, and has drawn up an agreement which now only awaits the sanction of Parliament.

Crediton.—Electricity Supply.—The Urban District Council on January 4th decided to press the Electricity Commissioners for a reply within 14 days with regard to proceeding with the scheme for providing the town with an electricity supply from Exeter.

Eastbourne.—Loans Sanctioned.—The Electricity Committee has received sanction to the borrowing of £20,000 for the installation of boiler plant at the electricity works, and £52,671 for sub-station buildings.

Guildford.—Loan Sanctioned.—The Town Council has received sanction to a loan of £125,000 in connection with the erection of a new power station.

Hants.—Proposed New Power Station.—A joint committee has been formed to consider a proposal to provide a central power station for the supply of electricity over a large area, including Aldershot, Farnborough, Fleet, Frimley, Farnham, and Hartley Wintney.

Liverpool.—Loan Sanctioned.—The Electricity Committee has received sanction to the borrowing of £20,000 for the provision of rotary convertors.

Electricity Supply.—The city electrical engineer has reported as to the change over to a.c. supply in an outer district, and the provision of a sub-station and equipment at an estimated cost of £2,000, structural alterations at an approximate cost of £300, and the provision of the necessary h.p. and l.p. mains at an estimated cost of £5,653. He has been authorised to carry out the work forthwith.

"All-Electric" Houses.—The Corporation has now completed 186 "all-electric" houses. Between 3,000 and 4,000 houses are now electrically equipped.

London.—Electricity Charges.—The North Metropolitan Electric Power Supply Co. has notified consumers that, although the increased cost of coal, due to the coal dispute, has caused heavy expense to the company, it is not intended to make any increase in the charges for supply.

Manchester.—Progress during November.—During the month of November the Corporation electricity undertaking showed an increase in connections of 3,027 kW, bringing the total to 296,889 kW; and the number of applications received for supply, including consumers for additional supplies, was 1,275, representing a total of 3,542 kW. The number of hired cookers connected increased by 176, bringing the total actually on circuit to 2,499. Applications for the hire of cookers totalled 189. Three new sub-stations were put into commission during the month and two 750-kW motor convertors were installed at Chorlton-cum-Hardy and Cheetham Hill sub-stations.

Supply to Housing Estate.—An application has been received from the Phormium Co., of London, for a supply of electricity to be furnished to 400 houses which are to be erected at Burnage.

Monks Kirby.—Electricity Supply.—The Leicestershire and Warwickshire Electric Power Co. has asked the Rural District Council for its consent to a Special Order to supply electricity in its area. The Council objects to the use of overhead mains across fields, and the question of supporting the application has been deferred pending inquiries into the probable results of the use of overhead lines.

Ossett.—ELECTRICITY IN BULK.—The Housing Committee is inquiring as to the possibility of obtaining a bulk supply of electricity for lighting the houses on the Council's estate.

Peterborough.—NEW PLANT.—The electrical engineer (Mr. H. A. Nevill) has submitted a report to the Town Council in which he recommends additions to the new power station by the installation of a further turbo-generator of 10,000 kW, which will raise the total capacity of the plant to 18,500 kW. The contracts already entered into in connection with the new power station amount to £176,620, and the expenditure on the proposed extension is estimated at £63,551, making a total of £240,171. The report was adopted at a recent meeting of the Council.

LOAN.—Application is being made for sanction to a loan of £1,637 for laying a main to provide an electricity supply to the Central Sugar Company's factory at Woodston.

Preston.—SUPPLY TO DOCKS.—On the recommendation of the Ribble Committee the Town Council has decided to light the offices and workshops at the Dock by electricity.

South Africa.—PAARL (CAPE PROVINCE).—The electricity supply for this town was until recently obtained from water power derived from the catchment area of the Paarl mountain. The water supply proved to be insufficient for the increasing demand, and it was first proposed to build a new power station operated by steam, gas, or oil, which would have involved a capital outlay of £50,000. It was decided eventually to take a supply from the Electricity Commission's new power station at Salt River, near Cape Town, and the Commission has erected a transmission line 34 miles in length to convey the energy at a pressure of 33,000 V to Paarl, where it will be stepped down to 3,300 V before it is delivered to the municipal switchboard. As the Salt River station will not be completed for some months, a temporary supply is being obtained from the Cape Town Dock road station.

SWELLENDAM (CAPE PROVINCE).—At a recent poll of ratepayers, the Municipal Council was authorised to raise a loan of £15,000 for an electricity scheme for the town.

Special Orders.—Application has been made to the Electricity Commissioners by Colchester Corporation for a Special Order authorising it to supply electricity in the urban districts of Brightlingsea, West Mersea, and Wivenhoe, and parts of the rural districts of Lexden and Winstree, Maldon and Tendring, and Samford.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the East Dereham Urban District Council to supply electricity in its area.

Stourport.—NEW POWER STATION.—The new power station of the Shropshire, Worcestershire, and Staffordshire Electric Power Co. is nearing completion, and it is hoped that it will be formally inaugurated early in the spring.

Torquay. — ELECTRICITY SUPPLY. — The Electricity Committee has adopted a recommendation of the engineer to change over and improve the system of supply at Knowles Hill from a.c. to d.c. by the erection and equipment of a new sub-station and the provision of new l.p. mains, at a total estimated cost of £890.

Wakefield.—LOAN.—The Electricity Committee is applying for sanction to the borrowing of £15,000 for mains and services.

Wessex.—ELECTRICITY SCHEME.—The *Financial Times* reports that a Bill to confer Parliamentary powers on a new electricity company operating in six counties has been deposited for next session in the Private Bill Office of the House of Commons. It is proposed to incorporate the Wessex Electricity Company for the purpose of supplying electricity within certain areas in the counties of Oxford, Buckingham, Berks., Southampton, Wiltshire, and Gloucester.

Wimbledon.—NEW SUB-STATION EQUIPMENT.—The Electricity Committee has prepared a scheme for enlarging and re-equipping the sub-station and constructing 17 new transformer stations, at a total cost of £25,000.

Winchester.—WIRING OF SMALL HOUSES.—The Rural District Council has consented to the municipal houses in the villages of Itchen Abbas and Easton being wired for electricity, which will be supplied by Sir John Shelley-Rolls, Bart., at a charge similar to that at Winchester. The wiring of the houses is being carried out by A. W. Sclater & Son, of London, and the cost per house for wiring and meter is about £25.

Wirral.—ELECTRICITY SUPPLY.—The supply of electricity in the rural area, in accordance with the agreement between the Birkenhead Corporation and the Wirral Rural Council, will be carried a step further as the result of the recommendation of the Birkenhead Electricity Committee for the immediate expenditure of £7,338 for cables and the laying of a h.p. feeder from Upton to the proposed Moreton sub-station.

Yarmouth. — ELECTRICITY EXTENSIONS. — The Corporation Electricity Committee is to proceed with an electricity extension scheme involving an outlay of over £60,000.

Tramway and Railway Notes.

Belgian Congo.—RAILWAY ELECTRIFICATION.—Although the Matadi-Leopoldville railway in the Belgian Congo is at present being worked by steam, it is proposed when the traffic attains a total of 1,200,000 tons a year to electrify the line. The question of utilising the water power resources of the Lower Congo, and in particular the Inkissi and M'Poso falls, for the generation of the necessary electricity, is being inquired into.

Bradford.—FARES.—According to the *Manchester Guardian*, important alterations in tramway fares on the Corporation system are recommended by the Tramways Committee. They include raising all 1½d. fares to 2d., the reduction of 2½d. and 3d. fares to 2d., fixing the maximum fare at 3d. instead of 6d., and the issue of six-day non-transferable passes for the 2d. stages at 2s. 6d. Revision of 'bus fares is also recommended. Mr. R. H. Wilkinson, the tramway manager, states that the net result of the changes would be an increase in income of £20,000 a year.

NEW TRAMCAR DESIGN.—A tramcar, designed by Mr. R. H. Wilkinson, city tramway general manager, which has been under construction at the Corporation depôt at Thornbury, is to be given a trial in February. It is a single-deck car, with seating for 60 passengers, and capable of travelling 25 per cent. faster than the present double-deck cars. The car is divided into smoking and non-smoking compartments, the entrance being in the centre.

Burnley.—NEW ROUTE.—The Town Council has considered a proposal for laying a tramway track at The Centre. The scheme entails an expenditure of £8,600, of which £5,000 will be expended on the track and £3,600 for road works.

India.—RAILWAY POWER STATION.—The Great Indian Peninsula Railway has decided to construct an independent power station in connection with its scheme for electrifying the lines between Bombay and Igatpuri and Bombay and Poona. A site has been chosen in Kalyan, about 20 miles from Bombay. The estimated cost of building and equipping the station is Rs.100 lakhs, of which Rs.90 lakhs will be spent on generating plant and transmission lines. The order for these will be placed in England through the High Commissioner for India. —*Reuter's Trade Service* (Bombay).

Leeds.—NEW TRAMWAY DEPOT.—In the face of substantial opposition, the City Council on January 5th approved a Tramways Committee recommendation that a scheme to apply for sanction to borrow £137,500 for building and equipping an extension to the central tramway depôt in Swinegate be referred to the Finance and Parliamentary Committee. It was pointed out by the Tramways Committee that the scheme was to provide accommodation for 200 cars at a depôt now housing only 50.

London.—NEW TUBE SCHEME.—A scheme to improve communication between the western districts of London and the City will shortly be put in hand by the Underground companies, and will probably take about two years to complete. It provides for the duplication of the lines between Hammersmith and Acton Town and the provision of a junction, by means of a tunnel under Hammersmith Broadway, with the Piccadilly Tube, so that trains on this system may run through to stations west of Hammersmith.

Middlesex.—'BUS OWNERS' PROPOSAL.—The *Financial News* reports that in view of the expiry in 1930 of the lease by the Middlesex County Council of the North London tramways to the Metropolitan Tramways Co., the Association of London Omnibus Proprietors has put forward a proposal to provide an omnibus service should the lease not be renewed. The suggestion is made in a letter to the Minister of Transport and the Middlesex County Council by Sir Charles Cleveland, secretary of the Association which represents the non-combine 'bus owners. In this letter he states that the Association is ready and desirous to take part in any scheme for dealing with the passenger traffic now carried by the trams. The letter states that the Association would be prepared to participate in a reasonable scheme of compensation by annual tax or donation to the County Council for loss of revenue due to non-renewal of the lease to the tramways company.

Middlesbrough.—TRAMWAY IMPROVEMENTS.—The Tramways Committee has decided to relay the tramway track in Linthorpe Road, and also to purchase, at an estimated cost of £18,000, 18 one-man-controlled 'buses to link up other parts of the town.

United States.—RAILWAY ELECTRIFICATION.—The *Electric Railway Journal* states that engineers who have been preparing plans for the electrification of some of the lines of the Reading Company at Philadelphia are expected to have their report completed early this year. Before the survey is submitted, officials at the Reading Terminal anticipate, the preliminary plans for replacing steam by electricity will be completed, covering the electrification of approximately 40 miles of line on the Chestnut Hill, Bethlehem, and New York branches of the Reading system. The new service will be introduced on the New York branch to Trevose, Pa., a distance of 20 miles from Philadelphia.

Telegraph and Telephone Notes.

Austria.—LINK IN ENGLAND-INDIA CHAIN.—The opening of the Vienna-Nuremberg telephone line on January 4th connected Austria with the main telephone systems of Western Europe. The new line will form an important link in the extension of the telephone from Great Britain across the Continent to the Black Sea, Persia, and India. It is hoped to open a direct service between Vienna and London in April; next year the Austrian system will be connected with those of Hungary, Yugo-Slavia, Italy, Switzerland, and Czecho-Slovakia.—*Reuter* (Vienna).

RADIO-TELEGRAPHY.—The Radio-Austria Gesellschaft, which maintains the foreign wireless-telegraph service in Austria, continues to make good progress. During the past year a third transmitter (25-kW Marconi) was installed at the Deutsch-Altenburg transmitting station. The receiving station at Laaer Berg was reconstructed and connected to the local municipal electricity supply mains. A short-wave transmitter has also been installed for experimental purposes. The average number of messages dealt with increased from 939 per day in 1924 to 1,708 in 1925.

Belgium.—TELEGRAPH BILL.—The Ministry of Posts and Telegraphs is preparing the draft of a Bill, which will probably be placed before Parliament about the end of this month, for the creation of a separate and autonomous administration of telegraph and telephone services, says *The Times*. The measure would provide the services with an accounts department on an industrial basis, and would empower the administration to borrow for extension purposes. Five companies have offered to provide the State with the necessary credit for the development of its plant, two of which would supply apparatus and the other three the cables required for extending the system. Payments would be spread over a period of five years, the first instalment becoming due six months after the completion of the works, and subsequent instalments every six months thereafter. This arrangement would enable the State to defray the cost of the new installations with the additional receipts which they would yield.

Borneo.—TELEPHONE EXTENSION.—A telephone system is planned to connect Bandjermasin (the principal port and city of south Borneo) with the interior towns of Martapoera Rantau, Kandangan, Barabai, Berajang, and Amoentai.

Hull.—TELEPHONE LOAN.—The Ministry of Health was to hold an inquiry on January 11th into the application to borrow £38,700 for the extension of the telephone system, the only municipal service in this country.

Mexico.—TELEGRAPH CONSTRUCTION.—The Telegraph and Postal Department of the Mexican Government will shortly call for tenders for the modernising of the entire telegraph and radio-telegraph systems of Mexico. Fourteen additional radio-telegraph stations will be installed, or acquired, and a considerable amount of equipment, including repair tubes, transmitters, and receivers, will be ordered.—*Reuter's Trade Service* (Mexico City).

Radio-Telegraphy.—"BEAM" STATIONS READY.—The short-wave "beam" telegraph stations which have been built by Marconi's Wireless Telegraph Co. on behalf of the General Post Office at Grimsby and Skegness for communication with Australia are now ready for handing over to the authorities for a seven-days' official test.

Radio-Telephony.—"BEAM" TESTS.—The first link in a possible Empire wireless-telephone "chain" was forged at noon on January 10th, when Commander C. P. Edwards, chief of the Canadian Radio Telegraph Service, talked to Mr. R. N. Vyvyan, chief engineer of the British Marconi Co., at Bridgwater, Somerset. The stations used in this demonstration were apparently those built by Marconi's Wireless Telegraph Co., Ltd., for the British Post Office "beam" radio-telegraph service between England and Canada, which service was successfully inaugurated last month.

The Telephone Service.—NEW AUTOMATIC EXCHANGE.—Although Middlesbrough itself still relies upon the services of operators for local telephone service, the neighbouring village of Marton-in-Cleveland, three miles south, has enjoyed the advantages of an automatic service since 1922, when a Strowger exchange was installed there for the Post Office by Automatic Telephone Manufacturing Co., Ltd., to serve about 80 subscribers, and comprised a Keith line-switch unit equipped with final selectors on the reverse side, the system being then 2-digit. The new equipment, which has also been supplied and installed for the Post Office by Automatic Telephone Manufacturing Co., embodies modern rotary line switches and has a present capacity of 245 lines, consisting of 150 regular subscribers, 90 p.b.x., and five coin-box lines. Moreover, in anticipation of the future conversion of Middlesbrough, provision has been made in the new Marton equipment for 5-digit calling.

CONTINENTAL SERVICE.—Work on the new Anglo-German telephone cables has been completed, and the service is now available between this country (both London and the provinces) and all parts of Germany.

Radio Notes.

Australia.—NO COMMISSION OF INQUIRY.—In the opinion of the P.M.G., Mr. Gibson, there is no necessity for the appointment of a Royal Commission to inquire into wireless matters in Australia, as was advocated by the Association for the Development of Wireless. "There is no need for any more Government control than what is provided for under present regulations," he added.

RESEARCH.—Important proposals were agreed to at a conference called by the Council of Scientific and Industrial Research recently. It was agreed to recommend that immediate steps be taken in Australia to form a Wireless Research Board, attached to the Council.

Denmark.—LICENCES.—Over 92,000 licensed receiving sets, about 44,660 of which are valve sets, are now operating in Denmark, according to a recent announcement made by the Government Control Board. Practically 90 per cent. of all the sets are in Copenhagen and its suburbs, says *Commerce Reports*, most of them being of the crystal type. It is expected that with a more strict enforcement of the licence law the figures for receiving sets in Jutland will show a great increase.

RELAY STATION.—The present station in Copenhagen, which broadcasts on a wave-length of 337 m., will in the near future use a new transmitter built by Danish firms. The energy will be 1 kW, and it will act as relay for Copenhagen and its suburbs in co-operation with the new high-power station now under construction near Kalundborg, which will be working next autumn with 7.5 kW aerial power. *World Radio* says that the provision of other relay stations will not be discussed until the Radio Council has experience to what extent the new high-power station will give satisfactory reception in the different parts of Denmark.

France.—NEW STATION.—It is reported that a 5-kW radio broadcasting station is to be constructed at Nice, and it is expected that the station will be in operation early in 1927.

Hungary.—DEVELOPMENTS.—Great improvements are being made in the Budapest station, which celebrated its first birthday on December 1st. The aerials are being raised, literally, and their capacity increased to 3 kW. By October the new transmitter, with a capacity of 20 kW, will be ready. The Post Office and Telephone Administration controls all broadcasting in Hungary, and according to *World Radio* the Minister of Education has ordered receivers to be supplied to all schools if funds permit, and the Minister of the Interior that all hospitals shall be supplied with equipment, including loud-speakers, at the State's expense. All Budapest municipal blocks of dwellings are also to be furnished with radio sets.

Reality in Reception.—BIRMINGHAM DEMONSTRATION.—Interesting and somewhat novel demonstrations are to accompany a short series of talks on "Reality in Broadcast Reception," which Mr. Colin H. Gardner, of Midland Radio-Telephone Manufacturers, Ltd., commenced from the Birmingham broadcasting station on January 13th, and is to continue on January 27th and February 10th. The demonstrations are to be given for the purpose of enabling listeners to ascertain what distortion is being caused in their receivers, where it is located, and how to remedy it, and, further, to enable listeners to measure the musical range of their sets. The tests will be of an ingenious nature, and should be of material assistance to listeners anxious to get the best possible results from their receivers. In the first tests, distortion will be deliberately introduced in the studio; there will be a preliminary transmission with the transmitter working at its best, sending out evenly-balanced and full-bodied music; the same piece will then be transmitted again, but with a certain proportion of the bass diminished. If the listener notices no appreciable difference, the test will tend to prove that the particular proportion of bass was never reproduced by the receiving apparatus. The more obvious causes of frequency distortion, such as may be due to the over-loading of valves, resonance in loud-speakers or 'phones, and the use of wrong voltages or excessive reaction, will then be dealt with. Gramophone records will be used for the demonstrations, made by the new electrical recording process, and in order to overcome machine noises a Marconiphone magnetic pick-up device will be substituted for the ordinary sound-box. This actually constitutes a minute electric generator, the output of which is varied by the vibrations of the gramophone needle as it passes over the record. The modulated current from this device is passed into a special amplifier, with resistance-capacity coupling, volume control at the input, and a series of filter circuits which enable the operator to vary the balance of tone at will by diminishing or strengthening any particular set of musical frequencies. The music, thus controlled, will be passed into any one of a row of loud-speakers of different types, the reproduction of which is received in the usual way by the studio microphone, and broadcast. It is of interest to note that the output characteristic curve of the Birmingham station's transmitting apparatus shows a straight portion between 50 and 10,000 cycles, which means an even degree of amplification over practically the whole of the fundamental audible-frequency range.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—February 28th. City Council. Two 2,500-kW motor-convertors and accessories, or two 2,500-kW rotary convertors, with transformers and accessories. (B.X. 3124.)*

March 14th. 6,600-V, 3-phase switchgear. (B.X. 3138.)* Postmaster-General's Department.

March 8th. Induction coils and registers (B.X. 3136), testing instruments (B.X. 3132.)* State Electricity Commission of Victoria.

March 7th. Paper-insulated, lead-covered control cable. (B.X. 3137.)*

March 14th. D.c. switchgear and accessories. (B.X. 3131.)*

Argentina.—BUENOS AIRES.—February 24th. Department of Navigation and Ports. Three 10-ton electric shunting locomotives (Diesel type). (A.X. 4016.)*

March 24th. Electric cranes, pumps, &c. (A.X. 4087.)*

March 15th. Ministry of Marine. Electrical machinery in connection with the extension of electrical generation (involving the enlargement of two existing power stations and the construction of two new ones) at the Naval Base, Puerto Belgrano. (B.X. 3140.)*

Askern (near Doncaster.—January 18th. Electric lighting installation at Sutton Road new school. Education Department, West Riding County Hall, Wakefield.

Barnes.—February 8th. Electricity Department. One 1,000-kW rotary or motor convertor with transformer, l.p. switchgear and connections. (January 7th.)

Bootle.—January 18th. Corporation. Electrician's work required in erection of 16 lock-up shops, with 16 flats above, Bailey Drive. Particulars from Borough Engineer, Town Hall.

Burnley.—January 27th. Tramways and Omnibus Department. General stores for 12 months. Schedules from the General Manager, Queensgate Depôt, Burnley.

Bury.—Bury District Co-operative Society. Power and lighting installation at new dairy, Georgiana Street. Mr. C. R. Cooper, architect, 20, Market Street, Bury.

Canada.—GREAT FALLS.—January 17th. Manitoba Power Co., Ltd. Three 7,000-kVA single-phase oil-insulated indoor-type transformers for Lac du Bonnet, Manitoba. (B.X. 3118.)*

Clacton.—February 2nd. Electricity Department. Two 1,125-b.h.p. Diesel oil engines, direct coupled to 750-kW, 3-phase alternators; two 750-kW alternators, two rotary-converters, and e.h.p. switchgear. (See this issue.)

Dundee.—January 21st. Electricity Department. E.h.p. and l.p. cable. (See this issue.)

Ecuador.—QUITO.—Municipal Council. 3,000-h.p. hydro-electric plant for which water power with a fall of 42 metres is available, to be owned and worked by the city authorities. A second installation of similar capacity, for the port and city of Guayaquil, is also contemplated.

Edinburgh.—January 25th. Edinburgh District Board of Control. Electric lighting installation at Bangour Mental Hospital. Mr. J. D. Gibson, surveyor, 60, Frederick Street, Edinburgh.

February 14th. Electricity Supply Department. E.h.p. and l.p. switchgear, e.h.p. and pilot cables. (See this issue.)

Greenock.—January 20th. Corporation. Electric lighting installation in 36 houses. Office of Public Works, Municipal Buildings.

India.—India Store Department. January 25th. Overhead electric travelling cranes. Specifications (5s.) from 15, Belvedere Road, Lambeth, S.E.

10 miles dry core telephone cable. (See this issue.)

Liverpool.—January 27th. Electricity Supply Department. Twelve months' supply of materials, including cables and accessories, insulated cables, meters, lamps, &c. (January 7th.)

London.—STEPNEY.—January 18th. Board of Guardians. Electric goods lift at the St. George's-in-the-East Hospital. (December 31st.)

Manchester.—January 31st. Electricity Department. Two electrically-driven circulating-water pumps, piping, &c. (See this issue.)

Newport (Mon.).—February 5th. Electricity Department. Two water-tube boilers, steam and feed-water piping, economisers, air heaters, induced- and forced-draught plant, steel stack and grit catcher, coal and ash conveyors, extension of boiler house, including structural steelwork and foundations. (January 7th.)

New Zealand.—DUNEDIN.—February 19th. City Corporation Gas Department. One motor-generator with control board and accessories. (B.X. 3095.)*

Salford.—January 22nd. Corporation. Electric lighting installation at Wash-house and Slipper Baths, Hodge Lane. Mr. Chas. Swain, architect, 12, Exchange Street, Manchester.

Sleaford.—Electricity Works. 50 tons Diesel oil fuel. (See this issue.)

South Africa. — PRETORIA. — February 3rd. Municipal Council. E.h.p. cable and accessories, switches and cut-outs. (B.X. 3097.)*

JOHANNESBURG.—January 20th. Municipal Council. Supply of electric lamps. (B.X. 3112.)*

February 10th. Electric cable. (B.X. 3130.)*

Stoke-on-Trent.—February 8th. Stoke and Wolstanton Union. Alterations and additions to the central-heating and hot-water services at the London Road Institution. The work includes large calorifiers, two electric generating sets, pumps, &c. Specification from Mr. T. Wood, clerk to the Guardians, Union Offices, Stoke-on-Trent.

February 9th. Electricity Department. Steam and water piping, valves, &c., constructional steel work, platforms, crane gantries, &c. (January 7th.)

Uruguay.—MONTEVIDEO.—February 18th. State Electricity Works. 65,000 kg. unvarnished black iron wire and 10,000 kg. g.i. wire. (A.X. 4019.)*

February 11th. 37,500 electric filament lamps. (B.X. 3117.)*

February 15th. 55,500 iron pieces (angles, ties, bolts, &c.) for overhead lines. (A.X. 4018.)*

Beckenham.—Electric signs and lamps at the Public Hall. U.D.C. Surveyor.

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—SYDNEY.—Electricity Supply Committee. Recommended:—

L.p. underground cables (Spec. 1064) (£27,236).—Enfield Cable Works (Aust.), Ltd.

10,000-V cables for 33,000/10,000-V sub-stations (items 2, 3, 4 (£3,461).—British Insulated Cables, Ltd.

33,000-V cables (items 5 and 6) (£1,234).—British General Electric Co., Ltd.—*Tenders.*

Birkenhead.—Electricity Committee. Accepted:—

"Ironclad Exide" battery (£192).—Chloride Electrical Storage Co., Ltd.

H.p. feeder from Upton to Moreton sub-station (£1,150).—W. T. Henley's Telegraph Works Co., Ltd.

Cable.—W. T. Henley's Telegraph Works Co., Ltd. (£7,289); Hackbridge Cable Co., Ltd. (£1,732).

Bradford.—Tramways Committee. Accepted:—

30 tons Peckham hand-brake shoes, and 30 tons track-brake blocks (£600).—Yorkshire Repetition Castings Company.

140 steel tramway poles (£2,332).—British Mannesmann Tube Co., Ltd.

36 tramcar split gear wheels (£214).—British Hele-Shaw Patent Clutch Co., Ltd.

Evesham.—Town Council. Accepted:—

Installing electric lighting at the Public Hall.—Abell and Smith, Ltd.

Finchley.—Electricity Committee. Accepted:—

Motor balancer.—Electric Construction Co., Ltd.

Glasgow.—Health Committee. Accepted:—

Heating installation at Mearnskirk Sanatorium—

Turbines and generators.—W. H. Allen, Sons & Co.

Switchboard.—William McGeoch & Co.

Hull.—Electricity Committee. Accepted:—
Intercommunication telephone system at Sculcoates (£634).—Relay Automatic Telephone Co.

Baths Committee. Accepted:—
Heating fittings and pipes for electrical vapour baths at Beverley Road (£791).—J. V. Coonan & Co.

Telephones Committee. Accepted:—
Cable (£126).—W. F. Dennis & Co.

Leeds.—Tramways Committee. Accepted:—
Conduits (£1,391).—Leeds Fireclay Co., Ltd.
Tram bolts (£645).—Stewarts & Lloyds, Ltd.
Grooved cadmium-copper trolley wire (£105).—Richard Johnson & Nephew, Ltd.

Electricity Committee. Accepted:—
Cable.—W. T. Henley's Telegraph Works Co., Ltd. (£2,016); Enfield Cable Works, Ltd. (1,599); Macintosh Cable Co., Ltd. (£4,602).

Sewage Committee. Accepted:—
Extension of electric lighting at Knostrop.—Wilson Hartnell Installation, Ltd.

Museums Committee. Accepted:—
Electric lighting improvements at Museum.—R. F. Winder, Ltd.

London.—London Power Co., Ltd. Accepted:—
Ten 4,000-kVA single-phase transformers, with switchgear for tap changing on load.—Ferranti, Ltd.

ADMIRALTY.
Night-sight lamps.—Edison Swan Electric Co., Ltd.

BOOTH STEAMSHIP CO.
Twelve months' contract for "Osram" metal-filament vacuum and gasfilled lamps and "Robertson" carbon-filament lamps.—General Electric Co., Ltd.

SOUTHWARK.—Electricity Committee. Accepted:—
Repairs to cooling tower (£360).—Davenport Engineering Co., Ltd.

HACKNEY.—Electricity Committee.
One 10-ton overhead travelling crane (£203).—Herbert Morris, Ltd.

The Metropolitan Asylums Board has decided to install six electrically-driven sewing machines at the Brook Hospital, at £170.

Liverpool.—Tramways Committee. Recommended:—
25,000-kW turbo-alternator, with condenser (£110,575).—Metropolitan-Vickers Electrical Co., Ltd.
Two cooling towers (£21,289).—J. Henshaw & Co.

Manchester.—Tramways Committee. Accepted:—
Telescoper pit bogie for handling tramcar motors.—Equipment & Engineering Co.
Steel girder tram rails.—Cargo Fleet Iron Co., Ltd.; Bolckow, Vaughan & Co., Ltd.
Special trackwork.—Titan Trackwork Co., Ltd.

Education Committee. Accepted:—
Electric lighting installation at Gorton Mount Municipal School.—E. Crossley.

Housing Committee. Accepted:—
Electrical installation at houses on Broadway housing estate.—J. V. Pyatt.

Mold.—Urban Council. Accepted:—
Installing electric light at the Town Hall, Market Hall, and public lavatories.—Mr. Alfred Jones (Caergwrle).

Oldham.—Electricity Committee. Accepted:—
Earthenware conduit.—Doulton & Co., Ltd.
A.c. motors.—English Electric Co., Ltd.

Reigate.—Town Council. Accepted:—
Wiring houses on the metal-sheathed system at 15s. per point (12 months' contract).—T. S. Marriage & Co.

Stoke.—Electricity Committee. Accepted:—
Overhead wiring and services to 120 houses on Abbey Hulton Bay Estate (£422).—Barnett & Soans.

Electricity Supply Charges.

Electricity supply authorities, who have already been urged here to bring down their charges again as soon as possible so as to facilitate the progress of domestic business, will have noted that the Gas Light & Coke Co. has just announced that 1.4d. of the 2.2d. per therm added to the price of gas since the coal stoppage began, is to be taken off as from the reading of the indices in March next. The company describes this as the first step in the return to normal prices.

Forthcoming Events.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, January 14th. Literary and Philosophical Society, Newcastle-on-Tyne. 6 p.m. "Progress in Economy of Turbine Machinery on Land and Sea." Sir Chas. A. Parsons and Mr. R. J. Walker.

Junior Institution of Engineers.—Friday, January 14th. 39, Victoria Street, S.W. 7.30 p.m. "The Thermionic Valve and its Characteristics." Mr. R. L. Kirlew.
Friday, January 21st. 6 p.m. Exhibition of Scientific Instruments and Apparatus.

Women's Engineering Society (Inc.).—Friday, January 14th. 41, Cadogan Square, S.W.1. 6.15 p.m. "Measuring Stress by Aid of Polarised Light." Prof. E. G. Coker, F.R.S.

Institution of Automobile Engineers.—Monday, January 17th. Royal Technical College, Glasgow. "Electric Lighting for Public Service Vehicles." Mr. G. E. McCaw.

Paisley Association of Electrical Engineers.—Tuesday, January 18th. Town Hall, Paisley. 7.30 p.m. "Electrical Industry in U.S.A." Mr. R. Hardie.

Institute of Wireless Technology.—Wednesday, January 19th. Engineers' Club, W. 7 p.m. "Some Absurdities of Wireless Nomenclature." Dr. F. T. Fawcett.

Electrical Power Engineers' Association (North-West Midland Section).—Wednesday, January 19th. Engineering and Scientific Club, Wolverhampton. 8 p.m. "Overhead Distribution." Mr. T. A. G. Margary.

Institution of Electrical Engineers.—Thursday, January 20th. London. 6 p.m. "33,000-V Cables with Metal-sheathed Cores, with Special Reference to the S.L. Type." Mr. P. Dunsheath.

(North-Eastern Centre).—Monday, January 17th. Armstrong College, Newcastle-on-Tyne. 7 p.m. Faraday Lecture, "What is Electricity?" Prof. W. M. Thornton.

(North-Western Centre).—Tuesday, January 18th. Midland Hotel, Manchester. 6.45 for 7.15 p.m. Annual dinner.

(South-Midland Centre).—Wednesday, January 19th. University, Birmingham. 7 p.m. "Electrical Equipment of Track on the Underground Railways of London." Mr. A. R. Cooper.

(East-Midland Sub-Centre).—Tuesday, January 18th. Technical College, Derby. 6.45 p.m. "Telephone Repeaters." Mr. R. M. Chamney.

(Sheffield Sub-Centre).—Wednesday, January 19th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "The Electricity Bill." Mr. H. E. Yerbury.

(Tees-Side Sub-Centre).—Monday, January 17th. Cleveland Technical Institute, Middlesbrough. 7 p.m. "Wired Wireless." Mr. L. C. Grant.

(South-Midland Students' Section).—Tuesday, January 18th. Temperance Hall, Temple Street, Birmingham. 7 p.m. Annual film exhibition.

(London Students' Section).—Friday, January 21st. 6.15 p.m. "Automatic Voltage Regulators," Mr. E. B. Watton.

Edinburgh Electrical Society.—Thursday, January 20th. Royal Scottish Society of Art, 117, George Street. 8 p.m. "Electric Lifts." Mr. J. H. Ross.

Meter Engineers' Technical Association.—Friday, January 21st. Lighting Service Bureau, 15, Savoy Street, W.C. 7 p.m. "The Testing of Large-Capacity Meters *in situ*." Mr. W. Casson.

British Electrical Development Association.—Friday, January 21st. Royal Society of Arts. 7.30 p.m. "Industrial Heating." Mr. S. E. Monkhouse.

Institution of Mechanical Engineers.—Friday, January 21st. London. 6 p.m. "The Use and Economy of High-Pressure Steam Plants." Prof. A. L. Mellanby and Prof. W. Kerr.

Association of Mining Electrical Engineers (North of England Branch).—Saturday, January 22nd. Neville Hall, Newcastle-on-Tyne. 3 p.m. "Static Transformers for Collieries." Mr. J. W. Rodger.

(Western Sub-Branch).—Saturday, January 22nd. 60, Wind Street, Swansea. "The Working of Thin Seams with Electrical Power." Mr. D. P. Jones.

Notes.

An Apology.

On page 963 of the ELECTRICAL REVIEW of December 10th last, under the heading of "Meters Sensitive to Music," we quoted a statement alleged to have been made by Mr. J. H. Canning, the engineer and manager of the Newport (Mon.) Gas Company, which we now find was not made by him. We very much regret the annoyance which has been caused to Mr. Canning through the unfortunate error which was made in attributing to him remarks made by another speaker.

Accident Prevention.

In a recent broadcast talk in America, Mr. A. Williams, president of the American Museum of Safety, said that organised safety effort, whether on the railways or in the industrial life of the country, when conducted under the direction of trained men and women, would eliminate by mechanical protection and human training two-thirds of the average number of accidents, with a corresponding percentage in those resulting in fatalities. It was asserted that only 10 per cent. of all the recent accidents could have been prevented by mechanical means, so completely guarded were most industrial processes to-day, and that in almost all other cases accidents were due to the carelessness either of the persons injured or others. From 1907, when safety work in America was begun, to 1925, over 95,000 casualties had been prevented, a reduction of more than 81 per cent., as a result of the organised safety effort in the operation of the American railroads. During the period 1921 to 1924 the saving in money as a result of the decrease of accidents amounted to $116,500,000.

Inventions in 1926.

Messrs. Hughes & Young, patent agents, of London, state that the number of patent applications filed by the end of the year shows only a slight increase over the previous year, but there is a considerable change in the nature of current inventions, as the modern inventor is setting out on entirely different lines from the normal procedure. There has been a large number of patents granted during 1926 for domestic utility appliances, many of which are for inventions by women with a view to minimising and facilitating housework. It is probable that the largest proportion in inventions relate to electrical and wireless appliances, great attention having been given to electric incandescent lamps, cables, and automatic telephone systems.

Accidents.

An accident occurred on January 7th at new works of the London Electric Supply Corporation at Deptford Dry Dock resulting in the death of four workmen and injuries to two others. An official explanation states:—"A shaft was being sunk in compressed air when there was a blow or the entry of a burst of water into the shaft; the four men down below were trapped, and they are believed to be dead. They are buried in mud and water. The tunnel was to have communicated with the river, and water was to have been drawn through the shaft for the power station. The two men who were brought out alive were not so far down as the others." One of the injured men subsequently died.

Three workmen employed at a sub-station of the Southern Railway Co., at Lewisham, received injuries on January 5th as the result of an explosion. Two of the men were taken to Lewisham Hospital suffering from burns on the face and arms. The train services were not affected.

Appointments Vacant.

Junior technical officer (£175+) for the Admiralty experimental establishment; electrical and mechanical foreman (Rs. 700 per month) for the Karachi Port Trust; working foreman (£200) and general assistant (£325) for the Cheadley and Gatley U.D.C. electricity department; senior and junior draughtsmen for the West Midlands Joint Electricity Authority; shift charge engineer for the United Alkali Co., Ltd.; engineer to act as clerk of works and canvasser (£271) for the Prestatyn U.D.C. Shift charge engineer for the Corporation of Dover Electricity Department. (See our advertisement pages to-day.)

B.E.S.A. Publication.

A recent specification, issued by the British Engineering Standards Association, No. 97, 1926, for Watertight Fittings and Incandescent Electric Lamps, is a revision of the 1920 edition, and applies to fittings of the bulkhead and well-glass types for use in conjunction with British Standard Lamps, Specification No. 161, having overall lengths not exceeding 150 mm. and 140 mm., respectively. The general clauses deal with the material and its finish, wire entry, earthing screw and lampholder, whereas the sectional clauses deal mostly with dimensions, packing rings and gauging. The dimensions standardised are those essential for interchangeability, but the full details of the design of the fittings are not standardised. It is mainly in the latter feature that the present specification differs from the old edition, wherein the details of the design were very minutely specified. An important item is the standardisation of the screw-thread on the guard and in the body of screw-guard fittings, this being of Whitworth form with 16 threads per inch. In the past great inconvenience has been experienced owing to the existence of an alternative screw-thread having 19 threads per inch, and the universal adoption of the present standard will be to the benefit of both users and manufacturers. Copies of this new specification may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, S.W.1, price 2s. 2d., post free.

Midland Students' Ball.

On Tuesday, February 22nd, at 8 p.m., the First Midland Student Engineers' Ball will be held at the Grosvenor Rooms, Grand Hotel, Birmingham. It is being organised for students of the Institutions of Civil, Electrical, and Mechanical Engineers; tickets are 5s. single and 9s. double, and the surplus proceeds will be handed over to the I.E.E. Benevolent Fund. The ticket requirements of the electrical students are being cared for by Mr. S. B. Warder, X Est. Dept., General Electric Co., Ltd., Witton, to whom application should be made immediately in order to prevent disappointment. The music will be by Jack Venables's Band, and the proceedings will continue until 2 a.m.

A Large Battery Locomotive.

The Christmas number of the "Chloride Chronicle" contained a picture of what is believed to be the largest storage-battery locomotive in existence. It is in service on the Chicago and North-Western Railway, and weighs 110 tons. The locomotive is capable of hauling a 1,500-ton train at a speed of from 8 to 10 miles an hour. It is propelled by an "Exide Ironclad" battery weighing nearly 40 tons.

N.A.S.E. Premiums.

The Examining Board of the National Association of Supervising Electricians for the "Economic Premiums" Competition, 1926, has awarded prizes as follows:—Members' section: First prize, £10, Mr. D. Williams, Pontllanfraith, for paper on "Distribution and Supply Economics"; second prize, £5, Mr. R. W. Whitley, London, "Economics at a Premium"; Associates' section: First prize, £5, Mr. J. Mulcaster, Darlington, "Reduction of Unit Costs"; second prize, £2 10s., Mr. H. J. Kimber, London, "Industrial Relations Between Employed and Employer." The examiners report that the papers received were of a very high standard and showed great appreciation of the difficulties facing the electrical industry generally.

Train Collision Report.

We have received a copy of the report of the official inquiry into the causes of the collision between a passenger train and an empty churn train which occurred on November 4th last between Farnborough and Fleet on the Southern Railway. It appears that the sudden stopping and starting of the milk train, as a result of the operation of the signal in front of the train from danger to clear as soon as the train had pulled up, resulted in a break-away of the rear trucks. Apparently the driver of the passenger train, who was killed in the accident, failed to observe or act upon the danger indication of the signals just in the rear of the goods train, and the distant signal had been in the clear position when he passed it. It is suggested that the accident would have been prevented if automatic train control had been in use in connection with the distant signal.

Institution Notes.

Institution of Electrical Engineers.

A.M.I.E.E. EXAMINATION.—The next examination will be held on March 30th and 31st and April 1st, 1927. Candidates must be either Students or Graduates of the Institution, or have lodged with the secretary a duly-completed form "E" for election as Associate Member. Entry forms for the examination, which must be completed and returned by February 1st, and particulars regarding election to membership of the Institution, may be had on application to the secretary.

WESTERN CENTRE.—An Monday last the annual dinner of the Centre was held at the Royal Hotel, Bristol. A report of the proceedings will appear in our next issue.

Royal Institution.

On Tuesday next (January 18th), at 5.15 p.m., Professor R. Whytlaw-Gray begins a course of two lectures on "Smokes as Aerial Disperse Systems." The Friday evening discourse on January 21st will be delivered by Sir William Bragg on "Tyndall's Experiments on Magne-Crystallic Action."

Institute of Metals.

At the annual general meeting, to be held in London on March 9th and 10th, seventeen papers are to be submitted. In the evening of March 9th the annual dinner of the Institute will take place at the Trocadero Restaurant, followed by a dance. The annual autumn meeting of the Institute will be held at Derby in September. The membership on December 31st was 1,801, as compared with 1,692 a year previously.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Recent changes of appointment in the staff of Metro-Vick Supplies, Ltd., are as follows:—Mr. N. V. EVERTON, secretary of the company, has, in addition to his previous responsibilities, taken up the duties of district manager, London area, Mr. E. MYHRE having been transferred to the sales management department, head office. Mr. H. A. NORMAN WHITE, who has been for some time sales engineer on the North London territory for the company, has been appointed to take charge of the Manchester office of Metro-Vick Supplies, Ltd. Mr. H. FILDES has been appointed to the domestic appliance department, specially handling the sale of electric cookers for the North of England.

Mr. J. G. MCLEAN, who has joined Industrial Combustion Engineers, Ltd., of 31-37, Wybert Street, Munster Square, N.W.1, was from 1900 to 1911 chief engineer and general manager of the Woking Electric Supply Co., Ltd.

Mr. A. H. DARKER, A.M.I.M.E., A.M.I.E.E., chief electrical engineer of Messrs. J. Stone & Co., Ltd., who, as already stated here, has been making a world tour, has now returned to London.

Mr. CHARLES VERNIER, of the Newcastle-upon-Tyne Electric Supply Co., Ltd., is joining the staff of the Macintosh Cable Co., Ltd., as chief engineer, on February 1st.

Messrs. F. COATES and H. W. MILLER have been invited to join the board of Messrs. A. Reyrolle & Co., Ltd. Mr. Coates, who has been with the company from its inception over 25 years ago, has been for many years the head of the drawing and design offices. Mr. Miller, who joined the company in 1920, has for the last few years been acting as general manager.

MR. ALEXANDER FARQUHARSON, of Tayport, Dundee, has been appointed tunnel engineer in the Punjab Public Works Department (hydro-electric branch) under the Indian Government. He served through the whole of the war, and during his service in Egypt he attended college, qualifying in electrical engineering.

The Workington Town Council has increased the salary of Mr. W. A. PARKER, distribution electrical engineer, to £300 per annum, with two annual increments of £25 to a maximum of £350.

ALD. A. HUNTSMAN, of Nottingham, was last week elected for the eighth year in succession chairman of the Joint District Council for the Electricity Supply Industry (No. 7 Area). He was also re-elected chairman of the District Joint Board for the staff.

The Accrington Electricity Committee has appointed Mr. ARTHUR BARLOW manager of the new electricity showroom.

MR. J. H. OSBORNE, of the staff of the British Thomson-Houston Co., Ltd., was recently presented by the staff with a canteen of cutlery upon the occasion of his marriage to Miss W. D. BRINKWORTH.

The Glasgow Corporation Tramways Committee is interviewing Mr. LACHLAN MACKINNON, the present deputy general manager, with reference to the appointment of a successor to Mr. Dalrymple.

Lord MONTAGU OF BEAULIEU has been elected president of the Electromobile Association.

Obituary.—MR. J. C. ROOTHAAN.—Mr. Jan Cornelis Roothaan, whose death was briefly reported here on December 31st, was born at Nymegen, Holland, in 1876. After serving with several Continental firms, among others, Brown, Boveri and the Ateliers de Constructions Electriques de Charleroi generally on switchgear design, he joined Messrs. Ferranti Ltd., in 1903, as chief draughtsman of their switchgear department, a few years later becoming chief engineer of their switchgear, transformer, and instrument departments. In September, 1916, when returning from a business trip from Amsterdam, he was taken prisoner by the Germans. The severe privations endured probably laid the foundations of the disease which ultimately caused his death at the early age of fifty years. After his return to England early in 1919, he joined the British Electric Transformer Co., Ltd., where he devoted himself to the development of transformers of core type construction. Mr. Roothaan's death leaves a distinct gap among his friends and colleagues of the British Electric Transformer Co., Ltd., where he held an important position as one of the company's chief designers.

SIR FRANCIS FOX.—We regret to record that Sir Francis Fox, M.Inst.C.E., Hon. Assoc. R.I.B.A., the well-known engineer, brother of Sir Douglas Fox, and a member of the firm of Sir Douglas Fox & Partners, passed away on Friday last at Wimbledon at the age of 82 years. Sir Francis was responsible, as engineer or in a special expert capacity, for large railway schemes and many other great works, including the boring of the Simplon Tunnel, the Mersey Tunnel, and the Liverpool Overhead Railway, also the Great Northern and City and the Charing Cross and Hampstead tube lines.

MR. H. T. FOWLER.—We regret to record the death of Councillor H. T. Fowler, who was recently appointed vice-chairman of the Basingstoke Electricity Committee. Mr. Fowler was machine-shop superintendent at the Basingstoke works of Messrs. John I. Thornycroft & Co., Ltd.

MR. A. C. LOXLEY.—We regret to learn that Mr. A. C. Loxley, the Leeds branch manager for the London Electric Wire Co. and Smiths, Ltd., passed away suddenly last week. Management of the branch has been taken over temporarily by Mr. S. A. Pearce.

MR. G. P. VARLEY.—The death occurred on December 29th, of Mr. George Pilkington Varley, J.P., managing director of John Varley, Ltd., electrical and general engineers, of the Waterloo Foundry, St. Helens.

MR. S. L. KILPIN.—The death took place on January 6th, at the age of 72 years, of Mr. Samuel Leach Kilpin, of Kilpin and Billson, electricians, of High Street, Bedford. He served for many years on the Town Council and acted as Mayor in 1907.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Index Lamp Co., Ltd.—Private company. Registered January 6th. Capital, £2,500 in 1,500 10 per cent. preference shares of £1 each and 4,000 ordinary shares of 5s. each. Objects: To acquire the business of an electrical equipment and motor accessories manufacturer, now carried on by T. W. Bennett, of 83, Grove Hill Road, Camberwell, S.E.5, as the "Index Lamp Company." The first directors are:—T. W. Bennett (managing director), 83, Grove Hill Road, Denmark Park, S.E.5; H. Weinbaum, 4, Morgan Street, Bow, E.3.

Electrical Coils, Ltd.—Private company. Registered January 8th. Capital, £100 in £1 shares. Objects:—To carry on the business of coil-winding specialists, electrical, mechanical, and wireless engineers, manufacturers of, and dealers in all kinds of scientific instruments, &c. The first directors are:—F. de Soiza, 4, Felsberg Road, S.W.2; Mrs. Annie E. de Soiza, same address; R. Jones, 18, St. Werburgh Street, Chester. Qualification, 1 share. Registered office: Calders Row, Brixton Hill, S.W.2.

J. Dyson & Co., Ltd.—Private company. Registered January 4th. Capital £20,000 in £1 shares. Objects: To adopt an agreement with J. Dyson, and to carry on the business of manufacturers of and dealers in electrical and wireless equipment, formerly carried on by him at 5 & 7, Godwin Street, Bradford, and that of manufacturers of and dealers in kinematograph apparatus, &c. The subscribers (each with one share) are:—J. Dyson, 289, Toller Lane, Bradford, engineer; and Mrs. W. Dyson, of the same address. J. Dyson is managing director and chairman for five years. Qualification of directors, £1,000. Secretary: L. Hodgkinson, 48, Sunbridge Road, Bradford. Solicitors: Howe, Denby & Bairstow, 38, Piccadilly, Bradford. Registered office: 7, Godwin Street, Bradford.

Millerphones, Ltd.—Private company. Registered January 5th. Capital, £200 in £1 shares. Objects: To carry on the business of motor and electrical engineers, manufacturers of electrical appliances and equipment, petrol and oil engines, telephones, radio apparatus, &c. The first directors are: P. A. Gooding, 16, Cambridge Road, Hammersmith, W.6, engineer; W. T. Miller, company manager, and Mrs. Ida L. Miller, 48, Park Road, Dulwich, S.E.21. Secretary, S. J. Pomeroy, 20, Coverdale Road, W.12. Registered office, 18, Coleman Street, E.C.2.

Accurate Recording Instrument Co., Ltd.—Private company. Registered January 3rd. Capital, £5,000 in £1 shares. Objects: To invent, manufacture and deal in gauges, valves, indicators, instruments and tools of all kinds, engines, motors and all kinds of machinery. The first directors are: W. M. F. Corry, 114, Eaton Square, S.W.1 (director of Cunard Steam Ship Co., Ltd.); R. T. Johnstone, 27, Catherine Street, Westminster; R. N. Reid, 72, Gloucester Road, Hampton-on-Thames, engineer; H. M. Hopwood, 53, Marloes Road, W.8. Qualification, 1 ordinary share. Solicitors, Samuel Price, Sons and Robertson, 3, Bond Court, Walbrook, E.C. Registered office, 23, Old Queen Street, Westminster, S.W.1.

Official Returns of Electrical Companies.

Highfield Electrical Co., Ltd.—Debenture charged on deeds and documents relating to premises in Holbrooks Lane, Coventry, and the company's undertaking and property, present and future, including uncalled capital, dated December 22nd, 1926, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd.

London Power Co., Ltd.—Trust deed dated November 19th (supplemental to trust deed dated April 15th, 1926), to secure £7,000,000 debenture stock, inclusive of £3,000,000 debenture stock secured by the original deed already registered, charged on the assets and revenues of the company, present and future. Trustees: Law Debenture Corporation, Ltd., Gresham House, Old Broad Street, E.C.

Cleartron Radio, Ltd.—J. H. Stephens, 6, Clements Lane, E.C., C.A., was appointed receiver on December 28th, under powers contained in debenture dated October 25th, 1926.

K.H.E. Ignition Co., Ltd.—P. W. Ardran, of 41, Castle Street, Liverpool (acting on behalf of the late A. A. Whittingham Jones) ceased to act as a receiver or manager on November 25th, 1926.

Charles Fitz-Hugh, Ltd.—H. Brown, of 71, Temple Row, Birmingham, ceased to act as receiver or manager on December 30th, 1926.

Ackroyd & Best, Ltd.—Mortgage on various properties at Morley, dated December 13th, 1926, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

British Di-Electric Co., Ltd.—Issue on December 4th, of £200, on December 18th, of £250, and on December 22nd, 1926, of £50 debentures, parts of a series already registered.

Teignmouth Electric Lighting Co., Ltd.—Satisfaction (1) to the extent of £3,500 on November 11th, 1926, of debentures dated February 19th, 1923, securing £4,000; (2) to the extent of £500 on March 13th, and to the extent of £300 on November 11th, 1926, of debentures dated March 13th, 1923, securing £800; and (3) in full on November 11th, 1926, of debenture dated April 16th, 1923, securing £100.

Thompson Manufacturing Co., Ltd.—Satisfaction in full on December 11th, 1926, of debenture dated March 12th, 1925, securing £500.

Express Cable Engineering Co., Ltd.—Particulars filed of £200 debentures authorised November 16th, 1926, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

H. E. Davis, Ltd.—W. A. J. Osborne, of Balfour House, Finsbury Pavement, E.C.2, ceased to act as receiver and manager on December 21st, 1926.

Godfrey Salmon, Ltd.—W. A. J. Osborne, of Balfour House, Finsbury Pavement, E.C.2, ceased to act as receiver on December 20th, 1926.

City Notes.

Perak River Hydro-Electric Power Co., Ltd.

A circular dealing with the progress which has been made by the company was circulated to shareholders this week. In this it was stated that the organisation for the London administration had been established, and Messrs. Topham, Jones & Railton (1926), Ltd., had been appointed contractors for the civil engineering work. This company had already sent out a party of engineers to study the dam site, and the construction work would be carried out to the designs of Messrs. Rendell, Palmer & Tritton. It was expected that the excavation of the dam site would be well in hand in the course of three or four months. In the meantime, orders had been placed in Great Britain for the electrical plant and machinery and other requirements for the generation and transmission of electricity. The site for the steam station was being selected by Capt. A. C. Sparks. That station would be capable of giving a continuous output of 6,000 kW, and to ensure continuity of supply two 6,000-kW generating sets were being installed, one of which would be held in reserve. From that station it should be possible to give a supply within 18 months to mines within reasonable distance, as well as to the town of Batu Gajah. When the hydro-electric plant was in service, the steam station would act in a stand-by or supplementary capacity. Mr. J. Ferguson, M.B.E., had been appointed general manager in Malaya, and he would settle the question of the prices to be charged to consumers when he had had an opportunity of studying local conditions. It was the belief of the board that the provision of cheap supplies of electricity would considerably extend the magnitude and the life of the tin-mining industry in the Federated Malay States. That was borne out by the interest which tin-mining companies were taking in the company's work.

Adelaide Electric Supply Co., Ltd.

The report for the year ended August 31st last shows a revenue of £670,877 gross and £374,895 net, the latter figure showing an increase of 22 per cent. over the net profit of the previous year. After meeting debenture interest, &c., a balance of £280,035 is available. The directors have transferred £80,000 to general reserve and £10,000 to dividend equalisation fund. A final dividend of 6 per cent. is being paid on the ordinary shares, making 12 per cent. for the year, as in 1924-25. A balance of £10,553 is carried forward with £8,116 from the last account. The dismantling of the Grenfell Street power station has been completed and the plant sold at scrap prices. The balance of the cost of the plant, £321,737, has been written off against general reserve, leaving the latter at £13,263. The board proposes to offer 250,000 6½ per cent. "C" preference shares of £1 each to shareholders at par.

New Issue.

Cia. de Electricidad de la Provincia de Buenos Aires, Ltd.—Last week the company offered to its shareholders one new £1 eight per cent. non-cumulative participating preference share for each preference or ordinary share held. These were part of an issue of £350,000, and they were offered to shareholders at £1 less a commission of 2s. 6d. per share payable by the Italo-Belgian Bank, London Agency.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

On January 10th an extraordinary general meeting of shareholders was held for the purpose of confirming certain alterations in the company's articles which will be necessary if the scheme of arrangement drawn up is approved by the Court. The business was purely formal, and the necessary resolution was carried unanimously.

British Columbia Electric Railway Co. Ltd.

The directors have declared the usual half-yearly dividend upon the 5 per cent. cumulative perpetual preference stock.

At an extraordinary meeting held on January 6th, the resolutions passed at the annual meeting on December 16th, increasing the capital to £5,320,000 and giving the directors further powers, were confirmed.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Telephone Co. of Pernambuco, Ltd.—100,000 ordinary shares of £1 each, fully paid, Nos. 1 to 100,000. £150,000 8 per cent. registered debentures of £100 each, Nos. 1 to 1,500.

The undermentioned securities have been ordered to be officially quoted:—

Ever-Ready Co. (Great Britain).—71,200 ordinary shares of £1 each, fully paid, Nos. 498,801 to 570,000.

Hellenic Electric Railways.—£200,000 7 per cent. sterling bonds, series "A," Nos. A1 to 1,000 (£100) and A1,001 to 1,200 (£500); and £200,000 7 per cent. (convertible) sterling bonds, series "B," Nos. B1,201 to 2,200 (£100) and B2,201 to 2,400 (£500).

Castner-Kellner Alkali Co., Ltd.

The company is paying a final dividend of 14 per cent. (making 22 per cent. for the year 1925-26) out of a net profit of £210,928.

American Loan for Italy.

The Genoa correspondent of the *Financial Times* reports that the Unione Esercizi Elettrici has arranged a $10,000,000 loan in New York.

Edmundson's Electricity Corporation, Ltd.

An interim dividend of 3 per cent. has been declared on the ordinary shares.

Stocks and Shares.

MONDAY EVENING.

FURTHER progress in the upward direction has taken place amongst investment stocks and shares, for the reasons noted in our first article of the New Year. These are, the Government's courage in offering new 4 per cent. Consols at the relatively high price of 85 and, secondly, the hope of money becoming cheaper. Capital in plenty is available for investment, and speculative new issues are being readily taken. Stock Exchange business is reasonably active. A revival in rubber shares followed with promptitude upon an advance in the price of raw rubber.

This last consideration weighs but little with the buyers who have come forward to take cable and electrical equipment

shares on the impression that big business is at hand. Several of the companies have published details of important contracts secured recently. The programme of electrical extension contemplated by the Southern Railway will mean, in itself, a very substantial accession of business to manufacturing companies. The Government's avowed policy of cheaper bulk electricity is expected to provide work for a year or two, at least. The re-conditioning of colliery plant, as one sequel to the conclusion of the coal stoppage, is regarded as another potent element in the electrical industry. The remarkable stimulus given to telephony by the linking of London and New York by air, is prayed in aid by those who foresee a time of profitable activity ahead, and the admission of Sir George Sutton, Henley's chairman, that conversations have taken place between some of the cable-manufacturing undertakings is another bull point.

Rises have occurred in Siemens, British Insulated, Henleys, General Electrics, Enfield Cables, Callenders, British Aluminiums, and Telephone Manufacturing. Johnson & Phillips remain somewhat dull, and Edisons have failed to rally from the decline caused by the falling-off in profits shown by the recent report. Ever Ready shares have come to life again, the ordinary spurting to 79s., on expectations of another bumper profit being recorded when the accounts come out in April next. The preference shares look reasonably-valued at 28s. 6d.: entitled to 7 per cent. dividend, they participate up to 10 per cent., and are receiving the latter rate, which gives a yield of 7 per cent. on the money, at the price just quoted.

Metropolitans and Districts have rallied after a drop of ½ apiece, and Underground £1 shares are better at 13s., and Central London Assented ordinary strengthened to 70. A feature in the Home Railway market is the ready absorption of the pre-ordinary stocks. A number of debenture and guaranteed stocks, and a few preferences are almost impossible to buy.

County of London Electric ordinary gained 1s. 6d. to 27s. 6d., upon the circulation of a tip to buy the shares. The dividend is due for declaration next month. No other changes have occurred in the list of London electricity supply issues. City of Londons are the only shares in the group not yet quoted ex rights. The increases which are now added to the previous ordinary share capitals of the London companies, as from January 1st this year, can be usefully set out in a table, as follows:—

COMPANY.	Ordinary share capital at 31st Dec., 1925.	Amount of capitalised reserves.	Bonus proportions.	Present ordinary share capital, including capitalised reserves.
Brompton & Kensington ...	£292,330	£58,466	20% (1 for 5)	£350,796
Charing Cross	£576,000	£460,800	80% (4 for 5)	£1,03*,800
Chelsea	£247,180	£148,308	60% (3 for 5)	£395,488
City of London	£800,000	£400,000	50% (1 for 2)	£1,200.000
County of London	£1,330.000	£1,77 ,834	133⅓%(4 for 3)	£3,103,834
Kensington &Knightsbridge	£105.000	£189,0 0	180% (9 for 5)	£294,000
London	£499,500	£199,800	40% (2 for 5)	£699,300
Metropolitan	£1,000,000	£500,000	50% (1 for 2)	£1,500,000
St. James' & Pall Mall ...	£200, 00	£440,000	20%(11 for 5)	£640,000
South London	£260,000	£234,000	90%(9 for 10)	£494,000
South Metropolitan ...	£250,000	£350,000	140% (7 for 5)	£6*0,000
Westminster	£755,620	£5*3.746	66⅔% (2 for 3)	£1,259,366

The Notting Hill Company has still to announce the amount of free reserves available for capitalisation.

United River Plate Telephones are 10s. better at 8⅜. It is contended that the price has been under-valued of late, and that the rise of the past fortnight is no more than a recognition of the shares' previous cheapness. There are, also, vague rumours as to the possibility of a bonus of some kind. Automatic Telephones are better at 55s., and so are International Automatic "B" at 2⅛, while American Telephone and Telegraph capital stock has gone up sharply in New York by reason of the inter-continental telephone service. The prices of cable stocks and shares are unaffected by this new departure. Globe ordinary are even 5s. higher. From this steadiness, it seems reasonable to conclude that cable stockholders have become shock-proof against wireless competition. Marconis are quiet at 13s. 9d., and Canadians at 3s. 4¼d. It is officially stated that the long-expected Marconi report will be out by the end of this month. Telephone of Pernambuco shares are attracting a little speculative attention at 12s. 6d.

Brazilian Tractions fell back to 107 before recovering to 110. The Mexican Utilities show irregular movements. Mexican Electric Light fives are lower at 58, and Mexican Light and Power seconds at 86¼, although the common shares of the latter have hardened to 32¼. British Columbia Electric Railway stocks are buoyant, the preferred and deferred both gaining 3 points. The Anglo-Argentine Tramways trio is somewhat better. Amongst the home industrials, Babcocks are a good market at 53s. 9d., and a disposition to buy low-priced iron and steel shares is evidence of a public willingness to speculate in this section.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1924.	Dividend. 1925.	Price Jan. 10 1927.	Rise or fall.	Yield p.c.
Bournemouth and Poole	£ 1	14	14	60/6	—	4 12
Brompton Ordinary	1	10	10	25/-	—	5 12 0
Charing Cross Ordinary	1	15	15	25/-	—	5 12 0
do. do. 4½ Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	25/-	—	5 12 0
City of London	1	15	15	2⅛	—	... ...
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/-	—	5 14 4
County of London	1	15	15	27/6	+1/6	... ...
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	30/6	—	6 11 2
Kensington Ordinary	1	15	15	24/-	—	5 16 8
Lancs. Light and Power	1	7½	7½	24/-	—	6 2 5
London Electric	1	10	10	24/-	—	5 17 8
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	26/-	—	5 7 8
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 8
Newcastle-on-Tyne Ordinary ...	1	7	7	21/8	—	6 11 9
do. 5% Pref. ...	1	5	5	17/6	+6d.	5 14 3
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref. ...	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	24/-	—	5 16 8
South London	1	15	15	24/6	—	6 8 0
South Metropolitan Pref.	1	7	7	1½	—	6 8 0
Urban Ordinary	1	4	7	1⅛	—	5 17 11
do. 6% Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	24/6	—	5 14 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	70	+1	5 14 4
Metropolitan	,,	5	5	64½	—	7 16 4
do. District	,,	8½	8½	58	—	6 1 9
Underground Electric	£1	Nil	Nil	13/-	+6d.	Nil
do. do. Income ...	Bonds	6	6	103	—	*5 17 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 18 10
do. Def.	,,	1½	1½	25	—	6 0 0
Automatic Telephone	1	8	10	2¾	+1/8	8 12 9
Chili Telephone	5	5	6	6¾	—	4 7 4
Cuba Sub. Ord.	10	5	5	7	—	7 5 6
Eastern Extension	10	10	10	17⅞	—	*5 11 4
Eastern Tel. Ord.	Stock	10	10	177½	—	*5 12 1
Globe Tel. and T. Ord.	10	10	10	18¾	+⅛	*5 6 8
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	22	20	26¾	—	7 9 6
Indo-European	25	8½	10	47½	—	*5 5 10
Marconi	1	10	Nil	⅛	—	... ...
Marconi-Marine	1	10	7½	1⅜	—	6 13 4
Oriental Telephone Ord.	1	12	12	2⅞	—	*4 18 4
United R. Plate Tel.	5	8	8	8/-	+½	*4 15 6
Western Telegraph	10	10	10	17½	—	*5 16 0

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	2⅞	—	9 11 4
do. do. 2nd Pref. ...	5	6	6	2⅞	+1/16	10 8 8
do. do. 5% Deb. ...	Stock	5	5	67½	+1/-	7 8 2
British Electric Traction Ord. ...	,,	7	8	144½	—	5 10 9
do. do. 6% Pref.	,,	6	6	109	—	5 10 1
Brazil Traction	100	4	5	110	+1½	4 11 0
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	89½	+1	5 11 9
do. do. Preferred ...	,,	96/-	136/9	120⅜	+3	*5 3 11
do. do. Deferred ...	,,	129/5	8	149½	+3	*5 7 0
do. do. Deb. ...	,,	4¼	4¼	79½	—	5 8 3
London & Sub. Trac. 5% Pref. ...	1	2⅜	Nil	7/-	—	Nil
London United Tram. Deb. ...	Stock	4	4	42½	—	9 8 4
Mexico Trams, 5% Bonds	—	5	5	64½	+1	7 15 0
Mexican Light Common	100	Nil	Nil	32½	+1	Nil
do. Pref.	100	Nil	Nil	76½	—	Nil
do. 1st Bonds	—	5	5	63½	−1	7 17 6
Yorkshire (West Riding)	1	5	—	12/6	—	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	13	53/9	+1/4	4 16 8
British Aluminium Ord.	1	5	10	49/6	+1/6	4 1 6
British Elec. Transformer Pref. ...	1	Nil	7	18/3	—	7 18 5
British Insulated Ord.	1	15	15	70/-	+⅜	4 5 9
Brush Ord.	1	10	10	26/8	—	7 12 4
Callenders	1	15	15	8⅜	+⅜	4 5 9
do. 6½% Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb. ...	Stock	5	5	84	—	5 19 1
Electric Construction	1	10	10	31/3	—	6 8 0
Enfield Cable Pref.	1	7½	7½	1½	—	6 6 4
English Electric	1	5	Nil	15/-	—	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	23/6	+1/-	5 10 8
do. Ord.	1	5	7½	31/6	+6d.	4 15 3
Henley	1	16	20	4⅛xd	+⅛	4 12 10
do. 4½% Pref.	5	4½	4½	4⅛	—	5 6 0
India-Rubber	1	5	5	1⅛	—	*4 14 1
Johnson & Phillips	1	10	17½	2⅛	—	5 19 1
Met.-Vickers Ord.	1	8	8	26/3	—	6 2 0
do. Pref.	2	8	8	2⅛	—	6 18 4
Siemens Ord.	1	7½	7½	1⅜	+⅛	4 16 0
Telegraph Construction	12	20	10	29½	—	*4 1 4

*Dividends paid free of Income Tax.

Minor African Markets.

Electrical Import Figures of Nigeria, the Gold Coast, Kenya and Uganda, and Tanganyika.

THERE are now markets for electrical goods in the Gold Coast, Nigeria, and Sierra Leone on the West Coast of Africa, and in Kenya, Uganda, and Tanganyika on the East Coast, that are well worth consideration. It will be seen from the following statistics, which are compiled from official sources, that there were healthy increases in the imports of electrical machinery and apparatus and telegraph material into Nigeria in 1925, compared with 1924. Imports of similar goods in those years are also given below for the markets mentioned, together with notes of increases or decreases.

Imports into Nigeria.

	1924. £	1925. £	Inc. or dec. £
Machinery, electrical—			
Total	3,600	19,600	+16,000
From United Kingdom	2,000	5,700	+ 3,700
,, U.K. Government	1,300	12,000	+10,700
,, United States	140	50	− 90
,, Germany	120	1,900	+ 1,780
Electrical and telegraphic apparatus—			
Total	30,000	32,500	+ 2,500
From United Kingdom	5,500	3,500	− 2,000
,, U.K. Government ...	23,700	28,000	+ 4,300
,, Germany	80	800	+ 720

Imports into the Gold Coast.

	1924. £	1925. £	Inc. or dec. £
Electrical and telegraphic apparatus—			
Total	49,000	36,000	−13,000
From United Kingdom	3,800	6,600	+ 2,800
,, U.K. Government ...	44,000	29,000	−15,000
,, Germany	200	200	—
,, United States	520	340	− 180
Electrical machinery—			
Total	31,000	22,000	− 9,000
From United Kingdom	4,000	11,500	+ 7,500
,, U.K. Government ...	26,000	9,800	−16,200
,, Germany	100	250	+ 150
,, United States	500	250	− 250

Imports into Sierra Leone.

	1924. £	1925. £	Inc. or dec. £
Electrical and telegraphic apparatus—			
Total	31,000	16,000	−15,000
From United Kingdom	29,000	13,000	−16,000
,, U.K. Government ...	2,000	3,000	+ 1,000
Machinery, electrical—			
Total (all U.K. Government)	790	—	− 790
Machinery, industrial—			
Total	270	1,200	+ 930
From United Kingdom	230	930	+ 700
,, U.K. Government ...	10	125	+ 115

Imports into Kenya and Uganda.

	1924. £	1925. £	Inc. or dec. £
Electric wires and cables, insulated—			
Total	1,000	8,400	+ 7,400
From Great Britain	900	8,200	+ 7,300
,, Germany	35	80	+ 45
Ditto on Government account*...	1,600	—	− 1,600
Electric wires and cables, uninsulated—			
Total *	5,800	2,200	− 3,600
Electrical goods and apparatus, n.e.s.—			
Total	22,000	20,500	− 1,500
From Great Britain	20,700	17,700	− 3,000
,, Germany	300	1,900	+ 1,600
,, United States	430	500	+ 70
Ditto on Government account*...	7,400	6,000	− 1,400
Telegraph and telephone instruments and apparatus—			
Total	350	900	+ 550
From Great Britain	350	800	+ 450
Ditto on Government account*...	7,000	12,000	+ 5,000
Electrical machinery and parts—			
Total	19,250	27,500	+ 8,250
From Great Britain	17,500	21,000	+ 3,500
,, Belgium	—	2,300	+ 2,300
,, Sweden	50	1,400	+ 1,350
,, United States	1,000	2,000	+ 1,000
Ditto on Government account*...	—	3,500	+ 3,500
Engines, steam—			
Total	27,000	36,600	+ 9,600
From Great Britain	26,000	32,000	+ 6,000
,, United States	1,000	—	− 1,000
,, Germany	—	4,000	+ 4,000
Ditto on Government account*...	—	3,000	+ 3,000

* All from Great Britain.

Imports into Tanganyika.

	1924. £	1925. £	Inc. or dec. £
Wires and cables, insulated—			
Total	560	860	+ 300
From United Kingdom	370	660	+ 290
,, Germany	10	180	+ 170
Electrical goods and apparatus, n.e.s.—			
Total	5,200	3,300	− 1,900
From United Kingdom	3,800	2,400	− 1,400
,, Germany	50	500	+ 450
Telegraph and telephone instruments and apparatus—			
Total	3,800	8,400	+ 4,600
From United Kingdom	3,600	8,300	+ 4,700
Electrical machinery—			
Total	200	190	− 10
(Mainly from Germany in 1925.)			
Steam engines—			
Total	4,000	10,600	+ 6,600
From United Kingdom	1,200	4,800	+ 3,600
,, Germany	550	4,200	+ 3,650
Lamps and lanterns—			
Total	7,800	10,300	+ 2,500
From United Kingdom	740	1,400	+ 660
,, United States	900	2,200	+ 1,300
,, Germany	2,000	4,800	+ 2,800

Lighting Business in Portugal.

A foreign official report states that the bulk of the table and floor electric light standards, pendants, &c., used in Portugal are imported. Local manufacture of such goods is not well developed, and is therefore not in a position to compete strongly. At Lisbon and Oporto there are about a dozen firms manufacturing such goods, but their products are mainly of cast iron, copper and bronze. Everything else required is imported. Glass lustres come from Czecho-Slovakia and Germany, alabaster bowls from Italy, and pendants and standards in wrought iron, copper, and bronze from Italy and France. French exporters find it a difficult matter to obtain much of the business owing to the relatively high prices of their products. The Portuguese buyer exhibits a preference for the highly decorative type of fitting, and there has been a very large sale of coloured glass and alabaster bowls, which are used in all the larger shops and dwelling houses. Payment is usually made by importing houses at 30 days with discount, or 60 or 90 days net, from the arrival of the goods. Where the customer is known to be financially sound, documents should be sent through a bank to be exchanged for acceptance. It is not advisable to send small goods by parcel post, as the service is very slow, and as much as three months' time may be occupied in the journey. Particular attention should be paid to packing, and very strong cases should be used.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

(*Continued from page* 33.)

Cambridge Instrument Co., Ltd.

A new recorder for measuring the percentage of dissolved oxygen in boiler feed-water was shown working. An outfit has been on test in the Deptford power station of the London Electric Supply Corporation, Ltd., for some months, and has aroused considerable interest. Illustrated in fig. 5, the outfit is a robust boiler-house instrument, which records the percentage of oxygen on a chart calibrated in cubic centimetres per litre of water, and thus enables defects in the feed-water system to be instantly detected; the full-scale deflection corresponds to one cubic centimetre of oxygen per litre, and the apparatus may be arranged to operate an electric alarm. The principle upon which it works is as follows:—Water from the boiler feed system is passed at a constant rate through a tower filled with extractor rings, where it is "scrubbed" by a constant flow of pure hydrogen generated electrolytically. The hydrogen mechanically displaces the dissolved oxygen in the feed water, and the relative rates of flow of hydrogen and water are so arranged that the displaced gas forms a considerable percentage of the total gas issuing from the top of the scrubber; this percentage is measured by a katharometer, and is shown on the chart of the recorder. The katharometer contains two identical spirals of platinum wire, enclosed in separate cells in a metal block, forming two arms of a Wheatstone bridge; when an electric current flows in the circuit, the spirals become heated and lose heat to the walls of the cells, their temperatures (resistance) depending on the thermal conductivity of the gases surrounding them. One of the cells is exposed to the pure hydrogen passing from the electrolytic supply, the other to the gas after passing through the scrubber tower. Owing to the presence of the oxygen from the feed water, the thermal conductivity of the gas in the second cell is different from that of the first, and the Wheatstone bridge circuit is thrown out of balance, causing a deflection of the galvanometer, the extent of which is an indication of the amount of oxygen present in the second cell. Fig. 6 is a diagrammatic arrangement of the complete outfit. The feed water is led through a needle valve and inlet cock A into B, arranged to keep the water supply constant, without exposure to the air, by the overflow C. The flow through the scrubber is regulated by the cock D to about 500 cc. per minute. The hydrogen is generated in M by about 1.4 amperes, and passes across one cell L_1 of the katharometer K, and then through the tube J to the bottom of the scrubber tower F. On leaving the top of the scrubber it passes across the second cell L_2 and out to the air. The katharometer is connected by 4-way leads to the recorder shown on the left in fig. 5; it is a standard thread recorder, may be placed a considerable distance away, is entirely clock driven, and consists of a moving-coil galvanometer, the pointer of which is automatically depressed once a minute on to an inked thread, which it presses into contact with a moving chart.

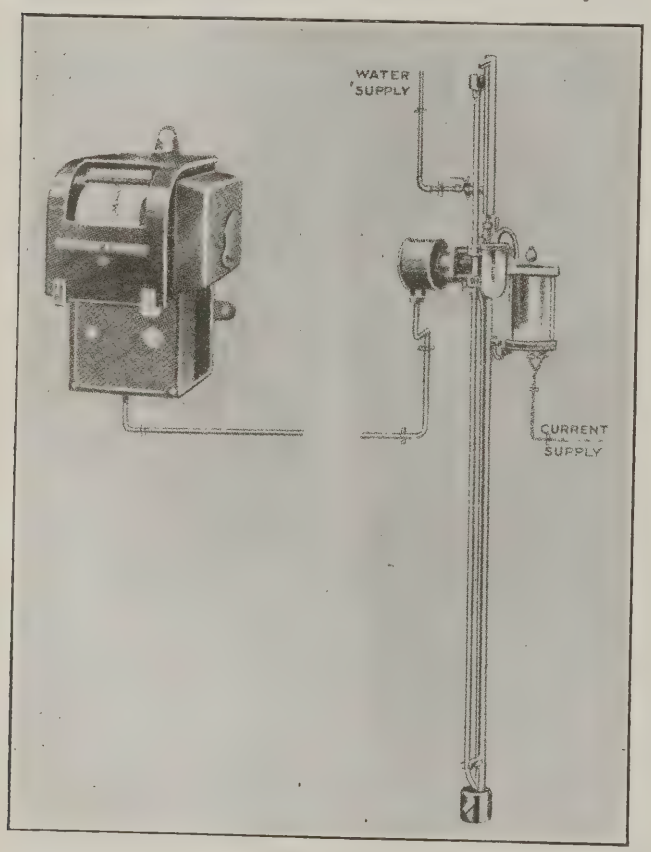


Fig. 5.—Boiler Feed-water Oxygen Recorder.

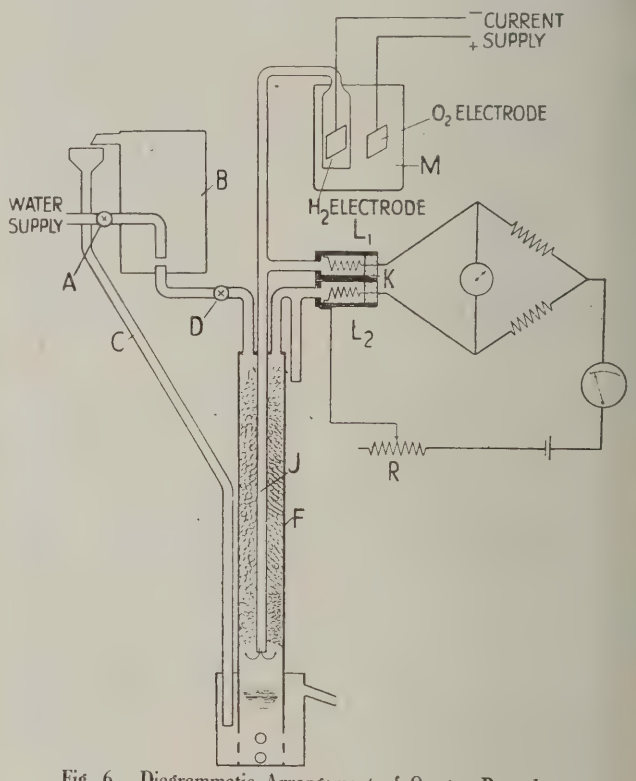


Fig. 6.—Diagrammatic Arrangement of Oxygen Recorder.

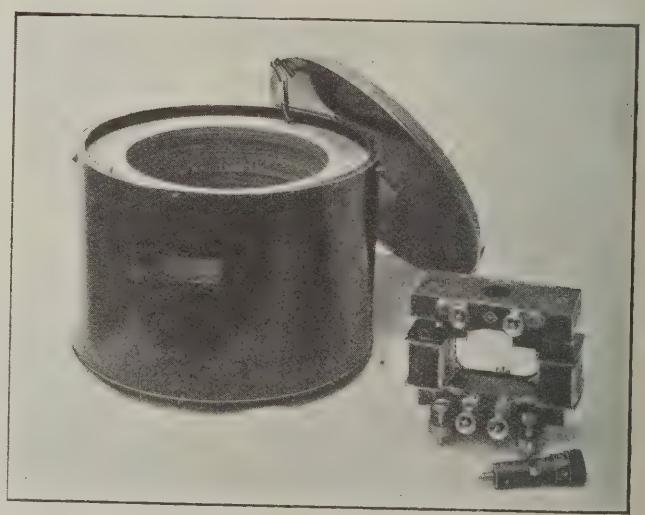


Fig. 7.—Vibration Galvanometer.

A compact outfit was shown for determining the hydrogen-ion

concentration of solutions by the glass-electrode method developed by Mrs. P. M. Tookey-Kerridge, of the Department of Physiology and Biochemistry, University College, London. A thin glass membrane separates the solution whose concentration is to be determined from a buffer solution of known pH, and the difference of electrical potential between the solutions is measured by means of a direct-reading potentiometer, a Lindemann electrometer being used as a null-point indicator in the electrode circuit. The glass electrode enables the pH value of small quantities (0.5 cc. or less) of liquids (clean, coloured, or turbid) easily reducible or unstable in air, and of semi-solids (such as minced tissues) to be rapidly and accurately measured, without the serious technical difficulties which have previously been associated with these measurements.

A vibration galvanometer exhibited (fig. 7), of the type originally evolved by Schering & Schmidt, and manufactured by the Cambridge Co. in accordance with designs furnished by the National Physical Laboratory, is particularly suitable for use in conjunction with the Schering bridge method of measuring power losses in dielectrics and for precision measurements on standard condensers. The instrument is tuned by varying a small d.c. polarising current which can be supplied by two or three small accumulators; if required, the instrument, battery, and adjusting resistance can be at a high potential above earth, the resistances being operated by an insulating handle. Since the alternating-current circuit of the galvanometer is fixed, and is not limited as to size and inertia, as it is in the case of a moving-coil vibration galvanometer, a large number of turns of fine wire may be used, which is an advantage when measurements on circuits of high impedance are to be made. The galvanometer can be used for frequencies between 25 and 120 periods per second, and consists of a small U-shaped magnet, made up of three pieces for providing the polarising field, and two other magnets, the pole tips of which are made to form radial arms about the vibrating system; the polarising flux passes through the two latter magnets. The polarising winding is wound on the two main limbs of the uprights, forming the arms of the "U" magnet, and the measuring windings, which consist of four small bobbins, are mounted, one each, on the limbs of the two small magnets. An alternating current flowing in the latter distorts the field by moving it through an angle, first in one direction and then in the other on either side of the neutral position. The vibrating system consists of a small piece of thin soft iron, suspended by a light phosphor-bronze strip which is anchored at both extremities and carries a plane mirror. The vibrating system is contained in a metal case, in which is fitted a lens of about one metre focal length, and a beam of light focused on to the needle mirror is reflected on to a ground-glass plate with graduated divisions. Provision is made whereby the earth capacity of the instrument is reduced to a low figure, and the galvanometer is protected from magnetic fields by means of a heavily-laminated shield.

Foster Instrument Co.

An example of automatic temperature-control apparatus (general particulars of which recently appeared in our pages)

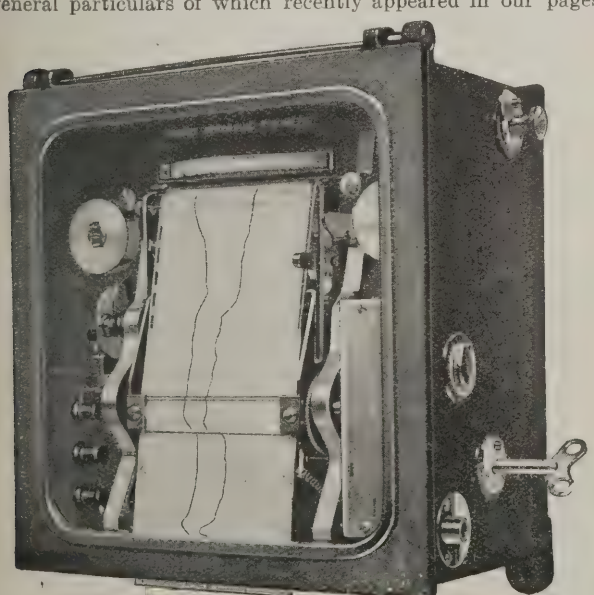


Fig. 8.—A Strip Recorder.

was exhibited: points worthy of notice are the following:—The actual mechanism for making the primary contacts inside the case of the pyrometer indicator is necessarily delicate, compared with the other parts of the apparatus. In order that these delicate parts shall not be subject to undue forces by misuse, or interference with other parts of the apparatus, they are so arranged that only a limited force, due to gravity, can be applied to the contacts. The motor-driven mechanism for producing these contacts is made heavy and capable of running continuously for many years, but its action on the delicate parts is only in a permissive sense; that is to say, it only permits the force of gravity to act inside the indicator. No adjustment, or maladjustment, by the user can put any extra force upon those parts.

The cylinder temperature pyrometer enables measurement to be made of the mean gas temperature inside the cylinder of an internal-combustion engine. Hitherto the chief difficulty of obtaining this information has been to provide facility for inserting a thermo-couple into the cylinder in such a position that it would attain the temperature of the gases. In the Foster instrument an ignition plug, while performing its normal function, serves also as a thermo-couple, its junction being at the tip of the centre electrode of the plug. The latest development of the strip recorder (illustrated in fig. 8) is also shown, in which six records of distinguishable colours are produced on one chart from six different thermo-couples.

Elliott Brothers (London), Ltd.

A sample of the many instruments on this company's stand is illustrated in fig. 9, being a portable frequency indicator of convenient pattern. A piece of apparatus which has not been exhibited before is shown in fig. 10; it is a new form of portable galvanometer made up in a metal case, and has a knife-edge pointer, anti-parallax mirror, and evenly-divided

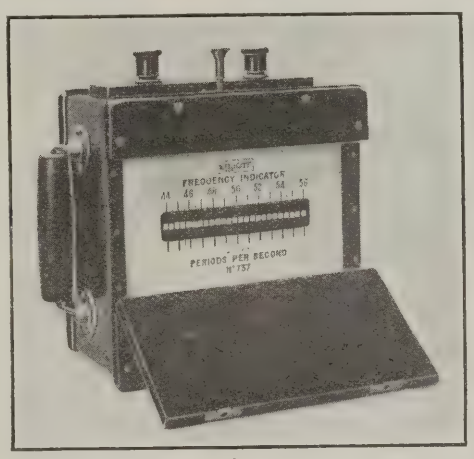


Fig. 9.—Portable Frequency Indicator.

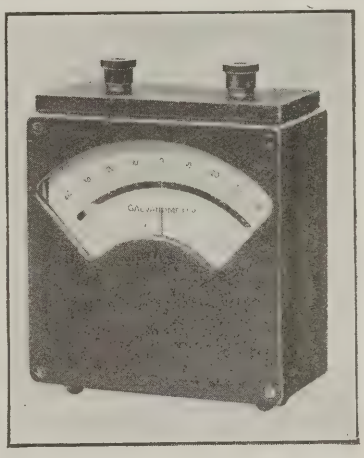


Fig. 10.—A Portable Galvanometer.

scale. It is of the moving-coil pattern, and can be used as a milliammeter, galvanometer, and micro-ammeter, its standard sensitivities being as follows:—

Scale length ...	80 m/m	80 m/m
Coil resistance	300 ohms.	50 ohms.
As a galvanometer:—		
Sensitivity ...	$0{\cdot}25 \times 10^{-6}$ amp. per div.	$1{\cdot}0 \times 10^{-6}$ amp. per div.
Scale (m/m divs.)	40—0—40 m/m	40—0—40 m/m
Periodic time	3 secs.	3 secs.
As a microammeter:—		
Range	0—10 and up.	0—100 and up.
Damping ...	Partially damped.	Partially damped.
Time to rest ...	3 secs.	3¼ secs.

Other devices which have recently been placed on the market are mentioned below, namely, a live-cable core temperature indicator (Fawssetts patent) which gives the core temperature of any cable, either low-tension or e.h.p., under working conditions. It consists of a combination of thermo-couples with millivoltmeter so arranged that the reading of the instrument gives directly the temperature of the core of the cable. It can be employed for indicating the temperature of cables working at any voltage. An averaging recorder for bulk power supplies gives the total consumption, and also the maximum demand averaged over a definite time interval. It can be calibrated as a kVA meter if desired. The particular sample shown was a 3-phase, 3-wire recording wattmeter for unbalanced or balanced loads. A pressure indicator consists of an electrically-operated valve and step-by-step contact mechanism, whereby pressure curves, such as are obtained in explosion engines, &c., may be plotted to any scale desired. The apparatus may be used to obtain, say, the pressure variation in the "scavenging" stroke of a Diesel engine, and also the "explosion" stroke. The curves are plotted in a manner similar to the wave-form curves of an alternator. The valve is pressure-tight against pressures of 1,500 lb. to the square inch; and the apparatus is suitable for speeds up to about 250 r.p.m.; by suitable modification speeds up to 500 r.p.m. can be dealt with.

(To be continued.)

The British Industries Fair.

Lists of Birmingham and London Exhibitors.

WE are now in a position to publish complete lists of exhibitors at this year's British Industries Fair whose goods are of interest to our readers. The London Section catalogue has actually been produced, although the Fair does not open until February 21st; it is a substantial volume, containing particulars relating to over 900 exhibitors, and the goods are very well classified and indexed. The Birmingham exhibits, which are generally on a larger scale than those at the White City, number over 500.

One feature of this year's Fair is the endeavour which British manufacturers have made to conform to overseas customers' requirements. Many of them took advantage of the slack months of 1926 to make a study of Dominion and foreign markets with a view to gauging their needs. As a result, first-hand information of a valuable nature has been obtained, suggesting new methods of production and design to meet special requirements. The organisers of the Birmingham Fair (the Birmingham Chamber of Commerce) have prepared a list giving a number of lines in which British manufacturers are making a definite challenge to foreign competitors. The list includes electric washing machines, electrical accessories, household appliances, water heaters, motors, electric vehicles, vacuum cleaners, power pumps, elevators and trucks, electric drills, welding machines, and flexible cords and cables. The following are the names of companies, firms and individuals who are taking part in the Fair:—

Birmingham.

Accles & Pollock, Ltd.
Allen-Liversidge, Ltd.
Allen, W. H., Sons & Co., Ltd.
Antrobus & Co.
Avery, W. & T., Ltd.
Barrett, Wakefield & Co., Ltd.
Batteries, Ltd.
Beatty Bros., Ltd.
Belliss & Morcom, Ltd.
Berry's Electric, Ltd.
Birkbys, Ltd.
Birmingham Electric Supply Dept.
Blackstone & Co., Ltd.
Britannia Tube Co., Ltd.
British Electrical Repairs, Ltd.
British Electric Transformer Co., Ltd.
British Thomson-Houston Co., Ltd.
British Vacuum Cleaner and Engineering Co., Ltd.
Brook, E., Ltd.
Bulpitt & Sons, Ltd.
Callender's Cable and Construction Co., Ltd.
Calvete, I., Ltd.
Cambridge Instrument Co., Ltd.
Canning, W., & Co., Ltd.
Carron Company
Castle Fuse and Engineering Co., Ltd.
Chloride Electrical Storage Co., Ltd.
Clayton & Shuttleworth, Ltd.
Cleworth, A. B., & Co., Ltd.
Coventry Electrical Accessories, Ltd.
Credenda Conduits Co., Ltd.
Crossley Bros., Ltd.
Damard Lacquer Co., Ltd.
Daulby, S. J.
Davidson & Co., Ltd.
Davis & Timmins, Ltd.
De la Rue, Thos., & Co., Ltd.
Dundee Electrical Repairs Co., Ltd.
Eastern Telegraph Co., Ltd.
Ebonestos Insulators, Ltd.
Electric Fires, Ltd.
Electric Heating and Hardware, Ltd.
Electric Transmission, Ltd.
Electrical Power Engineers' Association.
Electrical Power Engineering Co. (Birmingham), Ltd.
Electricars, Ltd.
Electroflo Meter Co., Ltd.
Ellison, George
Excelsior Shade Mfg. Co.
Falkirk Iron Co., Ltd.
Fielding & Platt, Ltd.
Gardner, L., & Sons, Ltd.
General Electric Co., Ltd.
Gent & Co., Ltd.
Gledhill Brook Time Recorder, Ltd.
Hackbridge Electric Construction Co., Ltd.
Harcourts, Ltd.
Harper, J., & Co., Ltd.
Hart Accumulator Co., Ltd.
Heenan & Froude, Ltd.
Hewittic Electric Co., Ltd.
Holden & Hunt.
Hunt & Mitton, Ltd.
Hunt, J. A. H.
Imperial Engineering Co.
Jackson Electric Stove Co., Ltd.
Johnson, Rd., Clapham and Morris, Ltd.
Kelvin, Bottomley & Baird, Ltd.
Kent, George, Ltd.
Kenyon, W., & Co., Ltd.
K.F.M. Engineering Co., Ltd.
Lister, R. A., & Co., Ltd.
London Electric Wire Co. and Smiths, Ltd.
Macintosh Cable Co., Ltd.
McGeoch, Wm., & Co., Ltd.
Manda Motors, Ltd.
Mawdsley's, Ltd.
May & Padmore, Ltd.
Mersey Cable Works, Ltd.
Metropolitan - Vickers Electrical Co., Ltd.
Midland Fan Co., Ltd.
Millington, E. H., & Co., Ltd.
M.L. Magneto Syndicate, Ltd.
Morton, A., Ltd.
Mouldensite, Ltd.
National Gas Engine Co., Ltd.
New Conveyor Co., Ltd.
Nobbs, Geo., Ltd.
Pantin, W. & C.
Parker, Winder & Achurch, Ltd.

Birmingham—*continued.*

Park Royal Engineering Co., Ltd.
Parsons, C. H., Ltd.
"Petosign" Co.
Porcelain Electric Fittings Association.
Premier Electric Heaters, Ltd.
Pritchett & Gold & E.P.S. Co., Ltd.
Rainsford & Lynes, Ltd.
Rapid Magnetting Machine Co., Ltd.
Rawlplug Co., Ltd.
Record Electrical Co., Ltd.
Rees Roturbo Mfg. Co., Ltd.
Reyrolle, A., & Co., Ltd.
Rudd, E., & Co.
Runbaken Magneto Co.
Ruston & Hornsby, Ltd.
Santon, Ltd.
Shropshire, &c., Electric Power Co.
Small, W. R.
Spauldings, Ltd.
Steam Gauge Mfg. Co.
Stewarts & Lloyds, Ltd.
Stone, J. B., & Co., Ltd.
Sturge & Baker, Ltd.
Tangyes, Ltd.
Telegraph Construction and Maintenance Co., Ltd.
Timpany & Tylor.
Tucker, J. H., & Co., Ltd.
T.V.E., Ltd.
Underfeed Stoker Co., Ltd.
Vickers-Petters, Ltd.
Ward & Goldstone, Ltd.
Westminster Tool & Electric Co.
Wiggin, Henry, & Co., Ltd.
Wilkins & Wright, Ltd.
Wingrove & Rogers, Ltd.
Wolseley Sheep Shearing Machine Co., Ltd.
Yorkshire Switchgear and Engineering Co., Ltd.

London.

Artistic Shade Co.
Ashton, H.
"Attracta" Electrical Co.
Beard & Fitch, Ltd.
Beetle Products Co., Ltd.
Bird, Sydney S., & Sons.
Birkbys, Ltd.
Bourne, Joseph, & Son, Ltd.
Brilliant Sign Co. (1907), Ltd.
Britain's Best Crystal, Ltd.
British Electrical Sales Organisation.
British General Mfg. Co., Ltd.
Brown, S. G., Ltd.
Brownie Wireless Co. of Gt. Britain, Ltd.
Calvete, I., Ltd.
Camden Engineering Co., Ltd.
Cooke, Troughton & Sims, Ltd.
Crystalate Mfg. Co., Ltd.
Dent, R. H.
Dowsing Radiant Heat Co
Eastick, J. J., & Sons.
Electrolux, Ltd.
Ever-Ready Co. (Gt. Britain), Ltd.
Formo Co. (A. Preen & Co.)
Graham, R. F., & Co.
Gramostyles, Ltd.
Grover & Co., Ltd.
Halcyon Wireless Supply Co., Ltd.
Hart Accumulator Co., Ltd.
Hinderlich, A.
J. M. O., Ltd.
Lissen, Ltd.
London Radio Mfg. Co., Ltd.
Marathon, Ltd.
New London Electron Works, Ltd.
Portable Utilities Co., Ltd.
Priory Loud Speaker Co.
Radiocoil Electro-Magnetic Blanket Co., Ltd.
Read Radio, Ltd.
Ross, Ltd.
See, J. W., & Sons.
Smith, S., & Sons (Motor Accessories), Ltd.
Stratton & Co., Ltd.
Synchronome Co., Ltd.
Technical Agencies Co.
Telegraph Condenser Co., Ltd.
Truphonic Wireless Co.
Tungstone Accumulator Co., Ltd.
Turner, Ernest.
Universal Cabinets, Ltd.
Vulco Dry Battery Co., Ltd.
Watmel Wireless Co., Ltd.
Western Laboratories, Ltd.
Whittingham, Smith & Co.
Wolff, M. & A. (Etherplus).

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A New Outdoor Circuit Breaker.

We have received some particulars of a new ("K") type of oil circuit breaker which has been introduced by MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, London, S.E.7. It is designed for outdoor working on 15,000 V, and is claimed to be completely weatherproof and constructed so as to prevent the ingress of rain, sleet or snow. The operating mechanism embodies the loose-handle feature, so that it is impossible to hold the breaker closed under heavy-overload or short-circuit conditions. It is constructed about a cast-iron base plate and surmounted by a sheet-steel cover. The apparatus is designed for chain operation, but if desired an alternative method can be supplied in the form of an operating lever. The tripping of the breaker is effected by operating the chains in the reverse direction; once the opening operation has been started the mechanism releases the switch, which then opens automatically at high speed. The contacts are of the double-break pattern, suitable for 200-A loading. For automatic operation series trip coils are mounted beneath the oil level. A delay action is obtained on the trip coils by means of a small oil dashpot which prevents the breaker from being opened unnecessarily by sudden kicks on the line. The h.p. leads are brought out from the fixed contacts through the top plate and thence through porcelain bushes to the exterior. Standard 2-ft. cable tails are provided. The insulation is of porcelain and bakelite material throughout. The oil tank is built up of welded sheet-steel, provided with strengthening straps, and is fitted with lifting handles and a filling plug and drain cock. Special precautions have been taken to prevent damage due to rust and corrosion; all the working parts are of non-ferrous metal, stainless steel, or treated with a special non-rusting process which permeates the metal. The weight of the switch, including the fixing straps, is approximately 420 lb., and 14 gallons of oil are required for the first filling of the oil tank. A suitable disk "on" and "off" indicator is provided. Fig. 1 shows the switch with the tank lowered and the lid cover removed.

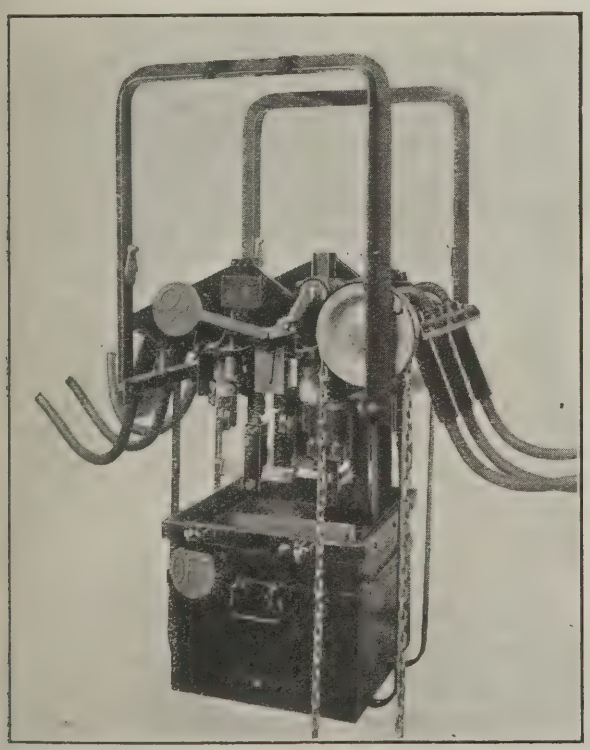


Fig. 1.—Outdoor Circuit Breaker.

A Light Shielding Fitting.

For providing sufficient illumination for theatre aisles and at the same time shielding the light so that it is not objectionable to the spectators or performers, is the purpose of the LA series of aisle light condulets, fig. 2, which are being marketed by the CROUSE-HINDS COMPANY, Syracuse, New York. These fittings, some particulars of which are given in *Electrical Merchandising*, are very narrow, and when installed at the end of a row of seats do not obstruct the aisle. The front of the condulet is easily removed, facilitating the renewal of lamps. No glass is used. If desired, coloured lamps can be used.

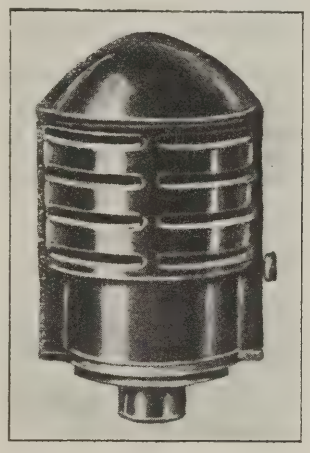


Fig. 2.—Theatre-Aisle Fitting.



Fig. 3.—Electric Floor Machine.

A Heavy-Duty Floor Machine.

A new floor machine for heavy work, described in *Electrical Merchandising*, has been introduced by the FAY COMPANY, 11, East 31st Street, New York. The machine, "Jumbo," fig. 3, is of the rotary type, weighs 125 lb., and is equipped with a ½-h.p. motor. The diameter of the base is 15½ in. The attachments provided for the machine are 14 in. in diameter, and include a bassine fibre scrubbing brush for scrubbing, such as wood, linoleum, rubber and composition floors; a steel-wire brush for scrubbing concrete, marble, and very dirty floors; a bassine fibre waxing brush for rubbing wax into wood, linoleum, &c.; a tampico polishing bush; a steel wire brush; and a sandpaper disk which is used for sanding floors.

An Electric Cable Vehicle.

A specially designed electric vehicle for transporting drums of cable has recently been introduced by Messrs. WINGROVE AND ROGERS, LTD., Mill Lane, Liverpool. It comprises a B.E.V. electric truck fitted with special lifting and conveying gear suitable for dealing with drums weighing up to 6 tons. The truck is so constructed that the chest containing the accumulators acts as a counterpoise to the load, thus reducing to a minimum the effort required to lift the drum clear of the ground, and enabling this task to be carried out by a motor of comparatively small size. The weight of the drum is carried immediately over the back wheels. The driving platform is arranged so that the truck can be driven in either direction. The vehicle is equipped with two brakes of the internal-expanding pattern, one hand and one foot operated, both being interlocked with the controller by the makers' special electric trip gear. The truck can also be used, it is claimed, for the laying of cables.

A New Electric Fire.

A recent addition to the products of THE BASTIAN METER CO., LTD., 58, Haymarket, London, S.W.1, is the "Super Imp" electric fire, which has been designed so that the reflectors throw the heat not only straight forward, but also in a downward direction to the floor. Two Quartzalite elements, each consuming 1 kWh per hour, glow at a bright red heat, giving a cheerful effect and a near approach to a hot coal fire. A further advantage is that a kettle can be boiled readily, and if by chance it boils over, the water falling on the elements, it is claimed, will not damage them in any way.

Electric Railway Track Equipment.

A Comparative Review of the Electrical Apparatus installed on the London Underground Lines, and Experience Gained in their Operation.

By ARTHUR R. COOPER, M.I.E.E.

(Abstract of a paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

THE paper describes generally the lay-out of the electrical track equipment of the London Underground Railways, including the District, London Electric, Central London, and the City and South London Railways, and deals particularly with the adoption of the insulated-return system, the conductor rails, insulators, h.p. cables, and other parts of the equipment.

The earlier tube railways adopted the earthed-return system, the track rails being used for conveying the current back to the sub-station. The electrification of the District and Metropolitan Railways was carried out with an insulated return, a fourth rail being provided. Undoubtedly the chief feature determining the decision to adopt this system was the possible injurious effect on the apparatus of public supply undertakings and, in particular, the Government observatories, from earth currents.

The decision to have an insulated return was influenced by the situation and construction of the District Railway. The tracks were near to the surface, and therefore to such outside interests as cables and pipes. The railway was not surrounded by a cast-iron lining as on the tube railways, and track-circuit signalling, employing d.c., was to be installed, making it difficult to use the track rails for the return traction current; it was also claimed that the insulated return allowed the railways to continue working if one pole became earthed due to failure of its insulation, and cases have occurred where for many hours the system has operated with the positive conductor earthed. The general supposition that the use of track rails for return traction current is much cheaper than the installation of a fourth rail for the insulated return is not necessarily correct where track circuits are employed for signalling purposes, and where the signalling installed has to provide for a very close headway of trains. The use of track rails for both traction and signalling current renders impedance bonds necessary for the separation of the a.c. signalling sections. The cost of the electrical equipment of the track with an earthed return and track circuits is about the same as the cost of the electrical track equipment for an insulated return system where the track has to deal with a close headway of trains, necessitating nine signalling sections per mile.

It is improbable that there will be any further adoption of the insulated return except for extensions to existing lines. In working the railways with an insulated return, certain effects have been encountered which were not anticipated when the system was adopted. It will be realised that if there is a short-circuit between the positive side of the low-pressure system and earth, the potential of the negative side of the system becomes 600 volts below earth. The amount of current that can flow through the positive short-circuit is limited by the leakage of the whole of the negative side of the system, and in consequence, although the current flowing through the positive short-circuit may be appreciable, it will probably not be sufficient to open the circuit breakers in the sub-stations, and the fusing at the positive fault will continue until either the cause is removed or a breakdown occurs on the negative side. This form of failure usually accompanied, or had the result of causing, breakdowns of the insulation at other parts of the system, such as the earthing of a train equipment, not infrequently at a distance of several miles from the original positive short-circuit.

It was difficult to account for the failures resulting from the original positive short-circuits, but investigation went to show that pressures above 600 volts must be present, apparently due to the sudden interruption of heavy currents flowing over considerable distances. A series of tests was made on the District Railway during non-traffic hours on the effect of the sudden interruption of large currents flowing along considerable lengths of conductor and track rails, and also on the use of various protective devices installed to prevent rises of pressure.

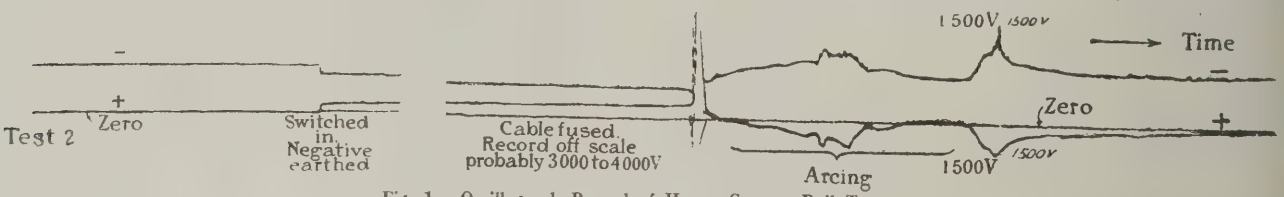


Fig. 1.—Oscillograph Record of Heavy Current Rail Test.

An oscillograph was connected between each conductor rail and earth, the connections being made to the positive and negative bus-bars at the East Ham sub-station. The iron framework of the sub-station building was used as the earth, and the resistance of each of the oscillograph circuits was 10,000 ohms; and they thus constituted a leak of this value between each of the conductor rails and earth. The sensibility of the oscillograph was adjusted so that 1 mm.= 60 volts. The records were made on kinematograph film travelling at approximately 6 in. per second. Three sub-stations, South Kensington, Victoria, and East Ham, each had one rotary connected. The positive conductor was earthed at Sloane Square and the records were made at East Ham.

In one test the positive conductor rail was joined to the track at Sloane Square; the negative conductor rail was joined to the track rails at East Ham in the train section with two 7/22 wires. Victoria, South Kensington, and East Ham sub-stations were on the line. The train section was switched in, causing an earth on the lighting circuit at East Ham, which brought out the lighting circuit breaker.

The commencement of the record, fig. 1, shows the positive conductor rail at earth potential and the negative at full-line voltage above earth. At the moment of switching on, the negative potential dropped and the positive rose slightly. As the resistance of the two wires increased, the negative voltage dropped and the positive rose until the cable suddenly fused, causing both lines to shoot right off the film. Following this, arcing appears to have taken place, after which the conditions settled to normal again. It is impossible to say exactly what the maximum voltage obtained may have been, but judging from the appearance of the lines on the film, I should think it could not have been

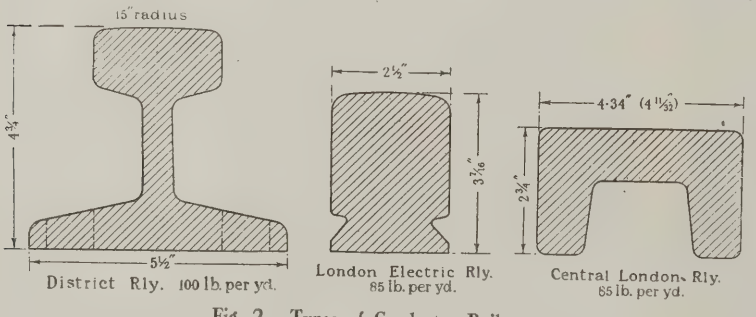


Fig. 2.—Types of Conductor Rail.

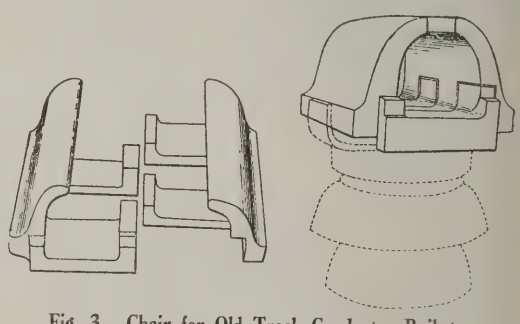


Fig. 3.—Chair for Old Track Conductor Rail.

less than 3,000 or 4,000 V at the moment of the fusing of the cable, and it was in the neighbourhood of 1,500 V at the point where the arc went out.

Certain steps have been taken to deal with this particular class of breakdown, in the first place by sectionalising the l.p. network, so as to lessen the likelihood of failure, and secondly by providing means whereby the current can be removed from the defective section at a moment's notice. As a first step, the District Railway was separated from the tube lines by dividing the sub-station bus-bars in joint sub-stations. Later the tube lines were divided. A series of lamps with the middle point earthed is provided in the traffic controller's office for each of the lines, and the presence of an earth on either the positive or negative side of the system is indicated by a change in the brilliancy of the lamps. Recording voltmeters are installed at a few places to record the voltage between the negative and earth, and are placed in such positions as to be frequently under observation. The types of conductor rail installed on three of the railways are shown in fig. 2. One of the reasons for the adoption of the rectangular rail on the London Electric Railways is the small amount of space available for the positive rail

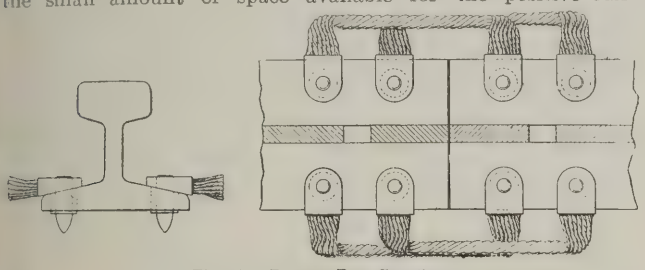


Fig. 4.—Present-Day Bonding.

in the tubes. Special soft steel containing about 0.08 per cent. of carbon is used for conductor rails, this having a resistance about seven times that of copper of equal cross-sectional area, or approximately 0.03 ohm per mile for the 100-lb. rail. A low manganese content in the steel is also necessary; in fact, it can be said that a maximum of iron and a minimum of the other constituents is required to obtain high conductivity.

The necessity for good conductivity deserves more attention than has been given to it. The resistance of individual rails in a consignment varies not infrequently from 6½ to 7½ times the resistance of copper by volume. It is difficult to explain what brings about such variation of the resistance, and chemical analysis has not made the reason clear. It is probable that the exercise of special care in the manufacture of the material, *e.g.*, in the temperature of rolling, would enable a better conductivity to be obtained. Commercial pure iron can be obtained having a resistance of about 6.2 times that of copper. This improvement of some 15 per cent. in conductivity, however, involves 30 per cent. extra cost, so that in situations where only conductivity is concerned, it is clearly cheaper to obtain greater conductivity by the adoption of heavier ordinary rails.

The flat-bottom rail allows of a better alignment at the joint, due to the provision of fishing angles, and is less liable to overturn; the bonding is also easier to arrange. On the other hand, it exposes a large surface for corrosion. The rectangular section would at first sight appear to be easier to roll, but the groove provided for fishing purposes does away with the otherwise simple section. The channel-section rail is more stable in position than the rectangular one, but its supports and connections are not so readily inspected, and bending is more difficult.

Old running rails, bull-head section, have been used as current rails in sidings and other places, where conductivity is of little account, with the object of lessening the cost. The rails are held in position by a special cast-iron chair, fig. 3, made in two sections, which rests upon an ordinary negative or short insulator for the positive rail, a specially low insulator being used for the negative. The two halves clamp over the two sides of the rail and automatically interlock when in position. The rail is placed head downwards, as the bottom of an old track rail provides a better surface for the shoe. The conductivity of the current rails is measured annually between the sub-stations by connecting through the adjoining tracks at those points and passing a test current through the rails. Tests on the track are carried out on any section length where the conductivity is less than 95 per cent. of that of a continuous rail, due allowance being made for the reduction of the cross-section of the rail by corrosion and wear. The tests on the track are first carried out by sectionalising the rail at cross-overs and other convenient gaps, and finally at individual bonded joints.

The instrument used for testing individual joints is arranged to measure the voltage-drop along a yard length of conductor rail containing the joint, and in comparison at the same instant the drop along an adjoining yard of rail, which naturally does not contain a joint; this comparison forms a measure of the efficiency of the bonded joint. In some cases the bond conductivity has been found to be as low as 80 to 85 per cent. of that of a continuous rail, but a figure less than 95 per cent. is now exceptional.

Pin bonds are used throughout the Underground Railways, the head being drop-forged to the cable connection, and a steel pin being driven in to expand the head in the hole of the rail. Originally two short bonds and two long ones per joint were installed, but the breakages of short bonds were very heavy. Bonds of the same length are used now, arranged as shown in fig. 4. To prevent the collector shoes bridging across the gap between a live and dead rail, a short piece of track, "train section," is provided between the two sections; this is a little longer than the longest train and separately fed from the sub-station bus-bars. The "train section" is switched off from the sub-stations whenever the adjoining section is made dead for any purpose. The present practice on new lines is to fit a special "gap" indicator a few feet in the rear of the actual section gap, the latter consisting of a piece of hard-wood, 2 ft. long. The indicator is a light signal of a special type, normally being extinguished; but when the section ahead is for any reason dead, three small red lights are automatically shown, notifying the driver that it is dead.

Protection against accidental contact with the conductor rails was originally provided by means of wooden creosoted planks secured on each side of the rail. After a time it was decided to remove the inside protection plank, and later still permission was obtained to remove the whole of the protection planking, except at certain places where an outside plank only is now provided.

Separate ramps, 4 ft. long, are provided at the rail-ends where the rails are not continuous, as opposed to turning down the ends of the conductor rails. The cast-iron ramp, fig. 5, whilst introducing another joint, has the distinct advantage, in that it has a wide top surface, of the possibility of the narrow shoes getting down by the side of the rail being materially lessened. The ramps are secured to the conductor rail by fishplates, but are not bonded. They serve for both facing and trailing positions, having a slope of about 1 in 20. Cases have occurred of rails being overturned, due either to atmospheric action pushing the rails out of position, or to defective train shoes getting down by the side of the rail. In several places hard-wood blocks of stout construction have been installed at rail ends, fixed to the sleeper, to break away hanging shoes.

(To be concluded.)

Discussion.

Mr. ROGER T. SMITH pointed out that the Admiralty clause in connection with the adoption of the third and fourth rails referred to private apparatus at the Greenwich observatory which had since been shifted to the wilds of Kent. He thought that the practice of putting the jumper cables above ground would have the approval of all engineers. The Underground Railways had taken advantage of the unique opportunity of comparing the abrasion in the tubes and in the open. He was particularly interested in the conclusions arrived at to neither clean the insulators nor paint the rails. It was a pity

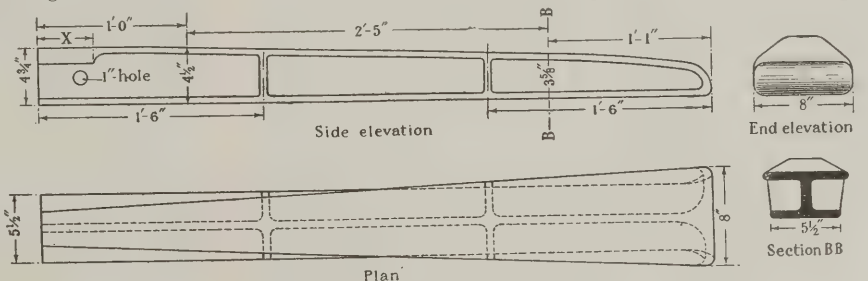


Fig. 5.—Details of Rail-End Ramp.

that no illustration was given in the paper of the method of fixing the insulators on the sleepers. Security and ease of maintenance were of the greatest importance on railways, and it would be generally agreed as more important to run the supply cables above ground than buried; but it must be remembered that about 15 per cent. of the carrying capacity of the cables was lost in the former case. Arising out of the 600-V choice was the question of a standard voltage; the arrangement of two current tracks was ideal in many ways, but it must be possible, when main-line electrification came along, to run the trains on all the lines.

Sir JOHN ASPINALL referred to the work of the committee on vibration which laid the blame for vibration on unsprung cars and on the rails. He thought the rails had nothing to do with it. He did not understand the suggestion that vibration accelerated corrosion. He had found that the third rail did not corrode as rapidly as the fourth, due probably to the vibration of the shoe, or perhaps because the third rail threw off the moisture. He suggested that vibration preserved the rails from corrosion. On the Liverpool and Southport railway, which was electrified in 1904, snow cars were sent out each morning in snowy weather, and they had had no trouble. On the Manchester and Bury railway, which was electrified in

1916, they were using 1,200 V, and it was necessary to protect the conductor rail more carefully; a special shoe was employed which fitted over the side of the rail, and no trouble had been encountered with snow. They also had first put the cables in the ground, but had after a few years took them up and put them on posts above ground. He suggested that by employing special rails and tires the Underground Railways could have got over the difficulty of the sharp curves, although this would have been costly. He had found that the effect was worse with the lighter cars.

Mr. G. BROUGHALL said that one reason in support of the third- and fourth-rails system was that it facilitated interconnection. With regard to the voltage surge trouble, he had found it most marked in dry weather. On his undertaking the trouble had been got over by installing electrolytic arrestors in the sub-stations. He had had no difficulty in getting rails of higher conductivity than those referred to by Mr. Cooper. He had found the use of the short bonds quite satisfactory if proper attention was given to the rail joints. The practice on his line was to anchor the rails every 100 ft. He favoured the use of ramps, which could be made of scraps of conductor rail.

Mr. R. A. MACMAHON saw a possible objection to arc bonding of the rails if Mr. Cooper's suggestion as to the weakening effect of burns was correct. It was the Swiss practice to arc bond the head of the rail at the side. The conditions on the Geneva-Lausanne line were similar to those on the Underground Railways, but no trouble had arisen from the arc bonding. He had difficulty in understanding the time lag between the faults which arose as a result of the pressure surges. Perhaps the subsequent faults caused secondary surges. Testing for similar conditions on a Paris system had been effected by flashing over on the sub-station rotaries, and the results were in opposition to the suggestion of condenser effect; oscillations did not occur.

Mr. P. BOULTON thought that the surge troubles might be due to the tendency to regard the negative conductor as unimportant. Tests he had carried out on conductor rail showed a resistance of 6.5 times that of copper, and the carbon and manganese contents were only 0.05 and 0.13 respectively. Commercial iron could be obtained at present with a resistance of only 6.2 times that of copper; it would be advantageous to use iron, due to its greater resistance to corrosion. There were also alloy-steels at present available with higher conductivities than those given. The wear on the third rail might be due to the fact that the positive repelled moisture.

Mr. COOPER, in reply, said that the fixing of the insulators to the sleepers was effected by malleable-iron clips secured to the sleepers by galvanised-iron screws. The square composition insulators afforded easier fixing. With regard to vibration, the surface of the track rails was never true, and it had been found that the amount of vibration depended on the speed. Manganese rails gave the best results. There was little wear on the track rails in the early days, due to the soft material which was used for the brake shoes. The discharge devices referred to by Mr. Broughall had been tried, and it had been decided that nothing was to be gained by their introduction. He strongly favoured the use of the giant strain insulator; it was simple and inexpensive. With regard to the suggestion *re* arc bonding, he thought that two important points ought to be considered—the intensive nature of the arc, and the favourable position on the rail at which it was applied. The end of the rail was not subjected to very heavy stresses. He thought that the possible flickering of the shoes on the negative rail on the curves might be the cause of some of the short circuiting.

The Electricity (Supply) Act, 1926.

A Summary of its Provisions.

(*Concluded from page* 37.)

* 28.—(1) The Board may issue stock (to be called Central Electricity Stock).

(2) All such stock, and interest thereon, shall be charged on the undertaking and revenues of the Board.

(3) Any stock created by the Board shall be dealt with according to regulations made by the Minister of Transport with the approval of the Treasury.

29.—(1) The Treasury may guarantee the payment of the interest and principal of any loan proposed to be raised by the Board: provided that the aggregate amount of the loans so guaranteed shall not exceed thirty-three and a half million pounds.

(2) Such sums as may be required by the Treasury for fulfilling any guarantees under this section shall be charged on the Consolidated Fund.

(3) The repayment of any sums so issued out of the Consolidated Fund, together with interest thereon, shall be a charge on the undertaking and revenues of the Board next after the principal and interest of the guaranteed loan, and any sinking fund payments for the repayment of the principal thereof.

(5) The Treasury shall so long as any such guarantees are in force, lay before Parliament every year a statement of the guarantees given, and an account of the total sums issued or paid in.

30.—The Board shall prepare an annual statement of accounts, which shall be audited by auditors appointed by the Minister of Transport, and shall be published at a price not exceeding one shilling a copy.

Miscellaneous Provisions.

31.—(1) On a power company commencing to receive a supply of electricity from the Board, the Minister of Transport may revise the maximum prices authorised under the special Act of the company to be charged by the company for supplies, other than supplies in bulk to authorised undertakers, and may revise the standard prices fixed by such Act; on such revision regard shall be had to any change in the cost of electricity to the company attributable to this Act.

(2) Where a special Act authorises such a power company to make good any deficiency in any previous dividends which have fallen below the prescribed standard rate of dividends, the Electricity Commissioners may, by special Order, make provision for the repeal or limitation of any such authorisation.

32.—(1) Where any company, being authorised undertakers and not being a power company, receive a supply of electricity from the Board, the Electricity Commissioners may, having regard to any change in the cost of electricity to the company attributable to this Act, by special order make provision as to the relation between the charges to be made for electricity and the dividends to be paid by the company.

(2) The provisions of this section shall not apply to any London company.

33.—The Board and any Joint Electricity Authority may adopt the provisions of the Local Government and Other Officers' Superannuation Act, 1922.

34.—(1) Where any tree or hedge obstructs the construction, maintenance, or working of any electric line, the authorised undertakers may give notice to the owner or occupier of the land requiring him to lop or cut it, subject to the payment of expenses reasonably incurred.

(2) If within twenty-one days the requirements of the notice are not complied with, the authorised undertakers may cause the tree or hedge to be lopped.

(3) If, within twenty-one days, the owner or occupier gives a counter notice, objecting to the requirements of the notice, the matter shall be referred to the Minister of Transport, who may make such order as he thinks just.

(4) The authorised undertakers shall issue instructions that trees and hedges shall be lopped or cut in a woodmanlike manner, and shall make good any damage done to the land.

(6) Where it is necessary to fell any trees, this section shall apply.

35.—(1) Unless otherwise agreed, nothing in this Act shall affect the powers of a county council to rebuild or repair any bridge upon which any work by this Act authorised shall be constructed. If the county council requires to carry out such works, and it is necessary temporarily to remove mains and other electrical appliances belonging to the Board from a bridge, the Board shall do the work at their own expense. Any dispute shall be determined by an arbitrator.

Amendments of the Electricity Supply Acts.

36.—For section five of the Electricity (Supply) Act, 1919, an amended section is substituted authorising the Electricity Commissioners to constitute electricity districts, to formulate

* The Act, in its final form, was issued last week, and contains two new clauses, numbered 19 and 24. The Sections on p. 37 of our last issue should therefore be renumbered as follows:—For 19 to 22 read 20 to 23; for 23 to 25 read 25 to 27. EDS.

improvement schemes, and to establish joint electricity authorities; and to hold local inquiries and hear representations with regard to the schemes.

37.—A scheme constituting a joint electricity authority may contain provisions for the carrying-out by the authority of any works for the development of the supply of electricity within the district; and for the subsequent alteration of the constitution of the authority.

38.—The power under the Act of 1919 to make orders altering previous orders shall include power by such subsequent order to constitute a joint electricity authority.

39.—Where a special order is made authorising a company to supply electricity, and the area of supply includes the whole of the districts of two or more local authorities:

(*a*) The purchasing authority may within six months after the expiration of a period of fifty years from the date of the confirmation of the special order, or such shorter period as may be specified, and within six months after the expiration of every subsequent period of ten years, by notice in writing require the company to sell their undertaking upon the payment of a sum equal to the capital properly expended on land, buildings, works, material, and plant in use or available at the time, less depreciation according to such scale as may be determined by special order:

(*b*) The Minister of Transport shall determine any questions which may arise.

(*c*) The purchasing authority—

(i) where the area of supply is situate wholly or mainly within the district of a joint electricity authority, shall be the authority: Provided that, if the area is situate partly within the district of one joint electricity authority any partly in that of another, the right of purchase shall be exerciseable by one of those authorities, or shall be divisible between them, as the Electricity Commissioners may determine;

(ii) in any other case, shall be the local authorities for the districts in which any part of the area of supply is situate, acting through a joint committee or joint board.

(*d*) Sections two and three of the Electric Lighting Act, 1888, shall not apply.

40.—Where a company, being authorised undertakers, have ceased to generate electricity, and are taking a supply in bulk from the Board, or from any other source, and the undertaking of the company is purchased by a local authority, in addition to the sum payable to the company under the Act of 1888, or any local Act or Order, there shall be paid a sum representing the capital properly expended upon plant rendered unsuitable for use by reason of the taking of bulk supply, after deducting such amount as the company, in the opinion of the Electricity Commissioners, ought properly to have written off. Any question arising under this provision shall be determined by the Electricity Commissioners, whose decision shall be final.

41.—Where any right to purchase the whole or any part of an undertaking is vested in a local authority (including a joint electricity authority), the authorised undertakers may at any time within ten years before the date of purchase enter into a contract with the local authority to alter the terms of purchase upon conditions to be agreed between the parties with the approval of the Electricity Commissioners.

42.—(1) The charge made to any ordinary consumer may consist of a periodical fixed or service charge and in addition a charge for the actual quantity of energy supplied, or for the electrical quantity contained in the supply. The fixed charge may include rent in respect of any meter and any electric lines, fittings, apparatus and appliances provided by the undertakers on the premises of the consumer, whether let on hire or hire-purchase terms to the consumer or otherwise.

43.—(1) The Schedule to the Electric Lighting (Clauses) Act, 1899, and similar provisions, shall have effect subject to the amendments specified in the Fifth Schedule to this Act.

44.—(1) Where applications for consent to the placing of an electric line above ground and wayleaves have not been agreed with the owners or occupiers of any land proposed to be crossed, the undertakers may serve notice of their proposal, and the Minister of Transport may proceed concurrently, under sections twenty-one and twenty-two of the Electricity (Supply) Act, 1919.

(3) Where an application has been made for consent to the placing of an electric line above ground, and representations are made that the line will prejudicially affect any ancient monument, shall take into consideration any recommendations made to him by the Commissioners of Works.

45.—Expenses reasonably incurred by authorised undertakers in reconnecting any electric line which may have been lawfully cut off by default of the consumer may be recovered by the authorised undertakers.

46.—The owners of any railway generating station may supply electricity therefrom to the owners of any other railway generating station upon agreed terms and conditions, with the consent of the Electricity Commissioners, who may authorise the breaking-up of roads, &c. The provisions of the Electricity (Supply) Acts, so far as they relate to the protection of the Postmaster-General, shall apply to any works for the supply of electricity under this section.

47.—Authorised undertakers may supply electricity for traction to the owners or lessees of a railway, dock, harbour, or canal undertaking situate partly within and partly without their district, subject to the consent of the Minister of Transport, for any purposes of such undertaking, whether within or without the district or area of supply.

48.—(1) Subject to the provisions of this section, a joint electricity authority and any local authority authorised by special Act or by Order to supply electricity may sell electric lines, fittings, apparatus, and appliances for lighting, heating, and motive power, and for all other purposes for which electricity can or may be used (in this section called "electric fittings"), and may install, connect, repair, maintain, and remove the same, and with respect thereto may demand and take such remuneration or rents and charges, and may make such terms and conditions as may be agreed upon.

(2) The exercise of the powers of this section shall be subject to the following restrictions:—

(*a*) The joint electricity authority or local authority shall not manufacture electric fittings unless expressly authorised to do so by special Act or Order;

(*b*) The joint electricity authority or local authority shall not sell electric fittings except—

(i) to a consumer or a person who intends to be a consumer of electricity supplied by them; or

(ii) to a contractor who requires such fittings to enable him to supply them to a person who is, or intends to be, a consumer of electricity supplied by the joint electricity authority or local authority;

(*c*) The prices charged by a joint electricity authority or a local authority for the sale of any electric fittings shall not be less than the recognised retail prices, unless the sale is to a contractor, in which case the prices shall not be less than the recognised trade prices, and if any question shall arise as to what are the recognised retail or trade prices of any electric fittings, that question shall be determined by the committee appointed as hereinafter provided;

(*d*) Every such joint electricity authority or local authority shall so adjust the charges to be made by them under this section as to meet any expenditure incurred by them in the exercise of the powers of this section (including interest upon and sinking fund charges in respect of money borrowed for the purposes of this section);

(*e*) The total sums received and expended by any such joint electricity authority or local authority under this section in each year, including interest upon and sinking fund charges in respect of money borrowed for the purposes of this section, shall be shown separately in the published accounts of the electricity undertaking of such joint electricity authority or local authority.

(3) The Electricity Commissioners shall appoint a committee comprising representatives of associations representing local authorities who are authorised undertakers, contractors, and persons engaged in the business of making and persons engaged in the business of selling electric fittings, such committee to be appointed after consultation with those associations, and that committee shall determine any question which may be raised under this section as to the recognised retail or trade prices of any electric fittings and shall advise and assist the persons concerned as to the method of giving effect to the provisions of this section.

(4) The purposes of this section shall be deemed to be purposes for which the joint electricity authority or the local authority may borrow money.

(5) In this section the expression "contractor" means a person engaged in the business of selling and installing electric fittings.

49.—Where the owners of a gas undertaking apply for a Special Order, and the Electricity Commissioners are unable or unwilling to make the Order, the Commissioners shall refer the matter to the Minister of Transport, and thereupon the Minister may, if he thinks fit, make the Order.

50.—Minor amendments.

General.

51.—(1) For the purposes of this Act, unless the context otherwise requires—

The expression "generating station" has the meaning given thereto by section thirty-six of the Electricity (Supply) Act, 1919, and not the meaning given thereto by section twenty-five of the Electric Lighting Act, 1909.

The expression "transmission line," when used with reference to a line which is a main transmission line within the meaning of the Electricity (Supply) Act, 1919, shall include all such works as are mentioned in that definition, and, when used with reference to a line which is not such a main transmission line, shall include any works necessary to and used for the control of the transmission line and the transmission of electricity thereby and the buildings or such part thereof as may be required to accommodate those works.

The expression "owners" in relation to a generating station includes lessees or occupiers of the station operating the station.

(3) If the price for a supply of electricity is under this Act to be the cost of production adjusted according to the load factor, the adjusted price shall be the sum of the following items:—

(*a*) the number of kilowatts of maximum demand in each month of the year of account multiplied by the fixed kilowatt charges component;

(*b*) the number of units supplied to the undertakers during the year of account multiplied by the running charges component.

For the purposes of this sub-section—

The number of kilowatts of maximum demand for any month shall be deemed to be twice the largest number of units of electricity supplied to the undertakers during any consecutive thirty minutes in that month: provided that, if the number of kilowatts of maximum demand so ascertained shall be less than the number of kilowatts of maximum demand in any previous month of the same year of account, payment shall be made on the higher number; and

The "fixed kilowatt charges component" and "running charges component" shall be ascertained in accordance with the rules contained in the Seventh Schedule to this Act.

(4) If the price for a supply of electricity is under this Act to be adjusted according to power factor or otherwise ascertained, such adjustment or ascertainment shall be made in accordance with regulations to be prescribed by the Electricity Commissioners.

(5) Where for the purposes of this Act it is necessary to calculate what the cost of taking a supply of electricity from the Board over a number of years will be, in making the calculation it shall be assumed that the price of fuel and the rates of wages remain constant.

Schedules.

The First Schedule provides that the price of a generating station or main transmission line shall be the amount expended, less depreciation on a scale fixed by special order, and shall be subject to arbitration.

The Second Schedule gives rules for determining the cost of production of electricity at selected stations.

The Third Schedule specifies the authorised charges and allowances in respect of transmission lines used for giving bulk supply to authorised undertakers.

The Fourth Schedule is an adaptation of Section 16 of the Electricity (Supply) Act, 1919, as amended by Section 21 of the Electricity (Supply) Act, 1922, relating to compensation of employés for loss of employment or other injury due to the working of this Act.

The Fifth Schedule contains amendments of the schedule to the Electric Lighting (Clauses) Act, 1899, regarding the disposal of surplus funds, and provides that the amount which may be applied in aid of the local rate in any year shall not exceed one and a-half per cent. of the outstanding debt of the undertaking; and after March 31st, 1930, no sum shall be paid in aid of the local rate unless the reserve fund amounts to more than one-twentieth of the aggregate capital expenditure on the undertaking.

The period of notice of works in streets is reduced, in the case of service lines, to seven days.

The Sixth Schedule contains minor amendments of the Electricity (Supply) Acts, 1882-1922.

The Seventh Schedule gives rules for determining the fixed kilowatt charges component, and the running charges component; the cost of production, ascertained in accordance with the second schedule to the Act, is to be allocated as between fixed costs and running costs in accordance with regulations prescribed by the Electricity Commissioners.

Correspondence.

The "H" Type of Cable.

We are glad Mr. G. H. Nisbett has at last experienced some amusement out of such a subject as super-tension cables. He is apparently anxious to reciprocate and be amusing by indicating to all and sundry that his company has said-from its pedestal the last word on this subject. Of course, he is not serious, but the position in which the authorities who have the responsibility of developing electricity supply under the Electricity Act are placed is quite serious, and it must be a matter of some satisfaction to them that there is now available in this country the supply of a super-tension cable which has been proved in many countries on the Continent the most satisfactory three-core super-tension cable to install.

To-day the "H"-type cable holds the field, and one is almost tempted to suggest that some of its detractors are a little bit influenced by "political reasons."

The last word is always with the user, and there is ample evidence that he is by no means convinced that the three-core belted-type super-tension cable supplied in the past, even by such an eminent firm as Mr. Nisbett represents, is a satisfactory job, either electrically or mechanically.

To deal with some of Mr. Nisbett's criticisms of the "H"-type cable from a manufacturing point of view, he says: "If a cable is faulty in manufacture and consequently contains air or vacuous spaces in the insulation" . . . This is evidently written for the benefit of those who are not intimately conversant with cable making. In a properly organised factory, and given the right materials and equipment, with intelligent workpeople, vacuous spaces are hardly possible in the insulated cores. It is on the outside of the cores that these vacuous spaces occur. With the "H"-type cable they can be neglected, but in the case of the belted type they constitute a very serious danger, and even in the case of a perfectly manufactured belted type of cable such spaces would be created by handling during the process of laying. It has been proved beyond doubt that the weakness of the belted-type cable lies between the insulated cores, the belt, and the packings.

The statement that the three-core "H"-type cable is essentially unmechanical because of the absence of a paper binding belt is sheer nonsense, but, in any case, an efficient egg-shaped cable is to be preferred to an inefficient circular product.

Further, the suggestion that the compound used for impregnation will leave the cores to fill vacuous spaces, depends entirely upon the compound used, and the reproduction of the conditions under which impregnation takes place, the latter a very unlikely event; on this point it is interesting to note that the metallised paper used for "H"-type cables admits the impregnating compound through minute apertures under external pressure, and is in itself an important preventive measure against leakage.

We do not share Mr. Nisbett's opinion that "H"-type cable is more costly to manufacture. On the contrary, and in spite of the quite reasonable royalty, we state that its cost is no greater than that of the belted type.

The Macintosh Cable Co. has not decided upon the adoption of the Hochstadter specification without considerable investigation, experiment, and thought for the future.

The Macintosh Cable Co., Ltd.
T. MARTIN-HARVEY, *Managing Director.*

London, *January 3rd*, 1927.

The letter in your issue of the 31st ult. from Mr. G. H. Nisbett, of British Insulated Cables, Ltd., scarcely does justice to the "H" type of cable.

In comparing the respective diameters of the two types of cable, *viz.*, "H" type and belted type, your correspondent assumes that for the belted type the insulation between cores for a 33,000-volt cable is 0.60 inch and 0.35 to earth, whereas the "H"-type cable is to have 0.7 inch insulation between cores, giving also 0.35 inch to earth.

It is not fair to assume that the insulation to earth should be the same for each type of cable, for the insulation in the case of the "H" type is much more evenly stressed and strictly radially, whereas the belted type is subjected to a rotating electrostatic field. Further, with the thickness of insulation given for the belted type, the outer belt is only 0.05 inch in thickness, which one would scarcely describe as "a substantial binding belt," and which would not withstand bending without having torn papers, a few of which would render it useless.

The main fact which the critics of the "H"-type cable are usually pleased to ignore is that whatever the maximum voltage gradient one cares to work to for a belted-type cable, a higher maximum gradient can be worked to for an "H"-type or single-core-type cable with equal safety, entirely on the ground of the even and radial distribution of stress, always assuming, of course, equally good quality of insulation.

I do not agree that the metal screening in the "H"-type cable does nothing to help ionisation troubles. It is well established by experience that single-core cables, although not perfectly impregnated or free from air or vacuous spaces, do not suffer so much as 3-core, belted-type cables from this cause, and that even with the latter type of cable the effects of ionisation are seldom seen in the core insulation, but almost entirely at the boundary of the centre filler where tangential stress is present.

While it is true that the "H"-type cable is a very old device, the reason for its present vogue is not far to seek, and must be well known to your correspondent.

C. Vernier.

Newcastle-on-Tyne, *January 5th*, 1927.

Cablon, Limited, the owners of the "H"-type patent in this country, have, as you are aware, so far made no public announcement of the claims in regard to the merits of this type of cable. The following leading cable makers in this country, namely:—

Callender's Cable and Construction Co., Ltd.
The Enfield Cable Works, Ltd.,
W. T. Henley's Telegraph Works Co., Ltd.,
The Macintosh Cable Co., Ltd.,
Pirelli-General Cable Works, Ltd.,
Siemens Bros. & Co., Ltd.,
Standard Telephones and Cables, Ltd.,

have, after careful research and consideration, applied for and obtained licences from Cablon, Limited, and others have advised us that they are considering applying for licences.

We feel, therefore, that it is incumbent upon us to reply to the criticisms Mr. G. H. Nisbett has made in his letters in your issue of December 31st, and in the issue of the *Electrical Times* of December 23rd.

(1) Mr. Nisbett alleges that the diameter of the "H"-type cable is greater than that of the belt type. This is incorrect. Owing to the better distribution of the electric stress much thinner insulating walls can be used in "H" cables than in belted cables, and as the foil coating only occupies a negligible amount of space any increase of diameter is avoided.

(2) The higher carrying capacity of "H"-type cables is due to their lower thermal resistance. This is brought about partly by the presence of metal paths from the centre of the cable to the lead and partly by the reduced thickness of the insulating walls. The actual superiority of this cable from the current-carrying point of view depends naturally on the thermal resistance of the soil, but in normal ground the figure mentioned, *viz.*, 8 per cent., is a conservative figure.

(3) The "H"-type design (including royalties) does not increase the cost of the cable over that of an ordinary super-tension type, and there are no increased difficulties in drying and impregnating, over and above those ordinarily encountered. On the contrary, the smaller dielectric thickness is more easily penetrated than a thick layer would be.

(4) With regard to Mr. Nisbett's statement that experience has shown that the ratio of power factor relative to voltage is an unreliable index of the dependability of a cable, Mr. Nisbett appears to have overlooked the fact that, apart from the difficulty of producing an approximate constancy of power factor at different voltages in belted-type cables, belted-type cable, after repeated heating and cooling, rapidly loses this property. On the other hand, it is an established fact that "H"-type cables, when built with no more than ordinary care, have initially a closely constant power factor at different voltages, and retain this after repeated heating and cooling.

(5) It has never been contended that "H"-type cable removes all possible difficulties incidental to the use of super-tenson underground transmission. It is, however, proved that the absence of tangential stresses and the lack of need for maintaining anything like perfect homogeneity in the filling spaces constitutes a great advance in the hitherto generally accepted type of cable.

The fact that 26 leading cable makers on the Continent of Europe, in America, and Japan have acquired licences and are successfully making "H"-type cables, and the rapidly increasing demand for "H"-type cable, based on the satisfactory performance of those laid during the past three to four years, are conclusive proof of the merits of the "H"-type cable.

Cablon, Ltd.
W. L. Smith, *Secretary.*

London, *January 4th*, 1927.

It would seem that some reply is due from us to the three communications in your last issue, in which comment is made on our letter in your issue of December 31st, and we therefore venture again to trespass on your space.

Mr. C. E. Watson accuses us of attempting to silence opposition by making a loud noise, but surely this is an inversion of the facts. Our letter was a mere whisper compared with the trumpeting that the Press has lately allowed to the advocates of the "H"-type cable.

These gentlemen write in such a way as to lead your readers to believe by inference that all the super-tension cable hitherto made has been a failure, and that it is only when they start to manufacture "H"-type cable that the millennium will be reached. Such an impression left unchallenged would do harm to the British cable industry, which has hitherto held such a deservedly high reputation.

Now there are many miles of the belted-type cable that have been at work successfully at 33,000 volts for years, both at home and abroad, and only comparatively insignificant quantities of the screened type have recently been put into service. Such trouble as has occurred with the belted cable has (so far as we know) been confined to abnormal cases of laying or handling, and there is no evidence that the "H"-type cable would have behaved any better under similar circumstances.

Mr. Watson questions our statement that the screened cable is necessarily more costly than the belted, but may we point out that the stresses on the insulation at the point of minimum thickness between any conductor and lead in a three-core cable are practically radial and the same in the two types, so that, making no allowance for the better impregnation of the belted-type cable, and assuming like qualities of material, both types need the same thickness of insulation to earth. The screened type *must* have twice this thickness between conductors, whereas the belted type *may* and does have less, so that the screened type must be the more costly to manufacture.

As to the mechanical weakness of a type of cable involving the use of three heavy insulated cores, necessarily laid up with a long lay and only lightly bound together, then sheathed with a ductile metal such as lead, your readers will be able to judge. Surely if it is a first essential, as seems to be admitted by all parties, that the lead covering shall be as completely filled as possible, it is desirable to see that there is no possibility of the stretching of the lead after it has once been applied.

In answer to our statement that the curves shown in your issue of December 17th are unfair to the belted-type cable, Mr. Watson points out that they do show the comparative values of the two methods of construction. Here we are in some measure of agreement because we readily admit that, with a badly-constructed cable, the use of a core screen will improve the p.f. tests, although we deny that such use will necessarily turn a bad cable into a good one. However, the point we wished to make was that a well-made belted-type cable does not need a screen, at least for working pressures up to 33,000 volts.

In the matter of relative carrying capacity, Mr. Watson claims for the screened-type cable increased heat conduction due to thinner walls, the impossibility of which we have already pointed out; others have claimed the same thing for the metal sheathing, and still others for the absence of ionisation losses. We can only say that all these causes put together only result in a small percentage difference, if the comparison is made between a *good* belted cable and a *good* screened cable.

Mr. G. H. Nash is much more modest in his claims for the "H" cable than are some other advocates, and we are glad to see that he deprecates over-enthusiasm and the claiming of too much. He agrees that the screened cable is more difficult to dry and impregnate, but says the difficulty can be overcome. He admits that the tangential stresses are within the capabilities of a belted cable on first manufacture, but says that they do not remain so in service.

Any deterioration that may occur in a cable after leaving the factory, and during handling, can only come about because of mechanical causes, and certainly a cable with a heavy belt must be less liable to distortion than a screened cable, necessarily practically without one.

Mr. Nash says that the belted-type cable shows a sharp rise in power factor on cooling after a heat run and the "H" type shows practically no change; this is no doubt true for some makes of belted cable, and conversely untrue for some makes of screened cable.

Mr. F. Richardson asks us why we criticise the relative power-factor and voltage curves as published in the Electrical Review of December 17th, in view of our statement in the *Electrical Times* that power factor relative to voltage is an unreliable index of the dependability of a cable. The answer is obvious, namely, that we were criticising a comparison made by someone else, and, in order to do so, had perforce to accept his premises.

For the rest of his letter, Mr. Richardson contents himself with a general statement somewhat to the effect that anybody who is anybody is making the "H"-type cable, that it has been successfully used for years past, &c.—quite in the best advertising style.

But the facts are: that throughout the world a much greater length of the belt-type 33,000-volt cable is working successfully to-day than there is of the "H" type; that there are in this country belted cables of our manufacture that have been continuously alive for the past five years without a single cable fault; and that many of the more experienced makers of super-tension cables are still manufacturing cables of this type.

We hope the subject matter of our letter will excuse its length.

British Insulated Cables, Ltd.
G. H. Nisbett, *Director and Engineer.*

Prescot, *January 10th*, 1927.

Electric Ovens.

Some little time ago the gas journals announced that electric ovens were being given up in Switzerland, owing to the fact that they generated ozone, which damages bread and pastry. It will be very interesting to hear if any of your readers have information on this subject, as I find that it is of great importance to large users of electric ovens.

Oven.

January 4th, 1927.

The Necessity for Higher Voltages.

I was particularly pleased to have it publicly emphasised at the I.E.E. meeting of December 16th, by an engineer of such reputation as Mr. J. S. Highfield, that higher voltages were bound to come, because the number of cables required to conduct great powers away from the generating station was too serious to contemplate if this were not done.

This is the more gratifying because, about two years ago, I went to the trouble of writing to several of the leading engineers of the country in order to bring home to them that higher voltages were not only necessary when extremely long distances had to be covered, *but also when very large bulks of power had to be transmitted* over what would be considered *short distances.*

The consulting engineers, it would appear, are waiting for the cable makers, and the cable makers hesitate to worry themselves about anything over 66,000 volts so long as they can carry out the great bulk of the distribution work at 66,000 volts.

Now that I have secured such eminent supporters as Mr. Highfield and (I was pleased to note, about a year ago) Mr. Gregory of Newcastle, I feel that I am no longer quite "a voice crying in the wilderness."

A. M. Taylor,
Major, S.O.2.

Birmingham, *January 7th*, 1927.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

ALDERSHOT.—Additional 104 houses, for the T.C.; borough surveyor.

AUSTRALIA (PERTH, W.A.).—Group of buildings for the Administration of Perth University (£150,000).

AYRSHIRE.—Extension of Prestwick Higher Grade School (electric light and central heating); W. Reid, Master of Works, Education Offices, Ayr.

BILSTON.—Kinema, High Street; W. Hurley Robinson (A. Wood's Picture Halls, Ltd.).

BIRMINGHAM.—Year's school programme (£234,000); Education Committee.

BOLTON.—Electric driving plant for screening and salvage plant; Cleansing Committee.

BRAZIL.—Press reports state that Platt Bros., of Oldham, and John Hetherington & Sons, of Manchester, have received orders for 100 looms and spinning and other machinery for a new mill in Brazil.

BRANSTON (NEAR BURTON-ON-TRENT).—Artificial silk factory; Rock Investment Co., Salisbury House, London Wall, London, E.C.2.

BRECHIN.—Cinema for Brechin Cinema, Ltd. (heating and ventilation); secretary, 5, Swan Street, Brechin.

BRISTOL.—Palais de Danse, Queen's Road, Clifton; C. F. W. Dening, architect.

BROWNHILLS (STAFFS.).—Isolation hospital, for the U.D.C.; surveyor.

BURNLEY.—Housing scheme (88), Stoops Farm Estate; borough engineer.

CANADA (ALBERTA).—New wing at the Banff Springs Hotel (£300,000).

CARDIFF.—350 houses; city engineer.

CHELMSFORD.—Electricity pumping scheme at swimming baths; borough engineer. Electricity for power at Mills; T. D. Ridley & Sons, Ltd.

CHELTENHAM.—Eighty houses, Hanks Estate; borough engineer.

CHORLEY.—Works, Bolton Road (£40,000), for Leyland Motors, Ltd.

CROMPTON.—Housing scheme (78), Twingates and Smallbrook sites; F. T. Jones, engineer, Town Hall.

DALTON-IN-FURNESS.—Central school; director of education, County Education Offices, Preston.

DERBY.—Large extensions to works for the Combustion Engineering Co. Extensions to Little Chester Sanatorium, for the T.C.; C. A. Clews, borough surveyor, Babington Lane.

DEVIZES.—Additional housing scheme (40), for the R.D.C.; surveyor.

DUDLEY.—Fifty-six houses, Watsons Green; Eadie, Towers and Co.

DUNDEE.—Dispensary for Royal Infirmary (£10,000); R. Still, chairman of directors.

DURHAM.—Boys' central school (£18,000); director of education, City Education Committee.

ECCLES.—Housing scheme (78), Gaskell Road Estate; T. Elce, borough engineer.

EDINBURGH.—Sanatorium for Edinburgh District Board of Control at Bangour (electrical work); J. D. Gibson, surveyor, 60, Frederick Street.

FULBOURN.—Enlargement, Mental Hospital, Cambridgeshire C.C.

GLASGOW.—Electric and steam heating, New Kelvin Hall; city engineer. Garage at Govan (£25,000); city engineer. Extensions Royal Glasgow Asylum for the Blind, Possilpark; governors.

GRAVESEND.—Extension main works; W. T. Henley's Telegraph Works Co., Ltd.

GRAYS.—Cement factory (electrically equipped); particulars from Edgar Allen & Co., Ltd., Sheffield.

GRIMSBY.—Housing scheme (64); borough surveyor.

GUILDFORD.—Houses (100), Curling Vale, for Onslow Village, Ltd.

HALIFAX.—One hundred and seventy-six Corporation houses at Bracewell Farm site, and 116 houses at Nursery Lane; borough engineer, Crossley Street.

HEATH TOWN (WOLVERHAMPTON).—Additional 86 houses, Brickfield Estate, for the U.D.C.; surveyor.

HEMSWORTH.—Forty houses, Grove Lane; U.D.C. surveyor.

HOYLAND NETHER (YORKS).—Housing schemes (88), Hawshaw Lane and Platts Common, for the U.D.C.; surveyor.

HULL.—Two hundred and eighty-two houses, East Hull; 1 Bilton. Two hundred and seventy-six houses, Nort Hull Estate; Fettlewell, Son & Co., Ltd. Isolation ho pital, Callingham; city architect. X-ray installatior Sanatorium; medical officer.

INDIA (BOMBAY).—Transmitting station, near Race Course Indian Broadcasting Co.

IRISH FREE STATE (DUBLIN).—Five hundred and thirty-fou houses in Drumcondra and Glasnevin, and 500 in th Kilmainham area; city commissioners. Two school and church, Fairview (£70,000); city engineer.

(DUNDALK).—Improvements to the port (£50,000) for th Harbour Board.

(LIMERICK).—Docks and wharfages on the River Shannon secretary, Minister for Industry and Commerce, Dublin

KINGSBRIDGE.—Cottage hospital; C. E. Ware & Son Exeter.

KING'S LYNN.—Contract for the erection of beet sugar fac tory at once has been placed with Fawcett, Preston and Co., sugar machinery manufacturing engineers, Liverpool.

LEEDS.—Electricity for heating and lighting at Killingbeck Sanatorium; medical officer. Tram depôt extensions Swinegate (£125,000); H. S. Chorley, architect. Eight hundred houses, Tait Estate, and 150 at Mearwood; city architect.

LEICESTER.—Premises, Campbell Street, for W. H. Smith and Sons, wholesale stationers, Strand, London (£10,000 to £15,000).

LONDON (GREENWICH, S.E.).—Concert hall, for the Enginemen and Firemen's Club; E.C. Kelly, secretary, 32, London Street. Heating system at infirmary (£17,000); Board of Guardians.

(BRIXTON, S.W).—Motor coach station, Effra Road; Keith and Boyle (London), Ltd.

(WIMBLEDON, S.W.).—Training college, Belmont Hall; G. E. Withers, architect for Wesleyan Church trustees.

Station (£250,000), for the Southern Railway.

(WALTHAMSTOW, E.).—Heating the isolation hospital; U.D.C. medical officer of health.

(EALING, W.).—168 houses; John Laing & Son, Ltd.

MANCHESTER.—Four hundred houses at Burnage for The Phormium Co., of London; city engineer. Boys' municipal high school, Chain Bar, Moston (£60,000); S. Hey, director of education, Education Offices, Deansgate.

MANSFIELD WOODHOUSE.—Sixty-eight houses, Clipstone Road, and Slant Lane; U.D.C. surveyor.

MARKET HARBOROUGH.—Refuse destructor; U.D.C. surveyor.

MORECAMBE.—One hundred and twenty-seven houses; Wm. Gardner & Co., Ltd., builders, Morecambe.

MOTHERWELL.—Re-erection of Dalziel Engineering Works (electrically equipped), for Chambers, Scott & Co., Ltd.

NOTTINGHAM.—Five hundred houses; city engineer.

NORTHOLT (MIDDLESEX).—Estate development (1,000 houses); Northolt Manor Estates, Ltd.

ORSETT.—School (£13,500); Essex county architect.

PLYMOUTH.—Hospital extension (£260,000); Thornley and Rooke, architects.

PRESTON. — Extensions, Smallpox Hospital; borough engineer.

ROTHERHAM.—200 houses, Meadow estate; borough engineer.

ROWLEY REGIS.—Housing scheme (700), Stile House and Church Farms estates, for the U.D.C.; surveyor.

SCARBOROUGH.—Conversion of Londesborough Lodge into medical baths (cost not exceeding £10,000); borough engineer, Town Hall.

SCULCOATES.—Motive power and stand-by lighting supply; Board of Guardians.

SHEFFIELD.—Kinema, Manor estate; city architect.

SHIPLEY (YORKS.).—68 Council houses at Saltaire; surveyor, Council Offices, Shipley.

SOUTHPORT.—Kinema, Liverpool Road, Ainsdale; Southport Coliseum Co., Ltd.

STOKE-ON-TRENT.—Housing scheme (2,000); city engineer.

SUNDERLAND.—Port development; borough engineer.

WATFORD.—Housing scheme (200), Beeches Estate, Boreham Wood, for the R.D.C.; surveyor.

WILMINGTON.—Forty houses; Dartford R.D.C. surveyor.

The

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Contents:

	PAGE
Fuel Research	81
The Central Electricity Board	82
More Big Contracts	82
The Spinning Electron	82
The New Tricity Restaurant (*illus.*)	83
The Electricity (Supply) Act, 1926, by W. S. Kennedy (*concluded*)	85
Our Overseas Electrical Markets (*illus.*)	88
Electrical Insulation, by Antony Seton	90
Reviews	91
Legal	92
Business and Industrial Notes	93
Lighting and Power Notes	99
Tramway and Railway Notes	100
Telegraph and Telephone Notes	100
Radio Notes	101
Contract Information	102
Forthcoming Events	103
Notes	103
Institution Notes	105
Our Personal Column	105
Financial Section— New Companies Registered	106

	PAGE
Financial Section—*continued.*	
Official Returns of Electrical Companies	107
City Notes	107
Stocks and Shares	107
The Physical Society's Exhibition (*illus.*) (*continued*)	109
Electric Railway Track Equipment, by Arthur R. Cooper (*illus.*) (*concluded*)	111
Electric Ploughing (*illus.*)	113
Hollow Electrical Conductors (*illus.*)	114
Selected Radio-Telephone Apparatus (*illus.*)	115
The Use of Low-Grade Fuels, by W. F. Goodrich ...	116
Correspondence—	
The Permissible Current-Carrying Capacities of High Pressure Cables	118
Power Supply for Wireless Sets	118
The "H"-Type of Cable	118
Wattmeter Calculations	119
Electrical Refrigeration	119
Great Britain's Power Resources in Truer Perspective	119
A Motor-generator Snag	119
Electric Ovens	119
New Work for Contractors	120

Fuel Research.

THE growing importance of the more economical use of fuel was recently emphasised by the action of the Parliamentary Secretary of the Ministry of Transport, Lt.-Col. J. T. C. Moore-Brabazon, who has deserted the political arena in order to take an active interest in a process for the low-temperature carbonisation of coal. He had previously displayed exceptional enthusiasm for reform in our methods of utilising coal, in his public speeches, and his sacrifice of a political career of more than ordinary promise is proof positive of a sincerity which is not always at the back of politicians' fervid utterances.

Almost simultaneously the Report of the Fuel Research Board for 1925 has been issued by the Department of Scientific and Industrial Research (H.M. Stationery Office, price 1s. 3d. net). It lays stress on the increasing tendency to buy coal to specification—especially on the part of foreign buyers—and in this connection draws attention to the work of the Physical and Chemical Survey of the National Coal Resources, which includes the difficult question of sampling large consignments, and the preparation of analyses; for this reason a memorandum reviewing the history and work of the Survey is appended to the Report. The Fuel Research Board itself came into existence in consequence of a recommendation of the Coal Conservation Committee in 1916, dealing with the subject of a chemical survey, but it was not until 1922 that the Survey was put in hand. The importance of buying coal to specification is not fully realised by electrical engineers, partly, perhaps, because from time to time—through wars and strikes—they are compelled to buy anything that will burn, regardless of its calorific value; but we have no doubt that in more settled times they will devote more attention to the subject. The presence of an excessive proportion of ash and moisture in their fuel imposes upon them financial burdens which commence at the pit's mouth and continue to exercise their baleful influence to the ash tip itself, increasing the cost of freightage, storage, boiler plant capital and maintenance, labour, and cartage, besides reducing the efficiency of the boiler plant and in some cases causing a nuisance to neighbours.

Much of the work of the Board, of course, relates to gas manufacture, but experimental research in connection with low-temperature carbonisation is constantly in

progress, and has a direct bearing on the future of electricity supply. Not only may the coke and gas be used in power stations, but also the fuel oil derived from the tar will be of the greatest service to internal-combustion engine plant when low-temperature carbonisation becomes a commercially practicable proposition. But that time is not yet, though a very few processes show signs of ultimate success.

The Board has also published two reports on domestic heating, and will co-operate with the Building Research Board of the Department in further work on this important subject at the new research station near Watford. From figures contained in a valuable appendix to the Report, it is interesting to note that in 1924, 22.4 per cent. of all coal consumed in this country was used for domestic purposes; colliery engine power absorbed 9.2 per cent., railway locomotives 7.5 per cent., gasworks 8.5 per cent., and electricity works only 4.3 per cent.

The Central Electricity Board.

Considerable interest and speculation have been evidenced of late as to the composition of this Board. This is natural, for upon a wise selection a very great deal will depend. We understand that some 200 names have been submitted to the Minister of Transport as being suitable candidates for membership of the Board. It appears that a selection will first be made of the chairman, who will then be consulted as to the composition of his Board. It is understood that the Electricity Commissioners are not eligible for these positions, as the Electricity Commissioners are the technical advisers to the Board. The indication is that preference will be given to commercial men, though it will not be a disability to have technical knowledge. At present, it is presumed that the Board will include two members who have electrical qualifications, two who have legal experience, one who is an agricultural expert (preferably also with some knowledge of the various aspects of rural electrification), one Scotsman (north of the Border interests are pressing strongly for this) and other men who have made their mark in the commercial world, including probably an accountant. The chairman and two or three of the members will probably be required to devote their whole time to the business of the Board. Their salaries have not been definitely decided upon, but they are not likely to be anything like as high as those mentioned in the daily Press. The chairman will probably receive £5,000 and the full-time members will be paid on the same salary basis as the Electricity Commissioners, while the part-time members will not exceed the £1,000 a year mark.

The Minister of Transport has duly invited suggestions for names from various associations. Apparently the names put forward by each such organisation were of men who represented their own particular interests, rather than recommendations designed to secure the best composition of the whole Board. This has resulted in the submission of the names of elderly men (as they generally comprise the ex-presidents), more noted for their technical ability than for their business capacity.

The names already mentioned in the Press, as suitable for chairman, have been considerably discounted. Nothing definite is known, or will be known, until the fate of the Ministry of Transport is settled. Even then, though the Board is not a Government department, political influence will probably carry a certain weight in the final selection; already ropes are being worked, and wires pulled in support of various candidates.

More Big Contracts.

Telephone development throughout the world produces a constant flow of remunerative business. The possibilities and the prospects both at home and in various parts of the British Empire are very encouraging. Like electricity supply, it is a section of the industry in which there cannot be mere stationary existence—there must be progress, and progress of a kind which means financial outlay, contracts and employment. The latest substantial orders to be placed in this country have been booked by Messrs. Siemens Bros. & Co., Ltd., of Woolwich, after competitive tendering, and the value is £200,000. The work is for the Commonwealth of Australia (Postmaster General's Department) and includes six automatic telephone exchanges in the Brisbane area, comprising Central 9,400 lines, with a satellite exchange at Paddington, 1,000 lines, and four other satellites—Yeronga 700 lines, Bulimber 800 lines, Sherwood 700 lines, Nundah 600 lines. The installation of these exchanges will provide Brisbane practically throughout with automatic telephones. Three exchanges, South, Albion and Newmarket, also of Siemens Brothers' manufacture, are already in operation. The equipment in all exchanges is Siemens Brothers' automatic equipment No. 16, which is also in use in Edinburgh, and, we understand, will soon be put into service in Sheffield, Brighton and other areas in this country. Another very gratifying contract that it is our pleasure to record this week (see our "Business and Industrial Notes") is that received by the Metropolitan-Vickers Electrical Co., Ltd., for 104 motors of 230 h.p. each for railway electrification work in Spain—the main-line sections of the Norte Railway near Barcelona. The mechanical parts for the motor coaches will be made at the Bilbao works of a Spanish company with which the Metropolitan-Vickers Company is associated.

The Spinning Electron.

In our issue of March 5th, 1926, we drew attention to the suggestion that the electron was not a mere passive particle revolving round the nucleus of an atom (or otherwise engaged) but might itself be actively spinning on its own axis—an hypothesis which, it was claimed, disposed of a number of difficulties that had been met with in electronic theory. An article by Mr. R. H. Fowler, F.R.S., in the issue of *Nature* for January 15th, explains why "the importance of the spinning model of the electron can scarcely be overestimated," though it is "as yet scarcely appreciated at its full value." The first serious suggestion that the electron should be regarded as something more complex than a mere particle with an external electrostatic field is attributed to Mr. A. Compton, who surmised that it might possess also a magnetic field, such as would arise from the spinning of its charge about an axis. Goudsmit and Uhlenbeck, whose work was the subject of our previous reference, are credited with finally establishing the value of the spinning electron.

The author then shows how this conception elucidates five paradoxical difficulties which arose when the electron was regarded merely as a point charge. These paradoxes are connected with atomic spectra, the Zeeman effect, X-rays, the behaviour of spectra in strong magnetic fields, and diamagnetism. Thus, says the author, the spinning electron has brought order out of chaos in the broad outlines of atomic theory; and another triumph must be laid to the credit of the physicists, who, though they have never seen an electron, are yet able mentally to picture it so vividly that they can assert with conviction that it is not at rest, but is endowed with rapid rotation about its own axis, as well as about the nucleus to which it may be bound. As we have pointed out, each step in electronic theory seems to increase the resemblance of the atom to an infinitesimally minute model of the solar system. Moreover, the spinning electron is not remotely related to the vortex-atom imagined by Lord Kelvin, who suggested that the ultimate particles of matter were vortices in the ether. But vortices possess a different mode of rotation.

As long ago as the nineties of last century Sir Joseph Larmor put forward a theory on similar lines, and definitely suggested that if the atom were regarded as containing electrons, the phenomenon of magnetism should be explained as a rotation of the electrons.

The New Tricity Restaurant.

A Complete Installation at the New All-Electric Restaurant, Strand, London, of Electric Lighting, Heating, and Cooking for a Seating Accommodation of 300 Persons.

THAT the all-electric restaurant is not a distant dream, and that the installation of electrical equipment for dealing with the large cooking requirements of hotels and restaurants is a practical and commercial proposition is evidenced by the establishment of the new Tricity Restaurant at the top of Savoy Street, Strand, London, the opening of which we referred to in our last issue. This new enterprise is the outcome of the restaurant conducted as Tricity House in Oxford Street for the past 14 years, the history of which is bound up with that of the British Electric Transformer Co., Ltd.



Fig. 1.—Pompeian Room, Tricity Restaurant.

Tricity Restaurant, which is capable of seating some 300 persons in two rooms, on the ground and basement floors, may be described as a rest house, for its design throughout is of quiet beauty, in sharp contrast to the whirl of the traffic and business in that part of the City. The rooms are artistically lighted, the "Sun Ray" lighting of the parent company playing no unimportant part in this connection. A well-lit entrance hall affords an inviting approach to a cheerful lounge through which the patrons pass in making for the restaurant.

The lounge is lighted, in addition to "Sun Ray" lamps fixed round the skirtings, by four specially designed semi-indirect wall fittings. These are particularly effective and are constructed of wood and silk.

The lighting of the ground-floor restaurant is probably unique in its variety of methods, although the result is pleasingly uniform. Two artificially-lighted windows of artistic design are equipped with Sun Ray lamps, and at the Savoy Street end of the west wing a large street window is flooded with light from similar lamps arranged internally over the windows. Wall fittings, also equipped with lamps of this type, are so constructed that, by means of swivelled reflectors, the flooding can be arranged upwards or downwards. Two large inverted silk fittings and semi-shell pattern inverted wall fittings provide the main lighting.

The basement or Pompeian room, of similar design to that on the ground floor, is provided with a well-sprung dance floor. The lighting here is duplicated, so that either white or red lamps will serve the room, or a combination of both. Inverted silk fittings, similar to those in the upper room, are provided, and 25 wall fittings of the wood and silk pattern are suitably spaced round the restaurant. A small alcove at one end of the room, shown in fig. 1, is effectively lighted by means of concealed cornice lamps.

While the Sun Ray lamps in the restaurants and other rooms provide very effective lighting, they serve also, of course, as very efficient heating apparatus. An elaborately designed ventilating system also serves the rooms; clean air is provided and the foul air extracted electrically through ducts.



Fig. 2.—One End of the Main Electric Kitchen.

A feature of the premises is a wine bar, very cleverly panelled and plastered after the style of an old-time tavern. This is electrically lighted by means of old Dutch pendant and bracket candle fittings.

The kitchens demonstrate clearly the great saving of space which can be effected when electrical apparatus is installed. They cover a floor space of some 520 sq. ft., and accommodate the whole of the equipment necessary to provide a continuous service for the maximum seating of the restaurant, in addition to the necessary working room for the chefs and their staff. At one end of the main kitchen, fig. 2, is a large hot cupboard covered with a hot serving top. This is arranged with two circuits and the total loading is 10 kW. The cupboard is provided with sliding doors. Part of the top of the cupboard accommodates a bain-marie, while suitably placed above the apparatus is a hot shelf. The main cooking operations are carried out by means of two banks of cookers, figs. 2 and 3, each comprising two complete stoves with ovens and hot plates. One cooker in each case is equipped with four open-type and two enclosed boiling plates, each about 8 in. square, and the second cooker is provided with one large enclosed plate about 2 ft. square. The total loading for each bank is 24.4 kW. The elements of the open-type boiling plates are particularly robust and, it is claimed, are unaffected by liquids and foodstuffs being directly spilled on them. They consist of steatite rods on which are mounted specially prepared spirals. The pastry cooking is provided for by means of a bank of four pastry ovens, the total loading being 9.6 kW. Each oven is controlled separately, and is provided with top and bottom heating. The remaining equipment in the kitchen includes two large 3-kW grills and a 3-kW fish fryer.

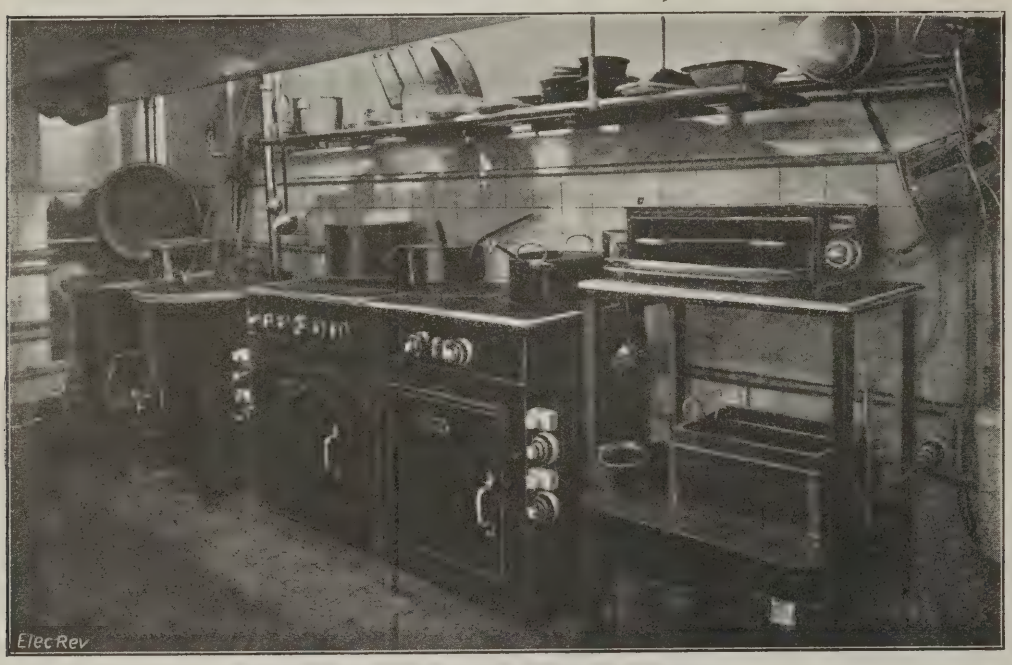


Fig. 3.—Some of the Electric Cooking Equipment.

Two identically equipped still rooms, fig. 4, accommodate the equipment necessary for the preparation of the lighter requirements of the restaurant, such as tea and coffee, and the service necessities. Each of these rooms is equipped with the following:—Two urns, one 1.5 kW and one 0.75 kW; two hot cupboards, one 6.5 and one 3.5 kW; two 2-kW water boilers; and a 1.6-kW boiling plate. One of the hot cupboards is fitted with a small grill and the other with a bain-marie.

Two distribution rooms, one on each floor, house the necessary control equipment for the restaurants and the bar. The supply to the apparatus in the kitchen and still rooms is controlled by specially designed ironclad distribution boards. Each circuit is governed by a d.p. fuse and a s.p. knife-switch, and a lamp indicates when the circuit is "on" or "off" and the apparatus which is supplied by that particular circuit. In order to limit the loading on each distributing board, a sliding-shutter arrangement, fig. 2, prevents more than a given number of switches being put "on" at one time.

The supply for the whole installation is received from the Metropolitan Electric Supply Co. at 6,600 V, 3-phase, and is converted to a 2-phase supply at 200 V by means of a bank of two 75-kW Scott-connected transformers. The whole of the wiring throughout the premises is run in screwed tubing, which is entirely concealed in the restaurants. In addition to most of the lighting equipment, the entire cooking apparatus was supplied by the British Electric Transformer Co.

A lift serves the kitchen and the ground-floor still room, and is used to convey the cooked food to the upper department, from which it is served. The ventilating system, already referred to, also aerates the kitchen and still rooms.



Fig. 4.—Still-Room Apparatus.

The architects responsible for the design of the premises were Messrs. Imrie & Angell, who are to be congratulated on having so successfully overcome the considerable structural difficulties. The electrical work was carried out by The Electric Shop of Chiswick.

The Electricity (Supply) Act, 1926.

An Explanatory Analysis of the Provisions of the New Act, and a Critical Review of the Measure from the Legal Point of View.

By W. S. KENNEDY, Barrister-at-Law.

(*Concluded from page* 53.)

IF standardisation of frequency is essential to the carrying out of the proposals for interconnection, the scheme is to provide for it. It should be noted that there is no provision for general standardisation, but only such as is necessary for carrying out the proposals of a particular scheme. When the Commissioners have submitted their scheme to the Board, the latter is to publish it and may, and almost certainly will, hold an inquiry at which all interested parties may be heard. The Board then adopts it with necessary modifications and proceeds to carry it out—that is, in effect, it proceeds to do three things: To arrange with owners of selected stations how they are to be worked; to arrange with some existing undertaker to build any required new stations; and to erect itself the necessary transmission lines. If in the scheme obligations are imposed on any undertakers which they think are prejudicial to them, they may appeal to an arbitrator selected by the Minister from a panel set up by the Lord Chancellor. The idea of the Act is that owners of selected stations, whether local authorities or companies, shall continue to operate their stations and shall themselves carry out any extensions or alterations which are provided for in the scheme or subsequently become necessary. If the owners refuse, which it is hoped is an improbable contingency, the Minister may, on the application of the Board, transfer the station to the J.E.A., if there is one, in the district, and failing a J.E.A., to any approved undertaker. The price to be paid is, roughly speaking, cost properly incurred less depreciation, to be certified by an auditor with an appeal to the arbitrator if the owners disagree. The Board has no right of appeal. The Minister's order transferring the station is not to be enforced until both Houses of Parliament have had an opportunity of discussing it, and if either House presents an address against it, it becomes of no effect. This is one of the most important provisions of the Act, and its existence should go far to make its use unnecessary. But without it the whole idea of co-ordinated generation and the economies to be obtained from it might go for nought.

Where new stations are to be built the Board is to arrange with the most suitable undertaker in the area to build them—not necessarily with a J.E.A., even should one exist. It will be possible, for example, for the Board to arrange with the London Power Company to build one station and the London J.E.A. another in the Home Counties District, if this seems advisable. It will be remembered that, as passed by the House of Commons, the Bill provided that the option of building new stations was given to a J.E.A. where one existed. Since there are only three such authorities, of which London is the most important, the amendment in the House of Lords may almost be regarded as for the protection of the London companies, and it brings the Act more into line with the provision in the Home Counties order that the companies should enjoy a large measure of autonomy.

All selected stations are to be operated under the Board's directions—naturally in consultation with their engineers, who may be appointed as a consultative committee. The electricity generated is to be sold to the Board at cost price, and the 2nd Schedule provides rules for ascertaining this which seem to cover all items which can properly be included. Such amount as the owners require will then be sold back to them by the Board at this cost price, plus a proper proportion of the Board's expenses, less an adjustment to the load and power factor of the station. Or if the general tariff of the Board (what is commonly called the "grid price") is lower, the owners pay the lower price. But it is further provided (Section 13) that if the owners show that they could, if the Act had not been passed, have generated the same quantity of electricity at a lower price, they are not to be charged more than this. This seems adequate protection—it is difficult to see what more could be given, assuming that the Act is to be worked at all.

If a scheme provides for standardisation, or if the Board thinks any further standardisation necessary, it may require it to be done, but must pay the undertakers the expense incurred and advance them the money required, free of interest. A railway company cannot be required under this Act to alter the frequency employed by it, nor can an undertaker supplying current to the railway.

The Board is under an obligation to give a supply to all undertakers in the area when a scheme is in operation—the energy required being obtained from the selected stations: but may not supply (with certain exceptions) to potential customers of power companies, nor in the districts of joint authorities. Other provisions protect the Board against being called on to give a peak load supply only or to incur undue expense in providing transmission lines. Where the Board is satisfied that the price at which it can supply energy is less than the generating costs of the undertakers who ask for a supply, it may require the undertakers to take their whole supply from the Board. Here, again, a difference may be referred by the undertakers to the arbitrator.

The "grid price"—the tariff for authorised undertakers other than owners of selected stations—is, in effect, to be fixed so as to enable the Board to balance its accounts, and is to show fixed and running charges separately. So far as sales to owners of selected stations are concerned, the Board's price is limited by the cost of generation at such stations, and theoretically, at least, this provision might result in the grid tariff being unduly high. Practically this depends on whether the estimates of cost and output prepared by the Commissioners are accurate or not. This is an engineering question on which opinion is, and will probably remain, divided until time decides the issue. If the spirit of co-operation recommended by the ELECTRICAL REVIEW, now that the Act is law, is happily adopted by the electrical profession and industry, the results looked to by the Commissioners and those assisting them will, of course, be far more speedily and surely realised. If this is to be—and in any case if the industry in this country is to progress as it should—it is essential that the smaller and less economical generating stations should be closed down as soon as a supply can be given from a better source. It is the fault of the legislature

rather than the industry that they exist: they are relics of the parochial system. Yet various reasons, not all unworthy, militate against their supersession by agreement, and Parliament has till now been loth to give any body compulsory powers over them. Section 14 of the Act confers this power, carefully guarded from misuse, on the Commissioners.

The Board must first be in a position to supply such energy as the undertakers will require if their station is closed down: it must undertake to give the supply for not less than seven years on specified terms and must satisfy itself that the cost of its supply is below the prevailing generating costs of the undertakers. It then notifies the undertakers that it is prepared to give a bulk supply on those terms, and the undertakers are given a period of three months to consider and to accept or refuse the offer. Should they refuse, the matter is referred to the Commissioners.

The Commissioners, if satified "as regards the next subsequent year that the cost of production . . . . substantially exceeded the cost the undertakers would have incurred had they purchased the like quantity of electricity from the Board," may if they also think "it is expedient that the station should cease to be used as a generating station," require it to be shut down as such and a supply to be taken from the Board. A difference as to whether the cost was substantially in excess of the Board's offer is to be referred to the arbitrator. It must be noted (1) that the cost must not be merely greater, but substantially greater, and though the term is not very definite, it obviously prevents quibbles over ten pounds when the total is many thousands—and (2) even if the Board's price is substantially lower, the Commissioners may consider it inexpedient for other reasons that the station should be closed. In other words, comparative cost is not to be the sole criterion. This compulsory power, from the point of view of those who have brought small stations to a creditable state of efficiency, will be regretted, but in the interests of the community sentimental considerations must give way.

In this group of sections only one more point can be noticed in a summary review. Section 19 provides that if any scheme made under this Act conflicts with any obligation laid on a J.E.A., local authority, or other undertaker or company under the London and Home Counties Order, the scheme made under the Act is to prevail. This is a distinct limitation on the powers of the London J.E.A., although it is, of course, competent for the Board to frame a scheme in accord with the wishes of that authority, and its views will be heard with respect. Yet the Board may override them should it appear expedient.

3. Subsidiary Provisions as to Board.

These are less important provisions. Sec. 20 (*inter alia*) prohibits the Board from supplying directly to persons who are not authorised undertakers, except to owners of selected stations who are not authorised undertakers (which will be very unusual) or to companies or others for power purposes, in an area which is not part of the area of an authorised undertaker. Persons or companies taking such a supply may use it for lighting any premises where the energy is used for power. This provision enables the main transmission lines of the Board to be tapped where they cross unoccupied territory, so to speak, if the operation is feasible. There is no obligation on the Board to give such a supply. Should a line be available in any place where a fairly substantial amount of energy might be employed, it is, of course, open to any company or body to become an authorised undertaker, when the Board will be under an obligation to supply on the terms of Sec. 10; that is, a reasonable return on the outlay required to give the supply. A subsidiary but important provision is contained in Sec. 21, which gives the Board power to acquire land or easements compulsorily for main transmission lines if the acquisition of a wayleave under the Act of 1919 does not meet the case efficiently and economically. With the extended erection of main transmission lines contemplated by the Act, the question of wayleaves becomes of great importance. Where owners are unreasonable, this provision may be valuable.

4. Financial Provisions.

These provisions of the Act have been much more abused than understood. The Board is not to receive large grants of public money with which to erect superstations and compete with existing undertakers. As has been shown, the Board is not to build or generate at all—save in very exceptional cases—and no question of competition can arise. A cursory reading of Secs. 26-30 will reassure those who had any idea that the Board is to be largely subsidised at the expense of the taxpayer. For certain specified purposes the Board is authorised to borrow money, and this it will do by the issue of stock in the ordinary way to the public. The Treasury comes in only to "guarantee in such manner as they think fit the payment of the interest and principal . . . or of either the interest or the principal." The public have shown no reluctance lately to put up money for electrical schemes without demanding an unreasonable return, and there is little doubt that the Treasury guarantee will enable the Board to raise its money without unduly burdening its undertaking. If this proves correct, the mere existence of the guarantee will ensure its not being called upon. The purposes for which the Board may borrow are given in Sec. 27, and are as follows:—(*a*) The construction or acquisition of generating stations, main transmission lines, and other works; (*b*) any other payment or permanent work, the cost of which the Commissioners think should be spread over a number of years, including payment of interest out of capital for such period as the Commissioners and the Treasury may determine; (*c*) working capital; (*d*) any other purpose for which it is authorised to borrow. The total maximum amount which may be borrowed is £33,500,000, and the Board may not borrow more without a Special Order under Sec. 26 of the Act of 1919. This sum of 33½ million pounds is not allocated in any way in the Act to any specific purpose, and it is not an optimistic engineering estimate which may be exceeded by actual cost. The figure, however, is obviously derived from estimates put before Lord Weir's Committee, and may be taken roughly to represent £24,000,000 for transmission (including necessary gear) and 9,500,000 pounds for standardisation of frequency. A slight digression may be pardoned here in view of the great importance of this matter. The full effect of the capital expended, both in revenue and in capital charges, &c., may be expected to be realised about 1937. The capital charges (interest and sinking fund) on the £24,000,000 expended on transmission may amount possibly—if interest is paid out of capital during the earlier years—to anything from 10 to 15 per cent. Taking an intermediate figure of 12 per cent., the annual charge would be 2.88 million pounds. It does not seem unduly optimistic to assume that in ten years' time the total units sold will be in the neighbourhood of 16,000 millions. If this figure is reached, the additional cost due to the grid system will be .04d. per unit sold. Against this has to be set off the saving due to interconnection, co-ordination of generation, and the closing down of uneconomical stations. If only the last of these be considered, and in reference to coal costs alone this additional cost can, it seems, be easily offset. The coal costs at the Barton station of the Manchester Corporation, for instance, are given as .142d. per unit sold, while Leeds and Glasgow, both of which are efficient and modern undertakings, have coal costs of .19d. and .2d. per unit sold respectively. The possible saving thus on economical undertakings in this one particular is sufficient to pay for the grid. Taking the average costs of all generating stations and the other factors which will make for economy, the result is, of course, even more favourable.

All borrowed money is to be repaid within 60 years,

and the Treasury is to report annually to Parliament the amount of guarantees, if any, which have been issued. So far as the Act goes, these financial provisions are simple. The Commissioners' estimates when issued in the scheme will, of course, receive and necessitate much more detailed examination.

5. Miscellaneous Provisions.

These sections contain two provisions of importance. Sec. 31 gives power to the Minister to revise a power company's maximum prices when the company begins to take a supply from the Board (except the price for bulk supply to authorised undertakers), and in such revision the saving of cost to the company attributable to the Act is, naturally, to be considered. This is simply an extension of the existing power to revise maximum prices, and only comes into operation when the company is getting supplies at a lower cost. It is one of the methods devised to ensure that the consumer gets the benefit of the Board's working. Power is also given to the Commissioners after due inquiry to abolish the authorisation to make up back dividends which some power companies possess. This has never been done, and if the power companies' position is unchanged is not likely to be operative. It would obviously be unfair to the consumer if the company utilised savings, which were in fact rendered possible by the Board's working, for this purpose. Sec. 32 authorises the Commissioners to impose a sliding scale, if they think it expedient, on other authorised undertakers taking a supply from the Board. The London companies, having such a scale already under the London Acts of 1925, do not come under this section. Other miscellaneous provisions deal with superannuation, lopping of trees, and protection of bridges: they require no special notice here.

6. Amendments of Electricity Supply Acts.

The first amendment is of Sec. 5 of the Act of 1919, and provides that the Commissioners and not "interested parties" are to prepare the scheme for the reorganisation of supply in a delimited district. In view of the larger schemes of the Board, schemes under the earlier Acts are not likely to be numerous. But should any such schemes be necessary, it is a more convenient procedure that one scheme should be drawn up by the Commissioners and criticised by the interested undertakers and others, than that rival schemes should be subjected to the prolonged examination necessary to discover their respective merits. The Commissioners are to consult with the authorised undertakers in the district before drawing up their scheme, so that their views and objections may be considered before the formal inquiry.

Secs. 39-40 deal with purchase rights. After December 15th, 1926 (the date of the Act), if a company is authorised to supply in an area covered by two or more local authorities, the purchasing authority is to be the J.E.A. for the district, if there be one, and if not, a joint committee of the local authorities concerned. This does away with the absurdity of the purchase of part of an undertaking. The purchase price is to be a sum equal to the capital properly expended, less depreciation, on a scale to be fixed by the Special Order authorising the supply. And the company's tenure is to be fifty years. Where a company has ceased to generate for itself and is taking a bulk supply, its generating plant no longer being used, would not be purchaseable under the 1888 Act. It is now provided (Sec. 40) that the purchase price is to include a sum representing the capital properly expended on the disused plant after deducting the amount which, the Commissioners think, should properly have been written off. This provision will make it much easier for a company to take a bulk supply and so assist the general scheme, while it prevents an unfair advantage being taken by the purchasing authority. Power is given to undertakers and local authorities having purchase rights to alter the purchase terms by agreement, with the approval of the Commissioners. Sec. 43 is important. Its intention and, it is to be hoped, its effect is to ensure that local authority undertakers should pass on any benefits received in the way of a cheaper supply by the operations of the Board to their consumers. It is sought to achieve this, in a somewhat roundabout way, by diminishing the amount which the authority may apply to reducing rates. In the case of companies, it may again be noted, this result is to be obtained by the imposition of a sliding scale under Sec. 32. Secs. 46 and 47 introduce some needed amendments with regard to railway supplies. The first provides that, with the consent of the Commissioners, any one railway generating station may supply to any other, and the Commissioners may authorise the breaking-up of streets, &c., necessary to carry out this supply.

Sec. 47 merits closer attention. It provides generally that where any authorised undertakers are supplying energy for haulage or traction to a railway, dock, harbour, or canal, they may supply the energy for any purpose and to be used in any part of the undertaking, and the company taking the energy may use it for any purpose for which it is authorised to use electricity. It should be remembered that this will not enable a railway company to undertake the lighting of houses not part of its premises, nor will this section override any protection given in other Acts to particular undertakers, *e.g.*, to Poplar, in the London Act of 1925.

The sale of fittings is dealt with in Sec. 48, and this vexed question is put on a more satisfactory footing. A general power is here given to joint authorities and local authority undertakers to sell (but not to manufacture) fittings, and provides that they are not to undersell the usual providers of such things. The Commissioners are to appoint a representative committee to determine prices and advise generally on the methods of carrying on the business. If it can be properly developed, a large increase in consumption, and therefore a reduction in price, may be hoped for in this direction.

The seven schedules to the Act are largely technical, and for that reason, if for no other, are outside the scope of this article.

Opinions differ greatly about the Act, and its provisions being arrived at by discussion and compromise, it is not a logical whole, and defects are bound to become apparent in its working. In the writer's opinion, it is, however, a great step forward, and if the various interests can follow the advice disinterestedly given now by many of their leaders who were opposed to the Bill, and co-operate to make it a success, it will prove a measure of benefit to the industry and to the country as a whole.

The Central Electricity Board.

According to the *Westminster Gazette*, the name of Sir Duncan Watson, the first chairman of the London and Home Counties Joint Electricity Authority, has been put forward to the Minister of Transport by some of the bodies that he has consulted with regard to the chairmanship of the Central Electricity Board.

The *Manchester Guardian* states that the National Joint Industrial Council for Electricity Supply has nominated some of its own members for membership of the Board, the employers having chosen the chairman, Ald W. Walker, and Ald. Huntsman, whilst the employés' side has nominated Mr. J. Rowan, vice-chairman and general secretary of the Council, and Mr. G. P. Dean.

It is rumoured that the name of Mr. Ll. B. Atkinson, director of the Cable Makers' Association, has been put forward for the chairmanship of the Board; and those of Mr. R. Borlase Matthews and Mr. J. W. Beauchamp, of E.D.A., have been mentioned for membership.

We refer to the position of affairs in our leading columns to-day.

Our Overseas Electrical Markets.

The Trend of Trade with Australia, New Zealand, India, and Africa. Factors Affecting Purchasing Power.

THERE is a growing realisation on the part of manufacturers and exporters in this country of the importance of keeping themselves acquainted with trade movements not only in the markets in which they may be especially interested, but also throughout the world in general. It is fairly well known how large a number of organisations—official, semi-official and private—in the United States are engaged in compiling and circulating statistics and other useful data regarding international trade exchanges and business conditions. Although a great deal has been done in the same direction in this country, it is probable that intelligence of an economic nature is available in greater detail and more widely disseminated in the United States, than in Great Britain. There is little doubt that more money for such purposes is available across the Atlantic than here.

The policy of the Electrical Review has always been to devote as much space to statistical information as could be spared, having regard to other demands made upon its columns. Manufacturers and exporters have been made aware, as soon as official returns were available, of the annual trend of the import trade in electrical and allied material of practically all the most important consuming countries. Similarly, they have been enabled to watch the activities of competitors, through the comparative tables published from time to time of the exports of the chief electrical manufacturing countries. That manufacturers' representatives and other readers have found these figures of value is certain. On occasions when, owing to exigencies of space or other reasons, some of this information has been curtailed, there have been requests to supplement the details and we have been pleased to meet the demand.

In this article we develop these statistical features and show, by means of charts, the trend of the electrical import trade of certain of Great Britain's most valuable markets during the month. At the same time a brief review is given of the principal factors affecting the purchasing power of the countries in question. By glancing at the charts, firms will be able to see how business has been varying from month to month, and, if a rise in imports has not been accompanied by an increase in their own orders from the market in question, they may consider it desirable to investigate the reasons.

Australia.

Although Australia experienced an unfavourable season last year for the products of her sheep, cattle, fruit-growing and farming industries generally, resulting in an adverse balance of over £20,000,000 during the first quarter of the 1926-27 fiscal year, traders towards the close of 1926 were optimistic as to the outlook. Prospects for the realisation of the wool clip, for the wheat harvest and butter production were considered satisfactory. In the course of a recent review by the Canadian Trade Commissioner at Melbourne, it is stated that trade has generally been well maintained, although some distributing houses report that tight finance, particularly in country districts, has had a depressing influence. The textile mills, metal works, and rubber factories are showing increased outputs, while manufacturers generally are working full time. The recently-published balance sheets of large trading and manufacturing companies show improved

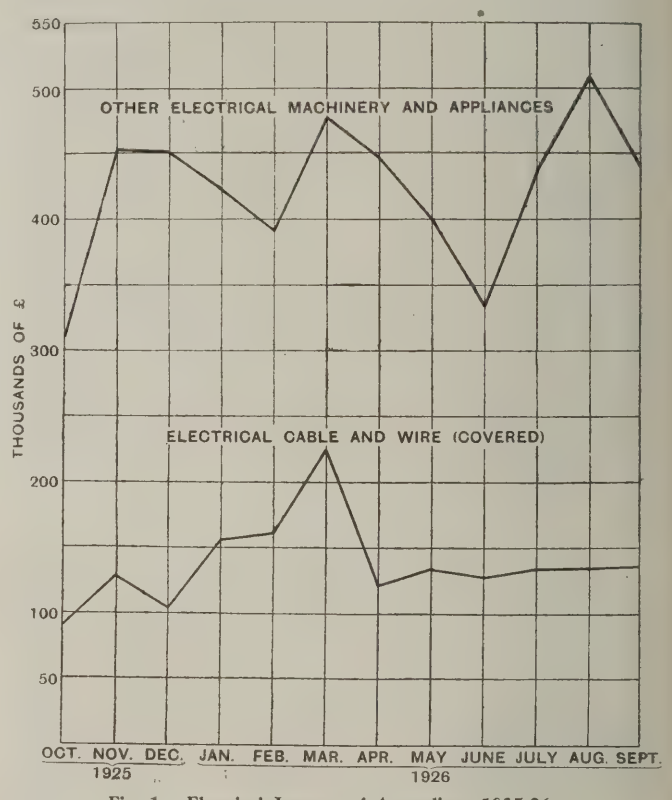


Fig. 1.—Electrical Imports of Australia, 1925-26.

results, while new issues of companies' shares have been readily absorbed by investors. Electrical imports for 12 months are shown in fig. 1.

New Zealand.

Although the value of New Zealand's exports during the first nine months of 1926 showed a decline of nearly £7,000,000 compared with 1925, the excess of imports was but £57,000. The fall in exports was due to lower prices, particularly of wool. The area under wheat and oats during the 1926-27 season is likely to be greater than in the previous season.

Building activity in the Dominion, as measured by the permits issued in the larger towns, well maintains its level. The total value of these permits for September, 1926, was again over £1,000,000 as in June, 1926, and October, 1925. In the intervening months it averaged £750,000.

At the end of the last financial year (March 31st, 1926) the total amount to the credit of depositors in the New Zealand Post Office Savings Banks was £47,911,322, as compared with £46,948,628 during the previous twelve months. During the first six months of the current financial year the excess of deposits over withdrawals was £56,000.

Imports generally into New Zealand fell off directly the effect of the British coal strike began to be felt, and for a time most buyers continued to operate cautiously. Now, however, it is anticipated that import business will revive for a spell. According to the

Canadian Trade Commissioner at Auckland, while conditions in New Zealand in November were not so bright as is usual at that time of the year, there was little cause for alarm.

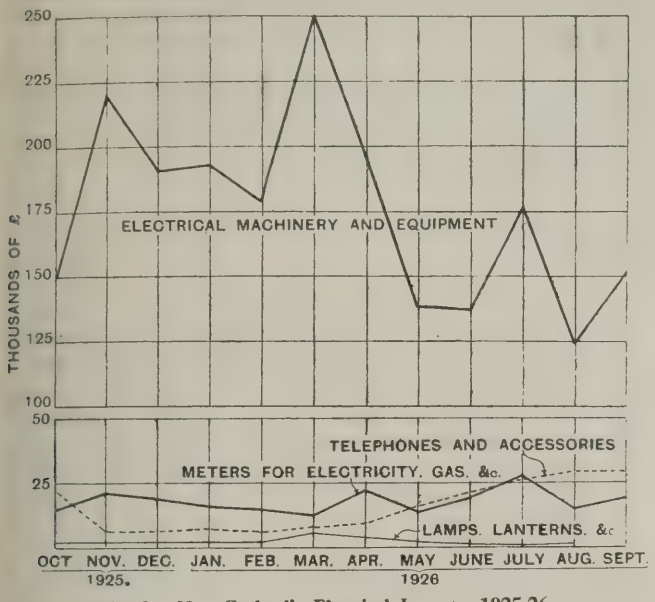


Fig. 2.—New Zealand's Electrical Imports, 1925-26.

The advent of the Christmas trade was expected to help the employment situation. Fig. 2 shows twelve months' electrical imports.

India.

The favourable monsoon and the good condition of the various crops are favourable factors that will have their influence, sooner or later, on Indian business in

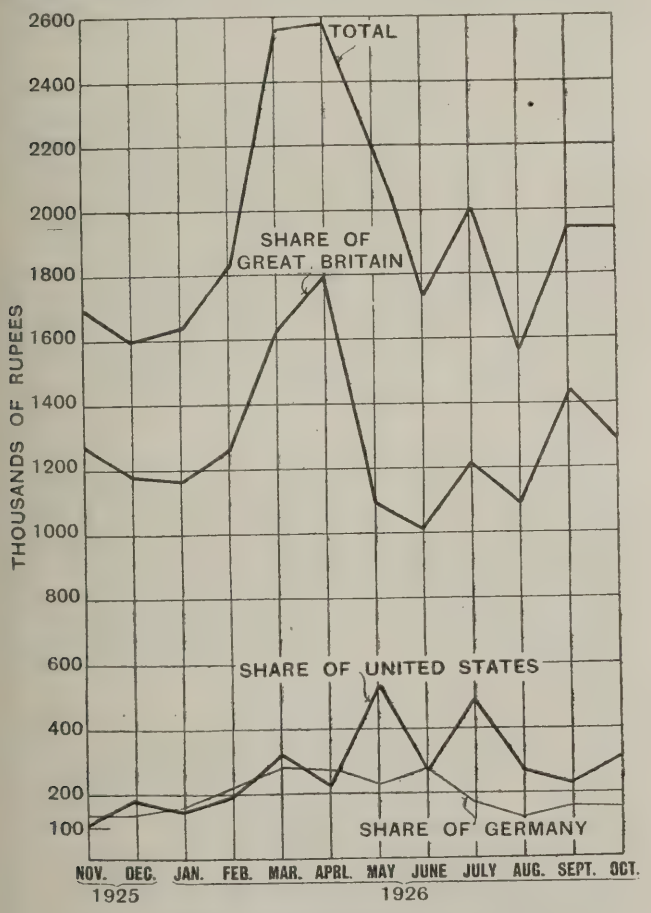


Fig. 3.—Indian Electrical Apparatus Imports, 1925-26.

general, but neither trade generally nor that in metal goods and engineering products has been helped by the situation in cotton piece goods. The steady decline in textile prices has placed dealers in a difficult position, for their stocks are large.

The engineering trades are likely to continue to benefit in many ways from the programme of railway and port work, to which the Viceroy referred at the recent meeting of the Associated Chambers of Commerce of India. India, he said, was on the eve of a great expansion of communications. A web of cross lines between the

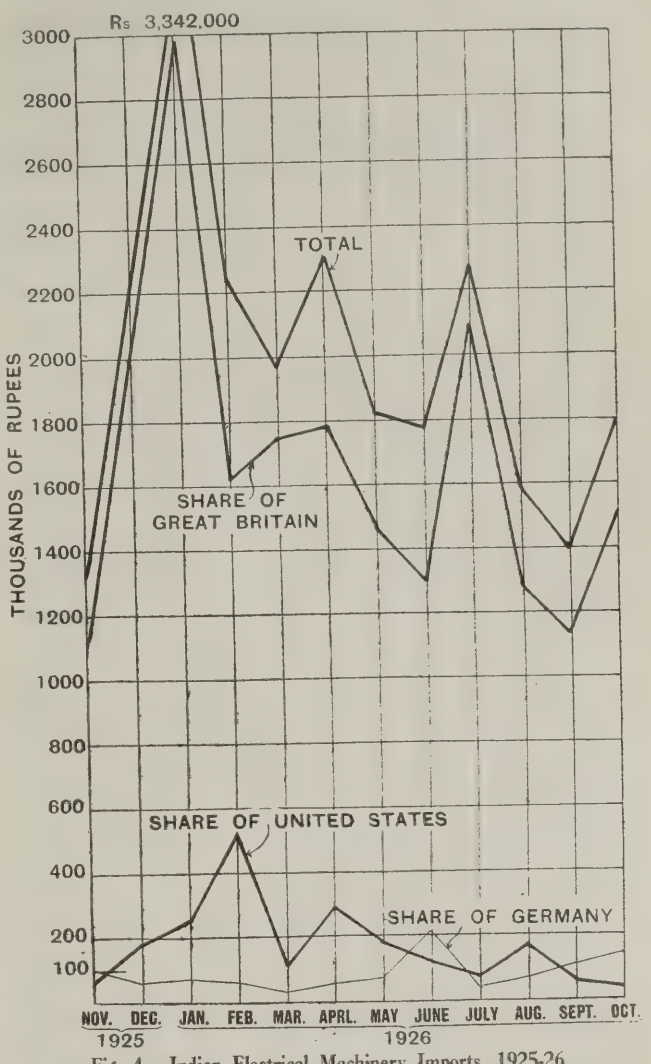


Fig. 4.—Indian Electrical Machinery Imports, 1925-26.

main trunk railways was being built, the smaller ports were to be developed and roads improved. Figs. 3 and 4 show the Indian electrical imports for 12 months.

South Africa.

The mineral production of the Union of South Africa in October was about £600,000 more than in the same month of 1925, *viz.*, £5,279,000, as compared with £4,665,000. The index number of European employment in manufacturing industries in August showed a

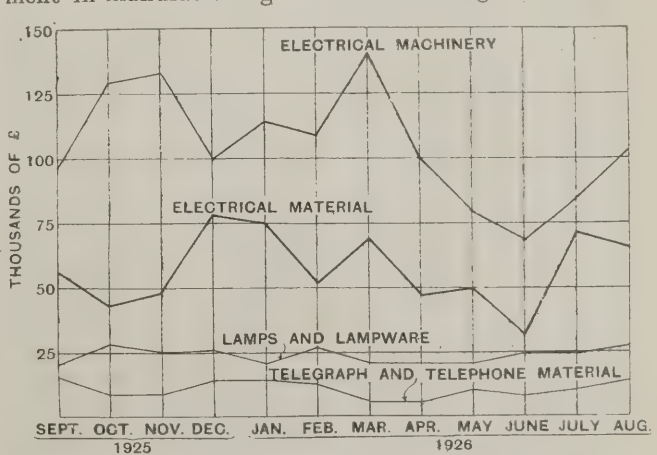


Fig. 5.—South African Electrical Imports, 1925-26.

general improvement, and the total number of Europeans placed in employment, apart from relief and public works, by the Government employment exchanges increased from 440 in September to 600 in October. The number of persons on relief and Government works decreased from 4,047 in September to 3,700 in October. The 1925-26 electrical imports are shown in fig. 5.

Electrical Insulation.

Recent Developments in the Varying Uses of Different Materials: Brief Definitions of their Composition and some of their Characteristics; to the Synthetic Resins, in particular, a wider Field of Usefulness is open than has been allotted to them hitherto.

By ANTONY SETON.

THE time has gone when there were available only a very few substances which acted as insulating agents for electrical conductors. With the advance of electrical science chemical science has kept pace, and there are nowadays very many insulating mediums that were never thought of a few years ago.

An insulator is a substance which impedes the passage of an electric current, and it is difficult to say when a substance ceases to be a bad conductor and begins to be an insulator. Generally speaking, substances which allow the passage of high-pressure currents, but impede low-pressure ones are spoken of as bad conductors, and those which prevent both high- and low-pressure currents are spoken of as good insulators. Insulators may be solid, liquid, or gaseous. Most fall into the first class, but there are several in the second, and a few in the third. Dry air forms one of the best insulators known, but it is apt to break down under very high pressure. Under the heading of liquid insulators are classed all non-electrolytes, and some electrolytes also, when dissolved in an inert solvent which prevents ionisation. Hydrochloric acid gas, for example, is a conductor, and remains one when dissolved in water; when dissolved in an inert solvent such as chloroform, however, it becomes practically a non-conductor. Absolutely pure water is an insulator, but the salts dissolved in it ordinarily give it good conductivity. Pure mineral oils are insulators, but fatty oils are not. Mineral oils find application in transformers and switchgear more particularly. Solid insulators include substances like paper, rubber, gutta-percha, mica, and the synthetic resins and gums made by the condensation of aldehydes and phenols. Gaseous insulators are not used in practical work, except in so far as bare overhead conductors are insulated by the air round them, and do not spark to earth except under very unusual conditions.

Liquid insulators find considerable use in power-station work in transformers and switches, for which their high specific heat renders them particularly suitable in preventing the rise in temperature of the apparatus beyond safe limits. In switches they are used mainly to prevent arcing when making and breaking contact. The oils used must be pure mineral oils, entirely free from moisture, sediment, and sulphur and sulphur compounds. They must be neutral in reaction and must remain stable at high temperatures. A moderately low viscosity is desirable, as the dispersal of heat generated depends to a large extent on this, but as a high flash point is also necessary, a mean must be struck, for low viscosity is usually accompanied by a low flash point. On the other hand, the more viscous the oil the lower is the break-down voltage, and a high dielectric strength is also required. The voltage required to break down a gap of $\frac{1}{8}$ in. between point and plane in a well-dried oil (traces of moisture makes a big difference) is between 15,000 and 30,000 volts. In transformer work it is found that after a period of use a sludge forms which, in the early stages, is a hydrocarbon simply, but later assumes the character of an oxidised compound, and is acid in reaction.

Varnishes may be divided into two classes, *viz.*: those in which oil is the vehicle, and those in which a volatile solvent is used. They are used to provide a protective coating for wires, especially cotton-covered ones, for impregnating paper and tape, and in the preparation of mica cloth. For windings a varnish of linseed oil, with a base of copal or fossil gum, is used. Windings which may be affected by oil should be treated with this kind of varnish. A solution of asphaltum in oil furnishes another varnish, but one that is not so oil-resisting as a copal varnish, and which, moreover, has a lower dielectric strength. For papers a linseed oil varnish with a gum base is used, to which is added a small quantity of lead or manganese driers, the whole being thinned, if necessary, with benzine or turpentine. Shellac varnish is made by dissolving shellac in methylated spirits until the specific gravity is from .84 to .89. Gum lac or garnet lac can be used in place of shellac. Windings can be protected also by solid impregnating materials, such as asphalt and paraffin wax. It is necessary that the composition, whatever it is, shall be fluid enough to permeate the windings at a temperature not exceeding 125 C., and it must not be brittle at ordinary temperatures.

Paper and tape are frequently used. Paper is cheap, but its use is limited by its moisture content, and its insulating value normally is low owing to its inherent moisture. Paper is made from the fibres of various grasses and plants and from wood pulp. It is frequently loaded with fillers, such as china clay, and these are not deleterious provided that they are chemically inert. They may, in fact, be advantageous in rendering the paper less springy. The use of rubber latex in the manufacture of paper suggests the possibility of an improvement in the insulating properties of the material. For securing a high insulating value, the paper may be impregnated with a varnish of some kind.

Tapes may be divided into three types: (*a*) those woven from cotton or silk and not treated; (*b*) those woven and treated; and (*c*) those loaded with a rubber compound. Untreated tapes are very hygroscopic, and their use is therefore limited. Tapes that have been varnished stand well, if they were bone dry when they were varnished. Tapes that have been loaded with a rubber compound cannot be used where they are exposed to light and air, as the rubber perishes quickly under the influence of air and light.

What is known as "vulcanised fibre" finds extensive use. It consists of cellulosic materials chemically treated and compressed into sheets, or manufactured into rods and tubes. Zinc chloride is used in its manufacture, and for this reason the product is always more or less hygroscopic, which is a serious disadvantage.

The value of wood as an insulator is determined by its condition as regards sap and moisture, and the drier the wood the better the insulation obtained. Well-dried wood, it is said, should stand 10,000 volts per inch of thickness without overheating or burning. Ash, teak, maple, hornbeam, and lignum vitæ are all used, and of these hornbeam is the best. Additional protection may be given by boiling the wood in oil, linseed oil for preference, but the pieces should be cut to size before this treatment, as the protective coating does not extend deeply into the substance of the wood.

Of mineral insulators there are several. Slate and marble are used extensively, but frequently give trouble owing to metallic veins which run through the slabs. Slate is a worse offender in this respect than marble, but even marble is not free from such veins. Slate can be treated with a varnish which renders surface leakage small, but holes for conductors must be bushed with vulcanite or one of the synthetic resins. Porcelain, when of good quality, is very good, but when it is of poor quality its value as an insulator is due entirely to the glaze, which may be full of pinholes and very imperfect. The mineral most widely used is mica. The micas are a family of related minerals which differ slightly in chemical composition. They are all complex aluminium silicates or alumino-silicates, and are distinguished by the ease with which they cleave into thin laminæ, which are flexible and more or less elastic. The three forms which are used chiefly in electrical work are muscovite, first found by A. B. de Boodt in Moscovia; amber mica, mined in Canada and so called because it is amber in colour; and lepidolite, which is chiefly obtained from India. Of the three, muscovite has the highest dielectric strength, but it is hard and not so easy to work as the others, and consequently is used less. Crystals of muscovite measuring 10 ft. across the basal planes have been found in India, but these are uncommon. Crystals of from 6 to 12 in. are common, however, and sheets 30 in. by 24 in. have been obtained in Canada free from flaws. Oil has a very harmful effect on the material, and T. O. Maloney found that a piece of mica which withstood 16,000 volts alternating current broke down under 9,000 volts after being lightly wiped over with paraffin oil. One of the chief uses of mica is for interposing between the segments of the commutators of motors, and the breakdown voltage of sheets 0.12 mm. thick has been given as 10,000 volts. Mica waste is made up into what is known as micanite, or mica cloth, by bonding the fragments with shellac varnish on a fabric base. Asbestos, another complex silicate, is also used, but its hygroscopic nature and poor insulating qualities make its scope limited. For fuse blocks and switch blocks it is used after impregnation with sodium silicate.

Rubber is produced from the sap of a number of trees, but chiefly from the Hevea brasiliensis. The sap, or latex, is a milky fluid holding the rubber in suspension in the form of exceedingly minute particles. By evaporation of the water, or coagulation, the rubber is obtained, and after washing is exported from the plantation in the form of loaves, balls, crepe or sheet. Pure rubber is little used as an insulator, but high-class cables and flexible conductors frequently have a layer of pure rubber immediately over the wire to prevent the sulphur of the vulcanised rubber from acting on the metal of the conductor. Whilst rubber, being waterproof, might be used for submarine cables, this is not the case owing to the difficulty of making good joints, its unsatisfactory resistance to water pressure (in comparison with gutta-percha) and the difficulty of preventing the action of sulphur on the conductor. Ebonite, or hard rubber, contains upwards of 30 per cent. of sulphur. It is somewhat brittle, but can be turned and takes a very high polish. It has a very high dielectric strength, but softens at comparatively low temperatures. It is not hygroscopic, and is useful where a first-class appearance is essential.

Gutta is obtained from a latex similar to rubber latex. It is a hydrocarbon of very similar character, being $(C_{10}H_{16})_n$, but has entirely different physical properties. It is not pure, but invariably contains more or less resin. At ordinary temperatures gutta is hard and tenacious, but it becomes plastic on warming, and can be moulded, the shape being retained on cooling without brittleness. Gutta is not affected by weak mineral acids, by strong hydrochloric acid, or by strong acetic acid, or by strong alkalis. It is readily attacked by strong nitric acid and strong sulphuric acid however. It slowly absorbs oxygen on exposure to air, becoming converted into a resin, and differs from rubber in that it is not attacked energetically by ozone. The value of gutta as an insulator depends solely on the proportion of gutta present and not at all upon the resin. Removal of the resin by appropriate solvents does not affect the electrical properties at all. Very hard gutta is made by extracting the resin from ordinary gutta.

Many of the synthetic resins form excellent insulators. The original researches were carried out by Kleeberg with formaldehyde and phenol, but those to which we owe most are those carried out by Baekeland, and it is one of his synthetic products which finds so extensive a use now under the name of Bakelite C. Other compounds of like nature have been used, and most of them have some value from the point of view of insulation. It is to be noted, however, that resins produced by the use of acid catalysts are less satisfactory, and have lower insulation values than those in the manufacture of which alkaline catalysts have been used. Bakelite C is a golden yellow compound of specific gravity 1.25. It resists pressure and shock, but is comparatively inelastic. It does not melt on heating, but above 300° C. chars, and at no time does it inflame. It is not hygroscopic and resists the action of strong mineral acids and of bromine. It is not so resistant to alkalis. Its golden yellow colour turns to red on exposure to light, but it has been stated that if the colour is not too deep the original yellow can be restored by heating the resin to 100-150° C. for several hours.

In concluding this account of some insulating materials, it must be noted that the list is not exhaustive, and that much more might have been said about each. The synthetic resins alone open a wider field of usefulness than the space allotted to them indicates, and as time goes on their application in all branches of the electrical industry will become more common and their value will increase to a much greater degree.

Reviews.

Electric Lighting and Power Distribution. By W. PERREN MAYCOCK. Vol. I. Ninth Edition, revised by C. H. YEAMAN. Pp. xiii+562; figs. 392. London: Sir Isaac Pitman and Sons, Ltd. Price 10s. 6d. net.

The lamented death of the author of the earlier editions of this work unduly delayed the appearance of the present edition. The necessary work of revision has been undertaken by Mr. C. H. Yeaman, who, without altering the general scheme of the work, has rewritten a large portion of the text. The popularity of the earlier editions of this book was undoubtedly due, not only to Mr. Maycock's peculiar gift for dealing with his subject in a simple and easily understood fashion, but also to the fact that few other books of similar character were available for the use of the elementary student. At the present time, however, there exists a large number of works of a rudimentary nature, of similar scope to the one before us, and we therefore rather regret that Mr. Yeaman has not made better use of the opportunity presented to him, by treating the subject in a more ordered and logical manner than he has. We very much question, for instance, the wisdom of endeavouring to describe the working of purely alternating-current instruments in a section devoted to the principles and application of direct-current work. These explanations can hardly convey anything to the student who has no knowledge of elementary a.c. principles. It is also to be regretted that the standard symbols for electrical quantities and for diagrams of connections have not been rigorously used. The obsolete symbol C has been retained for current, and a small, instead of a capital, omega has been used as the abbreviation for ohm.

Considering the work in detail, we find a very good introductory chapter dealing with mechanical units of force, energy, and power, which, if thoroughly assimilated, will be of excellent service to the student throughout his engineering studies. This chapter is followed by one dealing with electrical quantities and units, and elementary d.c. calculations. The author then leaves this part of the subject and proceeds to the fundamental principles of condensers, electromagnetism and electromagnetic induction. We then have a somewhat scrappy chapter dealing with batteries, bells, telephones, relays, and elementary transmission and distribution problems. The bulk of this matter should have followed immediately on the chapter on elementary d.c. calculations. The chapter on the magnetic circuit, and magnetic calculations, is a very good one, and deals with a difficult subject in a manner which will be most helpful to the beginner. A very large portion of the book is devoted to standards, measurements, testing and instruments, the two chapters dealing with these matters comprising no less than 211 pages, whilst the concluding chapter of the book.

treating of direct-current dynamos and motors, has 62 pages only. We consider that a more searching treatment of the principles of direct-current machines, affording, as it does, so excellent an illustration of the rudimentary principles discussed in the earlier chapters of the work, would have been more useful to the student than the detailed descriptions of many of the electrical instruments found in chapters 7 and 8. The latter chapters are, however, generally very sound and useful, although we came across one or two rather loose statements. On page 431, for instance, the moving-iron type of instrument is described rather contemptuously, as being suitable only in situations where accuracy is relatively unimportant. As these instruments are now supplied with a guarantee of Grade 1 accuracy, for a.c. work, this reference is hardly a just one, and, moreover, so far from the induction type of instrument superseding other types for a.c. work, as stated on page 463, the use of the moving-iron instrument is distinctly on the increase. On page 383 the author gives a list of the factory tests taken on cables before delivery, and states that these tests should be taken periodically after the cables have been laid. This is quite misleading, for few mains engineers would care to pressure-test their cables at regular intervals. The concluding chapter will serve as an introduction to the study of the elementary theory of direct-current machines.

There are large numbers of questions and exercises at the end of each chapter, and the answers are given to such as involve arithmetical calculation. The book has been admirably produced, and is very well illustrated. It will still rank as one of the best and most inexpensive of text books for the elementary student of limited educational attainments, although we are of the opinion that it would have been even more useful had greater attention been paid to the order in which the various subjects are dealt with, and to the allocation of space amongst them.

Notes on the Induction Motor. By H. E. DANCE, A.M.I.E.E., A.I.A.E., Lecturer in Electrical Engineering at the Birkenhead Technical School. Pp. viii+152; figs. 70. London: Oxford University Press. Price 6s. net.

This little volume is intended for those students of electrical engineering who desire to obtain accurate ideas concerning the theory underlying the operation of the induction motor without entering into matters which may be looked upon as falling within the province of induction motor design. The first chapter deals exhaustively with the production of rotating magnetic fields by means of polyphase currents in suitably disposed stator windings, and this is followed by a chapter in which consideration is given to the actions occurring in a conductor lying within a rotating field. The portion of the book dealing with the general theory of operation of the machine is completed by a study of the approximate circle diagram, the treatment being chiefly considered from the point of view of the utility of the diagram for testing purposes. Stress is laid upon the desirability of employing the phase currents and pressures when laying out the circle diagram, due allowance being made for the number of phases when determining the power scale. This may seem to be a point of minor importance, but we heartily commend the course advocated since we have in mind many cases where students have become involved in difficulties owing to lack of clear ideas as to whether line or phase quantities are under consideration.

In the succeeding chapters of the book, methods of starting, speed regulation, and power factor improvement are considered, and we find all the important methods described, the size of the book, however, necessarily limiting the amount of space devoted to each. The account of the phenomenon of "crawling," often a source of trouble with students, may be particularly commended.

The book concludes with brief accounts of the operation of the induction machine as a generator and of the single-phase induction motor.

The author achieves the object at which he aims, and the book, which is carefully and accurately compiled, can be recommended to the notice of students and engineers alike.

Legal.

Lazenby v. Gardiner

AT Plymouth County Court, on January 12th, Mr. G. C. Lazenby, wireless engineer, Plymouth, claimed the sum of £14 5s., the cost of a radio set supplied to Captain H. B. W. Gardiner, Marytavy, near Tavistock.

Mr. W. J. AMBROSE, for the plaintiff, said that his client supplied a "Marconiphone" receiving set to the defendant, who said that he did not want a loud speaker; headphones would meet his needs better. A cheque given in payment was stopped by defendant, who on the following day wrote alleging that the set was not what it was represented to be, and that he was getting very faint reception. Later the set was returned to plaintiff's shop. Giving evidence in support of this statement, Mr. Lazenby said that when he installed the set he obtained excellent reception from Daventry and good reception from Plymouth. Defendant did not say that he desired to get Continental and English stations other than Daventry and Plymouth.

Mr. FRANK JONES, of the Marconiphone Co., Ltd., said the set was capable, under ordinary conditions, of receiving radiotelephony on headphones up to a distance of 100 miles from a main broadcasting station and up to 250 to 300 miles from a high-power station. It was possible to get Radio-Paris, Madrid or Prague on the set. That day in Plymouth he had got Daventry direct on the loud speaker, and he thought that if the test had been made on Dartmoor reception would have been considerably better. Witness did not believe there were any such things as wireless "pockets," as had been suggested.

Mr. A. R. H. AKASTER, for the defence, stated that their case was that there had been gross misrepresentation by an expert on a technical matter to a person who had no knowledge of wireless. Plaintiff offered to supply a set which would get Continental and English stations apart from Daventry and Plymouth, which the set supplied would not do. Captain GARDINER bore out this in evidence, and Mr. W. E. GRAVES, a Tavistock wireless engineer, who examined the set, was called to report upon it. He gave it as his opinion that the set supplied by Mr. Lazenby had been very badly fitted.

His Honour Judge GURDON, remarking that upon the evidence put before him he was not satisfied that the set would not get the stations mentioned, gave judgment for plaintiff, with costs.

Action Against Stepney Borough Council.

IT is reported that Messrs. Pearson & Son, Ltd., printers, Aldgate, have entered an action against the Stepney Borough Council claiming £100, the amount of loss alleged to have been sustained on account of the cutting-off of the electricity supply during the general strike.

Rating Appeal by Aberdeen Corporation.

THE decision was given in the Valuation Appeal Court, Edinburgh, on January 13th, in the appeal by the Electricity Department of the Aberdeen Corporation against the refusal of the Valuation Committee to deduct sums of £6,971 and £419, in respect of sinking fund and interest on capital expenditure on buildings and plant before these were completed and became revenue producing subjects (*vide* our last issue, p. 53). The appeal was refused, the Court holding that the determination of the Valuation Committee was correct.

Lord SANDS, giving the leading opinion, said that in considering the application of the revenue principle it was necessary to keep in view that the question was not one as to the purpose to which the net revenue was applied or of profits or gains, but solely of the annual value of the subjects the value of which, if they were let, would be spelt in rent paid by a tenant. The revenue principle professed to ascertain this. But it had been contended that productive and unproductive works should be regarded as separate and distinct. Calling the productive works A and the non-productive B, admittedly B had at present no value, and they were not there concerned with putting any value upon them. The problem was to ascertain the annual value or hypothetical rent of A. His Lordship was unable to see how the rent which the hypothetical tenant of A was willing to pay could have any relation to the payments out of that rent by the landlord towards B. His Lordship was accordingly of opinion that the determination of the Valuation Committee was right.

The Court, on the same day, also dismissed appeals in three other cases in which the same question was raised.

Electric Sign Erection Dispute.

MR. JUSTICE FINLAY had before him in the King's Bench Division, on January 12th, an action in which Mr. Lewis Jackson, Gloucester Gate, W., sued Mr. John de Frene, Duck Lane, Wardour Street, W., for £200, one quarter's rent payable in advance for space for electric sky signs upon Harrington Mansions, Cambridge Circus. Defendant entered into an agreement with plaintiff to take the space at a rental of £800 a year. When defendant applied to the London County Council for a licence it informed him that it was superior landlord and that it would not allow electric signs to be put on its property. It appeared that there was a clause in plaintiff's lease to the effect that he would not without the written consent of the lessors cut or damage any of the principal walls or timbers. A clause similar to this was inserted in plantiff's agreement with the defendant. The latter pleaded that he did not know at the time he entered into the agreement that plaintiff had previously tried to get the permission of the L.C.C. to erect electric signs on the premises and that the L.C.C. had refused. In view of the failure to disclose this fact he submitted that consideration for the agreement which he entered into with plaintiff had failed, and therefore the agreement was of no effect in law. Defendant said he had re-let the space and had lost an anticipated profit of £5,000.

His LORDSHIP, in deciding for the plaintiff, said the agreement made it clear the signs to be erected must be in accordance with the lease. The failure to disclose the circumstance that the L.C.C. had previously refused permission to erect the signs was not a fraudulent concealment. If defendant had erected signs and the L.C.C. had taken action the burden would have fallen on the plaintiff. Judgment was entered for plaintiff for £200 and costs.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

The organisers' report upon the Wiring the Homes of Britain Campaign for the week ended January 15th shows that four new circles were formed during the week at the following places; the chairmen's names are given in parentheses:—Bournemouth and District (Mr. H. F. Alger, secretary Mr. Norman Aish); Chesterfield (Mr. E. Morris); Dorchester; and Cambridge (Mr. Pierce, *pro tem.*). Electric demonstration homes were to be opened during the current week at Glasgow (2), Leicester, Bath, and Exeter, and two more are to be opened at Birmingham next week. The Wembley house has proved a great attraction, and many orders for appliances and fittings have already resulted from it. The builder and the furnisher have also expressed their satisfaction with the results. The Bishop Auckland house is attracting visitors from a wide area, and "excellent attendances and good results" are reported by Walsall. Dorchester has decided to run a demonstration house, and further houses or exhibitions are in contemplation at Bristol and Cardiff. The three-day exhibition at Greenock drew 800 people who paid for admission. Exhibitions are being arranged in a number of towns. That at Derby will include evening lectures on home lighting. The North Metropolitan Electric Power Supply Co. has held an exhibition at Hoddesdon in the form of an electric flat in the basement of the company's local premises. Wolverhampton will hold an exhibition from January 27th to 29th; Bingley has arranged one to run from February 28th to March 12th; and during February and March an exhibition will be held at the Weymouth electricity supply showrooms. Chesterfield contractors are also thinking of organising an exhibition. Successful works meetings are being held in all parts of the country. A recent one at Messrs. Ferranti, Ltd.'s, works was attended by 200 workers; the company has offered an additional prize for any employé who wins one of the ballot prizes. A crowd of 600 people attended a recent works meeting at the Metropolitan-Vickers staff canteen, Trafford Park. It is suggested that competition booklets might be given away by large manufacturers with the weekly pay envelopes. Bingley contractors have sent out 3,400 copies of the booklet, with a covering letter, to the principal residents of the town.

A pamphlet describing the Glasgow electric demonstration houses has been received. The first of these houses was opened this week at Muirend; three others are to be opened at later dates. The following are co-operating in the arrangement of the houses:—The Corporation Electricity Department, the Clyde Valley Electrical Power Co., the Strathclyde Electricity Supply Co., Ltd., electrical manufacturers and local wholesalers and contractors.

The German Cable Industry.

The *Deutsche Bergwerks Zeitung* learns that the order of the Reich Railways for 230 km. of cable, valued at approximately 6,000,000 marks, has at last been placed. As the order has been distributed among about a dozen cable companies, each company receives a share which will only give it employment for about a month. Delivery is to be made before the middle of 1927. With regard to the recently-completed cable from Berlin to Vienna, the paper learns that the German section is being laid by the Süddeutsche Kabelwerke, of Munich, Felten und Guilleaume, of Nüremberg, and the Kabelwerke Duisberg; the value of the order received by these concerns is estimated at between three and four million marks. —*Reuter's Trade Service* (Essen).

National Fuel and Power.

The Fuel Economy Department of the Federation of British Industries has received a request from the National Fuel and Power Committee appointed by the Government as a result of the recent Royal Commission on the Coal Industry, to be supplied with an account of the work undertaken by the Department. A Memorandum has accordingly been submitted to the Committee, and attention has been drawn to some problems of urgent industrial importance.

G.E.C. Exhibitions.

In conjunction with the local electricity authorities the General Electric Co., Ltd., has organised three exhibitions. The first opened on Tuesday last and will run until January 29th. It is being held at the Stoke Newington Electricity Department's showrooms. The second opens at the Hampstead Electricity Department's premises on January 22nd and remains open until January 29th. The last takes the form of a special window display of domestic electrical appliances at Hackney from February 7th to 19th.

The F.B.I. and the Next Budget.

The Grand Council of the Federation of British Industries has communicated with the Chancellor of the Exchequer setting out its views with regard to taxation in view of the near approach of the presentation of the next Budget. Economy in policy and administration is stressed as essential and the Council recommends that wherever the Chancellor may look for money, there shall be no increase whatever in direct taxation The loss of revenue resulting from the coal stoppage should be regarded as a capital loss to be spread over a term of years. Other matters dealt with are the incidence of super-tax and the change-over in the basis of assessment.

Unemployment in Germany.

The returns of German unemployed show that there was an increase of about 278,000 during the last two weeks of 1926. The number in receipt of relief at January 1st was 1,745,000.

The Leipzig Fair.

We have received from the organisers of the Leipzig Spring Fair a number of pamphlets, &c., dealing with the display. The Technical and Building Fair is to be held from March 6th to 13th and the scope is wide, judging from a list of the goods that will be shown. The London office of the organisers is at 1, Gower Street, W.C.1.

Electrical Exhibits at Leeds.

At the Leeds Building Trades Exhibition, opened last week, Messrs. William E. Culkin & Co., manufacturing electrical engineers, Leeds, showed numerous examples of electric fires, cookers, washers, vacuum cleaners, and other household appliances. The firm also showed many kinds of electrical plant for industrial purposes, including dynamos, motors, switchgear, drills, meters, and various electrical instruments. A motor-driven planer and saw and the firm's own "WEC" blower were also exhibited. Mr. Arthur English, electrical contractor, Leeds, was responsible for the whole of the electrical work throughout the exhibition. He showed a model bungalow equipped with electrical appliances.

The Swedish Electrical Industry.

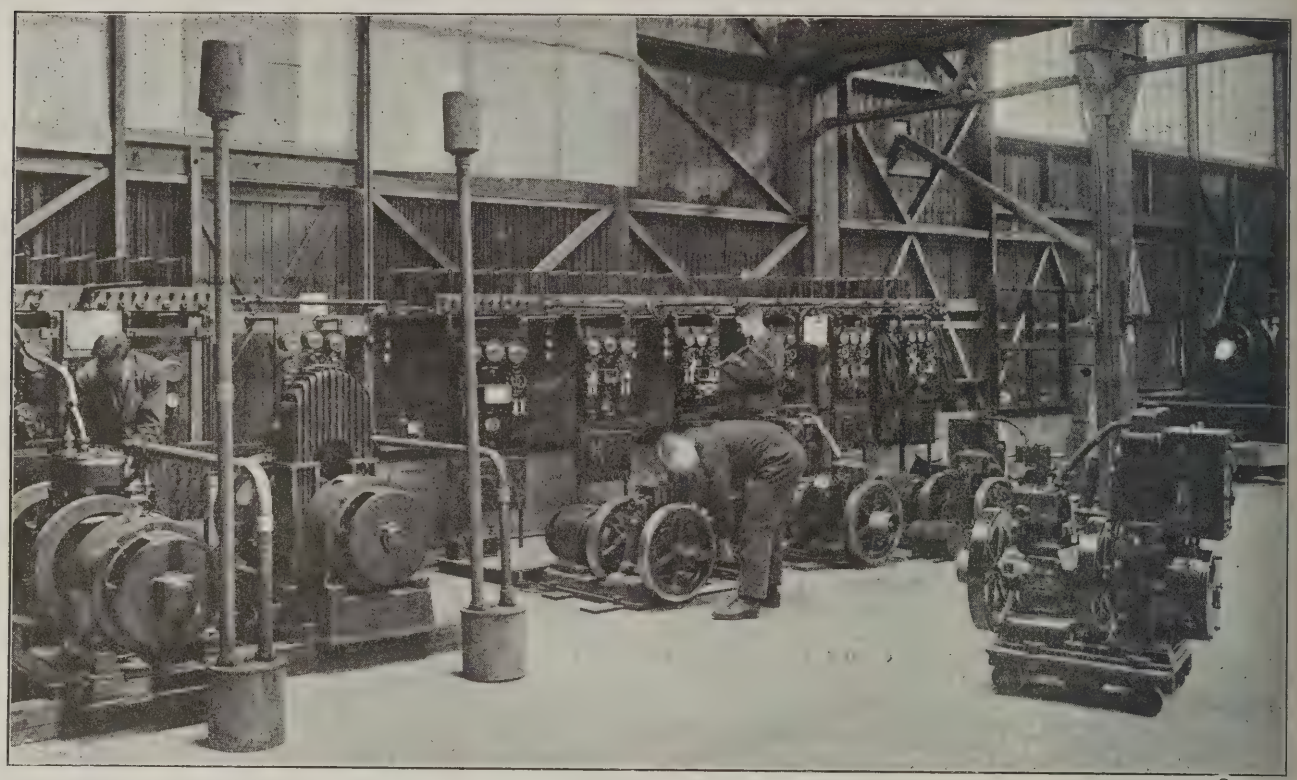
The electrical manufacturing industry in Sweden continued to improve last year. There was an increase in the value of the exports from 18.4 millions of kronen in the months of January-November, 1925, to 24.4 millions in the same period in 1926. In the case of the telephone industry further progress was made last year. The orders booked amounted to about 20 million kronen, of which 16.3 millions applied to foreign contracts. During the year the orders executed represented a value of about 14 millions, and the stock of orders at the beginning of 1927 was 20 millions, or twice the value of those in 1924.

Radio Apparatus Trade in Norway.

Various new broadcasting stations were established in Norway last year and it is said that such stations will cover the whole of the country at no distant date. It is calculated that the value of the wireless receivers already sold amounts to 8,000,000 kr., there being 100,000 registered owners. Good progress has been made with the development of the home radio manufacturing industry, which is claimed to be able to compete with foreign products in the matter of quality.

Messrs. Lister's Jubilee.

Last week Messrs. R. A. Lister & Co., Ltd., Dursley, Gloucestershire, celebrated their jubilee, and part of the proceedings consisted of tours of the works by p. of the company's distributing agents, electrical contractors, agriculturists, and members of the Press. The works is notable for the variety of products which it makes—ranging from butter churns to lighting sets. The shops are well laid out and equipped with the most modern labour- and time-saving machinery, practically all of which is driven electrically—mainly by overhead motors and line shafting. Messrs. Lister have a very large Continental and Dominion connection, generally taking the form of subsidiary companies in the countries concerned, and they have penetrated the United States market to a remarkable degree. In the production of "Lister" engines, which range from the equivalent of one to 10 kW, the work moves through the shops in a logical manner and is thus turned out with a minimum of labour and handling expenses. A feature noticed during the visit was a card on each large machine stating the cost of the machine and the running cost per hour when working and when idle, enabling the operators to understand that machines represent a burden when not running, apart from the stoppage of production. The impression gained from the inspection of the shops is that the work is carried out at a good pace, but without undue hurry. Most of the men are on piecework, which induces a sustained effort and they are afforded every assistance in the way of jigs and tools. It is noteworthy that no female labour is employed in the shops. The engines are subjected to thorough test before leaving the works. Our illustration shows a number of lighting and pumping plants on test in a department which also serves as a "showroom." Although this side of the company's business is very important, there are other branches of equal or greater moment. The works produces agricultural and dairy appliances, including ploughs, cream separators, butter churns, &c., which are known all over the world. Ornamental tubs, fire screens and other woodwork of a domestic kind are also made in large quantities. The stock of timber alone is valued at £25,000. The works covers an area of over eight acres and is well served in the way of transport. One of the latest developments shown to the visitors was an "Auto-truck," a run-about conveyor for workshops and loading platforms. This has a small petrol engine and simple controls. The company extended the most complete hospitality to its visitors during their short stay.



Testing "Lister" Electric Lighting Plant.

A Battery-Charging Chart.

We have received a copy of a new Exide publication which is one of the most useful things that have so far been issued. The primary intention is to provide at a glance all the needful information regarding the re-charging of all types of Exide batteries, and it is suggested that the chart should be fixed in garages, service stations, and any other places where batteries are charged. The comprehensive nature of the information it furnishes is another indication of the readiness of the makers to render the maximum service to all users of batteries and those who undertake the care of batteries. Copies may be obtained on application to the Chloride Electrical Storage Co., Ltd., Clifton Junction, nr. Manchester.

Anglo-French Discussions: F.B.I. Statement.

In view of certain inaccurate statements which have been published purporting to give details as to the scope of the proposed Anglo-French industrial conversations and the composition of the delegations, the Federation of British Industries has issued a statement that, up to the present, no definite arrangements have been made on either point. The present position is that the idea of such a discussion has been accepted in principle by both sides, but that the details remain to be worked out, when an authorised statement will be issued.

British Goods in New Zealand.

British Industries, quoting from the annual report of the New Zealand Association of British Manufacturers and Agents, says that during 1926 the bulk of the Government purchases of hydro-electric equipment, railway material, &c., were made from British firms, though there is still a good deal of business passed to foreign countries which could with advantage be placed in Great Britain. Local bodies have also mainly given preference to British goods. American firms practically control the market in garage air compressors, vacuum cleaners, washing machines, refrigerators, &c., though British makes of electric irons, kettles, &c., are now securing a large proportion of business. In electric cooking ranges there is a wide field for improved British products. Radio sets, &c., require to be more adapted to New Zealand requirements.

A German Export Selling Concern.

It is stated that a number of German electrical firms have formed a joint combination under the title of the Sales Company of the Special Electrical Works, of Berlin, to represent their interests in deliveries on reparation account, as well as in ordinary sales of material to France and Belgium, made by the interested firms. Herr K. Witthauer, of the Poege Electricity Company, of Chemnitz, has been elected manager of the company.

An International Rubber Exhibition.

There opens in Paris to-day (Friday) an International Exhibition of Rubber and Other Tropical Products, in which most of the principal rubber-producing countries are represented. The proceedings will include papers on the production, manufacture, and employment of rubber. The president of the exhibition is Lord Colwyn and the vice-president Sir Wyndham Dunstan.

American Enterprise in Poland.

The main points of an electrification scheme for Poland, involving an outlay of some £5,000,000, to be guaranteed by the Polish State National Economy Bank, have been agreed on in principle between the Polish Government and the representatives of the European and American Utilities Corporation. The machinery required will be imported from the United States. The American group is to obtain a long-term concession for the exploitation of the scheme, the final signature of which is expected shortly.—*Reuter* (Warsaw).

Our Foreign Electrical Trade.

The following were the values of imports and exports of electrical goods and machinery during December:—

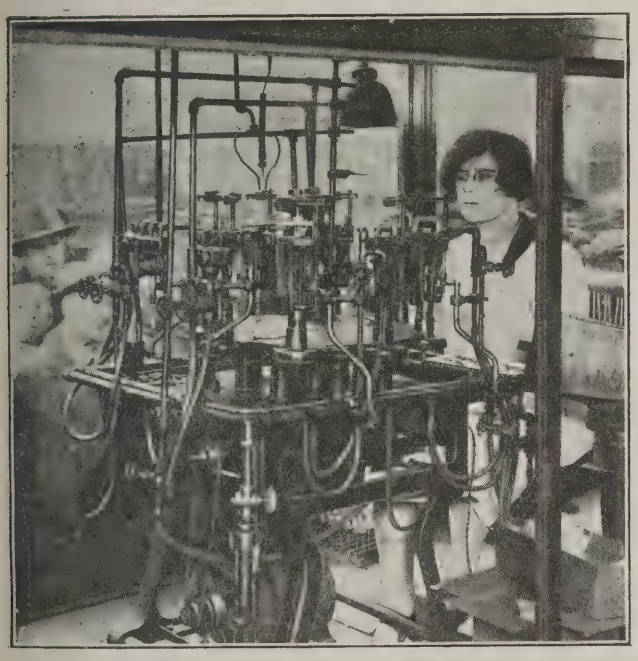
	December, 1926.	Inc. or dec.	12 months, 1926.
Imports—	£	£	£
Electrical goods and apparatus	395,079	− 16,647	− 490,965
Machinery	1,129,374	− 40,961	+ 839,222
(Electrical machinery)	145,790	+ 43,484	+ 68,222
Exports—			
Electrical goods and apparatus	1,022,706	+119,712	+ 582,025
Machinery	3,782,147	−554,956	−3,515,314
(Electrical machinery)	511,691	− 32,727	+ 54,739
Re-exports—			
Electrical goods and apparatus	21,289	+ 6,346	− 39,715
Machinery	121,383	− 47,878	− 200,493
(Electrical machinery)	7,698	− 107	− 14,911

Works Visit.

Forty-two members of the Association of Women Science Teachers paid a visit to the Osram Lamp Works, Hammersmith, on January 7th. The party was greatly interested in the various processes connected with the manufacture of "Osram" lamps and valves which were witnessed.

Valve-Making in a Showroom Window.

The movements of a machine fascinate the general run of people, and if the action is complicated the attraction is increased. It was therefore an excellent idea of the Edison Swan Electric Co., Ltd., to fix a valve-stem-making machine



Valve-making Publicly Demonstrated.

in one of the windows of its Queen Victoria Street showrooms. The process was one entering into the production of the company's "R.C.2" valves, which are being extensively advertised, and large cards were placed near the machine explaining the working of the machine. The result was that large crowds of people were attracted to the window all day long, and the interest thus aroused must have had the effect of impressing the company's name and its products upon the minds of these people.

A Receiver and a Power Company's Plant.

Mr. Justice Romer, in the Chancery Division on Wednesday, had before him an application by the Cleveland and Durham County Electric Power Co. in the debenture holders' action, Stewart *v.* Richardson, Duck & Co., Ltd., of Stockton-on-Tees, for a declaration that it was entitled to remove from the respondent company's premises a transformer and other electrical plant which it had installed there, in spite of the fact that a receiver of the company's assets had been appointed by the debenture holders.

The application was opposed by the receiver and the trustees for the debenture holders on the ground that the applicants were not entitled, under their agreement, to remove the plant until 16 years from the year 1915.

His LORDSHIP granted the application, but said it must be without prejudice to any obligation of the applicants to supply the respondent company with electricity.

Book Notices.

"Radio for the Million." Vol. 1, No. 1; pp. 48, illustrated, including diagrams and blue prints, and priced. London: Mullard Wireless Service Co., Ltd. Price 1s.—The aim of this quarterly publication, which is to be supplied free to the general public, is to provide those who have no knowledge of the technicalities of the subject with the essential constructional details of good-class receivers in a simple and understandable form. The importance of selecting the correct valves to use is stressed, for upkeep cost depends upon a wise choice, and full details of Mullard "PM" valves are included.

"Quarterly Review." January, 1927. London: John Murray. Price 7s. 6d.

"Post Office Electrical Engineers' *Journal*." Vol. LXIX. Part 4. January, 1927. London: The ELECTRICAL REVIEW. Ltd. Price, 1s. 6d. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LXV. January, 1927. No. 361. London: E. & F. N. Spon, Ltd. Price, 10s. 6d.

Calendars and Diaries.

Once again we have to return thanks for the kind wishes of a number of friends and for calendars, &c. Among the latter is one from MESSRS. ROPER BROS., 5, South Anne Street, Dublin. This is an elliptical wall card with a block of daily slips; the national emblem is given prominence.

From MESSRS. SAULTERS PATENT COILING DEVICE, 240, Lower Road, S.E.8, we have received a wall calendar with monthly sheets and an illustration of the device which gives the firm its name.

The Lytham St. Annes Electricity Department has sent two different calendars. One, which is intended for private residences, is very ornate, and bears a reproduction of a river scene in colour. The other is for golf clubs, hotels, &c.; it has a matchbox holder, and depicts a caddy with a patch upon his trousers on which matches can be struck. Both calendars have monthly date slips.

MR. J. MARTIN BLAIR, of Amberley House, Norfolk Street, W.C.2, has sent us a porcelain "Midget" insulator, made in Holland, in the form of a paper weight, representing the little couplings so named.

For 1927 the D.P. BATTERY CO., LTD., of Bakewell, Derbyshire, has again prepared a large wall calendar bearing a charming view in colour of the Bakewell country. Monsal Dale is the choice on this occasion.

We have to thank the RELAY AUTOMATIC TELEPHONE CO., LTD., of Marconi House, London, for a very neat ash tray in insulating material.

Trade Announcements.

The BILLING TOOL CO. has removed to larger premises at 89, Great Eastern Street, E.C.2, where it has opened showrooms. (Telephone: Central 7036-3).

The LONDON ELECTRICAL CO., of 1, Sherborne Lane, E.C.4, and other addresses in London, desires it to be known that it is in no way connected with the firm bearing the same name and recently trading under that title at Cardiff, and mentioned in our "Bankruptcy Proceedings" section to-day as well as in our issue of January 7th.

The ACME ELECTRIC WIRE & CABLE CO., LTD., of Shardlow, has opened a depôt at 12, City Garden Row, City Road, London, N., where stocks of cables, flexibles, and bell wires will be held. Telephone No.: "Clerkenwell 3197."

It is announced that the goodwill and stock-in-trade of the electrical engineer's business carried on by the late Mr. William Cargill at 14-16, Hilltown, Dundee, under the firm name of W. Cargill & Co., has been sold to Mr. JAMES HACKNEY, electrical engineer, residing at 93, Cobden Street, Dundee. Mr. Hackney will continue the business at the same address under his own name. Mr. P. J. McIntyre, C.A., 20, Reform Street, Dundee, will attend to debts.

Electric Heating and Hardware, Ltd., of Birmingham, have appointed the "QUICKFIX" ELECTRICAL FITTINGS CO., LTD., of 47, Sauchiehall Street, Glasgow, C1, as agents for their "Komet" and "Glowincoal" productions in Scotland, and large stocks will be carried.

New Catalogues and Lists.

MESSRS. SPENCER (MELKSHAM), LTD., Melksham, Wilts.—A pamphlet dealing with the company's gravity shutes and conveyors.

The BILLING TOOL CO., 89, Great Eastern Street, E.C.2.—List No. 48, containing illustrations and prices of hand and machine tools.

THE MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—A coloured poster and an illustrated and priced folder advertising "Marconi" valves. In the folder diagrams of typical receiving circuits are given.

MESSRS. HOUGHTON-BUTCHER (GT. BRITAIN), LTD., 88-89, High Holborn, W.C.1.—"Houghton's Radio News," containing notes on various radio components and accessories, as well as price and discount revisions.

AUTOMATIC & ELECTRIC FURNACES, LTD., 173-175, Farringdon Road, E.C.1.—Heat Treatment Bulletin No. 37, "Theory and Practice in the Hardening Shop," dealing with the use of Wild-Barfield electric furnaces.

MESSRS. HERBERT MORRIS, LTD., Loughborough.—A booklet illustrating and describing the "Morris" runway.

ENGINEERING AND LIGHTING EQUIPMENT CO., LTD., Sphere Works, St. Albans.—Catalogue No. 8, a well-illustrated list of industrial lighting fittings of many patterns for street lighting, docks and wharves, collieries, mills, &c. Full prices are given.

MESSRS. YOUNG & WILDSMITH, 20, Bloomsbury Street, W.C.1. —A list of "Association" radio valves of all makes, with details and prices.

KING'S SIGNS, LTD., 23, Collinwood Street, S.E.1.—A price list of advertising signs and brackets.

MESSRS. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.1.—List No. 39, containing illustrations, particulars and prices of domestic appliances, cables and wires, wiring materials, lighting fittings, violet-ray apparatus, &c.

MESSRS. HANS RENOLD, LTD., Didsbury, Manchester.—A January pocket-book blotter advertising standard chain drives.

THE BRITISH CENTRAL ELECTRICAL CO., LTD., 6 and 8, Rosebery Avenue, E.C.1.—An illustrated price list of switch- and fuse-gear, adaptors, plugs and sockets, flexible cords, cables, &c.

MESSRS. J. H. TAYLOR & CO., Macaulay Street, Huddersfield.—The "Reliability Wireless Guide," giving particulars and prices of all kinds of radio apparatus.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—Leaflet No. 77, describing the "Philips" rectifier for radio battery charging; and Leaflet No. 78, dealing with a h.t. supply unit for working off a.c. mains. Both are priced.

THE EQUIPMENT AND ENGINEERING CO., 2 and 3, Norfolk Street, Strand, W.C.2.—A brochure containing illustrations of the company's destination indicators and accessories fitted to omnibuses in various parts of the country, as well as pictures of the equipment itself.

MESSRS. WILLIAM C. JONES, LTD., Collyhurst Waste Mills, Manchester.—An illustrated brochure describing the production and packing of "Jonex" cotton waste. Also a sample in a cellophane wrapping.

Bankruptcy Proceedings.

COMTON WIRELESS MANUFACTURING CO. (A. P. Pacifico, J. P. Pacifico, and R. Feitelson), 26-28, Bartholomew Square, E.C.—This firm failed last June, and an application for an order of discharge was made last week to Mr. Registrar Mellor at the London Bankruptcy Court by the bankrupt Feitelson. The Official Receiver reported that the provable claims amounted to £2,552; the assets, valued at £1,830, had realised £332; and a dividend of 1s. 6d. in the £ was expected to be paid. The failure was attributed to the trade slump; heavy depreciation in the value of stocks; to general trade depression following the general and coal strikes, and to other causes. The application was opposed by the Official Receiver on statutory grounds. His Honour granted a discharge subject to judgment for £5 to be satisfied by an immediate cash payment.

N. H. PAYNE, 4, The Triangle, Teignmouth, late 11, Queen Street, Dawlish, electrical and radio engineer.—The public examination of this debtor was held on January 13th, at Exeter. The statement of affairs showed ranking liabilities of £798, against assets of £560. Debtor attributed his failure to his having no free capital to enable him to tide over the period of long term credit he had to give customers, and to his liabilities being considerably increased by creditors suing. He stated that he commenced business in 1925 without capital. He had never prepared any balance sheet to ascertain his position. He had borrowed from relatives, and had been sued by 24 creditors since March. The examination was closed.

A. A. WILLIAMS, 22, Elgin Mansions, Maida Vale, N.W.—The public examination of this debtor took place last week, before Mr. Registrar Mellor, at the London Bankruptcy Court, the accounts showing liabilities £1,328, against assets valued at £6. The debtor stated that in February, 1923, he was associated in the formation of a company styled "Radio Phonopore and Electricals, Ltd.," the nominal capital of which was £5,000, divided into 5,000 ordinary shares of £1 each, of which he subscribed for 1,000 shares. He was appointed joint managing director of the company, which, however, was considerably embarrassed through lack of sufficient working capital, and in January, 1926, he and his co-directors had recourse to a professional moneylender, from whom they borrowed the sum of £1,000 on their joint and several promissory note for £1,300; the whole of the principal was used in, and for the purpose of, the company, and he personally received no consideration. The company defaulted in the first repayment instalment to the moneylender, and in May, 1926, judgment was given against him and his co-directors jointly in respect of their liability. The company went into liquidation in June, 1926, and shortly afterwards these bankruptcy proceedings were initiated at the instance of the aforesaid moneylender. The debtor attributed his insolvency entirely to this liability. The examination was concluded.

G. MELLOR, electricians' agent, 59, New Oxford Street, W.—This bankrupt applied to Mr. Registrar Francke, at the London Bankruptcy Court on January 14th, for an order of discharge. The Official Receiver reported that the applicant failed in April, 1926, with liabilities of £450, and assets of £8. He commenced business in November, 1924, as an agent for manufacturers of wireless apparatus, and traded at Vernon House, Sicilian Avenue, W.C., under the style of "Mellors." Although he had no capital he did a very good business for a time in radio crystals, but closed down in August, 1925. His Honour granted a discharge, subject to judgment for £100, to be satisfied out of the applicant's future earnings.

D. T. DONOVAN and H. A. LANGLOIS, trading as the London Electrical Co., 119, St. Mary Street, Cardiff, late 124, Queen Street, Cardiff.—The first meeting of creditors was held on January 7th, at 34, Park Place, Cardiff. The statement of affairs had been lodged, and the matter was left with the Official Receiver as trustee of the estate.

W. K. COXON (separate estate) (trading with E. R. Weare as the Western Mfg. Co.), wireless apparatus manufacturer, Nurshill, Lydney.—Last day for proofs for dividend, January 28th. Trustee, Mr. C. Latham, 78, New Oxford Street, W.C.1.

E. D. S. MUNDAY, electrical engineer, 272, Lake Road, Portsmouth.—Last day for proofs for dividend, January 29th. Trustee, Mr. H. Ashton, Official Receiver, 87, High Street, Portsmouth.

G. W. TEMPEST (Northern Radio Co. and General Wireless Trading Co.), radio and telephone engineer, 40, Brazennose Street, Manchester.—Last day for proofs for dividend, January 24th. Trustee, Mr. A. Yearsley, 27, Brazennose Street, Manchester.

J. R. HEREFORD-LAVEY AND V. DE FRECE (Radio Cash Stores), 371, Upper Street, Islington, N., 5, New Station Street, Leeds, and Parliament Street, Nottingham.—Last day for proofs for dividend, January 28th. Trustee, Mr. C. Latham, 78, New Oxford Street, W.C.1.

H. L. WOOD, electrical engineer, late of Elm Grove, Southsea.—First and final dividend of 1½d. in the £, payable at the Official Receiver's Office, 87, High Street, Portsmouth.

H. E. PARRIS (St. George's Electrical Mfg. Co.), 134, Upper Thames Street, late of Sydenham.—Bankrupt discharged January 14th, 1927.

Company Liquidations.

KNIVETOWN ELECTRIC WIRE CO., LTD., electrical engineers and radio manufacturers, Queensway, Ponders End, Middlesex, and 32, Sun Street, E.C.2.—A meeting of creditors was held on January 10th at the Institute of Chartered Accountants, E.C. The chair was occupied by Mr. S. W. Tubbs, of Messrs. Dixon, Wilson, Tubbs & Co., C.A., 24, Basinghall Street, E.C., the liquidator of the company. The statement of affairs presented showed liabilities of £4,647, of which £3,387 was due to the trade, and Mr. H. C. Bayldon, one of the directors of the company, was a cash creditor for £1,260, having paid off the claim of the bank under his guarantee to them. The net assets were £4,537, leaving a deficiency so far as the creditors were concerned of £110. The preferential claims included an amount in respect of income tax, but having regard to the trading losses of the company, it was thought possible that the claim might be withdrawn. The stock had only been written down by 20 per cent., as there was a possibility of a sale as a going concern taking place. The plant and machinery had been written down by about £600; it was comparatively new. The issued capital of the company was £8,386, and as regarded the shareholders, there was a deficiency of £8,496. The company was registered on April 9th, 1925, with a nominal capital of £1,000, and Messrs. Frank and Harold Kniveton were appointed life directors. The company rented a factory at Enfield, and equipped it. The capital was increased to £2,000 on May 14th, 1925, the additional £1,000 being subscribed in cash. In June, 1925, Messrs. Arthur and Samuel Jones were appointed directors of the company, but retired the following September, when Engineer-Commander W. H. Waters and Mr. H. C. Bayldon were appointed to fill the vacancies. In October, 1925, the share capital was increased to £8,000. On April 13th, 1926, Mr. G. H. Wilkinson, jun., became a director, and subscribed in cash for 1,000 shares, but he resigned in the same month. A little later the company's capital was increased to £10,000. Offices and stores at Sun Street were opened in June, 1926, for the purpose of carrying on the business of wholesale dealers in the products of the company. Mr. H. Kniveton was appointed the branch manager. Mr. Tubbs stated that the company had suffered from lack of capital. During the year ended March 31st, 1926, the turnover was £9,006, with a gross profit of £539, and a net loss of £1,106. Between April 1st and December 20th last the turnover increased, the sales being £9,184, but there was a net loss of £3,879. Owing to the loss on the trading, Messrs. F. and H. Kniveton agreed to forego the greater part of their remuneration for the year, amounting to an aggregate of £800. The heavy losses sustained were apparently due to incorrect costing, and the expenses of administration. There were two or three works' managers, or gentlemen who occupied a corresponding position, for a turnover of only £9,000 a year. Last November and December matters were brought to a head by several of the larger creditors commencing proceedings, and it was then decided that the company should go into voluntary liquidation. A creditor said that the preliminary expenses appeared rather heavy, and the chairman replied that shares to the value of £800 each were voted to Messrs. Kniveton, and that

accounted for £1,600. Some of those shares were subsequently sold for cash, and the money went to the company. Mr. Kniveton said that during 1925 and 1926 the sales of radio goods were extremely low at certain periods. Then the company had rush orders, which had to be executed. In the lean times they were obliged to keep on the workers, although there was not sufficient work for them. The result was that at periods large amounts had to be paid in wages, and there was not an adequate return. The prices which the company had obtained for its goods, and the allowances made, were the highest possible in the trade. A suggestion was made that another liquidator should be appointed, but this was not agreed to, and a resolution was passed confirming the appointment of Mr. Tubbs as the liquidator, whilst a committee of the principal creditors was also nominated. The following are creditors :—

	£		£
Ariadne Draht-und Kabel-Werke	575	Guido Horn	114
Albion Sewing Cotton Co., Ltd.	503	Turner Bros. Asbestos Co., Ltd.	77
Mather, Ormesher & Co., Ltd.	385	Johns, Son & Watts, Ltd.	71
McConnel & Co., Ltd. ...	200	Booth & Co., Ltd. ...	70
Charlesworth, Peebles and Co.	182	Ormerod Bros., Ltd. ...	62
Blades, East & Blades, Ltd.	136	General Electric Co., Ltd.	53

AUTOMATIC COMPANY (BRISTOL), LTD., electric sign manufacturers, Broad Quay, Bristol.—A meeting of creditors was held recently at the offices of Messrs. Cozens, Bate & Co., Baldwin Street, Bristol. Mr. W. L. Bate, the liquidator in the voluntary liquidation of the company, submitted a statement of affairs, which showed liabilities of £852, all of which were due to the trade. The assets were estimated to realise £643, leaving a deficiency so far as the creditors were concerned of £208. The company was registered in August, 1923, with a nominal capital of £3,000, of which £2,550 had been issued and was fully paid. Between August, 1923, and December, 1924, there was a loss of £67 on the trading, but in 1925 a profit of £68 was earned. The creditors passed a resolution confirming the voluntary liquidation of the company, with Mr. Bate as liquidator, whilst a committee was also appointed consisting of the representatives of Messrs. Dunn & Co., Pinchin, Johnson & Co., and T. Reynolds and Son. The following are creditors :—

	£		£
Ackroyd & Best, Ltd. ...	74	Reynolds, T., & Sons ...	35
Chappell & Co., Ltd. ...	31	Russian Oil Products, Ltd.	22
Dunn & Co.	125	Simpson, Baker & Co....	33
General Electric Co., Ltd.	33	Cook, N. F., & Son ...	40
General Tyre Co. ...	21	Protection Lamp and Lighting Co.	102
Pinchin, Johnson & Co., Ltd.	61		

SLOGASIGNS, LTD., 51, Bethnal Green Road, E.—The first meetings of creditors and shareholders were held last week at Carey Street, W.C., before Mr. E. T. A. Phillips, Official Receiver. A statement of affairs was presented showing liabilities of £1,594, against assets valued at £476, and a deficiency of £6,117 with regard to contributories, the issued capital being £5,000. The chairman reported that the winding up order was made on November 9th, 1926. The failure was attributed to insufficient capital; the necessity for further experiments with the devices instead of being able to put them straight on the market as was anticipated; and to the restrictions put by the Government on the use of electricity owing to the general and coal strikes. The liquidation was left in the hands of the Official Receiver.

DOMESTIC & GENERAL ELECTRICAL CO., LTD.—A meeting of members is called for February 18th, at the offices of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C., to hear an account of the winding up from the liquidator, Mr. W. A. J. Osborne.

BUCKS ELECTRIC WIRE & ENGINEERING CO., LTD.—A meeting of members is called for February 18th, at the offices of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C., to hear an account of the winding up from the liquidator, Mr. W. A. J. Osborne.

COMPRESSION STARTER & SWITCHGEAR CO., LTD.—A meeting of members is called for February 14th, at the offices of the British B.A.G., Ltd., Ormes Buildings, Parsonage, Manchester, to hear an account of the winding up from the liquidator, Mr. J. Abson.

Private Arrangements.

CLEARTRON RADIO, LTD., 1, Charing Cross, S.W.—A meeting of the principal creditors was held recently at the company's offices, when a statement was made by one of the directors. It appeared that the company had an issued capital of £55,000, and last year negotiations were entered into with the object of raising additional capital to the extent of £100,000, in order to extend and consolidate the business, but the matter fell through. There was an overdraft at the bank, and debentures for £30,000 were created. With that money the bank was paid off, and the balance was utilised in discharging pressing debts. One or two creditors had commenced proceedings, and if judgment was obtained, the debenture holders might appoint a receiver. Since November, fresh negotiations had been commenced with a view to raising further capital, and it had been decided to call the principal creditors together in order to ask them to refrain from taking steps against the company, as it was believed that the negotiations could be carried through and the business continued successfully. The principal creditors decided to recommend the creditors generally to hold their hands for the time being. It was also decided that the meeting should be adjourned, and it was hoped by the time of the adjourned meeting that the negotiations would be carried to a successful issue. It was also suggested that Mr. Bertram Day, a large creditor, should be appointed to the board. The suing creditors would be asked to stay their hands. The liabilities, apart from the debentures, were stated to be about £30,000.

Dissolution of Partnership.

DEESIDE RADIO SERVICE, wireless instrument makers, 33, Grange Road, West Kirby, Chester.—Mr. J. L. Bull and Mr. K. W. Pardoe have dissolved partnership. Mr. Bull will attend to debts and continue the business.

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from January 12th :—

Octron. No. 475,558. All goods in Class 6. No. 475,559. All goods in Class 13. No. 475,560. All goods in Class 18.—H.S. Electric, Ltd., 32, Charles Street, Birmingham.

Contax.—No. 469,382. Class 8. Telemeters, searchlights, &c.—Contessa-Nettel Gesellschaft, Stuttgart. (British representatives : Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Sifam. No. 473,522. All goods in Class 8.—Sifam Electrical Instrument Co., 95, Queen Victoria Street, E.C.4.

Herculene. No. 475,891. Class 8. Electric cables.—W. T. Henley's Telegraph Works Co., Ltd.

Social Events.

The Committee of the G.E.C. Social and Athletic Club was "At Home" to the junior members of the staff at Magnet House on the evening of January 7th, when 150 members were entertained. Dancing, games and conjuring contributed towards a most pleasant evening. Sir Hugo Hirst, the president of the club, who was accompanied by Mr. L. C. Gamage (the chairman) and Mrs. Gamage, addressed those present. Mrs. Gamage presented and distributed prizes to the best dancers in a special competition.

The Magnet Club of Fraser & Chalmers Engineering Works, Erith, held its third dance of the season in the Belvedere Public Hall on January 8th, in which over 100 members of the club and their friends took part. Special "G.E.C." lighting effects, combined with the decorations, added to the enjoyment of the evening.

The annual dinner of the Willesden Polytechnic Electrical Engineering Society will be held on Saturday, February 12th (the 25th anniversary of the Society's formation), at the Café Marguerite, Oxford Street, the president, Mr. Frederic H. Taylor, A.M.I.E.E., A.M.I.Mech.E., in the chair. Old members of the Society should apply for tickets to Mr. T. Bowen, the hon. sec.

Mr. Arthur Cozens, registered electrical contractor, of Ascot, Camberley, Clacton, and Henley, again entertained his staff and friends of the firm at a New Year's party and dance at the Cordes Hall, Sunninghill, on January 7th, over two hundred being present. Dancing commenced at 7.30 and was followed by an entertainment excellently rendered by the Cozens Co-Pessimists. Songs, monologues, &c., were given by Messrs. G. Hyde, A. E. Godden, M. Adams, G. Ross, E. Sales, J. Beckwith, and Barry Cozens. Mrs. Bailey's band provided the dance music. During an interval Mrs. Cozens was presented with a bouquet of carnations.

The concluding portion of the first annual sales conference of the Pirelli-General Cable Works, Ltd., was held at the Royal Pier Pavilion, Southampton, on the 7th inst., and the directors of the company invited the members of the staff and their wives to a supper dance. About 250 people were present, and a most enjoyable evening was spent.

The annual carnival and dance of the staff of Messrs. Johnson and Phillips, Ltd., was held at the Blackheath Concert Hall on January 7th. The attendance exceeded 450 and included Sir Philip Dawson, M.P., Mr. J. Macgregor and Mr. C. Stewart, directors of the company. The costumes were judged by Miss Annie Croft and Mr. Reginald Sharland, of the Shaftesbury Theatre, and the prizes were presented to the winners by Lady Dawson, Mrs. Macgregor and Mrs. Stewart. These prizes were the gift of Mr. H. L. Dawe (South African representative), the provincial branch managers, and Mr. E. P. Weston.

Railway Rates Increase.

According to the Federation of British Industries, the increased rates upon railway goods traffic, mentioned in our last issue, are to come into force on February 1st.

Meter Approved.

The Electricity Commissioners have approved the "Rex" single-phase, type "SIP.1a," induction watt-hour meter (sizes 2.5 to 100 A, 110 to 240 V, at 50 cycles), for which Messrs. THOMPSON & Co., 1, Old Swan Lane, E.C.4, are sole British agents.

Colchester Joins Joint Board.

The Colchester Council has agreed to join the District Joint Board of Employers and Members of Staff (No. 9 area).

A Petters' Indian Award.

Messrs. Petters, Ltd., inform us that their agents for the Bombay Presidency, Messrs. Turner, Hoare & Co., Ltd., were awarded a gold medal at an Agricultural Show held at Poona in October last. This was in respect of a portable chain-driven pumping plant, comprising an 8-b.h.p. "Petter" crude-oil engine and a "Pulsometer" 6-in. centrifugal pump, mounted on a trolley. The Show is said to have been the largest ever held in Asia.

For Sale.

Lytham St. Annes Electricity Department has for disposal surplus generating plant. (See our advertisement pages to-day.)

The Contractors' Dinner.

The annual dinner of the Electrical Contractors' Association and Allied Associations was held at the Trocadero, W., on Tuesday last. The president, Mr. H. J. Miles, was in the chair, and the principal guest was Col. Wilfrid Ashley, the Minister of Transport. The speakers included Sir Hugo Hirst, Bt., and Messrs. P. J. Hannon, M.P., T. E. Alger, R. W. L. Phillips, W. R. Rawlings, J. Y. Fletcher, and H. J. Galliers. A report of the proceedings will appear in our next issue.

The Progress of British Electrical Industry.

At the end of last week several daily papers published statements which had been issued by the British Electrical and Allied Manufacturers' Association regarding the excellent record of the British electrical industry in 1926. As quoted by the *Daily Telegraph*, it appears that in spite of the severe industrial crisis which reigned throughout the last eight months of the year as a result of the coal stoppage, the electrical industry had a record year both at home and abroad. "All branches of production, with the exception of the industrial motor section, have been working full time; thousands of new employés have been engaged to cope with the increased demand, and the leading firms now report that they have work on hand sufficient to last for fifteen months. The orders received for generating plant on home account, due to the new super-power stations being erected in London, Coventry, Bristol, Oldham, Birmingham, and Kearsley in preparation for the national power scheme, were 24 per cent. higher than in 1925 and only 6 per cent. below 1920. On export account the increase over 1925 was 22 per cent., and over 1920 43 per cent., while, for the entire range of business, 1926 was 10 per cent. above all previous records. Britain has become the world's leading supplier of electrical goods, and, in the face of the most intense competition from Germany, the United States and Switzerland, obtained important contracts in 1926, totalling over £20,000,000 in the Dominions, especially India, Australia, New Zealand, and South Africa, in Brazil, Argentina, Japan, China, Norway, Sweden, Poland, France, Italy, Russia, Belgium, Spain, Holland, Denmark, Mexico, Chile, and the United States. Railway electrification, water-power schemes, giant power stations, transmission systems, and industrial electrification formed the bulk of overseas demand, many of the contracts secured being on a scale unparalleled in in the history of the industry. British electrical engineers are active now in almost every country of the world, developing power resources and consolidating everywhere the British reputation for high-quality production and sound design. Export shipments totalled £18,194,000 in 1926, an increase of £630,000 over the previous record year of 1925, and there are indications that 1927 should establish the £20,000,000 level. In electrical machinery the competitive position of the British electrical industry is higher now than at any previous time, and new markets are being opened every year for the British product."

Prices of Materials.

With reference to the lead position, Messrs. James Forster and Co. report, under date January 15th:—"A better demand from consumers, particularly for early delivery, has been experienced this week, which accounts for the firmer tone in evidence in the market."

The Board of Trade returns for December, 1926, are:—Imports 28,504 tons, exports 1,169 tons, left for home consumption 27,335 tons.

Messrs. F. Smith & Co. report, January 18th:—Copper (electrolytic) bars, £63, 10s. inc.; ditto ditto sheets, no change; ditto ditto wire rods, £73, 35s. dec.; ditto ditto h.c. wire, 9 3/16d., 1/16d. inc.

Messrs. James & Shakespeare report, January 18th:—Copper bars (best selected), sheet, and rod, £90, £2 dec.; English pig lead, no change.

Messrs. Edward Till & Co. report, January 18th:—India-rubber, Para fine, 1s. 5d., ¼d. inc.

Recent Contracts.

The METROPOLITAN-VICKERS ELECTRICAL CO., LTD., has received from Spain an order for one hundred and four 230-h.p. motors for motor coaches which are required in connection with an important electrification scheme for two main-line sections of the Norte Railway near Barcelona. The first sections of line to be electrified are from Barcelona to Manresa, a distance of 64 km., and from Barcelona to San Juan de las Abadesa, a distance of 106 km. The system adopted is 1,500 V d.c., with overhead conductor. The passenger stock arranged for comprises 26 train units, each unit consisting of one motor coach and one trailer coach, providing seating accommodation for about 200 people. The mechanical parts for the coaches will be manufactured by the Sociedad Española de Construcción Naval, which is associated with the Metropolitan-Vickers Company, at its Bilbao works. Each motor coach will be equipped with four 230-h.p. motors of the M.-V. self-ventilated series-wound type, each pair of motors being connected permanently in series on the 1,500-V supply. The field system of the motors is arranged for weak-field control, thus giving additional economical running notches on the controller. The trains will operate at an average schedule speed of 32 m.p.h., and will be capable of a maximum speed of 56 m.p.h.

The ELECTRIC FURNACE CO., LTD., 17, Victoria Street, S.W.1, which controls the patent rights, is supplying to Messrs. Edgar Allen & Co., Ltd., Sheffield, an Ajax-Northrup high-frequency furnace for the manufacture of special steel. The furnace, which will be of about 3 cwt. capacity, will be operated by a 150-kW high-frequency motor-generator. This plant is of interest as being the first high-frequency furnace for commercial steel making in this country. Messrs. Edgar Allen & Co. were the first British company to install an electric arc furnace for commercial steel making, a Héroult furnace erected in 1909.

MESSRS. SIEMENS BROS. & CO., LTD., of Woolwich, have received orders valued at £200,000 for automatic telephone exchanges in the Brisbane area for the Commonwealth of Australia (P.M.G.'s Dept.), concerning which we give some particulars in a leaderette to-day.

We learn that the Peking Chinese Electric Light and Power Co., Ltd. (a purely Chinese company, in which there is no foreign capital), has placed an order with the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., for a 10,000-kW turbo-generator.

Reuter's Trade Service reports that the English Electric Co. of Canada has secured a contract for the complete electrification of the Noranda mines.

Unemployment.

The Employment Exchange returns dated January 3rd showed a total of 1,495,000 persons who were totally unemployed. This was 144,755 more than on December 24th and 244,094 more than on January 4th, 1926.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during November last amounted to a value of £39,591, as compared with £48,166 in the corresponding month of 1925.

Electric Locomotives for Spain.

The North of Spain Railway Co. has ordered 22 electric locomotives from the Euskalduna concern. An important part of each of these engines will be manufactured in Switzerland.—*Reuter's Trade Service* (Madrid).

New Italian Companies.

Among the concerns recently organised in Italy are the Società Officine Elettrotechniche e Meccaniche, of Milan, capital 2½ million lire; La Società "Isolo" Fabbrica Isolanti Elettrici Sterlingati, Milan, capital 25,000 lire; La Società Industria Apparecchi Termo-Elettro Sanitari, Milan, capital 30,000 lire; and La Società Forze Idrauliche Alta Maira, Rome, capital 500,000 lire.

The Signs of Trade Revival.

In the article bearing the above heading in our last issue a sentence in the third paragraph—"Unhappily the restlessness of China, Russia, and Mexico are still features in the situation"—should have appeared at the end of the paragraph, as our readers will have seen. The sentence was misplaced during proof correction.

More Birmingham Exhibitors.

We inadvertently omitted MESSRS. EARLE, BOURNE & CO., LTD., and MESSRS. HOLLINGS & GUEST, LTD., from our last week's list of exhibitors in the British Industries Fair. In their capacity of metal and tube producers, Messrs. Earle, Bourne are closely connected with the electrical industry; and the machinery made by Messrs. Hollings & Guest is of special interest to the electrical trades.

Registered Electrical Contractors.

At a meeting of the Executive of the National Register of Installation Contractors, on January 14th, applications by the following for registration were approved:—

Savage, Thomas A., London, W.3.
Winship, William P., South Shields.
Dagleas, James T., South Shields.
Electric Wiring and Repair Co., Cambridge.
Fryer & Howarth, Rochdale.
Gatley & Co., Todmorden.
Velox Tool Manufacturing, Electrical and Wireless Engineering Co., Newcastle-on-Tyne.
Ross, David, Newcastle-on-Tyne.
Deal and Sandwich Electrical Co., Ltd., Deal.
Walker & Co., Smethwick, Birmingham.
Wright, T., & Co., Leicester.

At the same meeting one application was withdrawn and four were declined.

Lighting and Power Notes.

Australia.—TASMANIA.—The transmission line from Waddamanna to Railton, the erection of which has been carried out by Messrs. Armstrong, Whitworth, Ltd., has been completed, and secondary distribution feeders to supply different services on the North-West coast are nearing completion. Satisfactory progress has also been made with the erection of an 88,000-V sub-station at Railton. It is expected that the whole service will be in operation shortly. It will supply electricity to Sheffield, Railton, Devonport, Ulverstone, and Penguin, in addition to the cement works at Railton and the shale oil works at Latrobe.—*Reuter's Trade Service* (Melbourne).

Barnsley.—EXTENSION OF SUPPLY.—The Electricity Committee is to borrow £1,624 for the extension of its electricity supply to Monk Bretton.

Barrow.—ELECTRICITY SCHEME.—The Town Council has decided to make no further application to the Electricity Commissioners for sanction to proceed with the Backbarrow hydro-electric scheme, but has decided to request them to approve of extensions at the existing station by increasing the capacity by 6,000 kW. The cost of this scheme is estimated at £60,000.

Bradford.—ELECTRICITY SCHEME.—It is reported that the Corporation is to proceed with a scheme of extensions to its electricity undertaking, involving a capital expenditure of £300,000. It is proposed to enlarge the present Valley Road works and to erect a boiler-house which will contain extra-high-pressure boiler plant with a pressure of 1,100 lb. per square inch. The pressure employed in this installation will be the third highest in the world, one at Milwaukee having a pressure of 1,400 lb., and another (at Boston, New York) having a pressure of 1,200 lb. per square inch. The estimated cost of this section of the scheme is £80,000, and it is estimated that a saving of 12 per cent. of coal will be made. The Electricity Commissioners have already sanctioned a scheme which includes provision of a 20,000-kW set, and the whole of the scheme will cost approximately £300,000.

Bridge of Allan.—TRANSFER OF ORDER.—The Town Council is to make application to the Electricity Commissioners for sanction to transfer the Bridge of Allan Electricity Special Order, 1925, to the Scottish Central Electric Power Co.

Canada.—MANITOBA.—The third set of 29,000 h.p. at the Great Falls plant of the Manitoba Power Co. on the Winnipeg river was put into commission recently, bringing the capacity of the station up to 84,000 h.p. The ultimate capacity of the station will be 168,000 h.p., and the fourth set is on order and is expected to be in service by August next.

Cockermouth.—ELECTRICITY SUPPLY.—The Urban District Council on January 5th decided to appoint a committee to go into the question of providing an electricity supply for the town.

Continental.—BELGIUM.—A new power station is being established at Moli by the Société d'Electricité de la Campine. The plant will comprise two 10,000-kW turbo-generators, supplied by the Ateliers de Constructions Electriques de Charleroi, and Brown Boveri & Co., of Baden, Switzerland.

FRANCE.—The Compagnie d'Electricité Industrielle, of Paris, has recently secured a concession to establish a hydro-electric plant to utilise the water power of the River Pique near Saint Aventin in the Upper Garonne Department.

Dewsbury.—ELECTRICITY EXTENSIONS.—The Electricity Committee has authorised the expenditure of £8,000 for extension of the h.p. main from the generating station to various districts. The scheme involves the erection of four sub-stations.

Douglas (I.O.M.).—NEW STORAGE BATTERY.—Owing to delay in proceeding with the scheme of extension it will be impossible to have the new plant completed for next season's load, and in the circumstances the Committee has decided to duplicate the existing storage battery at an estimated cost of £4,000.

Eastbourne.—LOAN SANCTION.—*Correction.*—The amount recently sanctioned for sub-station buildings was £250, being an outstanding balance, and not £52,671 as stated in the Finance Committee's report and quoted by us in our last issue.

East Dereham.—PROPOSED BULK SUPPLY.—The Urban District Council has received an offer of a bulk supply of electricity from Norwich Corporation. The cost of an overhead transmission line would be £8,500, and electricity would be transmitted to Dereham at a pressure of 11,000 V. The charge to the Council would be £4 10s. per kW of maximum demand, plus .71d. per kWh for electricity taken. The Council has referred the matter to its electrical expert for advice.

Eastry.—ELECTRICITY SUPPLY.—The Rural District Council has decided to offer no objection to the Order of the South-Eastern Electric Power Co., for the supply of electricity in the area, but the company has been requested to lay cables underground wherever possible when crossing highways.

Edinburgh.—APPLICATION FOR ORDER.—The Corporation recently approved a recommendation of the Electricity and Lord Provost's Committees to promote an Order for powers to construct outlet pipes from the electricity station and a pier at Portobello, and for other purposes. The estimated cost of outlet pipes and pier combined is £60,000.

PRICE INCREASE.—The Electricity Committee has announced that, in consequence of the increase in the cost of coal, there will be an increase in the price of electricity for lighting from 4d. to 4¼d. per kWh as from the beginning of the spring term.

Hatton (near Warwick).—INSTITUTION SUPPLY.—New heating and lighting services are to be installed at the Warwickshire Mental Home, at an estimated cost of £35,638.

Hastings.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £7,000 for services and £1,000 for transformers and sub-station equipment.

Hereford.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £6,000 for electricity purposes.

Huntingdon.—ELECTRICITY SUPPLY.—The Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co. has informed the Town Council that, owing to the action of the Government, it is unable to proceed with the provision of the station at St. Neots as proposed, but it is hoped to provide a supply of electricity for Huntingdon and Godmanchester in eight months' time.

Irish Free State.—DUBLIN.—The City Commissioners have adopted a recommendation to reduce the charge for general heating from 2¾d. to 2d. per kWh. Other reductions and modifications, principally in connection with special classes of supplies, will be put into operation as from the beginning of the last (December) quarter.

ENNISCORTHY (Co. WEXFORD).—The Urban District Council's electricity undertaking is to be formally inaugurated on February 3rd.

Keighley.—LOANS SANCTIONED.—The Town Council has received sanction to the borrowing of £8,095 for mains and £3,011 in connection with the main transmission line from the generating station to the Bingley Urban District Council's distribution station.

Loughborough.—EXTENSION OF SUPPLY.—At a recent meeting of the Town Council a proposal to withdraw an application for sanction to the borrowing of £3,850 and to substitute a more comprehensive scheme for a supply of electricity to Nanpantan was considered. The new scheme involves the raising of a loan of £5,802, and includes the erection of a sub-station and the laying of underground mains to Nanpantan. The matter was referred to the General Purposes Committee.

Luton.—LOAN.—The Town Council has applied for sanction to a loan of £26,636 for supplying electricity to villages near the borough. There have been 178 applications for electricity from the area in question.

Newhaven. — ELECTRICITY SUPPLY. — The Rural District Council has been informed by the Electricity Commissioners that the Peacehaven Electric Light and Power Co., Ltd., has asked that the Council's consent should be dispensed with in connection with an application to supply electricity to the parishes of Piddinghoe and Telscombe. As the Piddinghoe Parish Council has decided in favour of the Order, the Council has withdrawn its objection in respect of that parish, but adheres to its objection regarding the parish of Telscombe, and has asked the Commissioners to hold a public inquiry into the matter.

North-West Midlands Electricity District.—TRANSFER OF UNDERTAKINGS.—At a recent meeting of the Stafford Town Council, a report submitted by the Electricity Committee with regard to the question of the transfer of generating stations by the authorised undertakers in the North-West Midlands Electricity District and the establishment of a Joint Electricity Authority for that district was considered. The Committee stated that it had given careful consideration to proposals contained in a report of a conference of the authorised undertakers, and recommended the adoption of the principles contained in the report, subject to the following reservations: (*a*) That an independent audit be made of each undertaker's capital accounts, which are to form the basis of calculation for the consideration for the transfer of generating stations. (*b*) That the basis upon which the transfer of stations should be made in each case should be the original capital cost, less an amount in respect of depreciation, to be determined at one uniform rate for all buildings to be transferred, and another uniform rate for all plant and machinery to be transferred, without regard to any outstanding liabilities in respect of either building or plant.

Portsmouth.—NEW TURBINE HOUSE.—The foundation stone of the new turbine house at the Corporation power station was laid by the Mayor on January 12th. The new building will house two 10,000-kW sets, and the total cost of the scheme will be approximately £70,000.

ELECTRICITY SUPPLY.—The Electricity Committee is to carry out extensions at the generating station at a cost of £1,700, to extend the mains in the Waterlooville area at a cost of £1,000, and to erect a sub-station near Prospect Road, the cost being estimated at £1,000.

Pwllheli.—INAUGURATION OF SUPPLY.—An electricity supply for the district was formally inaugurated by the Mayoress on January 15th. Electricity is supplied by the Electricity Distribution of North Wales and District, Ltd.

Rugeley. — ELECTRICITY SUPPLY. — The Urban District Council has approved of the draft agreement with the Power Development Co. for a supply of electricity to the district within 2½ years of the granting of the Order.

St. Austell (Cornwall).—ELECTRICITY SUPPLY.—Owing to the disappointment expressed by residents that a supply of electricity should thus be vetoed, the Rural District Council on January 7th rescinded the resolution which it passed recently refusing permission to the St. Austell and District Electric Lighting and Power Co., Ltd., to erect overhead lines in connection with an electricity scheme for Tywardreath and district.

Sheffield.—MAINS EXTENSIONS.—The Corporation Electric Supply Committee has approved extensions of mains, at an estimated cost of £28,227.

Slaithwaite (Yorks.).—LOAN.—The clerk to the Urban District Council reported recently that, in response to an application to borrow £3,150 for electricity extensions, the Electricity Commissioners had suggested that, as the Council would require £2,000 per year for normal extensions, the application should be increased to £7,250, which would cover the amount overspent to April 1st (£1,148), and leave £2,000 for each of the three following year's extensions, the sum of £6,250 being for mains and services and £1,000 for meters. Extensions made up to date had been greater than had been anticipated. The Council agreed to apply for a sum of £7,250.

South Durham.—SPECIAL ORDER.—Application has been made to the Electricity Commissioners by the Cleveland and Durham County Electric Power Co. to amend the draft of a Special Order so as to include certain parishes in the rural district of Darlington.

Spalding.—EXTENSION OF SUPPLY.—The Urban District Council is to apply for a Special Order to supply electricity to Crowland, Borough Fen, and Newborough. The estimated cost, with transformer, meters, and services, is £2,500.

Stoke-on-Trent.—RELAYING CABLES.—The Corporation Electricity Committee is to relay cables in Longton at a cost of £5,700. The Committee has decided that as the North-Western Electricity and Power-Gas Co. has not exercised any of the powers conferred upon it by its Act of 1903 in any portion of its area of supply within the North-West Midlands Electricity District, application shall be made to the Ministry of Transport for an Order annulling the powers of the company, so far as they affect that district.

Walsall.—ELECTRICITY EXTENSIONS.—The Town Council reports that in connection with the extension of Birchills power station, contracts for machinery, amounting to £140,721, have been placed.

Weymouth.—PRICE REDUCTIONS.—The Electricity Committee has reduced the electricity charges by ½d. per kWh, and hopes to effect a further reduction before next quarter.

Tramway and Railway Notes.

Australia.—SYDNEY.—Details of the new underground railways in Sydney and the electrification of the Sydney suburban railway system were given in a recent speech by the Assistant Commissioner of the New South Wales Railways. It had been found necessary, he said, to increase the width of the carriages and consequently to rearrange the tracks. This work, with the erection of overhead equipment and alteration of bridges to carry the overhead lines, was estimated to cost £15,000,000. Rolling stock for the electric services would cost £6,000,000, and the construction of the underground railways £7,000,000. In addition, £4,000,000 had to be paid towards the construction of the Sydney Harbour bridge.—*Reuter's Trade Service* (Melbourne).

Bradford.—PASSENGER SIDINGS.—The Tramways Committee has approved the alteration of Leeds Road tramway terminus to provide passenger loading sidings in Hall Ings, at an estimated cost of £1,537.

Continental.—SWITZERLAND.—Work is in hand on the construction of an electrically-operated cable railway between Lake Trub and Gerschnialp, near Engelberg. The line is being constructed on the Bleichert system, the electrical part of the work being in the hands of the Bell Gesellschaft, of Kriens, Lucerne. The difference in altitude between the upper and lower stations is about 6,560 ft., which, it is expected, will be covered in 10 minutes.

GERMANY.—According to a statement recently issued by the German State Railway Exploitation Co., owing to the existing financial stringency it will not be possible at present to consider the electrification of the railway system in Baden.

FRANCE.—A new mercury-arc rectifier station has lately been brought into operation near the Louvre, Paris, to supply the Nos. 1 to 7 lines of the Paris underground railways. The station, which has a capacity of 3,600 kW, comprises four rectifier-transformer sets of the Brown-Boveri mercury-vapour type, each capable of supplying 1,500 amps. at 600 V. The Compagnie Electro-Mécanique, of Paris, which has carried out the installation, has previously completed one at "La Nation" station, and is at work on a third transformer plant at the Saint Antoine station.

JUGO-SLAVIA.—It is reported from Belgrade that the Municipal Council proposes to extend the tramway network, enlarge the central generating station, and construct water mains, &c. Consideration is being given to an offer of credit of from $15,000,000 to $20,000,000, which is said to have been made by American circles for these purposes.

United States.—RAILWAY ELECTRIFICATION.—According to the *Tramway and Railway World*, work is in hand on an electrification scheme on the Great Northern Railway. The present undertaking involves the revision of the original electrification between Tye, Washington, at the western end of the Cascade Tunnel and the eastern portal of the same tunnel, and the extension of the electric lines westward to Skykomish, Washington. The electrified mileage will thus be increased from 4 miles to 24 miles of main-line track, exclusive of sidings. This project constitutes what is reported to be the first step in a programme that will include 96 miles of main line *via* a new tunnel, from Gold Bar to Wenatchee.

Telegraph and Telephone Notes.

Communication with Aircraft.—TELEGRAPHY TO SUPERSEDE TELEPHONY.—In order to bring into effect the decision of the International Commission for Aerial Navigation that wireless-telegraphy instead of wireless-telephony shall be used for normal communication between air liners and aerodrome ground stations, which was embodied in regulations that came into force this year, flying mechanics of Imperial Airways, Ltd., are being trained as operators at the Marconi Co.'s College at Chelmsford. Hitherto wireless-telephony has been employed for the convenience of pilots who have themselves been able to speak direct to Croydon or other aerodromes. With the increasing volume of air traffic, however, it has been considered advisable to relieve the pilot of large passenger-carrying machines of this duty, and Morse-code telegraphy is to be gradually introduced in order to speed up traffic and avoid confusion. To provide for this change, the regulations lay down that all machines carrying 10 or more passengers must include a qualified wireless operator in the *personnel*, who will give his undivided attention to the wireless service. No change in the apparatus used on Imperial Airways machines will be involved, as the Marconi AD-6 aircraft set, which is their standard equipment, may be used either for telephony or telegraphy by the simple movement of a switch; telephony can still be used, of course, when desired.

India.—BURMA TELEGRAPH TROUBLES.—Complaints are made regarding the inefficient telegraph service between Burma and India, and when the Director-General of Posts and Telegraphs recently visited Rangoon, the Burma Chamber of Commerce represented to him that a submarine cable should be laid between Rangoon and India; however, the sea bed is singularly unfavourable to such an enterprise. A senior officer of the engineering branch has been instructed to inspect the lines between Burma and India, and Rs.1½ lakhs have been sanctioned for the overhaul of these wires.

TELEPHONES IN BURMA.—The Posts and Telegraphs Department has, during the past two years, linked outlying places by public telephone circuits. In every case this has been done by making use of the existing telegraph wires, as the traffic would not be sufficient to justify the cost of erecting special telephone wires. The facilities thus provided have been much appreciated by the public, and Mandalay has in this way been linked with Maymio, Rangoon with Pegu, Thanatpin, Syriam, Kauktan and Tavoy with Harmingyi.

RANGOON'S FIRST WIRELESS TELEPHONE.—The Port Authorities in Rangoon have introduced a wireless telephone, the first one in Burma, between the Port Offices and the pilot vessel *Beacon*. The telephone is fitted with an automatic calling device, and the installation is capable of communicating with vessels at sea for a distance of 200 miles.

TELEPHONES IN CALCUTTA.—The report of the Calcutta Telephone Corporation for the year ended June 30th, 1926, draws

attention to the growth in traffic since the message rate system was introduced toward the end of 1924. The average cost of an exchange line has dropped from 23 rupees to 21 rupees 8 annas a month, and the number of lines has been increased by 100 a month. Ineffective calls have been reduced from 36 to 20 per cent. The profit for the year amounted to 570,000 rupees, says *Commerce Reports*. The number of exchange, extension, and private lines in Calcutta totals 11,549 for a population of 1,328,000.

Iceland.—TELEPHONE SERVICE.—Official figures show that the telephones in use now total 1,507,000, representing an increase last year of 145,000, the largest increase yet recorded, or 10.8 per cent. There is thus one telephone to every 29 persons, which leaves Britain still inferior to Iceland, with its one telephone to 26 persons. During the past year 170 new exchanges were opened.

Portugal. — SUBMARINE CABLE CONTRACT. — From Milan, Italy, we learn that a definite contract has lately been arranged between the Società "Italcable" and the Portuguese Government for the laying of new submarine telegraph cables between Lisbon, Malaga, Azores and Cape Verde. The Italian submarine cable system will, as a result, be notably increased by a new cable which, starting at Anzio, will cross the Tirreno and then continue across to Corsica and Sardinia, thence to Barcelona and on to Malaga.

Portugal.—INTERSTATE TELEPHONY.—The Portuguese Government is negotiating with the Spanish Government, says *The Times*, with the object of establishing telephone communication between Lisbon and Madrid.

Radio-Telegraphy.—"BEAM" STATION TESTS.—The short-wave "beam" stations recently completed by Marconi's Wireless Telegraph Co., under contract with the General Post Office, for wireless communication between this country and Australia, were taken over on January 14th by Post Office engineers for a week's official test. Preliminary tests indicated that the new Australian stations will provide a service as good as the Canadian, if not superior, says the *Daily Telegraph*. On the English side the transmitting station for the Australian service is situated at Tetney, a village six miles from Grimsby, and the receiving station is at Winthorpe, two miles from Skegness. Both the transmitting and receiving stations are connected by land wires with the Central Telegraph Office of the G.P.O. in London. In Australia the station for transmitting messages to England is near Ballan, fifty miles north-west of Melbourne, while the receiving station is at Rockbank, fifteen miles from Victoria's capital, with which both stations are connected by land wire to the chief telegraph office.

Submarine Telegraphy.—INCREASED OPERATING SPEED.—It is claimed that quicker communication between this country and South Africa is now possible, says the *Daily Mail*, as the result of two years' experiment by the engineers of the Eastern Telegraph Company. By abolishing the system of relaying messages from the islands of St. Vincent, Ascension, and St. Helena, and speeding up the rate at which the signals travel along the cables, it has become possible to receive messages in Capetown at the same instant as they are dispatched by the instruments in London. The new system of regenerator working, as it is called, will enable messages to be transmitted as fast as a person can talk, so it has been called "cable telephony." There will be no increase in charges.

The Telephone Service.—DEVELOPMENT IN LIVERPOOL.—Mr. W. J. Medlyn, superintending engineer, South Lancashire District, Post Office Engineering Department, has sent us a copy of the report of the Liverpool and District Advisory Committee for the year ended December 31st, 1926, which shows that progress has been made in all directions. The equipment at many exchanges has been increased, and complete new manual exchanges have been provided at Hoylake and Upton. A new exchange at Huyton will be ready for service early this year, and arrangements are also well in hand for providing new exchanges at Garston, Maghull, and Stockton Heath. Sites have been acquired for buildings at Prescot and St. Helens, in which exchanges of the automatic type will be installed. During the year 6,762 new telephones were fitted, a net increase of 4,125, or approximately 7¼ per cent. The provision of additional underground cables is proceeding steadily, and several additional long-distance circuits to London and other important centres have been brought into use by means of the repeater stations associated with the main underground cable routes. There has been a further substantial increase in the number of calls dealt with in the district, the total approximating 62¼ millions (58 million local and 4¼ trunk), an increase of 6 per cent. over the previous year. Phonograms numbered 214,000, an increase of 10 per cent., and the new phonogram room at the Liverpool head Post Office has been equipped with the latest type of ancillary panel board. The use of street telephone call kiosks is still being extended. A new coin box, permitting of shillings, sixpences, and pence being inserted, has been introduced in certain towns and, if it proves successful, its issue will be generally extended.

FIRE ALARMS.—The question of extending and improving the system of public fire alarms is under consideration by the Liverpool Corporation.

TELEGRAPHS.—The type keyboards and automatic transmitters on the London and Paris routes have been entirely successful, and this method of working is likely to be extended to other routes. Direct telegraph working between Liverpool and Antwerp has been introduced, and the question of further direct lines between Liverpool and the Continent has been reviewed. The circumstances, however, are not such as to justify any extension in this direction at the moment, but the matter is being kept in view.

Transatlantic Radio-Telephony.—NEW RECEIVING STATION.—In connection with the recently-inaugurated transatlantic radio-telephone service, work is to start at once on the erection of a new receiving station in Fifeshire, on the estate of Sir Donald Makgill, Bart., of Kemback. Three lines of aerial masts will radiate from the station for a distance of three miles each, and in the event of the station proving satisfactory, substantial buildings will take the place of those now to be erected. A lead-encased cable will be laid between Kemback and Cupar Post Office. It is of interest to record the fact that one of the first calls across the ocean was made *via* a Relay automatic telephone installation in the *Daily Express* office in London.

MEXICO NEXT?—Telephone communication between Mexico City and New York is expected to be established this year over a direct wire some 3,000 miles long. It will then be a matter simply of linking up this new development with the transatlantic service. The Mexico City-New York service will be made possible by a "hook up" between the American Telephone and Telegraph Co.'s line from New York to Laredo (Texas) and the International Telegraph and Telephone Co.'s line, which is to be completed between Mexico City and Nuevo Laredo across the Rio Grande from Laredo. The total distance, as the crow flies, is about 2,676 miles, but some 400 miles are added by the telephone route.

Radio Notes.

Australia.—NEW STATION.—Arrangements are said to have been completed for the erection of a new broadcasting station in Melbourne, of the "B" class, on the top storey of a high building in the centre of the city; it will receive no revenue from licence fees, but will rely solely on advertising for its income. The call sign will probably be 3BO and the wave-length 255 metres, with a power of 500 watts. Provision is being made for suitable programmes of music and other special features, and one minute's advertising will be allowed between each item. The station will operate for four hours on each of six evenings a week, Mondays to Saturdays. At the present time Melbourne has two "A" class broadcasting stations (3LO and 3AR) and with the new station it will have two "B" class stations (3UZ and 3BO).

MANUFACTURE.—Good progress is being made with the local manufacture of wireless equipment. One of the largest manufacturers of radio parts is the Electricity Meter Manufacturing Co., Ltd., whose lines are marketed under the name of "Emmco." The latest addition to its plant is machinery for the manufacture of headphones, which are now being turned out in large numbers.

RESEARCH.—Details have been completed of important proposals for conducting organised research into problems connected with broadcasting in Australia. The Broadcasting Co. of Australia Pty., Ltd. (which operates 3LO) recently offered the University of Melbourne a grant of £500 a year for three years to enable the University to undertake wireless research work. The offer has been accepted, and it is understood that a similar offer has been made to the University of Sydney by Farmers Pty., Ltd. (2FC). The research work will be performed by the Faculty of Science under the direction of the Dean (Prof. T. H. Laby).—*Reuter's Trade Service* (Melbourne).

Canada.—WAVE-LENGTHS.—The wave-lengths of the broadcasting stations in some Canadian cities may be changed as a result of negotiations now in progress between Lieutenant-Commander C. P. Edwards, Director of Radio for the Dominion of Canada, and the Hon. Herbert Hoover, Secretary of Commerce in the United States, who has jurisdiction over the broadcasting stations in the Republic. According to *World Radio*, reception in Canada has been far from satisfactory of late owing to the clash of wave-lengths and to the fact that, following the decision of a Chicago court, certain United States stations are poaching on Canadian channels. It is hoped that the necessary legislation conferring full authority on Mr. Hoover may be introduced at Washington.

B.B.C. Advisory Committee.—LISTENERS' LIAISON.—The B.B.C. officially announces that, as the result of a conference of wireless organisations on January 13th, it has been decided to set up an advisory committee representative of four national societies, *viz.*, the Radio Society of Great Britain, the Radio Association, the Wireless Association of Great Britain, and the Wireless League. Capt. Ian Fraser, the blind M.P., who is prominently associated with the Wireless League and Radio Society, has accepted the chairmanship of the Committee, which will have as its main function the establishment of an effective liaison between the national societies of listeners and experimenters and the B.B.C. on matters of mutual interest.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—February 28th. City Council. Two 2,500-kW motor-convertors and accessories, or two 2,500-kW rotary convertors, with transformers and accessories. (B.X. 3124.)*

March 14th. 6,600-V, 3-phase switchgear. (B.X. 3138.)*

March 8th. Postmaster-General's Department. Induction coils and registers. (B.X. 3136); testing instruments. (B.X. 3132.)*

March 7th. State Electricity Commission of Victoria. Paper-insulated lead-covered control cable. (B.X. 3137.)*

March 14th. D.c. switchgear and accessories. (B.X. 3131.)*

SYDNEY.—March 9th. New South Wales State Railways. Two sets of electric overhead travelling crane equipments. (A.X. 4103.)

Argentina.—BUENOS AIRES.—March 15th. Ministry of Marine. Machinery in connection with the extension of electrical generation (involving the enlargement of two existing power stations and the construction of two new ones) at the Naval Base, Puerto Belgrano. (B.X. 3140.)*

March 24th. Department of Navigation and Ports. Electric cranes, pumps, &c. (A.X. 4087.)*

Ayr.—January 27th. Education Committee. Electric lighting installation, school extensions, Prestwick. Mr. William Reid, Education Offices, Ayr.

Barnes.—February 8th. Electricity Department. One 1,000-kW rotary or motor convertor with transformer, l.p. switchgear and connections. (January 7th.)

Belfast.—February 5th. Electricity Department. One induction motor-driven vertical type centrifugal pump. (See this issue.)

Belgium.—IXELLES.—February 18th. Municipal Council. Armoured three-phase cable and armoured l.p. cable. Particulars for 9 fr. 30 c. from Bureaux du Service de l'Electricité, 20, Rue d'Alsace-Lorraine, Ixelles.

January 27th. Belgian Ministry of the Colonies, 7, Place Royale, Brussels. Seven tons of enamelled phosphor bronze wire in two lots, and 2,700 telephone line insulators. Particulars on application from Cahier des Charges. No. 116e.

Carlisle.—January 24th. Town Council. Electric lighting installation, blocks of 50 houses, Lower Sowerby estate. Mr. Percy Dalton, city engineer, 18, Fisher Street.

Clacton.—February 2nd. Electricity Department. Two 1,125-b.h.p. Diesel oil engines, direct coupled to 750-kW, 3-phase alternators; two 750-kW alternators, two rotary-convertors, and e.h.p. switchgear. (See this issue.)

Cheltenham.—January 31st. Corporation. Twelve months' supply of electric lighting fittings. Mr. J. S. Pickering, borough engineer.

Douglas.—February 28th. Corporation. 3½ miles of e.h.p. cable, two synchronous motor alternators. (See this issue.)

Edinburgh.—January 25th. Edinburgh District Board of Control. Electric lighting installation at Bangour Mental Hospital. Mr. J. D. Gibson, surveyor, 60, Frederick Street, Edinburgh.

February 14th. Electricity Supply Department. E.h.p. and l.p. switchgear, e.h.p. and pilot cables. (See this issue.)

January 22nd. Gas Department. One electrically-driven automatically-controlled pump, complete, including all wiring. Mr. H. H. Gracie, engineer and manager, 15, Catton Hill, Edinburgh.

January 31st. Corporation. Structural steel work for extension of turbine house, Westbank, Portobello generating station. City architect.

Egypt.—EGYPTIAN STATE RAILWAYS.—Chief Inspection Engineer, Queen Anne's Chambers, S.W. Signalling materials and 43,420 metres of braided cable.—*Reuter's Trade Service* (Cairo).

Huddersfield.—January 28th. Huddersfield Industrial Society, Ltd., Butchering Department. Electricians' work required at premises, Hillhouse Lane. Messrs. Jos. Berry and Sons, architects, 3, Market Place.

India.—India Store Department. January 25th. Overhead electric travelling cranes. Specifications (5s.) from 15, Belvedere Road, Lambeth, S.E.

10 miles dry core telephone cable. (See this issue.)

Ilford.—February 1st. Electricity Department. 660-V, l.p. paper-insulated cables. (See this issue.)

Liverpool.—January 27th. Electricity Supply Department. Twelve months' supply of materials, including cables and accessories, meters, lamps, &c. (January 7th.)

London.—LONDON COUNTY COUNCIL.—January 31st. Electrical installation at the Hornsey Rise housing estate (approx. 1,100 wiring points). (See this issue.)

HAMMERSMITH.—February 16th. Electricity Department. Twelve months' supply of stores, including several electrical items. (See this issue.)

Macclesfield.—January 31st. Rural District Council. Electric generating plant to supply 24 houses at Gawsworth, consisting of engine, battery, switchboards, cable, small motor and pump; wiring for electric light installation, including lamps and meters. Mr. Geo. Clayton, architect, 4, Wellington Street, Stockport.

Manchester.—January 31st. Electricity Department. Two electrically-driven circulating-water pumps, piping, &c. (January 14th.)

February 4th. One 1,500-kW and one 750-kW motor convertors, with switchgear. (See this issue.)

Newport (Mon.).—February 5th. Electricity Department. Two water-tube boilers, steam and feed-water piping, economisers, air heaters, induced- and forced-draught plant, steel stack and grit catcher, coal and ash conveyors, extension of boiler house, including structural steelwork and foundations. (January 7th.)

New Zealand.—AUCKLAND.—March 22nd. Harbour Board. Electric motors, gearing, shafting, and control gear for the operation of vehicular and passenger gangways at the New Devonport Ferry Wharf. (A.X. 4102.)

Sleaford.—Electricity Works. 50 tons Diesel oil fuel. (January 14th.)

South Africa.—JOHANNESBURG.—February 10th. Municipal Council. Electric cable. (B.X. 3130.)*

Stoke-on-Trent.—February 9th. Electricity Department. Steam and water piping, valves, &c., constructional steel work, platforms, crane gantries, &c. (January 7th.)

Torquay.—Electricity Department. Two vertical circulating-water pumps for Newton Abbot power station. (See this issue.)

Dismantling and removal of four Babcock & Wilcox boilers from Newton Abbot power station. (See this issue.)

Uruguay.—MONTEVIDEO.—February 18th. State Electricity Works. 65,000 kg. unvarnished black iron wire and 10,000 kg. g.i. wire. (A.X. 4019.)*

February 11th. 37,500 electric filament lamps. (B.X. 3117.)*

February 15th. 55,500 iron pieces (angles, ties, bolts, &c.) for overhead lines. (A.X. 4018.)*

March 2nd. Lead fuse wire, silver fuse wire, switches, cable end boxes, compound and insulating type. (B.X. 3159.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Barnes.—Urban Council. Accepted:—

Additions and alterations to switchgear (£1,626).—English Electric Co., Ltd.

Belgium.—Keen international competition was again in evidence last week when the municipal authorities of Schaerbeek opened tenders for the supply of 11¼ kilometres of h. and l.p. electric cable. Offers were received from three Belgian, three German, one Dutch, one French, one Czecho-Slovakian, and two British concerns—the last being the British Insulated Cables, Ltd., and Callender's Cable and Construction Co., Ltd. The quotations ranged from £2,199 to £3,182, the lowest being that of the Société des Câbleries et Corderies du Hainaut, of Dour.

Croydon.—Tramways Department.

10 sets of tramcar electrical equipments.—General Electric Co., Ltd.

Dartford.—Urban Council. Accepted:—

Installing electric light at 188 houses (£5 7s. 6d. per house).—Mr. E. E. Beaven.

East Ham.—Town Council. Accepted:—
Bodies and top covers for 10 double-decked tramcars (£15,870); trucks and brakes (£2,460).—Brush Electrical Engineering Co., Ltd.
Motors, switches, &c. (£4,081).—British Thomson-Houston Co., Ltd.

London.—LONDON COUNTY COUNCIL.
Dry cells.—Edison Swan Electric Co., Ltd.

SHOREDITCH.—Lighting Committee. Accepted:—
House-service cable, 1 mile 19/.052, 1 mile 7/.064, 2 miles 7/.052 (£1,280).—W. T. Glover & Co., Ltd.
Electrical installation work at the City Corporation Dwellings, Shepherdess Walk, and the L.C.C. Dwellings, Horner House.

	City Corporation Dwellings.	Horner House, L.C.C.
Barlow Bros. & Co.	£1,463	1,130
Electrical Installations, Ltd. ...	1,485	1,124
Malcolm & Allan, Ltd. ...	1,697	1,253
H. J. Cash & Co., Ltd. ...	1,540	1,250
Toy & Winslow (accepted) ...	1,526	**1,042**
City Electrical Co. (accepted)	**1,400**	1,165

ST. PANCRAS.—Contracts and Stores Committee.
One 3,750-kVA transformer, complete with equipment for linking up with Islington (£1,901).—C. A. Parsons and Co., Ltd. (recommended).
Cable for linking up (£1,570).—Siemens Bros. & Co., Ltd. (recommended).
4-way 4-in. conduits (£600).—Doulton & Co., Ltd. (recommended).

Marlborough.—Town Council. Accepted:—
Installing electric lighting at 20 houses (£136).—James Bros.

Rochdale.—
Electrical equipment of the Townhead Mill Co.'s Duke Street mill, including motors, 20-200 h.p.—Swedish General Electric, Ltd.

Forthcoming Events.

British Electrical Development Association.—Friday, January 21st. Royal Society of Arts. 7.30 p.m. "Industrial Heating." Mr. S. E. Monkhouse.

Junior Institution of Engineers.—Friday, January 21st. 39, Victoria Street, S.W. 6 p.m. Exhibition of Scientific Instruments and Apparatus.
Friday, January 28th. 7.30 p.m. "The Design of h.p. Sub-stations." Mr. C. E. Atkinson.

Meter Engineers' Technical Association.—Friday, January 21st. Lighting Service Bureau. 7 p.m. "Testing of Large-Capacity Meters *in situ*." Mr. W. Casson.
Saturday, January 22nd. Engineers' Club, W. 5.30 for 6 p.m. First annual dinner.

Salford Technical and Engineering Association.—Saturday, January 22nd. Royal Technical College. 7 p.m. Presidential address by Mr. J. Morris, and musical social evening.

Association of Mining Electrical Engineers.—Saturday, January 22nd. Newcastle. "Static Transformers for Collieries." Mr. J. W. Rodger.

(Western Sub-Branch).—Saturday, January 22nd. Swansea. "The Working of Thin Seams with Electrical Power." Mr. D. P. Jones.

Nottingham Society of Engineers.—Monday, January 24th. "Lightning Conductors." Mr. G. A. Collier.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, January 24th. London. "The Electricity Bill." Mr. M. Whitgift.

(Mersey and North Wales (Liverpool) Centre).—Monday, January 24th. Liverpool. "Electrical Equipment of Large Buildings." Messrs. J. Frith and F. Buckingham.

(North-Eastern Centre).—Monday, January 24th. Newcastle-on-Tyne. "60,000-V Underground Network of the Union d'Electricité," Col. E. Mercier; and "33,000-V Cables, with Special Reference to the S.L. Type." Mr. P. Dunsheath.

(North-Midland Centre).—Tuesday, January 25th. Leeds. Faraday Lecture, "What is Electricity?" Prof. W. M. Thornton.

(North-Western Centre).—Tuesday, January 25th. Engineers' Club, Manchester. "Recent Developments in Radio Reception." Mr. J. H. Reyner.

(Tees-Side Sub-Centre).—Thursday, January 27th. Middlesbrough. Annual dinner.

(London Students' Section).—Friday, January 21st. 6.15 p.m. "Electrons in Solid Conductors." Mr. S. N. Ray.

Institution of Production Engineers.—Wednesday, January 26th. 7.30 p.m. At the Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, London, S.W.1. Discussion on "The Professional Registration of Engineers." Mr. R. Hazleton.

Electrical Power Engineers' Association (North-West Midland Section).—Wednesday, January 26th. Wolverhampton. 8 p.m. "Overhead Distribution." Mr. T. A. G. Margary.

Manchester Association of Engineers.—Thursday, January 27th. Manchester. "The Link Between Theory and Practice in Engineering." (Open discussion.)

Birmingham Electric Club.—Friday, January 28th. Grand Hotel. 7 p.m. Presidential address.

Institution of Engineering Inspection.—Friday, January 28th. Royal Society of Arts. 7.30 p.m. "Manufacture and Uses of Arsenical Copper." Mr. J. Taverner.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

JASEN vacuum cleaners.

Notes.

Electric Vehicle Records.

We have received a copy of a mechanical road transport cost sheet, which has been prepared by the Electric Vehicle (Main) Committee of Great Britain. Each sheet forms a record for one vehicle for one month, and notes on the use of the sheet are printed on its back. Copies are obtainable from 15, Savoy Street, Strand, London, W.C.2.

Birmingham Electric Club.

The programme of this Club for the first half of 1927 includes the following fixtures:—January 28th, presidential address; February 25th, "Wireless Telephony," by Mr. C. G. A. McDonald; March 11th, annual dinner; March 25th, "Electricity Supply in the Midland Area," by Mr. S. T. Allen; April 22nd, "Radiation Effects," by Mr. J. B. Kramer.

"Wireless" Moving Pictures.

The broadcasting by "wireless" of moving pictures was demonstrated by Dr. E. F. W. Alexanderson in New York on January 10th, says *The Times*. With simple apparatus he projected upon a screen by wireless a moving picture of himself conversing with a friend. The reproduction was crude, but the heads and arms of the two figures moved as they had done in the original. In addition, the inventor exhibited three photographs which had been broadcast with his apparatus for a distance of two miles. They looked as though they had been painted with a brush, but were clear reproductions, one, the portrait of a woman, having much of the quality of an original photograph. The method employed by Dr. Alexanderson is, as he frankly said, similar to a process already used commercially, but the new process, though under the disadvantage of being more affected by atmospherics than the dot and dash system now used, has the advantage of speed. Even now it takes Dr. Alexanderson only two minutes to broadcast a picture, and when the apparatus is perfected television may be expected as an early development. To make a picture, the inventor directs upon a screen seven beams of light, multiplied 24 times by mirrors. The beams are rotated rapidly and travel from top to bottom and from right to left of the screen, illuminating its entire surface with lines of light of varying intensity. The modification of these lines by means of a reflected image, which modulates their tone values, produces the picture.

I.E.E., Western Centre, Dinner.

On January 10th, the annual dinner of the Western Centre of the Institution of Electrical Engineers was held at the Royal Hotel, Bristol. Mr. W. G. Heath, chairman of the Centre, presided, and about 130 members and guests were present. The occasion was marked by a presentation to Mr. A. J. Ostler, the retiring joint honorary secretary of the Centre, who received a slide rule, and a silver tray for Mrs. Ostler, in recognition of his valuable services to the Centre. In calling upon Dr. W. H. Eccles, president of the Institution, to make the presentation, Mr. Heath described Mr. Ostler as a large man with a still larger heart. Mr. C. T. Allan, hon.

secretary, spoke of the great help he had had from Mr. Ostler during their years of joint secretaryship.

After the loyal toasts, the Rt. Hon. the Lord Mayor of Bristol, Alderman E. M. Dyer, proposed "The Institution of Electrical Engineers." He referred to the rapid strides made of recent years in the electrical world and to the part played by England. His only complaint with regard to his local undertaking was that the product might be cheaper.

Dr. Eccles, in reply, said that the Institution constituted an electrical parliament. It represented all phases of electricity from the "nippy" little electrons to large-power turbines. This year would prove the most important year in the life of the Institution up to the present. It was marked by transatlantic telephone development, the passing of the Electricity (Supply) Act, and the introduction of new communication cables with "Permalloy" loading giving a tenfold speed increase. Now that the Electricity (Supply) Act was established he believed and hoped that controversy on the subject would be dropped and that all good citizens would help to make it a success. It would result in a much fuller use of electricity. He had recently returned from Northern Italy, where power lines were more numerous than telephone lines. He thought that as a result of the electrification of Northern Italy the people were more prosperous now than before the war. Our men were earning less in purchasing power than those in that country. This year ought to see us lead the procession in the world's electrical advancement.

Mr. C. G. Morley New proposed "Our Guests," to which the Sheriff of Bristol, Mr. Frank E. Sampson, and Mr. J. H. Inskip, chairman, Bristol Electricity Committee, replied. The Sheriff believed that largely as a result of the work of electrical engineers this country would again lead the world in industry. He was a mechanical engineer, but it was plain to him that the electrical profession was the leading one. He was impressed by the spirit of co-operation in the ranks of the Institution. Mr. Inskip referred to Bristol's new scheme and hoped that they would soon have the opportunity of showing the members of the Institution one of the largest and most up-to-date generating stations in the country. He paid a tribute to Mr. Faraday Proctor, city electrical engineer, Bristol, Mr. A. J. Newman, the deputy engineer, and Mr. Ostler, for the work they had done on the undertaking.

Mr. W. J. Bache, Cheltenham, proposed "Kindred Institutions" and referred to the cordial relations which existed between the Western Centre and other Institutions, in particular, the South Wales Institute of Engineers and the Institution of Post Office Electrical Engineers.

In reply, Mr. E. J. Eldridge, Institution of Post Office Engineers, referred to the close association which had always existed between the P.O. Institution and the I.E.E.

Mr. Thomas Hood made an appeal on behalf of the Institution benevolent fund. The estimated income for the present year was £1,700, which, for a membership of nearly 13,000, was unsatisfactory. During the evening musical items were given by the Bristol Glee Singers.

The proceedings were concluded by a vote of thanks to the chairman, proposed by Dr. Eccles, to which Mr. Heath very briefly replied.

Appointments Vacant.

Meter mechanic and tester for the Rawtenstall Corporation Electric Tramways and Motor Department. Mains assistant engineer for the Crewe Corporation Electricity Department. Cable jointer for the Corporation of Nelson Electricity Department. Meter mechanic for the Wimbledon Corporation Electricity Department. Assistant mains engineer (£271), for the City of Chester electricity department; draughtsman for the Stepney Corporation electricity department. (See our advertisement pages to-day.)

A Lecture to Contractors.

Mr. Alexander Ramsay, consulting engineer, Glasgow, read a paper before a meeting of the SCOTTISH ELECTRICAL CONTRACTORS' ASSOCIATION in Glasgow, on Tuesday last week, on questions relating to the industry, dealing especially with some aspects of the Electricity (Supply) Act.

Mr. Ramsay said it seemed probable that many undertakings would continue to retail electrical energy under the existing conditions, particularly where the supply was direct current, such stations purchasing a.c. energy from the Central Electricity Board to operate rotary converters or other transforming plant. Unless every undertaking retailed standardised alternating current, the argument in respect of mass production and consequent reduced cost of manufactured electrical goods completely broke down, even with regard to the home market.

It was claimed, and the general public had been led to believe, that under the Bill the cost of electrical energy would be materially reduced. There appeared to be little justification for optimism in this direction, however, since the conditions under which, it would appear, the business of generating, distributing, and retailing electricity was to be conducted suggested an increase rather than a decrease in the rate per unit. Whilst the annual cost of electrical energy, even in the case of the large consumer, was trivial in relation to the total oncost charges, rarely exceeding 2 or 3 per cent., it must be borne in mind that owing to the keenness of competition, manufacturers found themselves obliged to curtail their oncost charges in every direction. To assume that electricity would be left a free field for development would be absurd, and, it might be accepted, that the war between electricity, gas, and oil would be waged more fiercely in the future than in the past. Consequently, unl supply authorities continued to offer electrical energy on su terms that it could compete successfully with other for of power, it was probable that the tendency would particularly with the larger consumers, towards install private plant. Indications were not wanting that a per of industrial activity was about to be experienced, a instead of allowing our industrialists freedom to make go now that the opportunity has arrived, it seemed to have be decreed that many of them should be harassed with electri re-equipment. Was that sound business?

Dr. Eccles, when speaking at the recent dinner of t Glasgow Branch of the I.E.E., was reported to have stat that "in consequence of the Electricity Bill having beco law, the services of many additional professional engine would be required"; that might be, but it would appear th the chief beneficiaries were likely to be gentlemen attached the legal profession.

That the Bill was viewed with grave misgiving by certa sections of the industry was common knowledge; but, t Bill being an accomplished fact, it was for all concerned make the best of it.

Mr. Ramsay then dealt with other questions, and said wi regard to contract documents in Scotland, the conditions, terms of which work should be executed, were, as a rul framed in conformity with the Scottish National Buildi Code, the interests of client and contractor alike being fair well protected. But with regard to electrical work, revisio might be desirable since, in certain districts, the tendenc was to invite tenders on the lump-sum basis—a most pern cious practice, and one which was equally unjust to th parties principally concerned. In support of the lump-su tender the claim was made that the plans should be so pr pared, and the quantities measured therefrom should be s scrupulously accurate as to render after-measurement unnece sary. Such Utopian conditions were seldom encountered i practice, however. In the course of installation unforesee obstructions invariably presented themselves, or the client, t suit his needs, decided to alter the plans. Under such ci cumstances a contract let on the basis of after-measuremen could be readily adjusted, whereas, more often than not, th lump-sum tender was the subject of litigation. On a properl drafted specification and schedule the variation between th lowest and the highest offers should not exceed 10 to 15 pe cent., and more frequently than not it was well within th lower limit.

Extra-high-pressure Steam Plant at Bradford.

As briefly mentioned in a leaderette last week, Mr Thos. Roles, M.I.E.E., city electrical engineer, has put i hand for the Corporation electricity works at Valley Roa an installation of unusual design, consisting of a boiler t work at 1,100-lb. gauge pressure and a 2,500-kW turbin which will exhaust into the existing main steam range a 195-lb. gauge pressure, the turbine acting as a reducing valve The steam will be superheated to 800 deg. F., and will no require reheating; the boiler will have a rated output o between 75,000 and 94,000 lb. per hour. The size of th plant has been so chosen that the electrical output of the new set, together with that of the low-pressure plant using the exhaust steam from the former, will be as nearly as possible equal to the estimated future base load of the station, which will thus be dealt with on the most efficient lines. No condensing plant being required, the water supply to the station need not be augmented. Provision has been made for reheating the steam exhausted from the new set, if thought advisable in the future.

The boiler will be equipped with divided chain-grate stoker gear and compartmental balanced draught. A combination of air preheater and economiser has been adopted, and the furnace is to be provided with water screens and air-cooled side walls. The turbine will be a plain impulse machine running at high speed and driving the alternator through gears at 1,000 r.p.m. The feed pumps, valve gear, instruments, and control will be of special design.

The whole contract has been placed with the English Electric Co., Ltd., which, it is generally known, has for many years been quietly conducting experiments on the use of h.p. steam. The Benson boiler plant of the company, which generates steam at the critical pressure, has put the company in a position to test out many of the pressure and temperature problems met with in plant such as that referred to. During the last eight years a number of finished turbines for working at a pressure of 1,500 lb. have been tested out at the Rugby works of the English Electric Co. The h.p. boiler plant is to be supplied, through the English Electric Co., by Messrs. Babcock & Wilcox, Ltd. It is interesting to learn that, prior to placing the order for the new plant, Mr. Roles made an extended visit in the United States to all the power stations and engineers in that country where experience of the higher pressures had been obtained. While it was decided that at the present time the adoption of pulverised-fuel equipment would probably not be justified, provision has been made in the combustion chamber of the new plant for the adoption of the new system of firing should it be found to be economical. The estimated cost of the new plant and boiler house is £80,000, but we learn that the Electricity Commissioners have approved of a scheme which includes the provision of a new 20,000-kW turbo-generator the total cost of the scheme will be about £300,000.

E.A.W. Activities.

The first fixture of the Electrical Association for Women for 1927 was a visit to Messrs. Liberty's "All-Electric Canteen" on January 19th. Mrs. I. E. Bray, a member of the E.A.W. Council, lectured before the Women's Institute and Women's Citizens' Association at Wendover, Stoke-Mandeville, and Haddenham on January 10th and 12th. Mr. Turnbull, the Aylesbury engineer, provided electrical apparatus for demonstration purposes. The E.A.W. also took part in the recent Electrical Exhibition at Ashford, Kent, when Mrs. I. E. Bray lectured. A branch of the Association is about to be formed on the North-East Coast, with headquarters at Newcastle-on-Tyne. Miss Anna Holm is acting as hon. secretary, and the inaugural meeting will probably be held early in February.

Institution Notes.

Institution of Electrical Engineers.

SCOTTISH CENTRE.—Mr. R. Borlase Matthews, M.I.E.E., lectured in Edinburgh, on January 11th, under the auspices of the Scottish Centre of the Institution, on the subject of "Electro-farming." There was a large attendance of electrical engineers, while the farming industry was well represented; Mr. W. L. Winning, M.I.E.E., chairman of the Centre, presided. Mr. Matthews did not say that electricity was going to be the one salvation of the farmer, but the modern farmer, he contended, would not be able to "get on" without an adequate supply of cheap power such as electricity would provide. It was of vital importance to the whole nation that agriculture should be placed on a sound basis, and on this account alone the subject was well worthy of the most serious investigation by the electrical engineering world. The instinctive nature of the lecture was increased by the films and slides shown, illustrating many of the uses to which electric power is now being put on the lecturer's own farm at East Grinstead, Sussex and on farms abroad. An interesting discussion was taken part in by many well-known Scottish agriculturists.

Mr. Matthews also lectured to the members of the Institution, Dundee, last week. Mr. J. S. Thomson, of the Fife Power Co., presided. The lecturer said he had toured Fife that day and had found that something like 65 farms were using electric power. He was sure the methods adopted in Fife were more advanced than any he had seen.

INFORMAL MEETING.—At the meeting on Monday, January 10th, Mr. F. Pooley was in the chair, when Mr. O. M. Andrews opened a discussion on a paper by Mr. L. Henshaw, entitled "Some Notes on the Earthing of Metal Objects other than Conductors." The discussion, in which 16 members took part, showed how very difficult it might sometimes be to obtain an efficient "earth." In London and many big cities the water system might form a perfect earth, but in dry districts the difficulties were often almost insuperable. It was in the cities, however, where the extended use of domestic apparatus made efficient earthing imperative, that the occasion when, sooner or later, the "earth" would be called upon to function had to be provided for.

Faraday Society.

A general discussion on "The Theory of Strong Electrolytes" will be held at Oxford on Friday, April 22nd, and Saturday, April 23rd. On the first day "Ionic Mobility" will be the subject of debate, and on the second day "The Activity of Strong Electrolytes." Arrangements are being made to accommodate members attending the meeting at Exeter and Lincoln Colleges, but the accommodation is strictly limited, so that early application should be made. An inclusive charge of £1 2s. per head will be made to members. The charge to non-members will be 30s. Arrangements are being made with the railway companies for tickets at reduced rates. The second (experimental) "Report on Atmospheric Corrosion," by Dr. W. H. J. Vernon, will be read and discussed before the Society in London on Wednesday, March 30th, at 7 p.m.

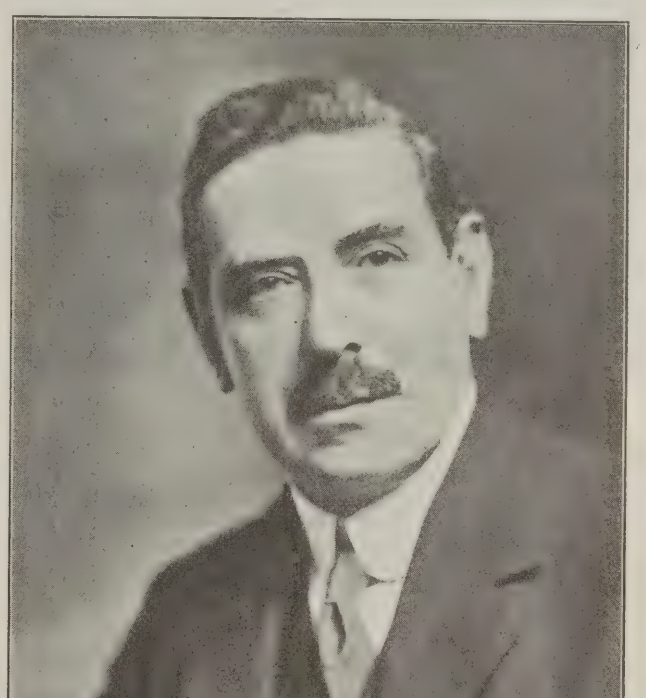
Junior Institution of Engineers.

On Friday, January 14th, Mr. R. L. Kirlew (Chairman of the Institution) read a paper entitled "The Thermionic Valve and its Characteristics." One of the points made by Mr. Kirlew was that it was always advisable to ascertain the plate current-grid volts characteristic of a valve with a loaded anode circuit when signals were being received, as there was a difference between the graphs obtained with a loaded and an unloaded valve. The curves issued by valve manufacturers with their goods were obtained with an unloaded valve. The method recommended really gave a characteristic curve of the complete receiving circuit, and so enabled the most suitable working conditions to be observed. Some little trouble was necessary to obtain the data in order to make the various adjustments, but the advantages to be gained were of value, especially in sets designed and constructed by amateurs. For very accurate work in a multi-valve set, a measuring instrument in each circuit was desirable, but quite a lot might be done with one combined instrument, of which there were several known types.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Mr. CHARLES VERNIER, who, as mentioned in our last issue, is leaving the Newcastle-on-Tyne Electric Supply Co. to become chief engineer to the Macintosh Cable Co., Ltd., on February 1st, was educated at the Regent Street Polytechnic and at the City and Guilds of London Technical College, Finsbury. He served his apprenticeship with Messrs. Reyrolle and Co., and after experience with other firms he was appointed in 1897 to be electrician in charge of testing work with the Brockie Pell Arc Lamp Co. Two years later he became assistant engineer on mains work with the Cork Electric Tramways and Lighting Co. He entered the service of the Newcastle-upon-Tyne Company as mains engineer in 1900 and has remained there until now. For 21 years he was in charge of the mains construction, repair and maintenance work for that company, and its associated concerns, from their absorption. When he joined the company it had only five miles of cable route in existence and he has been responsible for the laying down of the major part of the large transmission systems (overhead and underground) and of numerous distributing networks operated by the Newcastle companies over an area of 1,800 square miles. For the past five years he has been their technical expert on mains construction work. Amongst the most notable work for which Mr. Vernier was responsible we



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Mr. Charles Vernier, M.I.E.E.

may mention the laying down in County Durham of the first large 20,000-volt cable system in the world, comprising initially 40 miles of 3-core cable in 1906 and continuous current extensions in subsequent years; also the laying down of the first 66,000-volt cables and 66,000-volt overhead transmission lines in Great Britain, from 1923 to date. Mr. Vernier was chairman of the North Eastern Local Section of the I.E.E. in 1913 and a member of Council from 1920 to 1923. He is a member of the Overhead Lines Regulations Committee, and his papers read before the Institution include one on "The Laying and Maintenance of Transmission Cables" and one on "Wayleaves." He has performed numerous important activities in the electrical industry, such as his connection with the E.P.E.A., the Joint Industrial Council of the Electricity Supply Industry, and committee work under the British Electrical and Allied Industries Research Association, and he is, of course, well known as the inventor of various improvements in electrical cables and joints.

The Burton-upon-Trent Corporation has increased the salary of Mr. A. B. SLATER, the general manager of the tramway and motor system, by £75 per annum.

Mr. JOHN A. CRESSEY, control electrical engineer to the South Wales Electrical Power Distribution Co. at the Upper Boat Station, Cardiff, has been appointed engineer-in-charge of the power station of the Shanghai Municipal Electricity Department. He will sail on January 28th.

Mr. H. M. PEASE, managing director of Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.), of Connaught House, Aldwych, W.C.2, has been appointed vice-president of the International Standard Electric Corporation. It was in 1902 that Mr. Pease (whose photograph accompanies these notes) first became associated with the Western Electric Co., Ltd.; being in charge of the engineering side of the business, he was responsible for the installation of the majority of the central-battery telephone exchanges erected in this



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Mr. H. M. Pease.

country for the National Telephone Company and later the General Post Office. In 1908 he became sales manager of the Western Company and in 1919 managing director, which position he now holds. Mr. Pease included amongst his other activities a directorship in the recently dissolved British Broadcasting Company.

M. JEAN-BAPTISTE PERRIN, Professor at the Sorbonne, Paris, has been awarded the Nobel prize for physics.

M. BARTHELMY, who has lately been elected president of the Radio Club de France, is well-known in French electrical circles. After serving in the army for the first two years of the war he was appointed director of the French military wireless factory. Since then he has been associated as consulting engineer with several French manufacturers and in 1921 gave successful demonstrations of radio-telephony on moving trains.

Dumfries Town Council has appointed Mr. J. D. MARSHALL as Corporation electrician for the ensuing year.

With reference to the statement appearing on p. 1085 of our issue of December 31st regarding the appointment of Mr R. W. WILLIS as consulting engineer to the Corporation of Newark-on-Trent, Mr. Willis informs us that though the matter has been considered by the Corporation he has received no official intimation with regard thereto and in consequence he has made no decision.

Mr. G. E. WHITTLE has been appointed mains engineer to the Calcutta Electric Supply Corporation, Ltd., and he leaves for Calcutta on January 22nd.

In response to an invitation by the Ministry of Transport, the Emergency Committee of the Convention of Royal Burghs, Scotland, recommends Treasurer GRAHAM GUEST, Edinburgh, for appointment to the Central Electricity Board under the Electricity (Supply) Act, 1926. Mr. Guest is a member of the Institute of Treasurers, and managing director of Messrs. MacVitties, Guest, Ltd. He has taken a keen interest in electrical development.

We learn that Mr. J. W. THOMAS, B.Sc., assistant general secretary of the Electrical Power Engineers' Association, is one of the successful candidates in the Bar final examinations. Mr. Thomas expects to be called to the Bar of the Middle Temple in June next.

Obituary.—MR. J. W. CUSHNY.—From an announcement published in *The Times* we note that Mr. John William Cushny, electrical engineer for the construction of the Kojuk Pass Tunnel, India, 1888-89, "subsequently lighting Pretoria and Johannesburg, latterly resident owner of a ranch at Lumbwa, British East Africa," passed away on December 30th at Warner Beach, Natal, "after long suffering." He was 64 years of age.

MR. S. M. BANKER.—We regret to read in *The Times* that the death occurred on January 16th of Mr. Stewart Melville Banker, late Superintendent Electrical Engineer to the General Post Office, at the age of 82 years. The interment took place yesterday at the Great Northern Cemetery, New Southgate.

DR. E. HEILBRON.—The death is reported from Berlin, at the age of 65 years, of Dr. Ernst Heilbron. The deceased was one of the leading experts in Germany on electricity meters, and he had been associated with the A.E.G. for upwards of 35 years.

Will.—The late Sir J. W. SZLUMPER left £1,309 gross and £439 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Boynton & Co., Ltd.—Private company. Registered January 13th. Capital, £300 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in wireless apparatus, electrical goods, motor cars, &c. The first directors are:—H. Boynton, 4, Woodstock Road, Moseley, Birmingham; Ernest Boynton, 24, Valentine Road, King's Heath, Birmingham; Evelyne Boynton, 4, Woodstock Road (as above). Qualification, 1 share. Registered office: 34, Bradford Street, Birmingham.

Lamb & Co. (Westcliff), Ltd.—Private company. Registered January 12th. Capital, £100 in £1 shares. Objects: To acquire the business of Lamb & Co., Ronald Park Avenue, Westcliff-on-Sea, carrying on business as electrical engineers and contractors, makers of armatures, field coils, stators, &c. The first directors are:—A. A. Lamb, 30, Electric Avenue, Westcliff, electrical engineer; C. C. Mee (same address), electrical engineer. Qualification, 1 share.

Natural Power, Ltd.—Private company. Registered January 10th. Capital, £1,500 in 1,250 ordinary of £1 and 5,000 founders of 1s. each. Object: To adopt an agreement with H. Rowsell for the purchase of a scheme in regard to the production of light, heat and power from natural sources, of which he is the originator or inventor, and to carry on the business of electricians, mechanical engineers, dealers in electricity, &c. The first directors are:—H. E. Nickels, F.C.S., 125, Hendcorn Road, Thornton Heath, analyst; H. Rowsell, 41, Trafford Road, Thornton Heath, accountant. Solicitors: Jordan & Lavington, 78, Queen Victoria Street, E.C.4.

Wireless Pictures, Ltd.—Private company. Registered January 13th. Capital, £100 in £1 shares. Objects: To acquire any patents for inventions relating to television and what is known as "photo-telegraphy," and for the electrical transmission and reception by wire or wireless of signals, drawings, photographs and the like, &c. The subscribers (each with one share) are:—J. M. Sharp, 75-7, Shaftesbury Avenue, W.1, solicitor; F. R. Sprinz, 75-7, Shaftesbury Avenue, W.1, solicitor. Qualification, 5 shares. Solicitor: J. M. Sharp.

Johnson, Ross & Co., Ltd.—Private company. Registered January 14th. Capital, £100 in four 7 per cent. cumulative preference and 96 ordinary shares of £1 each. Objects:

To acquire the business of a vendor of electric lamps and wireless valves carried on by W. H. Johnson, at Kingsway Corner Buildings, 109, Kingsway, W.C.1. The directors are:—W. H. Johnson, Coppermill Road, Horton, nr. Slough, Bucks.; C. B. Liddell, 25, Cleveland Square, W.2; N. O. Liddell, The Croft, Chiltern Road, Chesham Bois, Bucks. Qualification: £1. Secretary: N. O. Liddell. Registered office: Kingsway Corner Buildings, 109, Kingsway, W.C.1.

Ernest Jones & Co., Ltd.—Private company. Registered January 13th. Capital, £500 in £1 shares. Objects: To acquire, as from December 1st, 1926, the business of electric light, power and radio engineers carried on by Ernest Jones and Co., at 1, Cateaton Street, Manchester. The first directors are:—E. Jones, 540, Hepshaw Lane, Stockport, electrical and radio engineer (permanent governing director); Mrs. H. Jones, 540, Hempshaw Lane, Stockport. Qualification, £10 shares. Secretary, E. Jones. Solicitors: Pearson, Son & Co., 438, Corn Exchange Buildings, Manchester.

Official Returns of Electrical Companies.

Robert W. Blackwell & Co., Ltd.—Particulars filed of £14,000 debentures authorised December 29, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Woodstock Power Syndicate, Ltd.—Particulars filed on December 29th, of £2,800 debentures authorised October 4th, 1926, charged on the company's undertaking and property, present and future, the whole amount being now issued.

H. L. Wood & Son, Ltd.—W. E. Beales, of 1, Worcester Street, Belgravia, S.W., ceased to act as receiver on January 6th, 1927.

Barnes Brothers (Radiex), Ltd.—Debenture dated December 14th, 1926, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holder: P. G. Barnes, 109, York Road, Southend.

Wye Lighting, Heating and Power Co., Ltd.—Charge on premises at Wye, Kent, dated January 3rd, 1927, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd., not exceeding £600.

Teignmouth Electric Lighting Co., Ltd.—Satisfaction to the extent of £500 on August 19th, 1924, of debentures dated February 19th, 1923, securing £4,000. (Notice filed January 8th, 1927.)

Electrical Devices, Ltd.—Debenture dated January 5th, 1927, to secure £1,250, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd., 15, Bishopsgate, E.C.

Oriental Telephone and Electric Co., Ltd.—Satisfaction to the extent of £2,316 on December 20th, 1926, of debenture stock secured by trust deed dated June 28th, 1905, and supplemental deed of acknowledgement dated June 12th, 1907, securing £200,000.

Win-Sum Electric Diffusers, Ltd.—G. A. Siday, Plant House, Ealing, W.5, ceased to act as receiver or manager on July 9th, 1926. (Notice filed January 11th, 1927.)

Patent Conveyor Co., Ltd.—J. R. Watson, Cheapside, Bradford, was appointed receiver on January 7th, 1927, under powers contained in instrument dated March 5th, 1908.

City Notes.

Marconi Interests in Argentina.

The November *Journal* of the British Chamber of Commerce in the Argentine Republic reports that an arbitration tribunal, consisting of Mr. A. G. Pruden, C.B.E., Major W. A. McCallum, and Mr. R. Fraser, of the Council of the Chamber, has issued its findings in a dispute between Marconi's Wireless Telegraph Co., Ltd., and the Cia. Marconi de Telegrafia sin Hilos del Rio de la Plata. The matter had been before the Argentine Courts for some years without result. The Argentine company brought an action against the British company for breach of contract, but finally the British company offered to purchase the undertaking of the Argentine concern outright. This was agreed to, and the tribunal was appointed to determine the purchase price and conditions. The total price has been fixed at $3,236,928 (Argentine gold), and this includes the cost of damages sustained by the Argentine company as a result of the British company's non-fulfilment of its obligations. The tribunal also stipulates the manner in which the money shall be apportioned to the shareholders of the Argentine company.

Companies to be Struck off the Register.

The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Blackpool and Garstang Electric Light Rly. Co., Ltd.
Bovey Light and Power Co., Ltd.
Clar-o-phon Radio Co., Ltd.
Electric Lamp and Bulb Co., Ltd.
High Temperature Generators (1918), Ltd.
Horsa Electrical Contracting Co., Ltd.
Ivor Electrical Co., Ltd.
Mayfair Light and Power Co., Ltd.
National Conduit and Cable Co,. Ltd.
Pneumatic and Electric Syndicate, Ltd.
Sceando Lamp Co., Ltd.
Searlight Projectors, Ltd.
Southport Electrical Supply Co., Ltd.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Compania de Electricidad de la Provincia de Buenos Aires—350,000 new 8 per cent. non-cumulative participating preference shares of £1 each, issued at par, partly paid and fully paid, Nos. 175,001 to 525,000.

Hankow Light and Power—4,000 8 per cent. cumulative second preference shares of £5 each, fully paid, Nos. 1 to 4,000.

The undermentioned have been ordered to be officially quoted:—

Coventry Chain Co., Ltd.—100,000 ordinary shares of £1 each, fully paid, Nos. 400,001 to 500,000.

Hendon Electric Supply Co., Ltd.—146,450 6 per cent. cumulaive preference shares of £1 each, fully paid, within Nos. 1 to 150,000.

London Power Co., Ltd.—£4,000,000 5 per cent. debenture stock.

New Chinese Companies.

The *Chinese Economic Bulletin* states that during the past few months the following electricity supply companies have been formed:—The Fuyang Ping Li Electricity Supply Co. (Szepo, Western Chekiang); the Sing Hing Electric Light Co. (Yuankiahsiang); the Shentang Electric Light Co. (Shentangchen); the Pu Yao Electric Light Co. (Yotsing, Eastern Chekiang); the Tsungjen Electric Light Co. (Chenghsien); the Chowhong Electric Light Co. (Yuyao), and others at Fotang and Santunchen (Hangkow).

Anglo-American Telegraph Co., Ltd.

The directors announce balance dividends of 1¼ per cent. on the ordinary consolidated and preferred stocks and a first and final dividend of 1¼ per cent. on the deferred stock. The total ordinary dividend is 3¾ per cent. and the total preferred dividend 6 per cent., as in the previous year.

Electrolytic Zinc Co. of Australasia, Ltd.

A dividend of 6 per cent. has been declared on the preference and ordinary shares for the six months ended December 31st, as in the preceding year.

Italian Loan in New York.

It is reported that the $10,000,000 loan floated in New York on behalf of the Unione Esercizi Elettrici met with immediate success.

Traction and Power Securities Co., Ltd.

The directors recommend a final dividend of 10 per cent. on the ordinary stock, making 14 per cent. for the year, as compared with 13 per cent. for the previous year.

Brazilian Traction, Light and Power Co., Ltd.

A quarterly dividend of 1¼ per cent. has been declared on the common stock, as against 1¼ per cent. last year.

Stocks and Shares.

MONDAY EVENING.

ACTIVITY and rising prices continue to characterise most of the Stock Exchange markets. The epidemic of influenza forms no check to the healthy expansion of general business. A boomlet in gilt-edged stocks is an excellent tonic to other securities. The reason is that, as investment finds the supply of the best-class stocks is diminishing, the would-be buyer enlarges the scope of his search, and takes what he can obtain in other issues. The market in the new 4 per cent. Consolidated stock is due to start on the Thursday in this week, and the recent advances in gilt-edged descriptions are deemed to hold the promise of a possible premium on the 4 per cent. scrip. London Power 5 per cent. debenture, at 98, stands at 3 premium over its issue price. Traction and Power Securities 4½ per cent. debenture stock has strengthened

to 87, at which price it returns £5 3s. 6d. per cent. on the money. The stock is redeemable at 100 in 1974. Recently-introduced, City of London Electric 5 per cent. debenture, January and July interest, is on offer at 99 ex dividend, the yield being £5 1s. per cent. on the money.

Shares in the London electricity supply group are steady in price, and there is still divergence of opinion as to the correct method to employ in calculating the yield derivable from investment in the ordinary shares at current prices. As previously explained, we take the austere, perhaps too austere, dividend rate of 7 per cent. that will become common to all the companies' ordinary capital after 1931. The Charing Cross date is after 1936. If the 1927-31 dividends, inclusive, are taken alone, the returns will be, of course, higher, and Westminsters, for example, show a little over 7 per cent., South Londons 7 per cent., Londons £6 19s. per cent. on the money for the next five-year period. Optimism, moreover, maintains it to be quite conceivable that some of the companies, after 1931, will be able to make such price concessions as will enable them to increase the statutory 7 per cent. dividend fixed by the Electricity Acts on the basis of existing charges to consumers. In this expectation resides the hopefulness of there being a possible rise in the share prices, a rise which otherwise could hardly be looked for in face of a known reduction to 7 per cent. dividends all round.

A jump of 3s. in Marconis to 16s. 9d. is an outstanding feature in their section. The precise reason has not yet been made apparent, but the accepted explanation in the market is that the company is regarded as likely to benefit by the long-distance telephony which is the latest marvel of wireless development. Probably there were a good many bears about, and they, rendered timid by the strength of markets as a whole, have turned buyers. Canadian Marconis are, sympathetically, the turn stronger at 3s. 6d. Cable stocks remain very steady. Great Northerns and Anglo-American preferred show moderate gains.

The idea of wireless telephony "cutting out" the cable service is treated with more politeness than attention. Every wireless scare in the past 20 years—and there have been many such alarms—has gone harmlessly over the heads of cable stockholders. Experience has, so far, demonstrated that plenty of room exists for both systems. Increased facilities have quickened the expansion of traffics, and, with the Eastern Telegraph Company taking an active hand in wireless work, the argument runs that the future can be viewed with equanimity, broadening into hopefulness, by the many investors who hold cable companies' stocks and shares.

We hear, incidentally, that the Eastern group handled 70,000 messages of greeting sent last Christmas under the scale of cheap rates offered by the companies.

In the manufacturing group, Henleys have strengthened to 87s. 6d., Brush ordinary and Metropolitan-Vickers ordinary to 26s. 9d. in each case, and Ever Readys to 4⅛. The last-named touched 4¼, and the preference are up to 30s. India Rubber shares reacted to 20s. The handsome appreciations in the prices of Henleys, Callenders, British Insulated and Enfields, with a few others, have aroused discussion as to whether proprietors of such shares are likely to see their interests go higher. We have mentioned several times of late that profit-taking has played its part in the market, though ample support took readily what stock came in. The opinion may be ventured that current quotations admit of little scope for further advance; indeed, that they are over-valued when related to the very modest returns on the investor's money that the prices now allow. Callenders yield 4¼; so do British Insulated. Henleys pay 4½, British Aluminium rather over 4. Better yields are obtainable from British Government securities available to strict trusts. But the holders and the present buyers of cable and allied companies' manufacturing shares are looking well ahead. It may be retorted that to-day's prices discount a great deal of expected prosperity in the future. They do; and, what is more, responsible Stock Exchange circles in touch for many years with the operations and growth of these companies, are calmly confident of the prices becoming both justified and higher. In the hills and the valleys of transitory changes, there may be falls in prices before the latter go ahead again actively. But the outlook for the future is held to be as bright as ever, and that this view finds serious favour is exemplified by the steadiness with which the prices hold what look to be unduly high levels.

Brazilian Tractions have continued their dramatic recovery, and are another 2 points up, at 112. The Brazilian Government bonds have returned to speculative popularity, and most Brazilian descriptions are in favour once more. British Columbia Electric Railway stocks have advanced, and a gain of a point lifted Anglo-Argentine Tramways 5 per cent. debenture to 68½. British Railway stocks are steady, and Undergrounds exhibit a further disposition to go ahead on dividend anticipations. Underground income sixes appear fully priced at their present figure of 104.

Iron, coal and steel shares are somewhat hesitant. Babcocks keep their price because the people attracted to this market, by the prospect of improved trade conditions, are discreetly choosing the best-class shares, for safety's sake. The rubber market is quiet, business having dropped back into a jogtrot groove after enjoying a spasm of animation last week.

Share List of Electrical Companies.

	Nom.	Dividend. 1924.	1925.	Price Jan. 17 1927.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£1	14	14	59/6	—1/-	4 13 6
Brompton Ordinary	1	10	10	25/-	—	5 12 0
Charing Cross Ordinary	1	15	15	25/-	—	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	25/-	—	5 12 0
City of London	1	15	15	2⅛	—	... ...
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/6	+6d.	5 12 4
County of London	1	15	15	27/6	—	... ...
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/-xd	+$\frac{1}{32}$	6 1 9
Elec. Supply Corporation	1	10	10	30/6	—	6 11 2
Kensington Ordinary	1	15	15	24/-	—	5 16 8
Lancs. Light and Power	1	7½	7½	24/-	—	6 2
London Electric	1	10	10	24/-	—	5 17 8
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	26/-	—	5 7 8
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary	1	7	7	21/3	—	6 11 9
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	24/-	—	5 16 8
South London	1	15	15	24/6	—	6 8 0
South Metropolitan Pref.	1	7	7	1½	—	6 8 0
Urban Ordinary	1	4	7	1$\frac{3}{16}$	—	5 17 11
do. 6% Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	24/6	—	5 14 3
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	1	8	8	27/-	—	5 18 6
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	70	—	5 14 4
Metropolitan	,,	5	5	65	+½	7 13 10
do. District	,,	3½	3½	58	—	6 1 9
Underground Electric	£1	Nil	Nil	13/6	+6d.	Nil
do. do. Income	Bonds	6	6	104	+1	*5 15 8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	101½	+½	5 18 3
do. Def.	,,	1½	1½	25	—	6 0 0
Automatic Telephone	1	3	10	2¾	—	3 12 9
Chili Telephone	5	5	6	6½xd	—	4 12 4
Cuba Sub. Ord.	10	5	5	7	—	7 5 6
Eastern Extension	10	10	10	17⅝xd	—	*5 13 4
Eastern Tel. Ord.	Stock	10	10	174½xd	—½	*5 14 7
Globe Tel. and T. Ord.	10	10	10	18⅜	—	*5 6 8
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	22	20	27	+¼	7 8 2
Indo-European	25	8½	10	47½	—	*5 5 10
Marconi	1	10	Nil	16/9	+3/-	... ...
Marconi-Marine	1	10	7½	1⅜	—	6 13 4
Oriental Telephone Ord.	1	12	12	2$\frac{7}{16}$	—	*4 18 4
United R. Plate Tel.	5	8	8	8⅜	—	*4 15 6
Western Telegraph	10	10	10	17¼	—	*5 16 0
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	2⅞	—	9 11 4
do. do. 2nd Pref.	5	6	6	2⅞	—	10 8 8
do. do. 5% Deb.	Stock	5	5	68½	+1	7 7 2
British Electric Traction Ord.	,,	7	8	144½	—	5 10 9
do. do. 6% Pref.	,,	6	6	109	—	5 10 1
Brazil Traction	100	4	5	112	+2	4 9 3
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	87½xd	—	5 14 3
do. do. Preferred	,,	96/-	136/9	121½	+1	*5 3 11
do. do. Deferred	,,	129/5	8	151½	+2	*5 5 7
do. do. Deb.	,,	4¼	4¼	79½	—	5 8 3
London & Sub. Trac. 5% Pref.	1	2½	Nil	7/-	—	Nil
London United Tram. Deb.	Stock	4	4	42½	—	9 8 4
Mexico Trams, 5% Bonds	—	5	5	64½	—	7 15 0
Mexican Light Common	100	Nil	Nil	82½	—	Nil
do. Pref.	100	Nil	Nil	76½	—	Nil
do. 1st Bonds	—	5	5	63½	—	7 17 6
Yorkshire (West Riding)	1	5	—	12/6	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	12	18	53/9	—	4 16 8
British Aluminium Ord.	1	5	10	49/6	—	4 1 6
British Elec. Transformer Pref.	1	Nil	7	18/8	—	7 13 5
British Insulated Ord.	1	15	15	70/-	—	4 5 9
Brush Ord.	1	10	10	26/9	+6d.	7 9 4
Callenders	1	15	15	8½	—	4 5 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	84	—	5 19 1
Electric Construction	1	10	10	31/3	—	6 8 0
Enfield Cable Pref.	1	7½	7½	1½	—	6 6 4
English Electric	1	5	Nil	15/-	—	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	5	7½	31/6	—	4 15 3
Henley	1	16	20	4⅜	+$\frac{1}{16}$	4 11 4
do. 4½% Pref.	...	...	...	4¼	—	5 6 0
India-Rubber	1	5	5	1	—$\frac{5}{16}$	*5 0 0
Johnson & Phillips	1	10	17½	2$\frac{15}{16}$	—	5 19 1
Met.-Vickers Ord.	1	8	8	26/9	+6d.	5 19 8
do. Pref.	2	8	8	2$\frac{3}{16}$	—	6 18 4
Siemens Ord.	1	7½	7½	1$\frac{13}{16}$	—	4 16 0
Telegraph Construction	12	20	10	29½	—	*4 1 4

*Dividends paid free of Income Tax.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

(*Continued from page 71.*)

Igranic Electric Co., Ltd.

Primarily intended to provide anode voltage to wireless receivers by obtaining the supply from a.c. mains, the recently improved Igranic units are made in three patterns, all intended to operate at 110 or 220 volts at 40 to 60 cycles. One model, fig. 11, has a maximum output voltage of 200 with tappings at 35, 50, 65, 100, 120, 180, and the full 200 V. Three

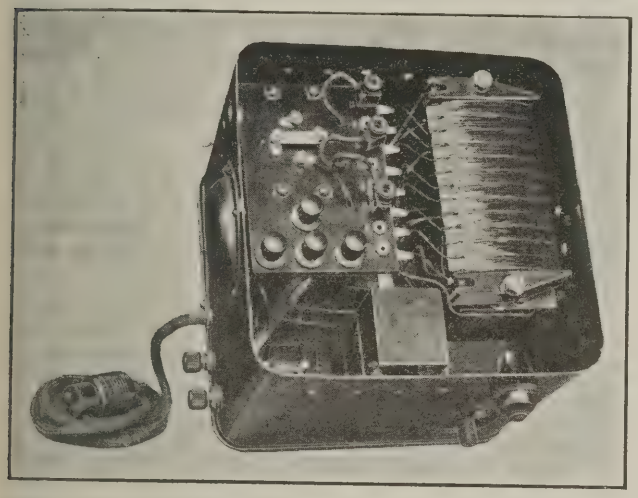


Fig. 11.—De Luxe H.T. Mains Supply Unit, showing Tapping Points.

tapping plugs are provided so that different voltages may be obtained to suit various valves in a receiver. An "on-and-off" switch is provided, and a ruby lamp indicates when the unit is operating. The second model has a maximum output voltage of 120, with tappings at 20, 30, 40, 60, 80, 100, and the full 120 volts. Two tapping plugs are provided and an "on-and-off" switch, but no indicating lamp. The third model has a maximum output of 70 volts, but no tappings, as it is possible to select suitable valves so that all receive the same anode voltage. They employ full-wave rectification.

The filament units are designed to operate off a.c. circuits at 110 or 220 volts at 50 to 60 cycles, and can be arranged for delivering current at 2, 4 or 6 volts. The current output will be sufficient for multi-valve receivers.

The "Neutrosonic Seven" receiver, fig. 12, is particularly compact, combining the advantages of the neutrodyne and superheterodyne principles. The receiver itself is contained in a black leatherette-covered carrying case, and the batteries are accommodated in a similar, but smaller, case. A flexible armoured lead fitted with a special plug enables the battery box and receiver to be connected rapidly and easily. The outfit is suitable for those requiring a powerful receiver suitable for use with a frame aerial which is readily portable, and yet equally suitable for home use. The short-wave tuning unit, also on show, with the interchangeable units obtainable for use with receivers built from the super-heterodyne outfit, gives the complete receiver a tuning range of approximately 40 to 3,500 metres. Amongst the smaller components exhibited the new peep-lamp indicating plug is designed for use in conjunction with an Igranic-Pacent jack as a means of switching the receiver "on" and "off" and indicating when the receiver is "on" by the lighting of the lamp. Other exhibits included a comprehensive range of components, amongst which was the neat frame aerial shown in fig. 13.

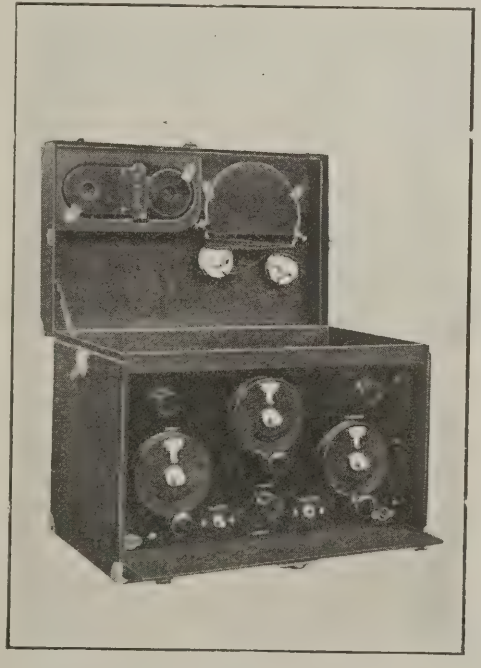


Fig. 12.—Igranic "Neutrosonic" 7-valve Receiver.

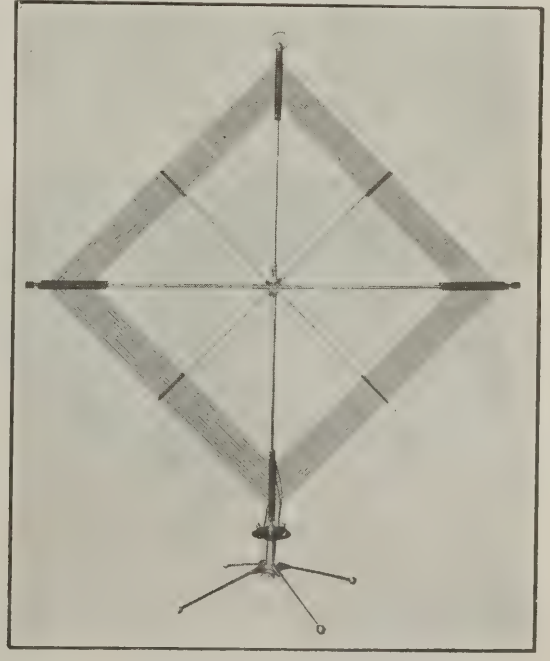


Fig. 13.—A Neat Frame Aerial.

Watson & Sons (Electro-Medical), Ltd.

This company's display included a "carboscope," a commercialised X-ray apparatus for examining the quality of coal. It consists of a tank containing the high voltage transformer immersed in oil, and in the same tank is arranged a self-rectifying Coolidge tube, also oil-immersed; the rays are focused upwards through a small window on the bottom of a shallow wooden drawer in which the specimens of coal to be examined are placed. Above the drawer is the fluorescent screen which is viewed from without by the aid of a tilted mirror. The tank and mirror afford ample protection, and control is by means of a single exterior contact. Very fine stereoscopic pictures have been taken by this apparatus, which should be of the utmost service for the examination of fuel for large central stations. The De-Lavel Watson oil-testing apparatus is, in effect a h.p. transformer giving easy graduations of pressure up to 70,000 r.m.s. volts by the agency of choke control arranged to electrify an oil-immersed gap. The gap can be set at the requisite distance, and the glass receptacle is then filled with the oil to be tested; the break-down pressure is read on a voltmeter on the outside of the apparatus, conveniently arranged over the control wheel. The metal casing lid is arranged to break the primary circuit when open, thus eliminating any possible danger of shock when filling the oil container.

Various Coolidge X-ray tubes were on view, and a series of radium ores with various appliances for storing, handling, and applying therapeutically the salts obtained therefrom; also a cadmium photo-electric cell for measuring ultra-violet radiation intensity. The radiations are allowed to fall on a plate within an evacuated glass cell the walls of which are cadmium covered, the window of entrance being of quartz. The intensity of the ultra-violet radiation is proportioned to the time taken for the loss of charge of the previously electrified plate, the electrification being measured by an aluminium-leafed electroscope. The Watson ultra-violet lamp was primarily designed for medical work, but is equally suitable

for use in a laboratory where a constant supply of ultra-violet radiation is required.

Cox-Cavendish Electrical Co. (1924), Ltd.

A selection of electro-medical instruments, such as diathermy apparatus, a simple portable photometer for gauging the intensity of ultra-violet rays, and goggles for use with lamps producing such rays. Of actino-therapeutic interest was a demonstration of the latest type of open tungsten arc lamp for ultra-violet radiation, popularly known as artificial sunlight, together with an improved quartz mercury-vapour lamp,

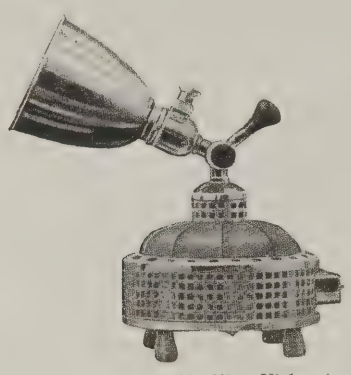


Fig. 14.—"Sunbeam" Portable Ultra-Violet Arc Lamp.

and a clinic type, combination open tungsten and carbon arc lamp. A new portable, impregnated, cored, carbon-arc lamp for home use, or microscopic illumination, was shown for the first time. This "Sunbeam" lamp (fig. 14) is arranged to work off d.c. and a.c. mains (approximately 100 to 200 volts) and is provided with a length of flex and plug adaptor; the current consumption is 3.5 amps. The light weight (2.5 lb.) and inexpensiveness of this outfit should appeal to the electrical trade.

Record Electrical Co., Ltd.

Apart from minor improvements in standard designs, the company this year introduced two improved instruments.

One novelty was a range of skeleton instruments suitable for demonstration purposes; they consist of the well-known "Cirscale" and "'xtra" type moving-coil and moving-iron ammeters and voltmeters mounted on a wooden base with transparent dials and enclosed under a glass cover, with front connection terminals attached to the wooden base. The object of the series is to enable the lecturer to explain the construction of various types of measuring instruments in everyday use to his students, all the important parts being easily visible through the glass case. The instruments are actual working models and can therefore be put to practical use in the laboratory and the student can watch the movements of the parts whilst the current is on. The transparent dial enables observers on both sides of the lecture table to read the indications of the pointer; furthermore, the scale can be stood in the path of a beam of light and projected on to a screen.

The bridge ohmmeter shown in fig. 15, is of novel design, being a recent patent of Mr. J. W. Record, its object being to provide means for extending the range of an ohmmeter to enable it to measure low resistances, such as are met with in

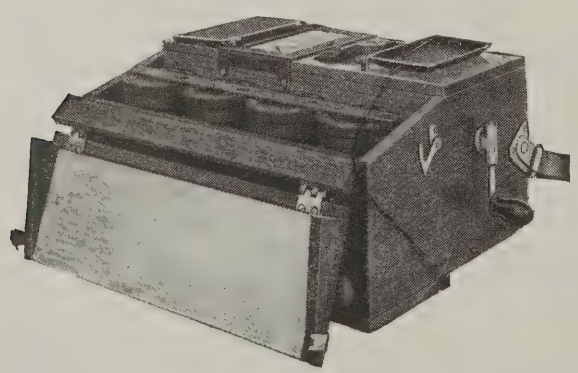


Fig. 15.—"Record" Bridge Ohmmeter.

ordinary general industrial work. An ohmmeter usually gives its first indication at 10,000 ohms, but the bridge ohmmeter will measure from .01 ohm up to 999,900 ohms on the bridge, and from 10,000 ohms to 100 megohms on the ohmmeter scale: it also indicates a short circuit (zero) or open circuit (infinity). The instrument consists of a generator, a direct-reading ohmmeter convertible into a galvanometer for bridge tests, a decade resistance box with ratio switch in one arm of the Wheatstone bridge, and a multiple-contact switch for changing connections, all arranged in a portable carrying case. The indicating unit is the same as that employed in the Record ohmmeter patented in 1902; constructional improvements, however, have been effected—chiefly the use of cobalt steel and a combination of resistance bobbin and dust shield, all forming a complete unit. The magnetic field for the pressure and current coils is provided by the same magnets, so that any loss of field strength due to diminishing magnet strength, or any change in temperature, would affect both coil systems equally, and as the pointer takes up a position which is the resultant of these forces, its true indication would be unaltered by such changes. Immunity from stray magnetic fields is effected partly by compensation as above and finally by shielding; the generator is also provided with cobalt-steel magnets, and its handle is an entire departure from the usual folding knee joint pattern.

H. Tinsley & Co.

Besides scientific instruments, a model was exhibited of Mr. Galletti's radio "beam" transmitter. The actual transmitter could be seen in operation by appointment at Hendon, but the model illustrated the principle upon which the transmitter works. It is capable of sending out an actual beam of radiation of radio-wavelength exactly like a searchlight, and not in the same way as the angular wedges of radiation are sent out by the "beam" stations at present working. Thus the beam can be directed upon a given target and limited both vertically and horizontally; the angle of the beam is negligible.

It will be realised that this is a very remarkable achievement, of which the future possibilities are large indeed. The actual apparatus at work at Hendon is operating on 4-metre waves, which could be varied without affecting the principle of the transmitter. The beam responds to all the optical laws of reflection and interference.

Amongst other items was a frequency bridge, built according to a suggestion of Dr. Pedersen, of Copenhagen, which has the unusual advantage of being suitable for low as well as high frequencies. The circuit employed is the well-known non-inductive combination of a resistance and a condenser in parallel with a resistance and an inductance; the frequency is measured by balancing the e.m.f. upon one of the resistances against the secondary of the mutual inductance, in series with the combination. The bridge shown had three ranges, which are obtained by three tappings on the mutual inductance, reaching from zero to 5,000 cycles, zero to 2,000 cycles, and zero to 1,000 cycles. Great latitude in the available frequency range is obtainable, and the bridge can be adapted for the measurement of quite low frequencies if required, as the square root of the resistance on the adjustable dial.

Hoope's conductivity bridge has been specially designed for for the convenient measurement of the percentage conductivity of copper samples. It is a Kelvin double bridge in principle, the sample being measured against a copper standard of the same nominal size: the procedure is to cut a specimen in the special cutting-off machine to a known length and to weigh the specimen against a special weight, the difference in weight being noted. The specimen is then put into the bridge and the "difference of weight" dial set to the value found when weighing. The slider of the bridge is then adjusted for balance and the percentage conductivity read directly upon the scale. The weight against which the copper sample is balanced is so adjusted that the percentage conductivity of the standard, as well as the dimensions of the standard, are compensated for, so that no further correction is required; there is a separate weight for each standard. Since measurements are made against copper, the temperature coefficient of the sample is compensated for, and measurement can be carried out without any rigorous temperature control; an accuracy of 0.1 per cent. is obtained.

A four-phase tuning fork has been developed to produce a continuous torque phonic motor. By means of a special type of contact, the fork is made to pass impulses of current displaced 90 deg. in time phase; the duration of these impulses can be controlled with great facility by the adjustment of the contacts. The fork exhibited was of a double type, provided with two pairs of limbs, one pair vibrating 180 deg. out of phase with the other set, both maintained by the same fork, so that a great many phased contacts can be obtained; there were five contacts on the fork exhibited, but several more can be added if required.

A number of N.P.L. pattern low-resistance shunts of wire construction were exhibited for the first time: the wire has the advantage of greater homogeneity than rolled sheet manganin, and shunts for carrying up to 16,000 amperes are under construction in this type. A curve-tracing machine of the "Ondograph" type, suitable for commercial frequencies, was shown operated by a tuning fork. A reflecting dynamometer specially designed for the measurement of zero power factor is intended for use in establishing quadrature in such measurements as dielectric losses; its sensitivity is such that, with full-range current, a power factor of 0.00013 can be detected. The instrument is provided with four current ranges, so as to make it suitable for a wide variety of tests. A submarine cable balancer (D. C. Gall's adjustment restorer) is designed to measure the errors in the duplex balance of submarine cables, the balance being obtained by operating the dial of the instrument. The settings of the dials give the resistance and reactance errors, a series of determinations of which is made at a number of frequencies, and from the nature of the errors, adjustments can be made by the artificial line, which will eliminate them. The position at which the adjustment to the artificial line must be made is found by means of a special chart, which was also exhibited.

(To be continued.)

Electric Railway Track Equipment.

A Comparative Review of the Electrical Apparatus installed on the London Underground Lines, and Experience Gained in their Operation.

By ARTHUR R. COOPER, M.I.E.E.

(*Abstract of a paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

(*Concluded from page 75.*)

Conductor rails endeavour to move or creep in the direction of the traffic, even on up-gradients, due to the effect of the train shoes and of the variation in temperature. These effects have been responsible for the over-turning of rails in many cases. Various types of insulators have been designed to act as anchors, but the best results have been obtained with a giant strain insulator, fig. 6. This is fixed at one end to a strap bolted to the underside of the rail, and the other end is secured to a sleeper by means of a strap fastened to the top of the sleeper and turned down over its side. The present practice for new lines is to install anchors, on the average, 300 yards apart.

Experiments are being made on a special joint for taking up conductor rail movement, fig. 7, and observation extending over 12 months shows that a daily movement up to 1¼ in. is recorded, the joint providing for movement up to 4¼ in.

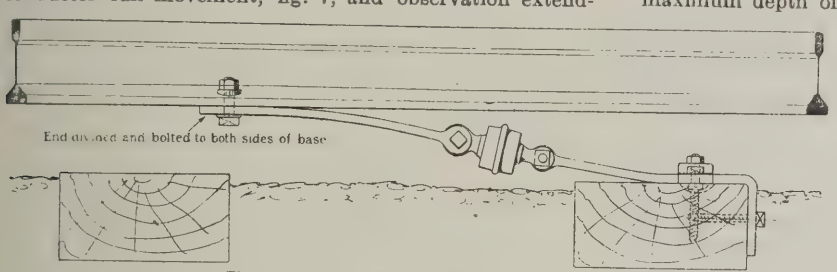


Fig. 6.—Giant Strain-Insulator in Position.

Failures have occurred with the earlier jumper cables laid direct in the ground at junctions and other places where gaps occur in the current rail, the cables being lead-covered and rubber-insulated. To overcome these failures it was decided to lay the cables in wooden troughs on the sleepers and above ground, the cable used being a special one with rubber insulation, having a covering of bitumen-rubber and being taped, braided, and compounded, but not lead-covered.

Cable connections to the conductor rails are made by flat lugs fixed with set-screws. An improvement made in recent years in such joints is the use of stainless steel in place of gunmetal for the set-screws; it is found that better connections result, apart from a clean surface being maintained.

The appearance of the rail is somewhat misleading, in that the heavy scaling would appear to indicate a much more rapid wastage than has actually occurred. The loss on the Underground Railways, due to corrosion and wear, varies from about 0.2 per cent. under favourable conditions to 1.2 per cent. under specially adverse conditions. The wear off the head of the rail is increased materially where moisture is present. It is suggested that a thin film of rust forms on the surface where moisture is present, and that this film is swept off by the train shoes and a clean surface left for a fresh formation of rust, and that as a result a much quicker corrosion effect takes place. Heavy loss from corrosion occurs at Earl's Court; it is suggested that vibration accelerates corrosion, and the amount therefore is dependent to some extent on the train service. In the tube tunnels the wear of the positive rails is about 0.08 lb. per yard per annum, and in the open 0.66 lb., or about 8 times as much.

It is interesting to note that positive rails wear a little more quickly than negative rails, and in particular where current is being collected. The wear on the conductor rails is also influenced by the weight of the shoe.

It is desirable to record a feature which has come to light in investigations on the loss of weight, and that is the extraordinary difference in the amount of wear that has taken place within the length of an individual conductor rail. The rail taken as an example is the worst one on record. The least vertical wear of the head is about ⅜ in. and the maximum depth of wear 1¼ in. These differences are about 20 ft. apart on the same rail, so that there can be no marked variation in chemical composition. Brinnell tests taken on the sections of rail cut out at these two places only showed that there was a slight difference in hardness. It is apparent that the painting of rails in the tunnels would not be justified. From experiments carried out on rails on the outside sections, the same conclusions have been drawn. To effectively stop corrosion by painting the rails would cost about £20 per annum per mile of rail.

For ordinary maintenance purposes the height of the current rail is hand-gauged by the permanent-way maintenance gangs who are responsible for keeping it to the standard level, the maximum variation permitted being ¼ in. up or down. Wood-packings fixed between the sleeper and the insulator are generally employed to adjust the height of the current rail. These are of creosoted pine for the open sections, and hard-wood for the tunnels. They are of sufficient size to take the insulator base and fastening clips, and are supplied in thicknesses from ¼ in. to ¾ in. Experience has shown that it is very necessary to bend, by careful "crowing," the rails installed on curves, to ensure that they are set properly to gauge.

The insulators originally installed on the outside sections of the District Railway were of two materials, some being of porcelain and some of a granite composition. They had a metal cap and a metal tripod base, as shown in fig. 8. The porcelain insulators have given little cause for complaint as regards insulating qualities, but a number of breakages have occurred almost entirely by crushing or breaking away at the jointing of the metal cap. In the type of insulator without a metal base this weakness still exists. The fractures have occurred with insulators having the centre lug on the metal cap cemented in, as well as where a flat cap is cemented on to the top of the porcelain. The breakages of porcelain and the desirability of doing away with the metal cap led to the introduction of the composition insulator, which has been found to be more robust, although experience has shown that some strengthening of the head or side lips is necessary; this has been provided by moulding in some metal reinforcement. The insulation under adverse

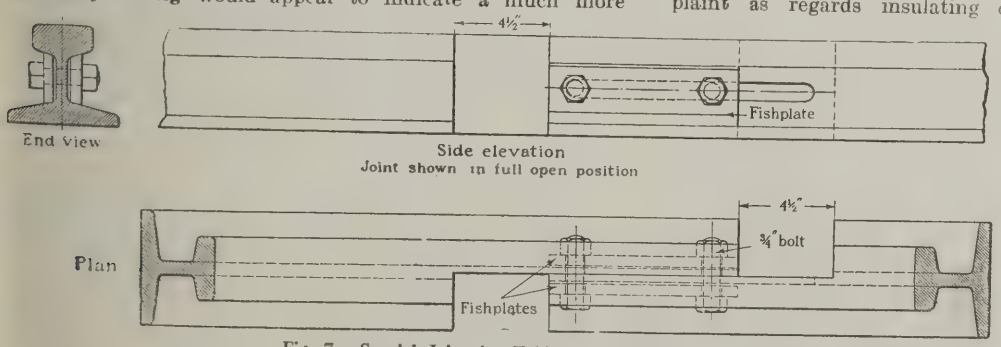


Fig. 7.—Special Joint for Taking up Rail Movement.

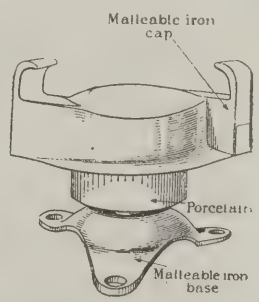


Fig. 8.—Outside-Type Insulator.

conditions is not so good as with porcelain, probably due to the less smooth surface. There is room for an insulator not requiring a separate cap and of a more robust nature than the porcelain or stoneware type of to-day, and yet possessing the smooth surface and insulating qualities of porcelain.

In doing away with the tripod base of the original type of insulator, it has been found necessary to obtain a more even surface on the sleeper top for the insulators to rest upon. Glass insulators with metal caps and metal-frame bases, but without petticoats, have been tried, but found to be too brittle; numerous breakages occurred. The use of insulators made from wood is not favoured, although good results were obtained from these insulators in the District Railway tunnels. They were used on the negative rail only and were dipped in hot insulating material. In tube tunnels earthenware insulators are used with moulded side-clips. This material is quite suitable for such conditions, and is cheaper, but is too absorbent for outside use. Insulators are installed at every third sleeper, 8 ft. or 9 ft., but it is general practice to provide an insulator on each side of the current-rail joints so as to lessen the tendency for vertical motion at the joint or rail-ends.

Some experiments have been carried out to determine whether the cost of cleaning insulators is justified, with the result that the practice has been discontinued. No case of short-circuit has occurred due to dirty insulators, and no ill-effects of any account can be traced to the small leakage currents which could be reduced during wet weather by cleaning the insulators. The value of the current lost is not a factor of any consequence.

Reference to the electrical equipment of the track would be incomplete without a description of the arrangements in force for cutting off the current from the track in emergency. Short-circuiting bars are carried on each tube train. These consist of an arm with a clip at one end to fit over the negative rail. The arm is arranged to pivot in this clip, and a conductor is arranged along the arm to connect to a contact so placed at the other end that it will fall on to the rail as the arm pivots; a wooden handle is provided on the arm. This device is placed across the rails after current has been taken off by a special device for making dead any section of the track in tube tunnels at a moment's notice. Two bare tinned-copper wires, tunnel lines, are run throughout the tunnels on insulators and at a height convenient for the train staff to reach. When these wires are short-circuited the circuit breakers at the sub-station relating to the section in question are opened automatically by relays. Provision is further made that the train staff, by attaching to these wires the portable telephone carried on all trains, can speak to the sub-station operator, giving particulars of the reason for switching off the current.

As forming part of the arrangement in connection with taking off current, relays have been installed across the conductor rails to switch on automatically the general tunnel lighting when the current rails become dead. The tunnel-lighting circuits are fed from the a.c. station lighting supply and are in general use during non-traffic hours for maintenance requirements. As a further arrangement, in each car of a train two small lamps are provided which, on the current rails becoming "dead," automatically light up from a battery on the train.

Interruptions to train working on account of ice or snow on the conductor rails occur on an average only about once or twice each year, but they are serious in effect. Snow itself does not prevent the shoes from collecting current, the trouble arising from a film of ice on the rail. The methods in general use to overcome this difficulty are mechanical. The most successful form of apparatus used up to the present is a steel strip brush fitted to a proportion of the motor-cars. The details of construction are shown in fig. 9, from which it will be seen that a raising and lowering device forms part of the equipment.

Experience has shown the need of exercising particular care with regard to the effect on the strength of materials of a burn from an accidental electric arc. On a steel rail the effect of an arc is practically the same as a nick, the burnt rail being easily fractured by a blow or similar shock. With regard to this effect on rails, an investigation was carried out some few years ago. A number of pieces were cut from the same length of rail, and in each case one piece was tested untreated and the other pieces were electrically burned and tested in various ways. The results showed that the strength of a rail to withstand impact, when the burnt metal was in tension, was very much reduced; with the burn in compression little or no diminution of strength occurred; the effect of a burn was very similar to that of a nick, and annealing after an electric burn produced a tendency to restore the strength, but only to a very limited extent. It is the practice on the Underground Railways, when signs of electric burning are found on a track rail, to have the rail replaced. A similar rule is adopted with regard to axles on the rolling stock.

The adoption of the insulated return has undoubtedly reduced the likelihood of injury to cables, particularly those in the railway tunnels. Breakdowns on the h.p. cables have been very few and, in the majority of cases, have been caused by mechanical damage rather than by an internal electrical breakdown or damage to the lead covering by electrolysis. No system of marking on the site the presence of "Underground" cables has been adopted, reliance being placed on the rule that before any work of opening up is undertaken the staff responsible for the h.p. and l.p. cables is to be consulted.

The h.p. cables for the District Railway tunnels were originally laid in sheet-steel troughs 12 ft. long, these being supported at each end on cast-iron brackets fixed to the tunnel walls. It was subsequently decided, with the concurrence of the Board of Trade, to take down this troughing entirely and provide a bracket support every 4 ft. No ill-effect of supporting old unarmoured h.p. cables in this way has been experienced.

In the open sections unarmoured lead-covered cables were originally laid in earthenware ducts a few feet in the ground, the ducts being surrounded with concrete. Some defects have taken place due to subsidence of these ducts, as well as from electrolysis in wet places and from the presence of impure water. The cables in the ducts have in several cases had to be removed and erected on posts. In being unarmoured, these cables do not accord with the general practice on railways, but our experience, extending over a number of years, does not show any ill-effect. It is our practice on outlying sections to run all new cable armoured, but the additional expenditure, about 20 per cent., is not justified where the cables are free from trespass.

Cables over bridges were originally carried in 4-in. wrought-iron pipes, no special steps being taken either to earth the lead covering of these cables or to insulate them from metallic structures. Some replacement of the cables has been necessary on account of cracks in the lead sheathing caused by vibration. The pipes are gradually being taken out, and where the cable is serviceable it is supported on raw-hide hangers provided at about 3 ft. spacing.

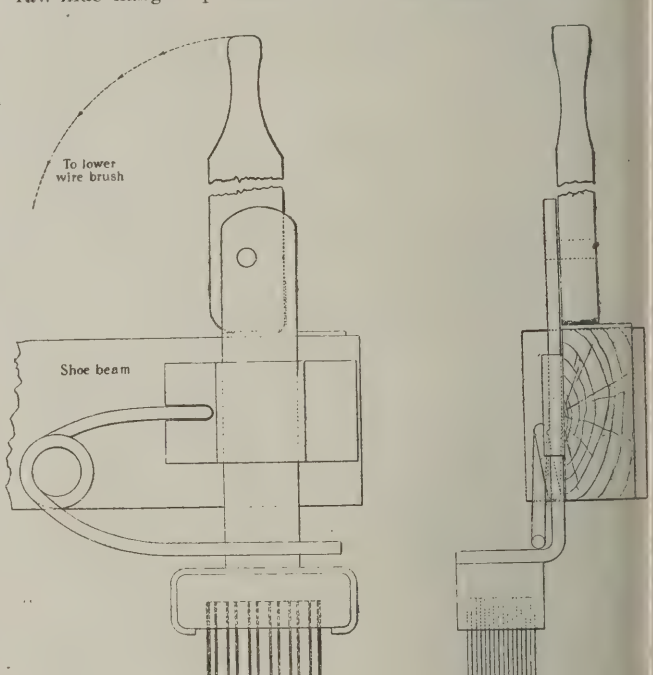


Fig. 9.—Ice Clearing Equipment.

On the tube railways the h.p. cables are unarmoured, and are supported from the iron tunnel lining on cast-iron brackets. On the railways where the insulated return has been adopted, no bonding either of the cables to the tunnel iron, or of tunnel iron to tunnel iron to make it continuous has been carried out, and no steps have been taken to keep the lead separate from the tunnel lining.

At points where sub-station feeder cables are connected to the rails short jumper cables are kept, with the necessary means for quick attachment to the conductor rails should a failure occur on the cables between the sub-station and the conductor rails.

There are two special items of electrical equipment particular to tube railway speed restrictions. The first is a machine to record the speed of all trains passing over some predetermined point, and is used to check the proper observance of speed restrictions. The recorder can be fitted up for use at any place. The second machine, a speed indicator, shows a motorman the actual speed at which his train is travelling over a particular place just in the rear of where the indicator has been installed. For the speed recorder two pairs of electric contacts are clamped to the track rail about 50 ft. apart at the point where the speeds are to be recorded, and are operated by the passage of the train. The first contact starts up the pointer of the recording instrument, and the second causes marks to be made on the chart as the train wheels pass. The record is made on a paper strip 6 in. wide, driven at 6 in. per hour, by mechanism which also moves the timing pointer, this consisting of an arm passing across the paper once for each train

recorded. A small electric motor drives the recording arm nd runs in synchronism with an electrically-driven tuning ork. The speed indicator consists essentially of a disk iming-device which is electrically released to rotate during he passage of a train over a measured section. The disk is ierced near the edge with numbers in decreasing order, nd when it stops, as the train leaves the measured section, lamp lights up and, by means of a small optical lantern rrangement, shows on a board an image of the number to vhich the disk has rotated and which naturally corresponds o the speed over the section. The measured section is about 80 ft. long, the indicator being placed about 200 ft. beyond his section. The rotation of the disk is carried out by a gravity arrangement assisted by a spring in order to increase the initial speed and thus allow of the numbers being evenly spaced round the disk. The rotation of the disk is controlled by the damping effect of the electric currents generated in it by its rotation between suitably-placed magnets. The disk is returned to normal by a simple electric motor device.

Both of these devices are worked from ordinary accumulators and, being portable, are frequently moved from place to place;; in fact, the recorder is generally moved after having been installed for about 24 hours on any one section. The use of these instruments has resulted in the much-improved observance of the speed restrictions.

Electric Ploughing.

A New Italian Development, employing a Double-Locomotive Equipment.

SOME particulars of what is described as the first electric ploughing outfit on the funicular or cable system of Italian manufacture have been given in the *Implement and Machinery Review*, whose permission we have to make use of he following information and reproduce the accompanying lustration. The makers of the equipment are Messrs. Fratelli iolati-Tescari, of Milan, and there are already many of the oughs at work in Italy, where it is expected they will prove great assistance in the campaign which has been instituted that country to produce more home-grown fruit.

The equipment, which is admittedly modelled on the Fowler stem, consists of two electric locomotives weighing about 55 vt. each. They are four-wheeled vehicles, the two front



Double-Locomotive Electric Ploughing Equipment.

heels being the steerers. The frame is rectangular and of annel-section iron. The driving motor is of 36 h.p., and is ced on the forefront of the locomotive chassis; its speed, 0 r.p.m., is so reduced by a double set of gearing that the um pays out or winds on slowly, up to less than 30 r.p.m. necessary, so that the cable, which is 400 metres long, is ound on at a correct speed for the task in hand. One locootive draws the plough or other implement as the drum of e second prime mover, running light, pays off the cable, d the reverse happens for the opposite run. The motor is itably enclosed, and the transmission system is also proted, as is the winding gear. The sheet-steel cabin contains the controls and the necessary instruments, and affords e operator a good view of the ploughing operations while lly sheltering him from the weather. The entire outfit is nply designed, permitting the use of wearing parts of ample rength without adding unduly to the weight, and the iving arrangements are conveniently arranged.

In a trial which took place at Rogoredo, a plough was erated at 500 V, the supply pressure of the district, and there was no need to use the portable transformer, which is supplied with the set for making the necessary pressure adjustments. The soil conditions were superficially favourable, but the draft was increased not so much by the matted top growth as by the dry and hard subsoil of land that had not usually been deeply worked. A four-furrow balance plough was hauled along at a rate of 2¼ miles per hour, and had an effective working width of about 4 ft. The operation was regular and uniform throughout, there not being a single hitch in the free flow of movement from bout to bout. The depth of the work was also well maintained throughout at approximately 10½ in.

The price of the apparatus is said to be about a third of that of a steam ploughing set. The equipment is capable of ploughing, it is claimed, about eight acres of ground, under the conditions which prevailed at the trial, in a ten-hour day with an effective power of 30 h.p. The necessary personnel is three men, one on each locomotive and one on the implement, though where a bigger implement is used and more work undertaken in the course of a day it might be necessary to supplement the crew. The average life of the outfit, with the exception of the cable and certain accessories, is placed at from 15 to 20 years, and where a working knowledge of the plant is used to advantage in protecting the delicate electrical apparatus from rust and water, the maintenance costs are reduced to a very low figure. It is claimed that the total cost for ploughing 2½ acres is about 16s., where the cost of energy is about 0.65d. per kWh.

It is interesting to note that the makers produce other electric ploughing sets ranging from 35 to 100 h.p., and that they have turned out some 350 of such sets in 10 different types. These include an electric prime-mover much on the lines of the double set mentioned above, but arranged for working on its own with an anchor placed at the far end of the field. Two drums are fixed horizontally in the middle of the chassis, and one of these pays off as the other draws on while the implement is hauled to and fro.

Hollow Electrical Conductors.

An Economical Means of Reducing Corona Loss.

NOTWITHSTANDING the fact that corona loss has been studied sufficiently to enable engineers to develop the transmission of power electrically by means of overhead conductors operating at pressures up to 220,000 volts, research is constantly in progress with the object of improving the efficiency of conductors.

The solution of the problem has hitherto generally been sought by the employment of a conductor of a diameter large enough to confine corona loss within tolerable limits. In the case of the highest-voltage transmission lines, however, such a policy often involves the use of more material in the conductor than would otherwise be economical. It is, of course, unnecessary to make the conductor solid; it may be stranded and wound round a core of some other material, either insulating or metallic, thus increasing the total diameter. Such a composite cable, however, introduces difficulties: its cost and weight may be increased, and in

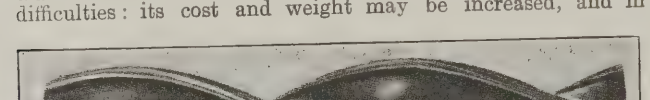


Fig. 1.—Cylindrical Core, Twisted Copper Strip of I-section.

some cases its use may necessitate the provision of extra strong towers and foundations; the core material may deteriorate according to climatic conditions, whilst differences between the coefficients of expansion of the conductor and core materials result in varying stresses with temperature changes, which may reduce the combined strength and cause alternate tightening and loosening of the conducting strands on the core, with the result that the surface-conducting metal tends to "crawl" towards the lowest point of the span sag, with the possible consequence of the conductor strands fracturing at their points of support.

In order to obtain cable of the desired diameter without the difficulties enumerated above, the Anaconda Copper Mining Co. and the American Brass Co. have introduced hollow cables, which are so constructed that their outside diameter and cross section are independent within wide limits, it is claimed, thus permitting transmission lines to be designed for maximum economy as regards both corona and resistance losses. Moreover, such cables are said to be advantageous for carrying alternating currents of such magnitude as to make the "skin effect" important.

Hollow conductors may be constructed in various ways: for the sizes required to accommodate the transmission voltages so far "standardised," the most rugged and economical design is claimed to consist of a core made by twisting around its longitudinal axis a copper strip I-section in shape (fig. 1). The web part of the strip at any section remains perfectly straight, giving a rigid column across the diameter of the cable, while the flanges provide a bearing surface for the strands laid around the core to form the cable. This I-section of copper can be twisted more or less closely as required to support the strands, and forms, in effect, a light-weight flexible cylindrical core capable of withstanding considerable compression and supporting the surrounding strands at short intervals. The first layer of strands is spiralled in the opposite direction to that of the core strip; successive layers can be spiralled alternately in opposite directions as in the construction of concentric cable.

The strength of such a cable is that of the strands, plus the strength of the core, and its conductivity is the conductivity of the strands, plus that of the core. The core in a cable approximately 1 in. in diameter and 500,000 c.mils will not be more than 7 per cent. of the total weight of the cable, and its conductivity will be about 90 per cent. of the conductivity of a solid copper wire of the same weight per foot. The conductivity of the complete cable will therefore be over 99 per cent., and the tensile strength approximately the same as that of a concentric cable of the same weight per foot. Whenever the cross section of copper required to carry the current economically does not give the desired tensile strength, the hollow conductor can be reinforced with bronze strands having the same temperature coefficient of expansion as copper, so that the strength of the combination cable does not change with temperature.

In January, 1925, a 500,000-c.mil "Anaconda" hollow-conductor line was installed by the Montana Power Co., near Great Falls, Montana. The operating engineer reported later that "On September 19th, 1925, our hollow-conductor line withstood, without the slightest deformation, the most severe wet snow and ice storm which this territory has experienced in twenty-five years. The adjacent spans of 1/0 copper were broken down by the snow, and there were twelve breaks within a distance of approximately five miles. Other lines in the neighbourhood of Great Falls were seriously broken down by the storm. We also had over 100 miles of telephone line laid flat on the ground." The cable in question was erected by the regular line crew without additional help, or supervision . . . "It was more flexible and, of course, lighter than a stranded conductor of the same diameter; it ran through the blocks without any difficulty whatever, and there was no tendency for the cable to crush or fray."

A hollow conductor can be handled and erected in the same manner as a concentric cable, except that it is necessary for the sheaves over which it is pulled to be made with grooves which closely fit the outside diameter of the cable; all clamps, both suspension and dead-end, should have accurately-fitted, smooth-bored surfaces. A 5-ton solid rubber tired motor truck with a load of 2 tons was run over such a cable laid on concrete, several times, without damaging it. Such conductors can be furnished bare; paper insulated and lead sheathed; and varnished-cambric insulated, either lead sheathed, or braid covered.

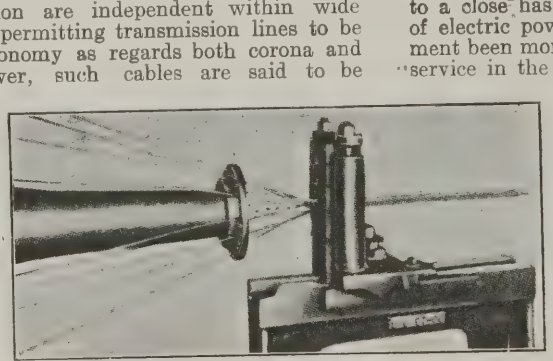


Fig. 2.—Stranding Wire Over Copper Core.



Fig. 3.—"Anaconda" Hollow Conductor.

Rural Electrification in Ontario.

A Canadian correspondent says that the year just drawn to a close has been marked by a great expansion in the use of electric power in Canada. In no respect has this development been more pronounced than in the rapid extension of this service in the rural districts of Ontario, where approximately 18,500 farms are now being supplied with power by the provincial Hydro-Electric Power Commission, the operations of which probably cover a larger territory than those of any similar organisation. The Commission has already constructed 2,24 miles of rural transmission lines, of which 700 miles were erected during 1926, supplying about 5,000 new customers. The plans of the Commission involve a considerable further widening of this field of its operations, by the extension of the system at the rate of about 600 miles of transmission line per annum for some years to come. Farm consumers at present are using about 8,000 h.p., and when the objective of the Commission is attained, it is estimated that about 20,000 h.p. will be required. These figures, it may be noted, are for *bona-fide* farms, and do not include the suburban areas near the large cities. The contracts for power are made with the townships in which the farms are situated, which are held responsible for the payment of all charges. The introduction of electric light and power has done much to lighten the labour and increase the efficiency of the farmers, as there is a wide range of services on the average Ontario farm to which electricity can successfully be applied.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

New 6-V "DE" Valves.

We have received samples of two new valves, one of which s illustrated in fig. 1, which are the first of the 6-volt class to e issued with the new Marconi nomenclature. As their ames imply, the DEH.612 and DEL.612 are high- and low-requency types respectively, having a filament consumption f 0.12 amp. The characteristics of the former, fig. 2, show hat it is a good detector and suitable for resistance or choke-

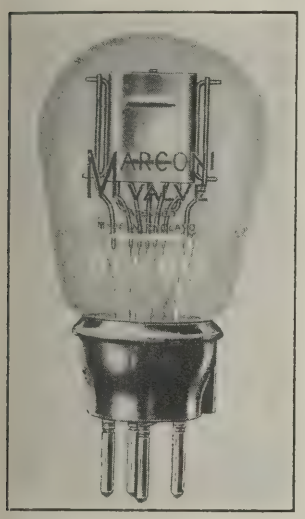


Fig. 1.—New DEH.612 Valve, 6 Volts.

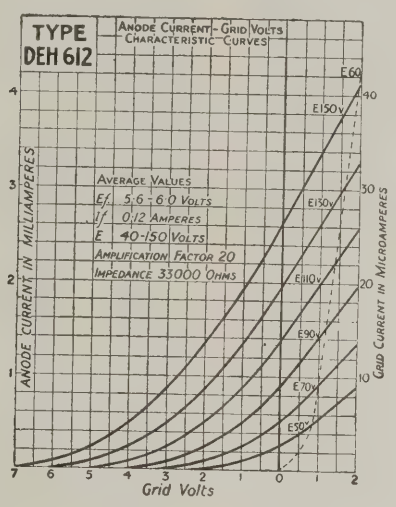


Fig. 2.—New Valve Characteristic Curves.

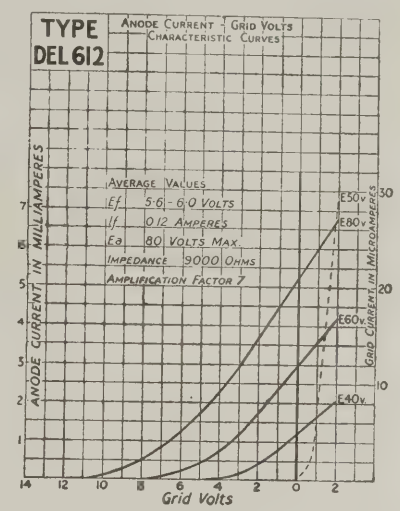


Fig. 3.—Characteristic Curves of DEL.612 Valve.

pacity coupling, or high-frequency stages. The latter, fig. 3, suitable for use in the first stage of a transformer-coupled nplifier, and with 80 volts on its plate will need about 4-volts id bias; it may also be used in the second stage when only oderate output is required. Both valves represent excellent lue, and their chief constants are shown in figs. 2 and 3. ese valves are manufactured by the M.O. Valve Co., Ltd., d similar ones are being marketed by the General Electric ., Ltd., under the name of "Osram." They offer all the vantages of the 6-V filament, taking 0.12 A only, for the me price as 2- or 4-V general-purpose valves, another step wards economy.

Battery Eliminator Components.

In view of the extraordinary interest which has been aroused the introduction of high-voltage plate-battery eliminators

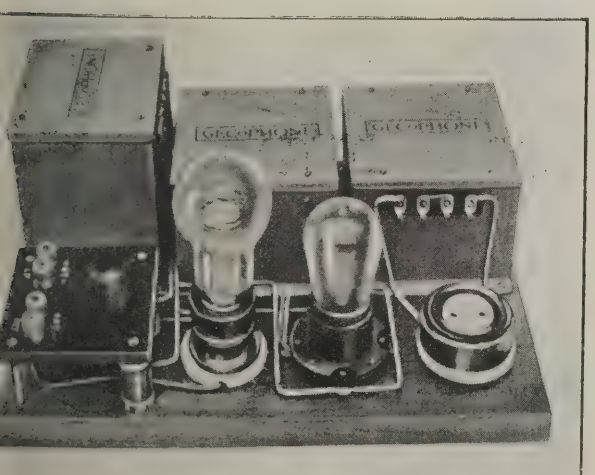


Fig. 4. G.E.C. Battery Eliminator Set.

the wireless market, it is gratifying to learn that a full set components, specially manufactured to enable the con-uctor to build up his own unit, can be bought for use in junction with a.c. circuits. This enterprising move has n made by the General Electric Co., Ltd., which also sup-plies assembled units, in attractive containers, for a.c. in 100/115-volt and 200/230-volt types, and for d.c. As the components, in the case of the a.c. units, are similar in every respect to the individual components now being sold separately, there would appear to be no valid reason why equally efficient and serviceable units should not be constructed by those who prefer to build up their own eliminators; moreover, the circuit for which they are designed is at the constructor's disposal, permitting him to assemble them in accordance with his own requirements. The components in question embrace a transformer, choke unit, condenser-bank unit, fixed resistance, regulating resistance, "Osram" GR.1 rectifier, "Osglim" voltage-regulator and lamp holders, each of which can be acquired separately, or the whole kit complete, as detailed (fig. 4).

A New "PM" Valve.

The valves used in a resistance-capacity coupled amplifier should have a higher amplification factor than those used for a transformer-coupled amplifier. Such a valve is the new Mullard PM.5B, whose amplification factor is 37 approximately, or 30 overall per stage in practice when correctly used, which value is nearly as high as that obtainable from the best transformer amplifier, it is claimed, but with superior quality: the new PM.5B valve has the very low impedance of 74,000 ohms. It must be emphasised that in a multi-stage amplifier, the amplification over two stages may be as high as 1,000 and therefore it is important that the valves used in the later stages must have a sufficiently long "grid base" to avoid the "cut off" effect which causes bad distortion in l.f. amplifiers. The anode current flowing when the grid is at zero potential, should be halved by the application of the negative grid bias. Other characteristics of the new valve are filament voltage from 5 to 6 volts and current 0.1 amp.; the maximum anode voltage is 150 volts and total electron emission 20 mA, while the mutual conductance is 0.50mA-volt (at anode volts = 100, grid volts = zero).

The Condenser Telephone.

A lecture on "The Condenser Telephone: a Development of the Speaking Condenser," was delivered to members of the Royal Philosophical Society of Glasgow last week by Dr. George Green, Lecturer on Natural Philosophy at the University, who explained that the idea of employing condensers as mechanisms for converting electrical vibrations into sound vibrations was by no means new, but none of them had been able to survive the competition of the ordinary electromagnetic telephone. Interesting demonstrations were given by the lecturer, whose experiments proved that the condenser telephone was capable of giving volume of sound as well as quality in transmission work. By means of condenser telephones of various capacities and having plates made of different materials, the tuning of the condenser telephone was demonstrated. The quality of the instrument improved and the volume of sound emitted also increased as the capacity was increased. Instruments of high capacity were apparently best suited for the reproduction of music. The lecturer pointed out that the condenser telephone was capable of being used either as a transmitter or as a receiver.

The Use of Low-Grade Fuels.

A Comparison of the Methods of Burning High Ash-and-Moisture-Content Coals for Steam Generation; Chain Grate Stokers *versus* Pulveriser Equipment.

By W. F. GOODRICH, M.B.E.

(*Abstract of a Paper read before the* INSTITUTION OF FUEL ECONOMY ENGINEERS.)

UNDER the conditions of acute coal shortage which have prevailed during the past few months, large quantities of low-grade coal have been used. It is not suggested that the users have been generally very enthusiastic, either in regard to its cost, calorific value, composition, or the results obtained, but its use has undoubtedly enabled many steam users to carry on. Opinions will widely differ as to what fuels may reasonably be placed within the category of "low grade," but the author would submit that the following may all for one or more reasons be classed as low-grade fuels: Coal having a calorific value "as received" of 10,000 B.th.u's or less; coal having an ash content of 20 per cent. or upwards, coal and coke dust; slurry, gum, duff, smudge, dant, pond tank or washery settlings, ballast, bats, and pickings; town's refuse; certain waste gases; timber, wood waste and sawdust peat; brown coal and lignite; and bagasse.

In a paper entitled "Notes on the Use of Low Grade Fuels in Europe," by R. H. Fernald, issued by the United States Bureau of Mines eleven years ago, the position in the United States at that time, in so far as the use of low-grade fuels was concerned, was referred to thus:—"The unrestricted use of our better grades of fuels and the ruthless waste and neglect of fuels which should be of real commercial value, are phases of our national extravagance which are but little short of appalling." Whether the United States can afford to neglect to utilise those fuels which are described by Mr. Fernald as "of real commercial value" is a matter for those concerned to decide. Our position, however, is entirely different, and it may without any hesitation be stated that we cannot afford to neglect to use any fuel of real commercial value. It would seem that the only hope of cheaper coal in the future is dependent upon the much more extended use of low-grade and so-called waste fuels; and the drastic reorganisation of the coal mining industry. It is idle to disregard the fact that as a whole the coal mining industry has functioned wastefully and inefficiently; and it can scarcely be denied that drastic changes must be made. All authorities are agreed that underground and surface waste of coal at collieries represents a colossal loss in revenue, a loss which has been and still is discreditable to all concerned.

Generally speaking, there can be no doubt that low-grade fuels should, so far as may be practicable, be utilised at or adjacent to the point of production. Providing that an assured supply of low-grade coal is available at an attractive price, the question arises as to the conditions which should obtain in order to ensure that the utilisation of such fuel is advantageous to the user. This question involves various considerations, but the main problem presented is essentially one of providing suitable steam generating plant and the correct firing equipment. It has been constantly asserted that while the utilisation of these fuels in the future is of national importance, the only satisfactory method of their utilisation is in pulverised form. The author dissents entirely from this view. Low-grade fuels have been burned in this country, as also in other European countries, in the raw condition on grates, both hand and machine fired, in increasing quantities for from thirty to forty years past.

If efficient use is to be made of those fuels which have a commercial value, instead of accumulating millions of tons as hitherto, this will only be accomplished by providing steam boilers of suitable design, with firing equipment of such a type as will ensure the most efficient use of the available fuel, at the lowest capital cost, consistent with low labour, operating and maintenance costs and reliability in service.

If these desiderata be conceded as essential, then it is submitted that to a very large extent internally-fired boilers such as those of the Lancashire type can no longer be used. Only in certain cases where the fuel has a low volatile content, and when the evaporative output demanded is very moderate, can the use of such boilers be justified. It is submitted that a water-tube boiler suitably designed, arranged, and equipped for burning fuel having a high ash content, will efficiently deal with low-grade fuels in such a manner as is clearly impossible with a boiler of any other type.

While comparatively little attention has been given to the fusion temperature of ash, in the burning of low-grade fuels this often presents a very serious difficulty. If ash in forming is subjected to a temperature in excess of its fusion temperature the formation of clinker is inevitable. The nature and condition of the clinker will depend upon the composition of the ash and the excess heat to which it may be subjected. In the case of many low-grade fuels the fusion temperature of the ash is relatively low, and when cold air is used for combustion, as the ash percentage increases so the furnace temperature is appreciably reduced. If, on the contrary, preheated air is used, while it is undoubtedly advantageous in improving the combustion conditions, increasing the rate of combustion, reducing the excess air used, and decreasing the percentage of combustible in the ash, it is frequently the cause of very serious trouble in the rapid formation of very difficult clinker and impossible operating conditions.

The alternative method of utilising certain low-grade fuels is that of pulverisation. Up to the present time there has been no opportunity of definitely determining the relative advantages of this and other systems. The author is aware that low-grade fuels have been used in pulverised form in some few installations during the past few months, under the stress of the conditions which have obtained, but whether it is more efficient and economical to burn certain low-grade fuels with high ash and moisture contents on grates or in suspension will not be settled until such time as comparative and conclusive trials are made over an extended period, with precisely similar fuels, and under normal operating conditions. Any system of utilisation which involves intermediate or preparatory treatment of fuel before its energy can be converted into useful work is clearly at a disadvantage, and all costs involved up to the time the fuel is actually fired must be taken into consideration in comparison with the use of raw coal, having in mind that there is no practical difficulty in burning raw coal as delivered despite its condition.

In considering the relative advantages of the two systems of firing, the question of ash demands attention. The problems presented in dealing with ash differ widely. When the ash is formed on a grate, one knows where it is, and it is to a large extent automatically removed. On the contrary, when the ash is all in suspension not only are the heating surfaces much more readily coated, but fusion and slagging much more easily occur. What becomes of the ash which escapes into the atmosphere in considerable quantities? The discharge of large amounts of finely subdivided material, even if it is invisible, very closely approximates to atmospheric pollution.

With very few exceptions, all fuels which may be efficiently utilised in pulverised form may also be efficiently utilised with suitable mechanical stokers.

Those fuels which are admittedly specially suitable for use in pulverised form, and which in their dry and grade condition alone are not suitable for stoker firing, are certain dry fuels finely subdivided, which, by reason of their size and physical condition, require but the minimum of drying and pulverisation.

It is imperative that such fuel should be utilised where it is produced; it would, however, be a mistake to suppose that it could not be utilised with mechanical stokers, either mixed with fine slack or in a moist condition. It is claimed that in the choice of fuels which may be efficiently burned for steam generation, there is beyond question no overwhelming advantage in favour of pulverisation. Among the most recent information available concerning the use of low-grade fuel for steam generation are details of boiler tests lately carried out at the Kashira power station, Russia, with both unscreened and screened, low-grade non-choking coal from the Moscow basin, containing a considerable proportion of fine. The approximate analysis of the unscreened coal was: Moisture, 33.1 per cent.; ash, 20.9; sulphur (volatile), 3.; volatile matter, 21.0; and fixed carbon, 21.9. The net calorific value of the fuel equalled 4,800 B.th.u's. per lb.

The tests were carried out with a Babcock & Wilcox boiler having 3,250 sq. ft. of heating surface, a superheater, but without an economiser. The firing equipment comprised

hain grate mechanical stoker having a grate area of 74 sq. ft. ir was supplied to the grate under pressure by means of a Schiele fan, being preheated by means of a mixture of a ertain volume of the hot gases. The range of the preheated ir temperature was from 265 to 590 deg. F., while a thermal fficiency of 70 per cent. was obtained, this being largely ue to the use of preheated air. In a second series of tests ith screened coal, the thermal efficiency was increased to he extent of 2.7 per cent.

The screened coal used had the following proximate analysis: loisture, 30.03 per cent.; ash, 18.20; sulphur (volatile), 2.24; olatile matter, 23.97; and fixed carbon, 25.56. The net alorific value in this case was 4,418 B.th.u. per lb.

Towns' refuse has been aptly termed the lowest of all w-grade fuels. Ever varying in its composition, usually aving both a high moisture and incombustible content, it anything but homogeneous in character. Nevertheless, it ossesses an unquestionable fuel value, and assuming that disosal by fire be decided upon, the available heat should be lly utilised, not only with a view to reducing the cost of isposal, but also in the interests of coal conservation. Rearded solely from the point of view of its fuel value, the tilisation of refuse for steam generation merits much more erious consideration than it has hitherto received. In a eport to the Electricity Committee of the Metropolitan orough of Shoreditch on the disposal of London refuse rather ore than a year ago, Mr. C. Newton Russell, A.M.I.C.E., .I.E.E., the then borough electrical engineer, estimated that the whole of the refuse collected in the Administrative ounty of London were burned in large, modern, and coneniently located destructors, designed for steam generation, ie steam being fully utilised, there would be a saving of wards of 128,000 tons of coal per annum, and 30 million Wh could be generated yearly and sold at 0.4d. per kWh, quivalent to a revenue of £50,000. Taking into account all ie charges, the estimated net cost of disposal would be . 11d. per ton, as compared with the present cost in London r burning of about 9s. per ton.

Waste heat as low-grade fuel may be said to include blast rnace gas, waste gases from various types of metallurgical rnaces, gas retorts, water gas plant, and producer gas.

In a report of the Electricity Commissioners, coke oven gas included as waste heat, while the reports for the three years ding March 31st, 1925, show that the respective annual perntages of the total units generated for the three years in estion from waste heat were 3.21 per cent., 3.26 per cent., d 2.51 per cent.

Whether it is desirable to utilise such a fuel as coke oven s for the firing of steam boilers is a debatable question, ving in mind the very moderate thermal efficiency which is o often obtained. The use of blast furnace gas has not en developed in this country to anything like the extent ich it should be. As ordinarily available, heavily charged th dust, the pressure varies considerably, thus introducing ficulties in adjusting the correct mixture of the air supply r combustion with burners of the aspirating type.

In the more recent practice the gas and air are conveyed the burners under pressure, the supply being maintained a minimum regardless of the gas pressure in the main. the burner the gas is broken up into thin streams, the air ing so introduced as to ensure complete diffusion before nition. Large furnace volume is essential, also great length gas travel. Compared with the early installations with ter-tube boilers, furnace volumes have increased in the io of from 4 to 6, to 1. It is essential that the furnace ckwork be so designed as to maintain the highest possible rnace temperature.

With a draught at the outlet damper of 2.2 in. W.G., 2.9 in. essure at the gas burners, and 1.7 in. air pressure at the rners, an average evaporation of 5.27 lb. of water per square ot of heating surface has been obtained over a continuous n of 168 hours.

Discussion.

Mr. W. D. Wylde, in a written communication, said that the penditure in terms of potential heat units involved in the -treatment of coal was not usually included in the comative test results. With low-grade coal at 15s. per ton ivered, the heat value referred to gave mechanical stokers per cent. start in the race for maximum steam-production ciency. He had in mind numerous instances where a 50 cent. increase in the steam demand was comfortably met boiler plant equipped with modern chain-grate stokers. re were the banking losses debited to the firing of solid l, but there could not be such a wide disparity in the losses he two methods of boiler firing as was generally supposed.

Mr. C. Newton Russell agreed that the pulverised fuel advoes had not yet proved their case. Recently he had had to sider whether he should go in for pulverised-fuel firing or , and in view of the extra cost of the pulverising plant, the ge staff required to look after it and the huge buildings uired, together with the risk that it would not work out as ected, he had decided that the time was not yet ripe for ting down that plant. Dealing with the prevention of the ssion of grit from small chimneys, he had devised a system which the bottom of the chimney was left quite open, there ng a receptacle with a volute round which the gases sped on their way to the chimney proper. It was found that 0.4 per cent. of the whole of the fuel burned was retained at the bottom of the chimney in the form of grit. He had been astonished to find that there were 4,000 B.th.u. per ton in the grit. With the pulverised-fuel firing system the grit was finer than when chain grate stokers were used, and if one were unable to catch it, it would float for miles and become a nuisance. He looked upon the coal deposits of the country as so much capital belonging to the nation in the bank; we were living on our capital, and the present wasteful methods amounted to practically a crime in some cases.

Mr. P. C. Pope agreed as to the necessity for making use of low-grade fuels when those low-grade fuels were other than coal, but did not agree that there was any necessity to make use of coal in the form of a low-grade fuel. It was very much more economical to treat the coal at the collieries and éliminate a very large proportion of the ash before it was sent to the boiler plant, and it was not a paying proposition to cart a lot of dirt to the boiler plant, heat it up, make clinker of it, handle it, and then get rid of it. If coal contained a large amount of inherent ash it should be crushed to ⅜-in. and then washed. The overall cost of washing or dry-cleaning coal did not exceed from 2s. to 3s. per ton as a rule.

Mr. J. D. Troup, referring to the coal treatment laboratory which had recently been opened at the Birmingham University, said that the equipment consisted almost entirely of various types of wet and dry plant for the screening and cleaning of coal. There seemed to be no practical reason why the gas producer should not be combined with a water tube boiler.

Mr. P. W. Griffin said that the collieries should utilise the low-grade coals, but the trouble was that most of the collieries in this country used Lancashire boilers. With regard to the burning of low-grade fuels when mechanical stokers were used, he said that one necessarily had to use a high draught in order to burn the fuels, and he would like information as to the cost of maintenance of the bars, because it seemed that a lot of trouble would arise from their wearing away, melting, and so on.

Mr. J. Golder wondered if the statement that all fuels which might be efficiently utilised in pulverised form might also be efficiently utilised with suitable mechanical stokers were true. What about the arch in a mechanical stoker? The quality of the fuel did not make much difference in the case of a pulverised-fuel fired plant, whereas in a stoker-fired furnace there was flexibility only with regard to the area of the grid, and stoker equipment designed for a particular fuel could not be made efficiently to utilise fuels of a widely varying nature. If the statements in the paper were entirely true, capital outlay alone would be the factor responsible for prolonging the days of the mechanical chain grate stoker. It was a fact that less than 5 per cent. of the coal consumed in this country annually was used for transformation into electrical energy. If all the "unsaleable" coal produced at our collieries were turned into electrical energy and distributed among the people, the present average consumption could be multiplied by five.

Mr. W. R. Griffiths said he had found that as against a Lancashire boiler using double-screened nuts at a calorific value of about 13,000 B.th.u. per ton, costing 19s., he could use a water tube boiler, with chain grate stokers or pulverised fuel equipment, with fuel having a calorific value of from 9,000 to 10,000 B.th.u. per ton, costing 11s. per ton, and in consequence of the savings effected it would pay for itself in seven or eight years.

Mr. Smeaton urged that the waste material in the dumps at the pit heads should be cleaned and utilised, and that we should look at the problem from the point of view of conserving our coal resources instead of comparing the merits of two firing systems.

Mr. P. O. Roberts said the calorific value of the dump face was extremely small, and could not be improved sufficiently to make the washing worth while; the consumer would not pay for the cleaning.

Mr. Goodrich, in reply, said it was generally found that with modern machine firing equipment the cost was about the same as the application of the unit system of pulverised fuel firing. The central system for one or two boilers only would be very much more expensive. With regard to the suggestion for the elimination of ash at the point of production, he pointed out that if only 5 per cent. of the incombustible were removed at the collieries, we should save the use of 425,000 ten-ton railway wagons in this country. He agreed that the gas producer could probably be applied even to the largest of water tube boilers of every type. He was surprised that rocking firebars had not been used to a greater extent in this country, because there was not the slightest doubt that a well-designed grate of that kind for hand-firing was very beneficial indeed in riddling through the air spaces a lot of the finer incombustible, thus preserving a cleaner fire and making it easier to burn a dirty fuel. With regard to the question of grate maintenance where low-grade fuels were used, with air temperatures not exceeding 250 deg. F. the grates seemed to stand up exceedingly well; he believed Mr. Newton Russell had grates in some of the refuse furnaces at Shoreditch which had been in use for nearly 30 years. He maintained that practically all fuels which could be efficiently utilised in pulverised form might also be efficiently utilised with suitable mechanical stokers, but it was very necessary to add that the question of relative efficiency had yet to be determined If time proved that pulverised firing was better than any other system he would be the first to hold up both hands for it.

Correspondence.

The Permissible Current-Carrying Capacities of High-Pressure Cables.

In your issue of January 7th there is an article by Mr. E. Berry Nixon giving certain sets of curves. As these stand they are of no real value and, in fact, might very much mislead.

In the first place, the permissible current that any particular cable should carry depends on several factors, none of which are so much as mentioned in the article :—

(1) Depth of cable in ground.
(2) Moisture content of soil.
(3) Ground temperature.
(4) What maximum temperature rise is allowable in the particular cable.

The article does not state on what bases the curves are prepared. Under fig. 1 there are certain reduction figures given for two cables laid together, but any particular reduction figure depends on the distance apart of the cables. It would be a different figure if the cables were 4 in. apart from when they were 12 in. apart, and the author does not say what distance apart his reduction figures are supposed to be based upon.

With regard to the curves in fig. 2, why does the author provide for three armoured cables for voltages up to 11,000 volts and for unarmoured cables at higher voltages? What has the voltage got to do with the question whether a cable will be armoured or unarmoured? One would have thought that the lower-voltage cables had better be unarmoured, seeing that they are likely to carry the heavier currents and that the sheath losses depend largely on the currents in the conductor. The sheath losses in single-armoured cables would be very great on 3-phase a.c. circuits, and consequently the heating in the sheath would have to be taken into account in fixing the allowable current in the conductor. Are the curves in fig. 2 supposed to take this into account? The losses and consequent heating in sheaths of single-core a.c. cables depend also on whether they can be worked with open-circuited or short-circuited sheaths; see paper on "The Use of Single-core Cables for Alternating Currents" by Prof. Cramp and Miss Calderwood, *Journal* of the I.E.E., April, 1923.

Then, how near are these three single cables together, and are they in triangular formation or in horizontal formation?—because this question determines, to some extent, the sheath losses and heating.

In the case of the high-voltage single-core cables the permissible current will also depend on the design of the cable, *i.e.*, the diameter of the conductor and the thickness of the insulation.

Instead of using the curves in this article, I should strongly recommend your readers to go to the proper place, *i.e.*, the "Technical Report" referred to by Mr. Nixon in the footnote on page 6. This "Technical Report" gives the loadings for various standard cables, and also states very clearly and definitely on what bases the different loadings are fixed.

For single-core cables working on a.c. circuits the maker's recommendations should be obtained.

J. A. Morton.

Prescot, *January 11th*, 1927.

Power Supply for Wireless Sets.

Having to do with a great number of wireless sets, most of them 2-valve and some 3-valve, all of the loud-speaker type, I long ago came to the conclusion that even on the 2-valve type, dry batteries are a "wash-out" for h.p. My customers were strongly urged to go over to accumulators, and none of them have regretted it.

But it has become very plain that regular touch with users is highly desirable. What happens is that, so long as the loud speaker works, the battery is allowed to drop far below two volts per cell, a 100-volt battery often going down to 70 or so without the user troubling himself.

There are two palliatives: the seller must give each customer a call every two months or so, carrying a high-pressure voltmeter; or, still better, he must try to sell to each user a small h.p. voltmeter. Moving-coil types, or those of extremely high resistance, are not required for this simple service, and there are plenty at a few shillings each which will not damage the battery in the time required to take a reading.

As to the high-pressure wattage required for good loud-speaking, remembering Mr. P. K. Turner's term as editor of *Experimental Wireless*, there is no one I would sooner listen to than to him, and, if it can be mentioned here, I have a grateful recollection of a prompt and personal reply by post on a point not very clear to me, in an issue of that journal.

A. O. Griffiths.

Caergwrle, *January 15th*, 1927.

The "H"-type of Cable.

As the question of the "pros" and "cons" of "H" cables is very much to the fore just now, it may perhaps be of help to that large class of mains engineers and consulting engineers who have not yet thought it necessary to make themselves fully familiar with the questions of potential gradient, thermal resistance, capacitance, &c., if I suggest that in the paper which I read before the Junior Institution of Engineers in January, 1925, they will find (in the Appendix) an analysis of the thermal and electrical characteristics of a 66,000-volt, three-core cable manufactured in England, and another 66,00-volt three-core cable manufactured in France (the latter I have since gathered to have been constructed under the Hochstadter patents, but of this I was not aware at the time of making my calculations), and also of a single-core cable.

Assuming that my figures are substantially correct, then, for any who wish to compare on theoretical grounds the performance of the "H" cable (both for heating and potential gradient) with that of an ordinary three-core cable, a first approximation can be obtained by considering—and this, of course, is favourable to the "H" cable—that the "H" cable merely consists of three single-core lead-sheathed cables; and taking the calculations given in my paper referred to as a guide, an approximate idea of the relative performance of the "H" cable can be arrived at.

For those who wish to investigate the matter further, I would add that in the *Electric Journal* (U.S.A.) for February, 1926, pages 60 to 63, there is given a rather careful analysis by D. M. Simons, of the Standard Underground Cable Co. of America, of the thermal resistivity, &c., losses occurring in the metallised paper coverings, which will enable those who are so inclined to get an idea of the deficiency in thermal conductivity, as compared with that of a cable, for example, of the Henley three-core type.

Of course it must be remembered that Mr. D. M. Simons represents a company which takes a commercial interest in "H" cables, but, on the other hand, his reputation as a scientific investigator is pretty high.

I may add that, in my paper referred to, calculations for capacitance currents are also given.

A. M. Taylor,
Major, S.O.2.

Birmingham, *January 10th*, 1927.

As Mr. G. H. Nash is away on the Continent, may I be allowed to clear up on his behalf a point which Mr. Nisbett has apparently misunderstood. In dealing with the point that the ability to withstand tangential stresses is considerably weakened by service conditions, he suggests that the only source of deterioration is due to mechanical causes. That a cable can be seriously damaged by bad handling no one will dispute, but there is, in addition, a structural change due entirely to expansion and contraction of compound under service conditions which cannot be avoided. This expansion of the compound on heating permanently stretches the lead in spite of any reinforcement, with the result that minute voids are produced on cooling. These are most likely to be of appreciable dimensions in the filling, which is screened in the "H"-type; and are least dangerous when the stress is across their smallest dimensions, as it will be in the case insulation when the stress is always radial.

That this change occurs is shown by the power factor-voltage characteristic. Can Mr. Nisbett obtain on a belted type cable a power factor-voltage characteristic which is initially flat and is unchanged on cooling after a heat run to, say, 50 deg. C.?

T. N. Riley,
Cable Engineer,
Standard Telephones & Cables, Ltd.

London, *January 15th*, 1927.

As all that I could usefully say in answer to Mr. Nisbett's reply to my previous letter on this subject is contained in one or other of your correspondents' remarks, I write this solely to correct a slight misprint: I am not C.E., but

C. G. Watson.

Alston, *January 15th*, 1927.

Regarding the very interesting letters that have been lately published in your journal on "H"- and "belted"-type cables, I am loth to let the subject pass without making some comment.

The mileage of "H"-type cable operating at different voltages is easily obtained, and has already been published in different pamphlets.

I notice Mr. G. H. Nisbett mentions in his last letter in your current issue the fact that there are many miles of the "belted"-type that have been working successfully for years both at home and abroad, at 33,000 volts. I suggest it would be most interesting to all engineers if particulars of and places where these cables are installed could be published. Mr. Nisbett further points out that there are cables made by the firm installed in this country that have been alive for five years, presumably at 33,000 volts—I say presumably because one hears of other cables which have been designed for 33,000 volts, but, after being installed, have been operated at about half, or even less than half, the working pressure. Regarding the comparison of thickness of insulation, Mr. Nisbett says both types of cable need the same thickness to earth. As others have already pointed out, this is not so. Owing to the perfect distribution of the electrostatic field, the "H"-type cable can be designed to work with perfect safety with much

less insulation to earth than is necessary in the "belted"-type. It follows, therefore, that for a given size of conductor, "H"-type cables are smaller, and consequently cheaper, than the "belted"-type.

I think we must face the facts that, electrically, the "H"-type cable is a distinct advance on the "belted"-type, and, if made properly, is at least mechanically equal; whilst not wishing to be too optimistic, I think the "H"-type cable for super voltages has come to stay. Whether this be so, time will tell.

D. D. Watson.

Liverpool, *January 14th*, 1927.

Wattmeter Calculations.

Contrary to the conclusions come to in Mr. M. G. Scroggie's article in your issue of December 31st, I suggest that the volt-coil of a wattmeter should *always* be connected on the load side of the current-coil for the following reasons:—

(1) The power consumed by the volt-coil circuit can, if necessary, be quite easily and accurately allowed for when the resistance of this coil is known by simple subtraction, and the allowance is not vitiated by changes of resistance as the coil warms up.

(2) When it is required to deduce the current in the load, the volt-coil current is easily allowed for because it is in phase with the load voltage.

(3) The loss in the current-coil with any given current is uncertain to perhaps 20 per cent., or more, owing to the change of its resistance as it heats up.

(4) It is very troublesome, even when possible, to deduce the load voltage from the total because the p.d. across the current-coil is not in phase with the current in it, and the phase difference is seldom known.

(5) The volt-circuit should be joined to the terminal of the load itself, and not to that of the current-coil as shown on his fig. 1, in order to eliminate unknown losses due to the resistance of the connecting main and contacts; this is especially important where the load current is large.

Incidentally, your contributor goes a long way round in order to obtain an incorrect result. The error is the ratio of the power used in the volt-circuit, or current-coil, as the case may be, to the load power, which is the same thing as the ratio of the active currents in the one case, or of the in-phase components of the voltage in the other. The last line but one in his expressions for E is simply this same statement put down in symbols, and might far better have been written down without any mathematical gymnastics; but it is only the second case that this ratio works out to the simple form given. In the first, it reduces to $(R_v/Z_v^2) \div (R_L/Z_L^2)$, where the z's are the impedances of the two circuits. This gives R_v/R_v only in the particular case of unity power-factor for both circuits. Consequently, figs. 5 and 6, together with the deductions therefrom, are based on error.

David Robertson.

Bristol, *January 14th*, 1927.

Electrical Refrigeration.

Your leader in No. 2561, December 24th, is interesting, but where are the *British made* refrigerators, cooling cabinets, and home ice-making plant? The American companies which sell through English agents try, in every instance, *to sell direct to the user*; there is no percentage usually reserved to the factor, and precious little to the electrical contractor. With clients who settle quarterly, half-yearly, and annually it is not worth while to the contractor under at least 15 per cent., and the factor who takes financial risks, as well as the charges for boosting, advertising, and tendering, must have at least 10 per cent. to exist.

The American companies usually allow 5 per cent. to the contractor, *if he introduces the business*, and there is nothing further for *anyone* else, though the prices for the equipment are HIGH. There is a *great* chance for British firms, at *good* prices, even if they allow factors and the trade reasonable terms, to make and sell suitable equipment. Will any British firm rise to this and design equipment on British lines, to compete easily with transatlantic stuff, whilst giving all arrests a chance to live?

Refrigerator.

January 3rd, 1927.

Great Britain's Power Resources in Truer Perspective.

Hoping all have length and breadth of vision sufficient for a perspective, may I recall attention to the position of Great Britain in relation to its consumption of electricity, while agreeing that it is justly placed by two writers in the *Journal* of I.E.E. below 14 other countries in potential water power resources? The other countries envy our abundant, cheap coal as some here seem to envy their water power.

On page 4, current Volume 65, *Journal* I.E.E., Great Britain is credited with 350,000 potential water horse-power, and on page 129 with 1,070,000. In each case the developed water horse-power is given as 280,000, which figure, I believe, is very considerably above the truth; you published my request three weeks ago for the location of the sites of those 280,000 water horse-power in Great Britain, without drawing a reply.

I should prefer to collect up-to-date figures, but time is not available. I therefore quote those dated February 3rd, 1925, as follows:—

Table I.—Kelvins Output in a Year.

1. U.S.A.	49,802,000,000
2. British Isles	6,400,000,000
3. Canada	5,125,000,000
4. Switzerland	2,700,000,000
5. Italy	2,400,000,000
6. Sweden	2,144,000,000
7. Norway	1,331,000,000
8. Netherlands	343,000,000
9. Denmark	190,000,000
10. New Zealand	136,000,000

It appears practical to also look at the horse-powers in relation to the areas and populations of the countries, because this places Great Britain, with her relatively small water-power resources, in a very different position in the list.

Making use of the horse-powers shown on page 129, *Journal* I.E.E., and the areas and populations in *Whitaker's Almanac*, the countries rank as follows:—

Table II.—Developed Horse-power (Water).

	Per square mile.	Per 1,000 population.
1. Switzerland	102	410
2. Norway	17	830
3. Italy	14	47
4. France	10	54
5. Sweden (g)	8	225
6. Japan	7	21
7. Spain	6	51
8. Germany	5	16
9. U.S.A.	3	104
10. Great Britain	2	6
11. Canada	0.7	370
12. Mexico (f)	0.4	20
13. Brazil	0.2	33
14. India	0.2	1
15. Russia (f)	0.03	1

(f) From *Journal* I.E.E., Vol. 65, p. 4.
(g) Sweden is placed above France below.

Incidentally, on page 129 J.A.I.E.E., January, 1927, Sweden is credited with 34 per cent. more potential water power than on page 4 of the same journal December, 1926, and it credits Sweden with 1,350,000 water h.p. developed, while my reference, February 3rd, 1925, gave it as 1,950,000. Using the latter figure, Sweden has 11 water horse-power per square mile average, which places Sweden fourth in Table II above, and with 325 w.h.p. per 1,000 inhabitants.

Theodore Stevens.

London, *January 15th*, 1927.

A Motor-generator Snag.

Mr. Theodore Stevens asks for the seat of the pain in my complaint respecting difficulty with a motor-generator whose field coil burnt out when run at no load. Mr. Stevens may have no objection to field coils burning out in these circumstances, but in this respect he is exceptional. Most people prefer a generator to run without trouble.

All that is necessary is that the field coil should be made of such proportions that the field coils will not become unduly hot when the generator is run for long periods at no load.

"Rheostat" suggests a variable resistance, but one cannot rely on this in an ordinary charging station. The machines are usually run by unskilled people who regulate the current by putting lamps in series with the batteries that are being charged, or by any other method that may be handy.

One might have expected that makers would have themselves applied field coils which would stand up to all conditions of running, but my experience is that one must specify this to ensure that there will be no trouble.

Motor Generator.

January 13th, 1927.

Electric Ovens.

Is your correspondent trying an experiment in leg-pulling, or starting a "spoof" correspondence? None of the conditions which are present in an electric oven, when it is in use, fulfil the conditions necessary for the production of ozone by electrical means, and one condition which is present is sufficient to render any attempt at ozone production futile. I refer, of course, to temperature.

I have not yet heard that ozone in any concentration but the highest is damaging to bread or pastry. As a matter of fact the presence of ozone in such quantity as might be produced, even if the conditions were favourable, would be certain to improve the quality of the food, whilst being cooked in an electric oven, rather than otherwise.

Edward L. Joseph,
Managing Director, OZONAIR, LTD.

London, *January 15th*, 1927.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

AMPTHILL.—Electrical installation at Scones & McMalin; U.D.C. surveyor.
ASHFORD (KENT).—Housing scheme (65), Beaver, for the U.D.C.; surveyor.
AUSTRALIA (HOBART, TASMANIA).—Factory, Sackville Street; Fur Traders, Ltd.
BARNSLEY.—Central 'bus station; borough engineer.
BEBINGTON.—Schools (£92,350), for Cheshire E.C.; F. A. Brown, county architect, Newgate Street, Chester.
BIRKENHEAD.—Additional 553 houses, Bidston, for the T.C.; C. Brownridge, borough engineer.
BLACKPOOL.—Kinema, Whitegate Drive; W. Halstead Best, architect.
BRADFORD.—880 houses, Eccleston estate; city architect.
BRIDGWATER (SOMERSET).—Housing scheme (50), for the R.D.C.; surveyor.
BURTON-ON-TRENT.—Brewery extensions, with electric lift, for James Eadie, Ltd.; T. Lowe & Sons, contractors, Curzon Street. Electricity supply, Mount Pleasant Works, Woodville; John Knowles & Co.
BURY (LANCS.).—Power and lighting installation, dairy, for the Co-operative Society; C. R. Cooper, architect, 20, Market Street.
CAERNARVON.—Town hall, Special Committee.
CAMBRIDGE.—Art school extensions (£11,830), for Cambs. E.C.; C. Kerridge, builder.
CARDIFF.—Additions to the National Museum of Wales, Cathays Park; Museum authorities.
CHELTENHAM.—Hospital extension; governors.
COLYTON.—Town hall; J. Archibald Lucas, architect, Exeter.
CORK.—Wharf and stores (£8,220); city engineer.
DAGENHAM (ESSEX).—Housing scheme (75), for the U.D.C.; surveyor.
DARWEN.—35 houses; borough engineer.
DUNDEE.—Proposed extensions at Baldovan Institute for Children (£40,000); Mr. R. Freer Myles, clerk to Forfar District Board of Control, Forfar. Proposed 500 additional houses for Corporation; city architect.
EASTCOTE (MIDDLESEX).—Kinema, Field End Road; Telling Bros., Ltd.
EDINBURGH. — Gynecological and maternity hospital; Medical superintendent, Royal Infirmary.
EGHAM (SURREY).—Housing scheme (100), for the U.D.C.; surveyor.
ELLESMERE PORT (CHESHIRE).—Additional 80 houses, for the U.D.C.; surveyor.
FENTON (STAFFS.).—Erection, Camacs Potteries; Baker and Co., Ltd.
FERRYHILL (Co. DURHAM). — Kinema, Main Street; W. J. R. Wallace, architect, North Shields.
FLEETWOOD.—Extension of Fleetwood Hospital; hon. sec.
GLASGOW.—Premises for Boots, Argyle Street and Union Street (£50,000); Campbell & Harley, 18, Duke Street, Edinburgh. 156 houses in Govan (£61,327); Messrs. Robert Anderson & Co., builders.
GOLDENHILL.—40 houses, Collinson Square; Stoke City engineer
HAYES.—100 houses; U.D.C. surveyor. 50 houses; Great Western Garden Village Society.
HESTON.—48 houses, Bulstrode Avenue; W. H. Allen.
HORSFORTH (LEEDS).—54 houses, Cragg Hill; J. Davidson, clerk to Council.
ISLEWORTH.—80 houses, Victoria Gardens, &c.; W. W. Harbrow.
KETTERING.—Hospital extension; Joint Hospital Board.
KIDDERMINSTER.—Dance hall, Vicar Street, for the Midland Counties Circuit, Ltd. Carpet weaving shed, Green Street, for T. & A. Naylor. Municipal offices, Mill Street, for the T.C.; borough surveyor.
LEISTON (SUFFOLK).—Re-erection of Leiston Hall, residence of A. J. Wearey.
LINCOLN.—Central 'bus garage and workshops, and additional 20 houses, for the T.C.; city engineer.
LITTLE HULTON (NEAR BOLTON).—Housing scheme (46), Worsley Road; surveyor to U.D.C., Council Offices.
LONDON (EAST HAM, E.).—38 tenements, Central housing estate; Johns Bros.
(ILFORD, E.).—Schools, Valentines, for the borough E.C.; Adam Partington, clerk.
(MUSWELL HILL, N.).—Congregational Sunday school (£10,000); trustees.
(GREENWICH, S.E.).—Dismantling and removal of six water-tube boilers, with economisers, at Greenwich power station; general manager of tramways.

LONDON—*continued.*
(CAMBERWELL, S.E.).—Isolation accommodation, Grove Hospital; J. Crewsdon, of Horley.
(PECKHAM, S.E.).—Rebuilding 138, 140, 142, and 144, High Street; Selfridge & Co., Ltd.
(TOOTING, S.W.).—Sisters' Home at South-Western Hospital; W. S. Sharpin, Bow.
LUTON (BEDS.).—Factory extensions, Collingdon Street, for Lincoln, Bennett & Co. Shops, Ridgway Road, for the Industrial Co-operative Society. Block of shops, George Street, for Edgson & Wilsdon.
LYTHAM ST. ANNES.—Sewage disposal works (with pumping machinery); G. W. Lawson, borough engineer.
MACCLESFIELD.—Housing scheme (48), for the T.C. borough surveyor.
MAIDENHEAD.—Additional 60 houses, for the T.C.; borough surveyor.
MAIDSTONE.—Re-erection of the Len Cabinet works, Water Lane (£10,000); the proprietors.
NESTON AND PARKGATE.—Waterworks pumping station for the U.D.C.; H. B. Ward, engineer, Commerce Chambers, 15, Lord Street, Liverpool.
NEWBURY (BERKS.).—Housing scheme (80), for the T.C. borough surveyor.
NORTHALLERTON.—Registry of Deeds building (£10,584 for North Riding C.C.; D. Oakley, builder.
OLDBURY.—Re-erection of kinema, Freeth Street, for C. Dent.
OLDHAM.—Maternity home (£9,000); borough engineer.
PLYMOUTH.—36 flats, Mount Stone, Stonehouse; borough surveyor.
PORTSMOUTH.—56 houses, Merthyr Road, Coshan Gammons & Coffin. Block for 62 patients, Milton mental hospital; E. H. Harvey, architect, The Square
REIGATE.—Housing scheme (40), for the R.D.C.; W. Hatton, surveyor, 48, High Street.
ROMFORD.—Houses (64), for Harber & Cox.
RUGBY.—Extensions, Hospital of St. Cross (out-patients' and administrative block); Young & Hall, architects, Southampton Street, London, W.C.
SALE.—Secondary schools, for Cheshire E.C.; F. A. Brown, county architect, Newgate Street, Chester.
SALFORD.—Trades Exhibition Hall, &c., on Cattle Market site; chairman, Exhibition Hall Committee.
SCUNTHORPE.—Housing scheme (38); W. Farrar, engineer and surveyor, Council Offices.
SHEFFIELD.—New kinema, Barkers Pool; Provincial Cinematograph Theatres, Ltd., Regent Street, W.
SOUTHPORT.—Kinema, Liverpool Road, Ainsdale; Southport Coliseum Co., Ltd.
SOWERBY (YORKS.).—Housing scheme (77), for the U.D.C. surveyor.
STARCROSS.—Extensions, mental hospital; Devon C.C.
STOKE-ON-TRENT.—Wholesale market; city engineer.
TORQUAY.—Houses (52) and seven shops, Barton Nurse estate, for A. Nettleton. Houses (62), Barton Road, G. E. Tozer. Additional 36 houses, for the T.C. borough surveyor. 100 houses; borough engineer. Central depôt (£3,500), for the T.C.; borough surveyor.
TWICKENHAM.—Development of the Carpenters' Company estate for 300 houses; Sir B. Fletcher, F.R.I.B.A.
WAKEFIELD.—Electric lighting, Alverthorpe School; education director. Electricity supply, Silcoates School managers.
WARRINGTON.—Housing scheme (258), for the T.C.; A. Ker, borough surveyor. 60 houses, Bewsey estate borough engineer.
WATFORD.—Housing scheme (124), for the T.C.; W. Newman, borough engineer. Extension and improvements, Leonesden Asylum (£107,000); Metropolitan Asylums Board.
WEMBLEY.—Hospital; H. Kenchington.
WHETSTONE (HERTS.).—70 houses, Totteridge Lane; R. Peachey & Sons.
WOLVERHAMPTON.—Extension of Wolverhampton and Staffs. Hospital (£45,000); W. Sharratt, Ltd., builders, Wolverhampton. Schools, Low Hill (£16,500), for the borough E.C.; Mr. Warren, director of education. Extensions, Staffs. Hospital (£45,826), for the Board of Management; Elcock & Sutcliffe, architects, Northumberland Avenue, London. W. Sharratt, Ltd., builders,

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Contents:

	PAGE
The Importance of Trade Expansion	121
High-Pressure Cables	122
Smoke Abatement	122
Further Artificial Silk Openings	123
The Electric Drive in Woodworkers' Shops	123
The Chairman of the Board	123
The "Agreed Clause"	123
Generating Station Costs, by Reginald O. Kapp (*illus.*)	124
Electricity Supply Tariffs, by Professor W. Cramp	126
Extra-High-Pressure Transmission, by A. T. Scott	128
Legal	129
Correspondence—	
Maximum Potential Gradients	129
The Electric Market Place of the Future	129
The Signs of Trade Revival	130
Electric Ovens	130
River Water—or Cooling Towers?	131
Power Supply to Wireless Receivers	131
The "H"-Type of Cable	131
Business and Industrial Notes	132
Lighting and Power Notes	138
Tramway and Railway Notes	140
Telegraph and Telephone Notes	140
Radio Notes	141
Contract Information	141
Forthcoming Events	143
Notes	144
Our Personal Column	145
Financial Section—	
New Companies Registered	146
Official Returns of Electrical Companies	146
City Notes	147
Stocks and Shares	147
Britain's Foreign Electrical Trade (*illus.*)	149
The Physical Society's Exhibition (*illus.*) (*continued*)	151
High-Voltage "S.L."-Type Cables, by P. Dunsheath (*illus.*)	153
A Large Electrical Export Organisation (*illus.*)	156
The Electrical Contractors' Association	156
Institution of Electrical Engineers	157
Selected Radio-Telephone Apparatus (*illus.*)	158
Trade-Mark Applications	159
Published Specifications	159
New Work for Contractors	160

The Importance of Trade Expansion.

DURING the past few weeks there has been another of those periodical epidemics of speeches and newspaper articles on peace and goodwill in industry which always occupy so much thought without seeming to yield any tangible result. The discussions are strangely reminiscent of the war years, when in the heart of London something like mothers' meetings were held whereat, after tea and cake, men and women discussed the problems of industry in a comfortable drawing-room atmosphere. We suppose it is because we have had to listen to so much from so many that we deplore the want of originality on the part of those who, in 1927, pose as advisers of industry. If only we could hear something new! Something new and practical at the same time!

The most helpful contribution, as we regard it, that has lately come under our notice is a speech delivered from the earth, not from the clouds, by Mr. Frank Hodges. Mr. Hodges doubts whether industrial relations can be improved by any formula, and asseverates that any plan that can be devised is useless unless it is based upon the will to good relations which must begin in the workshop itself. He declares that good relationships between Capital and Labour cannot be imposed from without—they must spring up from within. Of what use is it merely to preach goodwill? The better plan altogether is to employ practical means in the works themselves to introduce it or to give effect to it if already there.

Works committees have in quite a number of electrical and other factories done much to secure smoother working through the early consideration of grievances and suggestions and the introduction of various reasonable facilities and improvements.

Mr. R. R. Hyde, the Director of the Industrial Welfare Society, has lately quoted in the Press the outcome of an inquiry that he has made regarding the results attending the operation of such committees in many

trades. In respect of an electrical engineering works on the South Coast, he says: "there has been a greater tendency to settle minor disputes and grievances since the committee was organised"; and of similar works in the Lancashire area it is stated: "the committee has formed an invaluable medium between employers and management in settling the problems of working hours and short time during trade depression. Certain aspects of shop discipline have been greatly improved by the activities of this committee."

We are inclined to believe that, so far as the immediate outlook is concerned, all parties in industry are likely to obtain greater good from a large addition to the number of properly organised works committees than from any other single measure.

We have passed through a year of sore trial and have learned at what a gigantic cost we can engage in struggles to attain economic impossibilities. We have witnessed the great failure of the professional agitator, and now we need to get down together in each individual business, each of the parties interested therein contributing its own best efforts toward the re-establishment of stability and prosperity. It is certain that we cannot secure goodwill and contentment when the conduct of a business is unprofitable. When trade is low and losses take the place of profits, bankruptcy threatens and the menace of insecurity settles down upon worker and shareholder alike, the possibilities of improvement are at a minimum. Prosperity makes many things possible that without it cannot be introduced.

The Industrial Parliament that is again proposed for the twentieth time cannot provide a solution to our troubles unless it can find a way for our industries to be well occupied with profitable work. It may be the legitimate occupation of the politician and some others to engage in conferences, to draw up Bills, and to deliver speeches. Many of us have had our fill of this sort of thing, and we prefer to direct our effort primarily to securing additional trade for our manufacturers; nothing is more immediately essential for the well-being of the nation. All parties in industry ought to concentrate upon measures for securing new work. All kinds of schemes for finding ways out of the great unemployment problem of the British people must be examined and adopted; that is recognised. But while such ways are being developed throughout the Empire we must concentrate on reviving world trade and bringing business to our factories.

In his speech at the British Industries Fair luncheon last week the President of the Board of Trade referred to the perceptible growth in world trade as the world settled down, and he said that the advice to "Buy British Goods" had now become a national determination. We must sell British goods in every market that could be reached—there must be efficient salesmanship and advertising to that end, especially for trade development in our Empire markets. With "Peace, Progress and Trade" as our national policy at Home and abroad, we must increase our share of the expanding trade of the world while other countries were treading the path that we had already trodden back to financial stability.

As we desire to be above all practically minded in making these observations, let us look right at home in our own trade. The electrical industry—save perhaps the motor section which awaits the fuller revival of the various industries upon which it partly depends—is in a very active condition, and the prospect is excellent. This state of things should encourage electrical undertakings and traders to make further additions to their staffs, who shall at once get to work on ground that is waiting for attention and extract therefrom the new orders for goods and work that will produce more employment for electrical and allied manufacturers and contractors. If everybody in the industry and trade would see that his staff was adequate for the present opportunity, electrical men who are now waiting for a chance to make better use of their faculties might be absorbed.

High-Pressure Cables.

ONE effect of raising the pressure employed on underground cables from 11,000 to 33,000 volts has been to increase the frequency of breakdown to an altogether disproportionate extent, and it is clear that there is much to be learnt before the high standard of reliability attained at the lower pressures can be claimed for cables operating at 33,000 volts. At first the troubles were attributed largely to the joints, but experience has shown that faults occur in the cables themselves, for no obvious reason, and cable makers and users in all parts of the civilised world have been anxiously seeking the cause and the appropriate remedy. One theory, which appears to be well founded, is that however completely the interior of the lead sheath is filled with solid or liquid matter when the cable leaves the maker's hands, it is possible for spaces to be formed after the cable is laid, which are filled with gas of one kind or other; the gas being ionised by the electric field becomes a conductor, and permits electric discharges to take place, at first on a small scale, which eventually lead to the breakdown of the insulation. The fact that such failures frequently occur during times of light load suggests that when the cable is heated, the sheath is slightly stretched by the expansion of its contents, and lead being inelastic, it does not resume its original volume when the cable cools, so that spaces are left in the interior. We recall a somewhat similar trouble which arose in connection with 10,000-volt alternators, 15 to 20 years ago; the stator conductors were found to be attacked by nitric acid or other such corrosive agencies, which could only have been formed by electrostatic stress from the gases of the atmosphere. To prevent this class of mischief, the greatest care is taken to avoid the formation of air pockets and high potential gradients in the windings.

The importance of this subject, and the keen interest with which it is regarded by cable makers, are evidenced by the lively correspondence which has recently taken place in our pages, but even more significant are the reports that reach us and the disinterments of cables that may be seen in progress. British cables in the past have attained a world-wide reputation for reliability, and we have no doubt that our manufacturers will successfully solve the problems with which they and their competitors are faced.

One method which promises to attain the desired end was the main theme of the excellent and timely paper read by Captain P. Dunsheath, O.B.E., before the Institution of Electrical Engineers last week; another, which has been adopted by a number of British cable-makers, gave rise to the correspondence above mentioned. This is a matter for experts to decide, and we shall not presume to anticipate their ultimate verdict. But we may express satisfaction at the evident readiness of our manufacturers to undertake prolonged investigations and to adopt new methods when the need arises, and our confidence in their ability to deal with the present difficulties. Is not this the kind of problem which could be most efficiently tackled by co-operative research, such as is contemplated under the schemes of the Department of Scientific and Industrial Research? Presumably this aspect of the matter has not been overlooked by that admirable organisation, the Cable Makers' Association, which has done so much to enhance the status of our cable industry, and done it so well.

Sir George Sutton, in his speech at the recent extraordinary meeting of the Henley Company (ELEC. REV., December 24th, p. 1046), seemed to suggest some such pooling of research with other companies, with a view to eliminating wasteful expenditure.

Smoke Abatement.

THE Public Health (Smoke Abatement) Act, 1926, which is to come into force in July, 1927, whilst it still excludes the greatest sinners of all—the innumerable domestic chimneys—from the scope of its censure, greatly increases the penalties imposed on the emission of "smoke in such quantity as to be a nuisance" from other chimneys, and extends the

definition of smoke to include soot, ash, grit, and gritty particles. However, it accepts as a defence in proceedings for sending forth smoke other than black smoke (the unpardonable sin) from a chimney evidence that the person charged "has used the best practicable means for preventing the nuisance, having regard to the cost and to local conditions." The limiting colour, density, or content of smoke may be prescribed by by-laws made by any local authority, and it is to be hoped that the Minister of Health, in approving such by-laws, will take measures to secure something approximating to uniformity of treatment throughout the country.

An interesting section is one authorising urban authorities to make by-laws requiring the provision in new buildings of such methods of heating or cooking as are calculated to prevent or reduce the emission of smoke; but here again, unfortunately, private dwelling-houses are excepted. Local authorities are also put under the supervision of county councils, which may report them to the Minister of Health if they fail to carry out their duties with regard to smoke nuisances, and may be by him authorised to do the work at the expense of the defaulter.

It seems, therefore, that in future the laws against the emission of smoke will be enforced in many places where they have hitherto been allowed to lie dormant, and the owners of works in such areas had better take steps to make sure that they have a clean sheet—and clean chimneys—to show.

Further Artificial Silk Openings.

CONSTANT developments are taking place in the artificial silk industry in various parts of the world, and the opportunities for the electrical trade are considerable in view of the increasing use of the electric drive. The International Paper Co., of America, is now planning the erection of a mill for the preparation of artificial silk on its land near Ottawa, where it already has large pulp and paper mills.

In France, the Compagnie Française des Levure, Alcool et Drechure de Grains has formed a subsidiary company known as Soie Artificielle d'Amiens for the purpose of commencing the manufacture of the fibre, and as recently announced, the Rock Investment Co., of London, has let a contract for machinery to the value of £400,000 for a new factory at Branston, Burton-on-Trent. It is understood that extensive electrical power supplies and plant will be required in the latter case.

The development of the eucalyptus plant as a raw material for the preparation of wood-pulp both for paper and artificial silk manufacture, has resulted in the establishment in Brazil of a paper factory to be operated by the Paulista Railway Co. In this connection it is interesting to note that an effort is being made to persuade the Brazilian Congress to allow the importation of machinery duty free when required for the manufacture of national fibres.

The Electric Drive in Woodworkers' Shops.

A SERIES of visits to sawmills and pattern shops in the Midlands and North Country, recently, revealed the fact that in a very large proportion of them the electric drive has been adopted.

One of the great advantages of driving woodworking machines by electric motors is that their consumption of power varies almost in direct proportion to their loads: this is a very important consideration in pattern shops, because it is seldom that all the machines are in operation at the same time. In a sawmill, and in some carpenters' shops, the machines are run steadily throughout the day, but in pattern shops this is not so. The individual drive has obvious advantages when machines are used intermittently, one point in its favour being the fact that upkeep and maintenance costs for shafting and belting are reduced; small electric motors require little attention and cost but little to maintain: also, if additional machines are purchased and fitted with an individual electric drive, no difficulties are experienced with the existing countershafting and the output of the driving motor. In the case of the heavier saws and planers, there are obvious advantages in installing the electric drive and doing away with counter-shafting.

At one time it was considered the most economical policy to drive this class of machinery entirely by steam, because the burning of the wood shavings and cuttings enabled a certain amount of power to be generated for next to nothing: but with the installation of the electric drive, it was found that the wood refuse could be sold in a ready market, and that its value exceeded the cost of the electric power purchased from an outside source for operating the machinery employed. Hence, the woodworker, or sawmill owner, has obtained a reliable, steady, economical and safe drive by employing electric power, purchased from the public mains at a cost that may be covered by the sale of the refuse he was formerly in the habit of burning in inefficient and uneconomical steam-boiler plant.

There are, of course, other uses for electricity in the woodworking shop besides that of driving the machines. The electrically-heated glue pot, with facilities for regulation of the temperature, is a case in point. A very important recommendation of electricity in sawmills and other woodworking shops is the material reduction of the fire risk, for in such shops machinery has to be used in close proximity to heaps of shavings, and other inflammable material.

The Chairman of the Board.

THE announcement last Friday that the Minister of Transport had appointed Sir Andrew Duncan, M.A., LL.B., to be chairman of the Central Electricity Board put an end to the suspense in which the electrical industry has been hanging during the past month. It is in conformity with the statement of the Prime Minister a year ago, that the Board should be constituted of men of the highest business capacity, for although Sir Andrew has not figured prominently in the public eye, he has undoubtedly made his mark in the public service, as the record of his career which we print elsewhere will fully demonstrate. Though comparatively a young man, he has acquired much experience in national affairs during recent years, and has given evidence of fairness, tact, and breadth of vision, allied with energetic action and organising ability, which should admirably fit him for the very responsible and onerous post that he has accepted; we wish him all success in his new sphere of work.

It remains for the Minister, with the help of the chairman, to select the remaining members of the Board, whose names, it is anticipated, will be announced before the reassembly of Parliament next month. The various interests specified in the Act have been consulted by the Minister, but some of them appear to have taken a narrow view of the matter, making a selection from their own membership instead of casting the net over the whole country and seeking the best men for the job, irrespective of all other considerations. The Electricity Commissioners are charged with the technical work—the Board with administration; it should really resemble a first-class board of directors.

The "Agreed Clause."

EVERY speaker at last week's dinner of the Electrical Contractors' Association made reference to the "agreed clause" inserted in the Electricity (Supply) Act, to govern the sale of appliances, &c., by municipal electricity supply authorities. While the general tone was optimistic, in one or two passages a certain anxiety could be sensed. Of course, the scheme is not yet actually working, and it will need the continuance of the good feelings engendered by the Conferences under Mr. D. N. Dunlop to make it a success. Nevertheless, we think that, generally, success will be attained, for both parties realise that continued dissension will be harmful both to themselves, and to the industry as a whole.

Generating Station Costs.

Logarithmically ruled paper has certain advantages over ordinary squared paper, but hyperbolic ruling is more generally useful in engineering work. It suits costing problems particularly well, as is shown below.

By REGINALD O. KAPP, B.Sc., A.M.I.E.E.

LOGARITHMIC paper is well known, though not very extensively used. There are two principal types of problem for which its use has advantages over that of ordinary squared paper: Firstly, it enables curves to be plotted over a wider range of values with equal percentage accuracy at all parts of the curve; secondly, certain functions which give curved lines on ordinary squared paper give straight lines on logarithmic paper. For instance, a rectangular hyperbola of the type $yx = a$ constant gives a straight line at 45 deg. if plotted on paper in which the scale divisions are logarithmic both in the horizontal and vertical direction. Equations of a type to give straight lines on logarithmic paper are very rare in engineering work, and that may be a reason for the restricted use of such paper.

Many problems in engineering work involve calculations on the lines of a two-part tariff for electricity. This tariff may, therefore, be taken as an example. One wants to find out the cost per kWh of electricity where that cost is made up of a kilowatt charge and a unit charge. To arrive at the total cost, one divides the kilowatt charge by the number of kWh per kilowatt and adds the unit charge to the result. Written in a formula, the calculation becomes:

Cost per unit = kilowatt charge/8,760 × L.F. + unit charge.

The equation is, therefore, of the form—

$$y = b/x + a.$$

This equation gives, if plotted on ordinary squared paper, a rectangular hyperbola, of which the origin is not on the x axis. Plotted on logarithmic paper, it does not give a straight line, and therefore logarithmic paper is of little use for plotting such an equation.

If plotted on hyperbolic paper, a straight line is obtained.

The convenience of being able to employ a straight line for any plotting operation is considerable. It is only necessary to determine two points in order to rule the line. Intersections with other lines are definite, and the operation of drawing with a ruler is much simpler and more accurate than drawing a curve. In fact, the time spent in determining a sufficient number of points to draw a curve through them, the inevitable inaccuracy of the curve when drawn, and the lack of clarity, particularly at the steep parts, is sufficient to make the use of squared paper hardly worth while. This is unfortunate, since curves give more information than "spot" readings obtainable from pure arithmetic. If an engineer can plot his results on a curve, he sees not only the general tendency of the occurrences he is interested in, but also obtains a better idea of the relative importance of various factors. There is nothing like plotting results to help one's sense of proportion. Moreover, one may make a mistake in arithmetic and not notice it very readily. A curve is more likely to show up any errors.

Problems of maxima and minima can, of course, be solved by algebra or differential calculus. They can often be solved more readily by the simple process of plotting a couple of curves and finding where these intersect. In this case the advantage of the plotting method, apart from the fact that it is easier and more convincing, is that it shows up clearly whether a departure from the mathematical minimum matters much or not. It may often happen that one pedantically designs for the mathematical minimum in cases where there is hardly any difference between the minimum point and points quite a long way on each side. For instance, one can calculate the amount of condensing water required to give the minimum running cost, taking account of turbine steam consumption and energy expended in pumping. The calculation does not show readily that the cost is almost the same, even if one employs a good deal more or a good deal less condensing water. I think that much time and argument would be saved and better engineering practice employed if co-ordinate paper were more fully used. Some works put up placards in their shops with slogans intended to improve the minds of their staff. A slogan that I have never seen, but which would be more useful than many adopted, would be: "Use more squared paper." This excellent advice would be more readily followed if the plotting of curves were easier; but ordinary squared paper does not always meet the bill and functionally divided paper is of greater practical value.

Since so many cases are of the hyperbolic type mentioned above, a useful scale in which to divide the paper is a hyperbolic one, since this enables all

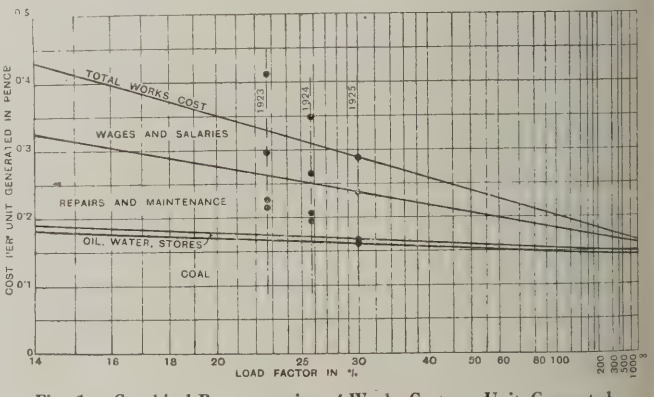


Fig. 1.—Graphical Representation of Works Cost per Unit Generated.

equations of the above form to be plotted as straight lines. The costing of electricity is not the only case where this equation forms the basis of one's work. It is the basis of all costing operations. For instance, take the case of a motor-car; it costs so much per year to *keep* a car, and it costs, in addition, so much a mile (for petrol and the like) to *run* a car. It costs so much per year to be in a position to manufacture screws (capital charges on the machines, and so on), and it costs, in addition, so much for materials per screw. The total cost per mile run in the case of the car, or per screw manufactured, is obtained by dividing the annual charge by the number of miles or number of screws per year, and adding the unit charge. All costing problems of this type can be plotted as straight lines on hyperbolically-divided paper. As an example, let us consider the case of generating costs of electricity.

Figure 1 shows the generating costs as imagined for

a station in the year 1925. The actual load factor for that year was 30 per cent., and the lines show what each item would have amounted to at any other load factor. They enable, therefore, a direct comparison to be made with the results obtained in previous years, and "spot" readings for these are plotted for the years 1923 and 1924, showing a steady improvement in total works cost. The graph shows clearly how much of the improvement is due to improvement in load factor and how much is due to improved working conditions. There is a reduction in coal per unit and in wages and

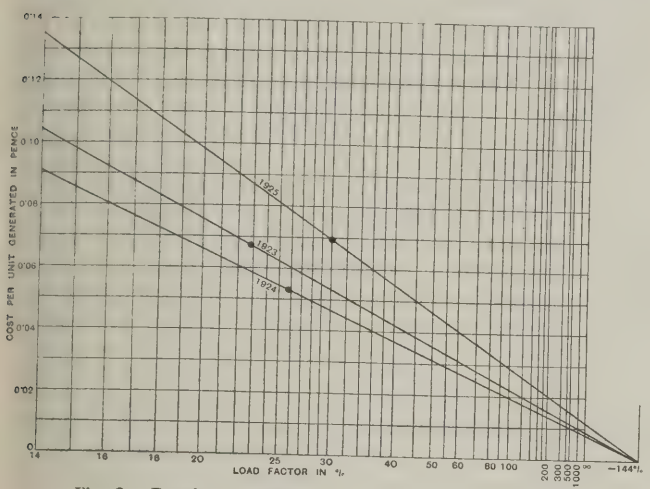


Fig. 2.—Repairs and Maintenance Costs Per Unit Generated.

salaries independently of the reduction due to improved load factor every year.

Repairs and maintenance lines for the three years are plotted separately on fig. 2, and these show that, whereas there was an improvement in 1924, the 1925 figures are not so good. If, instead of plotting the curves, "spot" readings were taken, it would appear that the 1925 results were almost equal to those of 1923. When allowance has been made for improvement in load factor, it is seen, however, that they are distinctly worse, and the lines on fig. 2 show this immediately. Clearly the repairs and maintenance items need investigation. Here is a case, therefore, where the station engineer can, by plotting curves, see clearly what his station is doing in all respects. He can see clearly where his results are gratifying and where there is room for improvement.

Other costing problems arise when a decision has to be made between alternatives. Suppose, for instance,

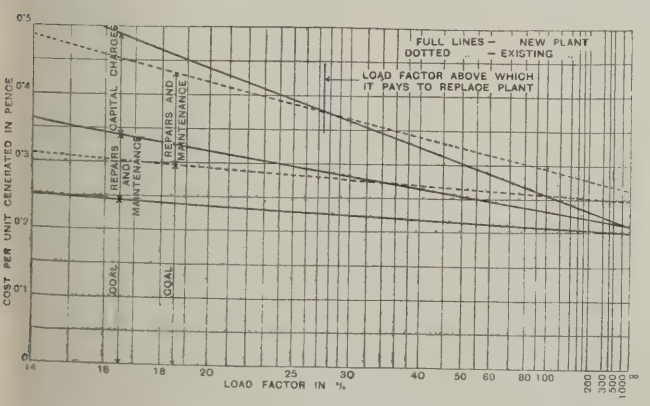


Fig. 3.—Relative Costs Per Unit with Existing and New Plant.

a station engineer wants to find out whether it is worth while retaining an old somewhat inefficient set, or whether it would pay to replace it by new efficient plant. If he buys new plant he has to incur the capital expenditure on it, and in exchange he will reduce his running costs. Such an example is worked out on fig. 3. Let us assume the load factor is 30 per cent. and that the coal costs at this load factor amount to 0.28 pence, and that repairs and maintenance cost 0.09 pence per unit. The engineer finds that this cost is subdivided for coal into 79.3 pence per kW maximum demand + 0.249 pence per unit generated, and for repairs and maintenance 195 pence per kW maximum demand + 0.0155 pence per unit generated.

New plant could reduce these costs to 63.6 pence per kW maximum demand + 0.2 pence per unit generated for coal and 126 pence per kW maximum demand + 0.01 pence per unit generated for repairs and maintenance. Suppose the new plant would cost £10 per kilowatt of maximum demand and the capital charges are 9 per cent., this amounts to an additional kilowatt charge on the new plant of 216 pence per kW maximum demand. We will assume that the other items of works cost are identical in both cases and need, therefore, not be introduced into the calculation. If the plant is to be worked at a high load factor, the saving in works costs of the new plant will be great compared with the extra cost per kWh due to capital charges on the new plant, whereas if it is to be worked at a low load factor the bill for coal and repairs and maintenance will be small in any case and will not matter much. There must, therefore, be a point above which the saving in coal, repairs, and maintenance predominates over the extra cost per kWh, due to the capital expenditure on new plant. Where this point is can be found without great difficulty by arithmetic, but it is much easier to obtain it graphically as is done in fig. 3, where it will be seen that it is at a load factor of 27.5 per cent. If, therefore, the plant is to be worked above this load factor, it is worth replacing it. If below this load

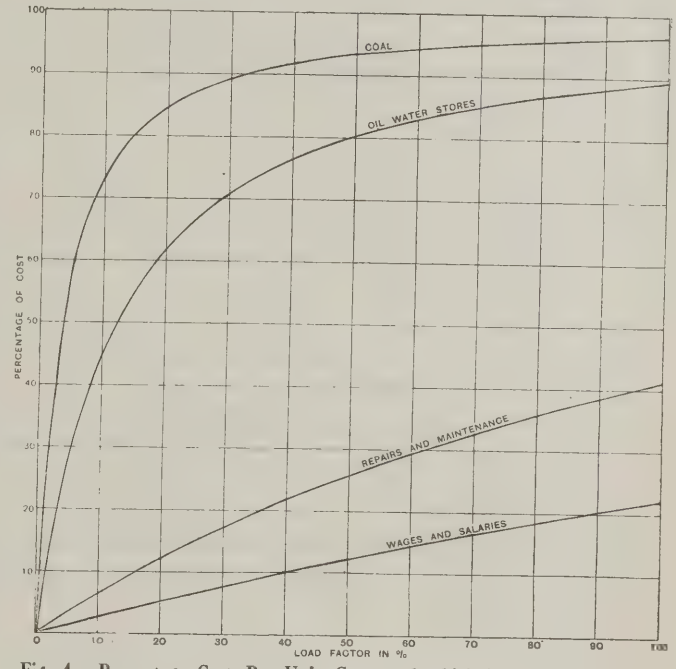


Fig. 4.—Percentage Cost Per Unit Generated which is a Running Cost.

factor, it is better to retain the old plant. It will be seen, however, that the lines do not intersect at a very sharp angle, and that therefore there is not much in it between load factors of, say, 20 per cent. and 40 per cent., so that probably in a case like this the engineer would decide to wait a while before making a change.

Though, as mentioned above, the same result can be obtained by arithmetic, or can be expressed in the form of a table to the engineer's satisfaction, he may often find that he has not finished his job when he has satisfied himself on the point in question. There may be a committee or a board of directors to convince, and many engineers have found out that a non-technical body of men has little faith in figures and little ability to understand them or patience to try to do so. It is often much easier to convince non-experts of a technical matter, in itself sound, if one can show them a graphical representation. Even if they do not understand the graphical representation, they may think they do, which for all practical purposes is just as good. A graph impresses itself on one's memory more definitely than mere figures can do.

It is convenient to have a ready rule to determine

what the slope of the lines corresponding to each item should be. This depends, of course, on the particular conditions of the station, since the proportion of fixed to running charges must vary somewhat in each station. It is not quite easy to analyse station costs in such a form as to be very certain what the proportion should be: it is admittedly largely a matter of opinion, but I think that fair average figures are as follows:—

For coal, kW cost = 318 × unit cost.

For oil, water, and stores, kW cost = 1,080 × unit cost.

For repairs and maintenance, kW cost = 12,600 × unit cost.

For wages and salaries, kW cost = 31,100 × unit cost.

In this form the figures convey little to the mind. They can be expressed in other ways. For instance, at 30 per cent. load factor the running cost part of the total cost of each item is as follows:—

Coal, 89.2 per cent. of the total cost for coal.

Oil, water, and stores, 70.8 per cent. of the total cost for oil, water, and stores.

Repairs and maintenance, 17.3 per cent. of the total cost for repairs and maintenance.

Wages and salaries, 7.8 per cent. of the total cost for wages and salaries.

Given the works costs for each of these items at a load factor L, the following formulæ give the part of each item, which is the running cost component:—

Call the percentage of the total cost per unit, which is a running cost, n and the load factor L, then for coal—

$$n/100 = 87.6\ L/(318 + 87.6\ L);$$

for oil, water, and stores—

$$n/100 = 87.6\ L/(1{,}080 + 87.6\ L);$$

for repairs and maintenance—

$$n/100 = 87.6\ L/(12{,}600 + 87.6\ L);$$

for wages and salaries—

$$n/100 = 87.6\ L/(31{,}100 + 87.6\ L).$$

From these formulæ the unit charge for each item can be obtained, or it can be read off the curves on fig. 4. If an infinite number of kWh are sold, the only cost per kWh is the unit charge. This is the figure that, when using hyperbolic paper as in figs. 1 to 3, must be plotted on the scale at infinity and a straight line through the point thus obtained, and the working point at the working load factor gives the cost at any load factor.

In the case of items having a steep line, an even simpler construction is possible. The line for each item passes through a certain characteristic point on the x axis. For repairs and maintenance this is the point which will be given by minus 144 per cent. load factor if fig. 4 is applicable to the station in question, that is, a point as far to the right of the infinity line as 144 per cent. load factor is to the left. Of course, load factors above 100 per cent. are practically impossible, let alone negative ones. The graph, however, does not take account of this practical absurdity. On fig. 2 the point is shown through which all repairs and maintenance lines must pass. A similar point for wages and salaries is at minus 355 per cent. load factor. For capital charges and anything containing no unit price at all, the point is, of course, at infinity l.f., that is, at the bottom right-hand corner of the sheet. The point for coal is at minus 3.63 per cent., and for oil, water, and stores minus 12.35 per cent. l.f. These points are, however, inconveniently far away.

With regard to the use of hyperbolic paper, it should be noted that the figures on the horizontal scale can be multiplied by any figure, and the scale still remains hyperbolic, so that, for instance, the left-hand edge of the scales used in figs. 1 to 3 (starting at 10) could be made 1 per cent. or 20 per cent. the 1,000 per cent., or 50 per cent. mark then respectively becoming 100 per cent.

Electricity Supply Tariffs.

Some particulars of the various deferred-payment agreements and electric light and power tariffs in force at Basle, Switzerland.

By Professor W. CRAMP.

IN the course of his article upon Tariffs for Electricity Supply in the Electrical Review of October 22nd (pp. 659-660), Lieut.-Col. Vignoles plumps for two-part tariffs, and in his concluding paragraph uses these remarkable words:—"It is to be hoped that engineers will consider this question of tariffs as settled." By a "two-part tariff" Lieut.-Col. Vignoles means a tariff consisting of a first charge, based directly, or indirectly, on the consumer's maximum demand, and a second small running charge per kWh.

On the other hand, in the President's address to the I.E.E., we read that 90 per cent. of the houses in Switzerland are electrified as against 18 per cent. in Britain, and we know that the load factor in Basle was 56 per cent. in 1915 and 74 per cent. in 1924. We know further that in the same city no less than 8,200 kW of water heaters are installed, largely for domestic purposes, and many of them in quite small houses. Have these results been obtained under a two-part tariff? I think not; nor do I believe that like results can be obtained in this country by "considering the question of tariffs as settled." For the two-part tariff fails in one most important respect. It does not give the consumer enough encouragement to take his energy during the periods of very light load. In Manchester I was on a two-part tariff of the kind approved by Lieut.-Col. Vignoles. I paid, I believe, 12½ per cent. of my rateable value plus ½d. per kWh. This led me to use electric radiators day and night, but it did not encourage me to switch off during the periods of heavy load. That is not the way to achieve a 74 per cent. load factor.

For the chief obstacle to a cheap domestic supply of electricity is the absence of such adequate storage as the gas undertakings possess in their gas holders, whereby any load factor, however poor, may be increased to unity at the generators. In Switzerland, the importance of this principle has been more fully recognised, and arrangements have been made to combine the supply of apparatus with such tariffs as shall encourage the virtual storage of energy by the consumer. In effect, this amounts to the substitution of a large number of small local holders for a small number of large central holders. It may be that these developments in Switzerland are due to the fact that the power comes chiefly from waterfalls; for the cost per kWh in a hydro-electric station is dependent very largely upon capital charges, so that a high load factor is of the greatest importance. On the other hand, in this

country the perpetual increase in the size of the steam generating station and its power units, coupled with the greater radii of distribution, tends also to increase that part of the cost per kelvin which is due to capital charges, relatively to the part which is due to fuel.

Thus the conditions in this country constantly tend to approach those in Switzerland, and we should do well to compare the Swiss results with our own, that we may benefit by their successes while avoiding their mistakes.

My assistant, Mr. L. G. A. Sims, who was recently in Switzerland, has brought back for me the various regulations and tariffs published by the Electrizitätswerk, of Basle. These seem to be so important that I have translated and analysed them. They may be divided into: A, those regulations which govern the supply of apparatus; and B, those which govern the supply of energy. In all cases I have interpreted the prices at the exchange rate of 25 francs to £1, which is roughly correct to-day.

In group A we have deferred-payment agreements provided for various purposes, but in all cases the payment is extended over a period of six years from the installation of the apparatus. Also in all cases the work is carried out by firms holding special concessions from the supply authority for that purpose, the supply authority exercising a control over the apparatus and the manner of installation.

Although the period for the complete payment does not vary, the period for the instalments varies considerably, some being half-yearly, some quarterly, some monthly, and so on. This must complicate the accounts of the supply authority, as well as those of the purchaser, and the amount of bookkeeping involved must be very great. It is difficult to see any reason in or for this variation.

A (1) Coming now to examples of these agreements, we have first the regulations to "facilitate the installation of electric lighting in small dwellings," which seem to refer chiefly to flats (Etagenwohnungen). Here the installation includes the supply and installation from and including the main switch to the lamp holder, but not the lamps. A maximum of ten lamps per dwelling is allowed on the deferred system, although extensions of this number may be arranged privately by the tenant. However small the first installation may be, once it is completed, no extension whatever is permitted on deferred payment; and the first installation must include those points where light is most used, *e.g.*, living room and kitchen. The standard installation includes:—

(*a*) For the parlour or dining room, one simple rise and fall pendant, with an ordinary lamp holder and porcelain shade.

(*b*) For the remaining rooms, a plain pendant with a porcelain shade, or a simple ceiling fitting.

For each lamp a switch is provided, but all making good of paint, brickwork, &c., is at the charge of the tenant. No reduction is made if the tenant provides his own fittings.

The payment for each point installed is 55 cts. (5.3d.) per month. The cost of an installation, therefore, is about 5s. 4d. per year per point for six years. This would be regarded in England as exceedingly dear, since it is quite possible to wire a small house in this simple fashion for 15s. per point.

A (2) Next we may take the regulations "to facilitate the installation of small boilers (and to reduce unemployment in electric factories)." Here the installation consists of the supply and erection of the boiler, switches and fuses, also wiring up to a length of 10 metres (33 ft.). Anything beyond this length must be paid for in cash, and the connection of the boiler to the water supply is not included. Two sizes of boiler are offered, and the extended payments are quarterly. The details are:—For a boiler of 30 litres (6.6 gallons) capacity and 360 watts loading, 12 fr. (9s. 8d.) per quarter; for a boiler of 50 litres (11 gallons) capacity and 600 watts loading, 16 fr. (12s. 10d.) per quarter.

These prices amount to £1 18s. 8d. and £2 11s. 4d. per annum for six years, and are relatively much cheaper than the lighting installation, doubtless because boilers have been developed to a greater extent in Switzerland. It is also of interest to note, in conformity with what has been said above, that long-hour heating of the water is taken for granted. It is evidently anticipated that advantage will be taken of the terms offered for energy supplied during off-peak hours (see B8 below), and thereby the equivalent of heat storage of energy is introduced. For a simple calculation shows that to raise the temperature of the water in either of these boilers by 70 deg. C. will require at least seven hours. The list price of the smaller boiler in this country is £16. 16s., and of the larger size £20, which compare unfavourably with Swiss prices.

A (3) A third example of this deferred-payment policy is found in the regulations to facilitate the installation of automatically controlled electric lighting in the staircases common to two or more flats or other dwellings. In this case again the installation is complete up to, but not including, the lamp. The owner is responsible for the proper use and maintenance of the installation, as well as for any painting and making good of the building after installation. Simple ceiling fittings are provided, but if better fittings are desired, they must be supplied by the owner, and no reduction is made on that account. The conditions apply to a new installation in an existing building, or to the exchange of an old non-automatic system for one with automatic control, but they do not apply to new buildings. The actual hours during which the automatic switch turns on the light are in the agreement for the supply of energy (see B11 below), clearly indicating that the two are supposed to be related. The charges for the installation are as follows:—Two points, three switches and 22 metres (73 ft.) of wiring, 9.5 fr. (7s. 7d.) per six months; for each further point with one switch and 7 metres (23 ft.) of wiring, 2.5 fr. (2s.) per six months.

Thus for the first two lamps the charge is about 15s. per annum for six years. Considering that this includes special switches, it is quite reasonable; for the cost of the switch alone in this country would be about £12.

B (1) We turn now to the electric light and power supply prices. The ordinary flat rate for electric light is 55 cts. (5.3d.) per kelvin.

B (2) There is, however, a double tariff for installations controlled by time-switches, as follows:—

Peak-load hours, *i.e.*, 6.30 to 10 p.m. in summer, and 6.30 to 9 a.m. and 4.30 to 10 p.m. in winter, 55 cts. (5.3d.); all other hours, 20 cts. (1.92d.).

B (3) For power purposes the following tariff holds:—

Kelvins per month.	Price per kelvin. Centimes.	Pence.
Up to 1,000	22	2·1
1,001 to 2,000	18	1·72
2,001 to 3,000	14	1.34
above 3,000	10	0·96

A discount is allowed from these prices which introduces the maximum demand. It is calculated as follows:—

Discount per cent. = (kelvins per annum) ÷ 150 times the maximum demand for the year in kW. The nearest whole number to this figure is taken, and no discount is allowed below 5 per cent. or over 40 per cent. Also the value of the monthly consumption must not fall below 7 fr. (5.6s.) per kW of maximum demand, or the latter minimum is charged. The calculation of the maximum demand for large power users is obtained from an m.d. meter, which gives the mean of the maxima over any quarter of an hour in the year. As a method of calculating the monthly payments, the m.d of the previous year is taken until December, when the adjustment is made for the whole year. In the case of a new load, the m.d. is reckoned as 70 per cent. of the installed kW. It is usual to grant more favourable terms than these to electrochemical and other industries with a specially high load factor. Nothing whatever is said as to power factor.

(To be concluded.)

Extra-High-Pressure Transmission.

With the adoption of extra-high-pressure distribution to outlying districts, continuity of service may be sacrificed to some extent for the sake of economy in first cost. This article emphasises the importance of guarding against that error.

By A. T. SCOTT, A.M.I.E.E.

AT the present time transmission lines and cables are being rapidly extended by electricity undertakings to their outlying districts in order to increase the load on the generating stations, and to cover the authorised supply areas. The immediate gain in revenue from such extensions is often small in comparison with the expenditure, and is not helped by the fact that the price per unit is cut as low as possible in order to obtain increased business; consequently the initial cost of extensions tends to become a leading consideration, and it is to be feared that under these circumstances the continuity of the supply given, and the service rendered, is not always comparable with that formerly given from the l.p. networks supplied direct by local generating stations.

It might appear unnecessary to draw attention to the fundamental importance of maintaining a good supply and a truly continuous service, but there is a real danger of too frequent breakdowns being explained away, and of a certain number of interruptions being accepted as a necessary evil common to e.h.p. transmission systems of any considerable magnitude. This is especially so when such interruptions are not confined to one particular area. A 90 per cent. supply has been advocated as being better than none, but on the other hand, continuity of service is essential in order that electricity may be universally adopted, not merely as a stand-by, but as an indispensable source of energy. If an electricity supply can be absolutely relied upon, the demand for it will increase and its usefulness reach a maximum value.

That an electric supply can be cheapened more effectively by increasing the demand and load factor than by any other means has often been pointed out, and there can be no doubt that good service will eventually contribute more towards this increase than the initial cheapening of a supply at the expense of reliability. An e.h.p. supply is vastly more important than any individual l.p. supply, and generally the importance may be considered as proportional to the transmission voltage. Very satisfactory and reliable supplies have been and are being given at pressures up to 20,000 V in many places.

More recently 33,000 V has been adopted for long-distance transmission, and for large modern generating stations this is now the usual bus-bar voltage, yet it is very doubtful if the use of this pressure has contributed towards any improvement in the reliability of the supply up to the present. It is not the highest pressure that has been used in this country, but it is the highest contemplated by many undertakings, and it is considered the most suitable for main transmission and for interconnecting within the bounds of the areas outlined by the Electricity Commissioners. In certain cases where it is being used, the results are not as good as had been anticipated, and in other cases the results have been altogether unsatisfactory.

During the past few years it would appear that there has been a tendency for certain undertakings to be unduly ambitious in their endeavours to cover their authorised areas with transmission lines or cables, and that they have been guided far more by political than commercial or economic considerations. Where such influences as over-ambition and politics have predominated it is quite possible that a higher voltage than necessary has been chosen and put into use before sufficient experience has been gained, before any really complete scheme has been formulated, and before sufficient capital has been available to enable adequate provision to be made for the effective operation of the extended system.

Under such circumstances it is more than likely that only the bare necessities for a supply have been provided, that switchgear and protective gear have been reduced to an ill-considered minimum, and that very possibly the factors of safety of overhead lines and cables have been reduced below the safe value. Static sub-stations may have been left unattended and overhead lines unpatrolled, and an organisation for speedily attending to breakdowns may have been conspicuous by its absence.

The present uncertainty with regard to the future national developments is no doubt responsible for certain important centres being left dependent upon one source of supply only, whereas with a proper scheme of interconnections, a duplicate and alternative supply could be provided. It should not be inferred that continuity cannot be realised with e.h.p. transmission without providing elaborate and expensive apparatus, neither is there any reason to suppose that 33,000 V is particularly difficult to deal with. It is, however, desirable to bear in mind that as the voltage of transmission is increased so the minimum economic load is increased, and also that if interconnections are desirable for the maintenance of continuity on l.p. networks, they are much more so where e.h.p. supplies are concerned.

Attention might also be drawn to the practice of laying cables made for a comparatively high voltage and using them at a lower one until the demand justifies their use on the pressure for which they were designed. This practice creates a premature demand for high-pressure cables, and the experience which might be gained by their normal operation is deferred; so that, as cable design and manufacture are rapidly improving, the cables are liable to become of an obsolete type before they are used on their designed pressure.

Having now emphasised the importance of continuity of supply and considered certain conditions which possibly hinder improvement, the following brief suggestions will probably suffice to indicate where advancement might be made.

A definite improvement can be effected by the provision of a greater margin of safety throughout the insulation of the line, by the adoption of a more liberal design of insulator which will definitely ensure that an adequate factor of safety over the worst conditions under which the insulators may operate. Certain rules are laid down in reference to tests etc., but such rules are likely to be very misleading. Operating

conditions vary very considerably in different parts of the country, and an insulator may operate very well in one locality while proving very unsatisfactory in another. Herein lies the danger of the adoption of general rules. The design of insulator should be studied in connection with each line, and the ideal solution will be found as a result of close co-operation between the designer of the line and a reputable firm of insulator makers with the advantage of experience behind it.

The provision of more liberal clearances between the lines, and if necessary the use of suspension insulators in place of the pin type, may also prove to be advantageous. Faults due to external causes will also be diminished in number by the same means, and further improvement will be realised by a strict and periodic patrol of the lines, by the provision of a liberal right of way cleared of trees, and by duplicate lines to any given point being run along separate routes. When the factor of safety of the insulators is low, efficient means of cleaning these will be desirable. Duplicate supplies are essential for loads above 1,000 kW, and effective discriminating protective gear, working in conjunction with reliable automatic switches, is necessary in order that a faulty feeder or line may be disconnected while the supply is still maintained through the other line. When substations are unattended, automatic self-acting switches are desirable in order that a line or feeder may be switched back into service after a fault has been cleared.

Important centres of distribution or load centres are served to the best advantage when supplied from more than one generating centre, and therefore interconnection becomes a necessity. When several generating centres feed a common load area, unity of supervision and control is essential. Long-distance transmission lines require sectionalising at suitable intervals, and organised repair gangs located at strategic points connected by telephone are desirable. In times of war and civil disorders underground supplies are freer from disturbances than overhead lines, and they are also less liable to be damaged by, or constitute a menace to, aircraft; and where a large number of circuits have to emanate from a given centre, overhead lines may be impracticable on account of the space required for their accommodation. For these and other obvious reasons it is worth while to consider whether eventually all main or national electrical supplies shall be laid underground or overhead, and in this connection the practice of the G.P.O. with regard to trunk telephone lines may be significant.

Legal.

British Thomson-Houston Co., Ltd., v. West Yorkshire Electric Co., Ltd.

ON an *ex parte* motion, Mr. Justice Tomlin, in the Chancery Division on January 21st, granted an injunction over a week to the British Thomson-Houston Co., Ltd., restraining the West Yorkshire Electric Co., Ltd., of Leeds, and its manager from parting with certain incandescent electric lamps which the plaintiff company alleged infringed its patents.

Mr. BASIL DREWE, for the plaintiff company, said he moved *ex parte* because they found that persons in possession of infringing lamps very often got rid of them as soon as the writ was served on them.

Theft of a Vacuum Cleaner.

AT Darlington Police Court, on January 20th, Robert Evans, a labourer, was fined £3 for the theft, as bailee, of a vacuum cleaner, valued at £20, the property of Mr. William Sykes, electrical engineer, Darlington. The evidence showed that the accused was engaged by the prosecutor to sell goods on commission, on the representation that he was accustomed to demonstrating and selling vacuum cleaners. He was given a cleaner for demonstration purposes only, but becoming dissatisfied with accused's conduct, prosecutor demanded the return of the cleaner, and then found that it had been sold. Accused had had other articles from Mr. Sykes to sell on commission, and they had been sold, but the money had not been handed over. In all £45 worth of goods had been sold by accused in that way. Evans's defence was that he bought the goods and that he was to pay for them at the end of the month and receive 2½ per cent. trade commission.

General Engineering Development Trust, Ltd.

MR. JUSTICE ROMER, in the Companies' Winding Up Court, on January 18th, had before him the petition of Walter Hill and Co., Ltd., for an order for the compulsory liquidation of the General Engineering Development Trust, Ltd., which was formed to exploit an invention relating to an electrical route indicator called "The Pathfinder."

Mr. SWORDS, for the petitioners, who are judgment creditors, said suggestions for a scheme of arrangement and an offer to pay had been made, but the petitioners were not satisfied with them.

Mr. WALLINGTON, for the company, said that a good deal of money had been put into the invention, and it was now getting on to its feet. The company was short of capital, and an arrangement had been made to provide a further £10,000. The majority of the shareholders were in favour of the scheme.

His Lordship adjourned the petition for 14 days.

Correspondence.

Maximum Potential Gradients.

Perhaps I may be allowed a few lines in your esteemed journal to reply to the question raised by Mr. Dunsheath in the discussion on his paper this week.

I do not wish it to be taken that I am at all putting forward the maximum potential gradient in any "blindfold" way, as the figure obtained by a stereotyped formula; I am contending for the importance of knowing *what is* the maximum potential gradient, and *at what part* of the cable it takes place.

May I give the following quotations:—

Messrs. Roper & Halperin (paper before the Amer. Inst. Electrical Engineers, May, 1926):—

"The brown or black spots generally appear in the middle or outer portion of the conductor insulation, sometimes accompanied by tiny punctures *in the layers near the conductor*. . . .

"The evidences of ionisation are generally found in the largest quantity *where the stresses are the greatest*. . . ."

The next paper I would refer to is that by Mr. Farmer, read before the Am.Inst.E.E. in May, 1926, in which, after attempting to get the relation between life and stress based upon average values of the gradient, he finds he gets a much more consistent result by introducing the *maximum* gradient.

The third reference which I shall give is from the paper by Mr. Hoover, presented to the Amer.Inst.E.E. in June, 1926, in which he endeavours to show that the volt-ampere characteristic of the insulation, which has its critical point at about 3 milli-amperes per sq. cm., is the determining factor of the maximum gradient itself, and he arrives at the rather interesting result expressed by the following quotation from his paper:—

"It is seen that the maximum gradient is at some point near *the centre* of the wall of insulation, and is *not* at the surface of the conductor as is ordinarily assumed. In fact, the gradient at the conductor is less than that at any other point in the insulation."

My present position in the matter is that an engineer must be guided by various practical considerations in assessing the position of the maximum potential gradient.

Such things, for example, as the non-uniformity of the arrangement of the layers of the paper, the poorness of impregnation towards the centre of the cable (except in the case of Pirelli) and the temperature gradient through the insulation under load have all, it seems to me, quite an important bearing, apart from the latest qualifications introduced by Mr. Hoover.

Other things being equal, the current density through the insulation would be a function of the potential gradient at that point, for uniform permittivity and resistivity.

A. M. Taylor,
Major, S.O.2.

Birmingham, *January 22nd*, 1927.

The Electric Market Place of the Future.

I was very interested in Mr. Berry's article in your issue of January 7th.

I think the idea of holding demonstrations of and lectures on domestic electricity in cities and towns is excellent, but I do not think it would be of much use in villages, even where there already is power, as villagers proper would not be likely to install electrical apparatus in farm or cottage even if they could afford to do so, and the large houses probably

have all the latest appliances. I think this method is far better than house-to-house canvassing, which often annoys people, but after the public demonstrations it would most likely be possible to arrange to give some at private houses to likely purchasers. A great deal might be done by qualified demonstrators and lecturers; the lectures should be of the popular type, and be given by women—in fact, "the use of electricity by women for women" might be a good heading for placards and advertisements.

At present I am sure the majority of women are scared of electricity and absolutely ignorant even of fundamentals. I quote two instances from personal experience. A friend asked me if it was a sign that her iron was hot *when it made a noise!* Her little girl used to say: "Mummie, the iron's talking!" and she thought it was then hot enough to use!! The solution was probably a loose connection. Another woman always took her iron about with her and put it on to the lighting circuit of any hotel at which she was staying, blissfully ignorant of such a detail as difference in voltage! These instances are, I think, representative of the average woman's attitude towards electrical apparatus, and this must be overcome if power is to be used to any extent in ordinary homes.

One point I think important is that women should be taught simple maintenance repairs, just as the woman driver can do ordinary running repairs to her car. Probably the local contractor would disapprove of such knowledge being general, as he would lose a great many jobs which can be very profitable under the vague wording "time and material," the latter usually meaning a piece of fuse wire! It is not enough to demonstrate a vacuum cleaner or cooking stove and leave the woman without the slightest idea of what to do if minor faults develop; particularly does this apply to replacing blown fuses. With a cooking stove a fuse *might* blow just before the arrival of guests for dinner, and the local contractor *might* have gone home; the result is awful to contemplate! Nor should such practical knowledge be left to the man of the house; domestic appliances are in the women's department, and she ought to have the necessary knowledge to keep things running. One thing that is very much against the greater use of electrical apparatus in the home is the extraordinary conservatism of servants, and this is a very real difficulty that the mistress is up against; they have a fear and distrust of "new-fangled" notions—whether this applied equally to the pioneer days of gas perhaps some reader older than I may remember.

Gladys F. Moreland.

Shinfield, Berks., *January 22nd*, 1927.

I should like to express my appreciation of the article by Mr. H. H. Berry in your issue of January 7th, and particularly to emphasise the desirability of all supply undertakings which are contemplating holding an electrical exhibition getting in touch as soon as possible with the Exhibition Committee through the director of the Electrical Development Association.

The value of a special electrical exhibition for a week or a fortnight cannot be too highly appreciated, and my own experience, which will no doubt be supplemented by many other supply engineers, is that the money is well spent whatever the cost may be.

Mr. Berry's vision of an electric market-place in every city is that of the idealist, but without an ideal to aim at we shall not make progress, and I am certain that many will agree with me that of all propaganda that which gives the best return is actual demonstrations and exhibitions where all interested may see actual apparatus, examine it, test it, and criticise it.

Mr. Berry is throwing himself heart and soul into this particular aspect of electrical development, and it is to be hoped that all will contribute their full measure of support, suggestions, and assistance in order to ensure its fullest practical use for the purpose in mind.

As Mr. Berry says, Wembley on a miniature scale in every town and village in the country should be our ultimate aim.

Fredk. W. Purse,
Engineer and Manager,
West Ham Electricity Dept.

Stratford, *January 17th*, 1927.

The Signs of Trade Revival.

Some friend of mine—I do not know him personally, but anyone who believes in better times is a friend—writes an interesting article in your issue dated January 14th, 1927. No more suitable time than the opening weeks in the New Year could be selected for making resolutions, even though they be doomed to failure.

Among a few, the cry of "Trade Revival" has become a catch-word, and if the Electricity (Supply) Act has supplied politicians with a want, it does not prove that industry can assimilate the suggested improved conditions; admitted that everything is new in the world, and that no one knows who is bankrupt, and who is solvent, the scheme cannot do what is suggested. On the other hand, it offers serious objections and features that have been disparaged and denounced, and, like all the other fashionable huge combinations in and out of operation, causes grave and serious discontent, especially among the middle class, which has not the "ear of the Press" or the public. That class bears all the burdens of changing life silently, and with no offer of co-operation; the outlook is not encouraging, for all these amalgamations provide a channel for scrapping loyal servants, usually of middle age.

Platform speakers urge the necessity of preserving individual liberty and freedom, and immediately agree to conditions that destroy the possibility.

The cotton industry, it is said, offers great hopes! If I read correctly, the reason is that orders for new machinery have been placed, but where is the machinery going to? Read in the *Manchester Guardian* of the world's competition, and probably you will assume that our foreign rivals have reaped another advantage. Read, also, of the efforts of various professors, and well-known economists, to salvage the industry, and discern any improvement, if possible. With cotton at about 2s. 6d. a lb., a boom was prophesied when it dropped to 1s., but to-day, at less than 7d., the state of prosperity is as far off as ever; consequently, many cotton shares stand at a discount. Textile people do not buy on a falling market, and it is just possible that the foreign customer will not buy for stock until he thinks the market has touched "bottom"—raw cotton has; but can he think the same of the existing high taxes, rates, and other items? The fact of working a few hours a week, or "short time" as it is called, instead of being fully occupied, is sufficient proof that prices have not touched "bottom."

It is pleasing to read of the "record" prosperity of the electrical trade. Statistics indicate full time work in all branches of production, with the exception of the *industrial* motor section; just so. Again, an increase of 24 per cent. due to orders for super-stations at home is reported, but as this type of order savours of "taking in one another's washing," perhaps we can only be thankful that Bumbledom did not send these orders abroad.

The world we live in is a new one, and history teaches us nothing. Commerce is new, and, unfortunately, there is a tendency to employ soulless methods, where loyalty and service are not of recognised value. Many unpleasant facts are not brought into light and frankly discussed, prosperity requires more confidence and co-partnership under the new conditions. For years past, a few gentlemen in high estate have seen a "silver lining in the sky" and preached optimism, but their arguments were not based on facts, so perhaps you will believe that the trial and anxiety of waiting for something to turn up has forced many thoughtful people to expect new remedies, and view with suspicion any prophecy.

L. E. Wilson.

Manchester, *January 17th*, 1927.

Electric Ovens.

Our attention has been drawn to a letter in your journal by "Oven," referring to the above subject.

We have had nearly four years' practical experience of baking, both bread and confectionery, in electric ovens, and can assure you this experience proves that the statement made—that the products taste of ozone—is entirely erroneous.

A "Magnet" oven which we obtained from the General Electric Co., Ltd., is in daily use at one of our depôts, and with this type of oven it is impossible for the food to come into direct contact, as the heating wires are entirely enclosed. One might just as well claim that a steam-pipe oven, when fired by coal, coke, or oil, creates a taste in the products according to the fuel used.

Assuming that ozone was created, every baker knows that, in the case of bread, for at least the first half-hour steam is being given off by the dough, and therefore it cannot absorb anything during that period, after which the crust would equally prevent any contamination.

In conclusion, it may be of interest to many of my friends in the trade to know that since we have had these ovens in use not a single one of the heating wires has melted.

Trusting the foregoing explanation may help to dispel any doubt on the point raised.

W. Parker-Butler,
Manager,
F. Carrington.

London, *January 18th*, 1927.

We are particularly interested in the letter signed by your correspondent "Oven" in your issue of January 14th, and wish to offer our opinions based upon fairly wide experience. As Switzerland is mentioned, we may say that our parent house, situated in Aarau, has installed large numbers of electric ovens in bakeries in Switzerland, and obtains better baking results than with steampipe ovens, which type is known to be fired alternatively with coke, oil, gas, &c.

Our sister house in Pantin, Seine, has similar experience; also our Milan house. So much for Continental users.

Our experience in this country and the United States, combined with intimate knowledge of Continental practice as above mentioned, prompts us to state that there is no foundation for the statement of the gas journals unless they have located some isolated oven or ovens of bad design and with unique characteristics.

We do not place the elements in the baking chamber, but locate them in tunnels directly below the oven deck and above the oven crown. In common with most designers, we grade the resistors to dissipate their full rated energy at normal temperatures without reaching red heat. Can you imagine

such a design generating ozone to spoil the bloom, flavour, colour, or odour of the baked loaf?

Being impartial on the question of types fired by coal, coke, wood, coal gas, natural gas, and oil, and ignoring working cost in view of the unreasonably high charges per kWh prevalent in most parts of this country, we can assure "Oven" that the goods baked in a well-designed electric oven are superior in every respect to goods baked by any of the other types enumerated, and far from being damaged, they are many points ahead under all tests known to bakery experts: volume, bloom, flavour, colour, odour, and keeping qualities. As usual, the gas journals live up to the scare-monger reputation.

We conclude with the following facts given to the undersigned in June last when at Berne with President Ad. Ingold and Secretary Hans Haldemann, of l'Association Suisse des Patrons Boulangers et Patissiers (Association of Swiss Master Bakers and Confectioners). This Association has 145 local Associations, comprising 5,300 Swiss bakers out of a total of approximately 6,000 throughout Switzerland, and they are antagonistic towards the prohibition of night baking, which is now law. Although this edict is in force, they have a strong case against it. The Associations have estimated that with the 6,000 ovens in Switzerland, and assuming that 4,000 will be electrified within the next fifteen years, they will save 120,000 tons of imported coal per annum, and will use 320 million kilowatt-hours of electricity, which is available from their natural resources through the hydro-electric power stations. This conversion will only be possible so long as they are able to use the ovens during the night hours, when special low rates are charged. At present in Zürich alone, 30 per cent. of the ovens are electric.

Does this indicate that electric bake ovens damage the goods? Would they talk of wide conversions of ovens to electric heating if the finished articles were inferior?

Gas journals please copy.

Artofex Engineering Works, Ltd.
W. ELLERD-STYLES, M.I.E.E.,
Managing Director.

London, *January 20th*, 1927.

River Water—or Cooling Towers?

I feel sure that many of your readers, in common with myself, have read the article in your issue of the 14th inst. on "River Water or Cooling Towers," by Mr. J. N. Waite, M.I.E.E., with considerable surprise.

Mr. Waite sets out to prove that instead of there being a difference of 10 per cent. in thermal efficiency as between a station using river water and one using cooling towers, only half that gain can be obtained in practice. Mr. Waite's basis of comparison, namely, 29.1 in. for river-water conditions and 28.2 in. for cooling-tower stations, is cutting the difference very fine, and I doubt whether he could substantiate that difference by a series of comparative calculations. This, however, does not account for the main difference, nor does the fact that he neglects to make any allowance for the additional power required to raise the circulating water to cooling-tower level, which in practice generally amounts to the equivalent of practically 1 per cent. of the steam consumption of the unit. His main argument is based on the statement that modern steam turbines are not able efficiently to utilise the difference in energy available at the lower terminal pressures. The half-load figures published in fig. 1 prove that practically the whole of the theoretical gain can be obtained, given a correctly designed low-pressure end.

I believe that every turbine maker, not only in this country but all over the world, is prepared to guarantee his ability to build turbines of the largest sizes required which will utilise the heat energy efficiently down to 0.9 in. Hg, and even below that. Are we to assume that all these engineers are mistaken, and that they are staking huge sums of money rashly on opinions which they cannot substantiate, practically every day of the week?

There is no need to question the accuracy of the methods employed by Mr. Waite in carrying out the tests which have led him to his conclusions, but the figures he shows seem hardly sufficiently conclusive to justify such a sweeping condemnation of a world-wide industry, that incidentally has the honour of including the greatest living inventor of our generation.

R. J. Kaula.

Erdington, *January 19th*, 1927.

Power Supply to Wireless Receivers.

With all due respect to the position which Mr. Turner holds, I do not think that some of the statements he has recently made regarding wireless receivers should be allowed to go unchallenged.

I think that the human ear, provided it be competent, must be the final judge as to whether a broadcast receiver is distortionless or not, and after several years' experience with receivers of all types, including Burndept, I am now using instruments which, to my mind, give absolutely distortionless reproduction of both speech and music, although they break all the laws recently laid down by Mr. Turner.

In the first place, the low-frequency amplifier in these receivers employs THREE transformers, two intervalve and one output, which should, according to Mr. Turner, absolutely ruin the quality of reproduction. Also the h.t. consumption at 120 volts maximum is as follows:—2-valve receiver (1 power valve) 3 mA; 3-valve receiver (1 power valve) 5 mA; 4-valve receiver (1 power valve) 8 mA, as against Mr. Turner's figures of 13 to 20 mA, below which he states it is impossible to obtain good reproduction.

I do not wish to name the receivers, as I do not think the Correspondence Column is the place for any kind of advertising, but I should imagine that Messrs. Burndept have a great respect for the makers of the receivers that I have in mind, as they are using a cone type loud-speaker manufactured by this firm in conjunction with their own Ethophone receivers, and I should be glad if Mr. Turner would confirm my measurements if he has an opportunity.

I should state that my opinion as to the excellent quality of the reproduction of these receivers is supported by many other users, most of them far more competent to judge than I am, and whose names are well known in the musical world.

With all due respect to resistance capacity coupling for the good reproduction of music, I have yet to hear really good speech reproduced by this method, and it seems to me that the whole question is a matter of correct receiver design.

To avoid any risk of being accused of attempting to advertise a rival receiver, I enclose my card, but prefer to sign myself

Interested.

January 14th, 1927.

The "H" Type of Cable.

I have read with some regret, not amusement, the many letters which have been published in the last two issues of your journal. Quite apart from the relative merits of either the belted or the "H" type of cable, Mr. Nisbett is quite right in intimating that there is no reason for booming the "H"-type cable as though it is the only satisfactory one which is being made by British manufacturers; obviously this attitude is very depreciatory towards our colleagues. Mr. Nisbett is to be congratulated for his stand in this direction, as there are undoubtedly as good brains in this as any other country, and it was noticeable that at least one C.M.A. cable designed to eliminate tangential stresses was not received with the same joy as the "H" type.

There is no reason why the "H"-type cable should not be made by our cable firms, but we can surely overcome the difficulties in three-core cables in our own manner, and one way to this end would be to eliminate destructive criticism and obtain our amusement at the expense of others quite apart from business.

No one is entirely blameless, but let us try to expend our energies in the right direction.

E. B. Nixon, A.M.I.E.E.

Newcastle-on-Tyne, *January 15th*, 1927.

New Uses for Electricity in Switzerland.

Our correspondent at Vevey, Switzerland, says that the year 1927 opens with yet further demonstrations of the wide use to which electric power can be put in Switzerland. There are two new undertakings, both of which have to do with quarries, but for very different purposes. In the Ajoie, a new society, "Electrolyse" by name, has taken over the quarries at Cornol, rich in gypsum, from which it hopes to extract sulphuric acid and sulphate of aluminium. To this end the "Electrolyse" has acquired an old foundry in the district, and transformed the whole thing into an electrical works with all the latest appliances likely to speed up the purposes for which the quarries have been bought. Thanks to this up-to-date plant, the "Electrolyse" has already made progress; the yield from the gypsum is most satisfactory, and the residuum after the sulphuric acid and the sulphate of aluminium have been extracted can be used as a fertiliser, and on account of its low price is fairly certain to obtain a ready market.

The second undertaking is in the canton of the Tessin, near Mendrisio. The marble quarries of Arzo, near by, have been celebrated for centuries in Switzerland and North Italy for their reddish-tinted marble, beautifully veined and spotted, and visitors to the Milan Cathedral never fail to admire the Baptistery Chapel, which is decorated with this particular marble. Thanks to the far-sightedness of the present director of the quarries, the output, which had been languishing a little, has more than recovered its former activity. Mr. Rossi has taken the initiative, and under his superintendence all the plant of the Arzo quarries has been electrified. One of the specialities of these quarries is a thin slab of marble used for facing purposes; the new electrically-driven saws give much satisfaction, as the thickness desired can be more evenly obtained than by means of the old hand saws, or even machine saws, and the marble facings can be kept at the desired size. In order to encourage the development of the new enterprise at Arzo, the Swiss Government has ordered this marble to be employed for the decoration of the lobby and office of the new post office at Bellinzona, now in course of construction, and the electrical installation at Arzo is at present working at high pressure.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

The official report of the Campaign for the week ended January 22nd states that new circles were formed during the week at Peterborough (chairman, Mr. H. Sanders) and Beckenham (Mr. J. Tapper). Demonstration electric houses were opened at Muirend (Glasgow), Hull, and Leicester. The attendance at the Denton (Manchester) demonstration house is reported to be satisfactory. The Hull demonstration house is being opened officially by the Lady Mayoress. In connection with the Sheffield house, which was to be opened on January 24th, 1,000 bills have been posted in the city tramcars. Coloured lighting has been freely used in the Muirend house, which was opened by Lady Paxton; between 750 and 1,000 people are visiting the house daily. "Electroville," one of the latest Newcastle houses at Bishop Auckland, is attracting an average of 1,000 visitors per day. It is expected that a demonstration house will be opened at Carlisle next week. The Manchester circle has decided to run four more houses at Rusholme and Chorlton-cum-Hardy (Manchester), Prestwich (Salford), and Stretford. The demonstration house at Beckenham has resulted in a considerably increased demand for cookers in the district; another, larger, house is in contemplation. Tamworth is preparing to open a house early in February. Over 5,000 people visited the Walsall house during the first fourteen days of its run. As reported below, the Hampstead Circle opened an exhibition at the borough electricity works on January 22nd. The North-East Coast Area Committee is organising a special children's competition in connection with the campaign. Prizes are being awarded for the best models of the prize house—the materials to cost not more than two shillings; for the best "slogan"; and for the best reproduction of the front cover of the competition booklet.

We have already made several references to the big part which is being played in its area by the Shropshire, Worcestershire, and Staffordshire Electric Power Co., to further the objects of the campaign. We now illustrate another phase



A Campaign Display at Dudley.

of the company's activities—a special campaign display at an electrical exhibition at Dudley organised by the company in conjunction with Messrs. Cook & Co., Lloyd & Ferrer, G. G. Walker & Co., and F. H. Jennings, all Dudley electrical contractors.

An exhibition organised by the Wolverhampton Circle was to be opened by the Mayor of Wolverhampton yesterday (Thursday). Mr. W. N. Gordon, A.C.I.S., is the hon. secretary of the circle.

Last week at the London Lighting Service Bureau, the organisers of the campaign had on view a model of the prize house prior to its being sent to the Provinces. The model is on a fairly large scale and is provided with a vertically-hinged front which opens outward and closes again continuously, actuated by a small motor and gearing concealed in the base. The little rooms are handsomely furnished and equipped with tiny "electrical" appliances. While the cooker seen in the kitchen does not cook, all the lamps light and provide ample illumination to enable the interior to be inspected. The model is available to local circles, which are required to pay a small fee for its use. Its first public appearance will be made in a shop window in one of the main streets of Liverpool.

Since being opened on January 17th, the all-electric house at Muirend, Glasgow, has been visited by large numbers of people. Lady Paxton, who performed the opening ceremony, is a vice-president of the Electrical Association for Women. The equipment is of the most up-to-date character. The pantry-kitchen has a "High-Low" cooker installed in it. The vacuum shown is a "Little Glutton." Among the heating apparatus of different types in the various rooms are a "Magicoal" fire and an "Inventum" heater. Downstairs the lighting fittings are by Messrs. Osler & Faraday, and upstairs by the General Electric Co., Ltd.

The Americans are watching the progress of the Campaign with interest, and will not be slow in taking advantage of the benefits which will accrue from it. *Commerce Reports*, after commenting on the campaign and indicating the share of the United States in the British domestic electrical appliance business, says:—"These figures indicate that electrical household appliances of American manufacture meet with a favourable reception in the United Kingdom, and that if our manufacturers take full cognizance of the co-operative marketing campaign now under way, they should have an excellent opportunity still further to increase their sales for this particular class of apparatus." There seems to be room for a "Buy British Electrical Goods" slogan.

Russian Orders for Germany.

The head of the Russian Trust for Mass Production, M. Ots, who recently returned to Leningrad from the Ruhr, has sent an order to the Deutsche Maschinen Fabrik A.G., Duisburg, for the delivery of the equipment for a metal works. The German firm has accepted the required guarantee that the factory equipped by it will deliver annually two million poods of rolled metal and only twenty workmen will be necessary to look after the machines. The Siemens-Schuckert concern has received the order for the electrical equipment of the factory. Other German firms have received orders for the equipment of other factories under the Trust to the value of half a million roubles. —*Reuter* (Duisburg).

The B.E.A. and Railway Rates.

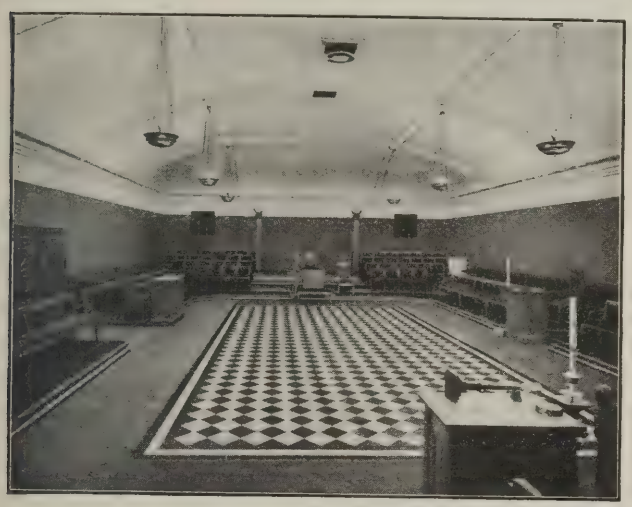
The following resolution was passed last week by a special committee of the British Engineers' Association:—"The British Engineers' Association deplores the policy of the railway companies in proposing to increase the burden of railway rates to be borne by industry and trade in their present state of depression, and at a time when they are struggling to recover from the serious effects of their recent dislocation. The engineering industry, like most other producers, is working on very small margins with the object of recovering trade, and in these circumstances it is thought to be most unfair that railway rates should be increased without at least three months' notice being given to enable the manufacturer to avoid or minimise this new encroachment on his margins in respect of existing contracts. The daily experiences of manufacturers and traders in this country make it abundantly clear that considerable railway economies could be effected, and it is strongly felt that the possibilities of such economies should be thoroughly investigated before a further handicap is placed on industry and trade by any such increase of railway rates as is now threatened."

The Radio Manufacturers' Association.

This Association has addressed to the wireless trade a request for particulars of any matters which the recipients consider to militate against the maintenance and improvement of the sale of British radio apparatus. Replies are required before February 1st, and upon the receipt of these the matters raised will be analysed and collated. The Association points out that the greater the backing which is received "the greater the prospect of a successful issue to any case presented by the Association—in whatever quarter—on behalf of the industry."

A "Mazda" Lighting Installation.

The accompanying picture has been reproduced from a photograph taken solely by the light provided by the lighting installation. The view shows the interior of the Masonic Temple, Douglas, I.O.M. The installation consists of eight "B.T.-H." "Eye-Rest" fittings, each furnished with a 500-W "Mazda" gasfilled lamp. The fittings give an excellent daylight effect



The Masonic Temple, Douglas, I.O.M.

and the lamps being hidden from normal view no glare is caused. The illumination is obtained by means of secondary reflection from the ceiling and upper parts of the walls. The installation was carried out by Messrs. V. A. Bellamy, electrical contractors, Douglas, to the specification of the architect, Mr. W. H. Lomas, Douglas.

Employment During December.

The *Ministry of Labour Gazette* states that employment in the engineering industry during December last was bad, but showed a general improvement as compared with the previous month. The industry was still handicapped by a shortage of raw materials. There was a marked improvement in electrical engineering; the percentage of unemployed fell from 6.8 in November to 6.1 in December. The "overall" figures for the engineering industry were 16.7 per cent. in November, and 14.3 in December. The improvement extended to other branches of electrical industry. In the electrical wiring and contracting section unemployment decreased from 8.7 to 8.2 per cent., and in electrical cable, wire and lamp manufacturing there was a fall from 7.9 to 7.1 per cent.

Unemployment.

There was a decrease of 63,840 in the number of registered unemployed during the week ended January 10th. The total at that date was 1,432,000, as compared with 1,221,400 on January 11th, 1926.

Radio Business in Poland.

The British Commercial Secretary at Warsaw has forwarded statistics from the local Press which show that the number of broadcast receiving licences issued in Poland increased from 4,977 in 1925 to 34,556 in 1926. On the other hand, the number of dealers declined from 269 to 239, indicating that Poland has also experienced the usual process common to the initiation of a wireless industry, in that numbers of small firms which went into the business, lacking both experience and capital, have not been able to withstand even favourable conditions.—*Board of Trade Journal.*

Radio Royalties in Australia.

It is reported from Melbourne that Amalgamated Wireless, Ltd., has claimed the exclusive Australian patent rights for the principal articles used in the construction of radio receiving sets. The company has notified manufacturers that it requires them to pay royalties of 12s. 6d. and 17s. 6d. per valve in respect of each set sold. The report also states that the company is endeavouring to make this claim retrospective, and this has caused some concern among the smaller traders. The Commonwealth Government holds a large interest in the company, but is reported to have declared that it does not intend to take any action.

The Hampstead Electrical Exhibition.

We incorrectly stated in our last issue that the Hampstead Electrical Exhibition, which opened on Saturday last and closes to-morrow, was organised by the General Electric Co., Ltd. The Hampstead Circle under the E.D.A.-E.L.M.A. Campaign is the responsible body, and while the G.E.C. has a stand at the show, other leading companies are also playing an important part. The British Thomson-Houston Co. has a display which includes electric lighting fittings and other domestic electrical appliances, electric fans, and industrial motors suitable for driving sewing machines, washing machines, and other appliances. There is also exhibited a quantity of radio apparatus, including the "R.K." loud speaker, which faithfully reproduces both speech and music. "Tungar" battery chargers, in sizes suitable for home use and for the battery-charging station or garage, are also shown. A special demonstration exhibit of the various stages of manufacture of "Mazda" lamps provides a very instructive feature. The Siemens & English Electric Lamp Co., Ltd., also has a good display of domestic and other appliances, including irons, kettles, vacuum cleaners, many types of electric fires, table cookers and cooking ranges of the "Siemens-Xcel" pattern. The exhibition, which is being held at the Electricity Department's premises, Lithos Road, was opened by the Mayor of Hampstead, who was accompanied by the Mayoress; he was received by the chairman of the Circle, Ald. Geere Howard, Mr. Leadbeater (borough electrical engineer), and Mr. M. Watson (hon. secretary and treasurer of the circle). An excellent handbook has been prepared in connection with the exhibition, containing details of the exhibits. In addition to those mentioned above, the following companies are showing appliances of various kinds:—Messrs. Falk, Stadelmann & Co., Ltd.; the Metropolitan-Vickers Electrical Co., Ltd.; the Edison Swan Electric Co., Ltd.; the Sun Electrical Co., Ltd.; the Hotpoint Electric Appliance Co., Ltd.; the Cable Accessories Co., Ltd.; the Jackson Electric Stove Co., Ltd.; Berry's Electric, Ltd.; the British Electric Transformer Co., Ltd.; Standard Telephones & Cables, Ltd.; and Burndept Wireless, Ltd. The circle has a special display which includes "Arora," "Belling" and "Heatrae" fires, the "Tellus" vacuum cleaner, "Helios" adjustable fittings, "Selz" shades, "Frigidaire" refrigerators, "Ever Ready" novelties, &c.

A French Company's Centenary.

The works at Mulhouse and Belfort, Alsace, of the Société Alsacienne de Constructions Mécaniques were recently *en fete*, the occasion being the 100th anniversary of the establishment of the undertaking. Commenced in a small way in 1826, the concern is now one of the largest in France, and in recent years has considerably extended its electrical engineering department, which has turned out the bulk of the plant for the large power station at Gennevilliers.

Philips Lamps at the "Astoria" Kinema.

In the "Astoria," a palatial kinema in Charing Cross Road, W.C.2, which was opened on January 12th, Philips electric lamps have been extensively used. No fewer than 3,000 of these lamps have been installed in the outside signs, which are shown in the accompanying illustration, and 840 have been used in the interior lighting, in addition to flood-lighting



The "Astoria" Kinema.

lamps and special Philips projector lamps used with the kinematographic apparatus. The outside signs are made up of 650 daylight lamps and 1,900 red, blue and yellow colour-sprayed and clear lamps. For the interior lighting special diffusing fittings have been installed which provide soft and restful, but adequate, lighting.

Local Exhibition.

The Electricity Committee of the Stepney Borough Council has recommended that an electrical exhibition be held at the Queen's Hall and Winter Garden, Stepney, between April 25th and May 13th next.

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A New Cable Company.

According to a report in the *Western Mail*, a new company is in process of formation with a capital of £100,000 to manufacture electric cables. Sir Edward Nicholl, who is described as the head of the concern, has purchased an aircraft works at Addlestone, in Surrey, for £17,250. Sir Herbert Blain is one of the directors. It is stated that the existing machinery in the factory is to be disposed of, but that the new plant for cable manufacturing is already available for installation.

An Illuminated Tramcar.

The illustration herewith shows an illuminated tramcar provided by the Bristol Tramway and Carriage Co., for collecting purposes in connection with the Lord Mayor of Bristol's Christmas Dinner Fund. This car was equipped with over 1,000 "Siemens" helical traction lamps, and its journeys



An Illuminated Tramcar at Bristol.

created considerable interest, and were responsible for the collection of a large sum of money. The Automobile Accessories (Bristol), Ltd., operated their public speech equipment on this car, thereby providing amusing nightly programmes.

British Electrical Equipment in Canada.

In connection with cabled dispatches from London, quoting the criticisms of the British Press concerning the requirements of the Fire Underwriters' Association that all electrical installations and equipment in Canada, as well as in the United States, must conform with the National Electrical Code and be sanctioned by the Chicago Testing Laboratories, which apparently discriminate against British-made equipment, it is stated here that the new Canadian electrical code will probably be completed within a few months. A committee of the Engineering Standards Association, at the instance of the Trade and Commerce Department, has been working on the intricate problem for several years, and on January 20th the first draft was completed; it conforms largely with the American National Code, which is also undergoing revision. The final revision of the Canadian code is expected to be ready for submission to the meeting of representatives of fire underwriters, provincial authorities, and others interested, at Winnipeg, a few weeks hence. This code will provide for Canadian autonomy in respect of both fire and safety "hazards" of all electrical installations in Canada, though it will be necessary subsequently to establish adequate testing laboratories to obviate the present necessity of the Chicago tests. At present, the standards prescribed by the Ontario Hydro-Electric Power Commission are accepted by the underwriters for that province, and in some measure also by the other provinces, though there is not yet uniformity for the whole Dominion. It is declared in Canada that, in respect of Canadian importation of British electrical equipment, there is no evidence to show that any important contracts have been lost through failure to secure the sanction of the Chicago authorities, since compliance with the Ontario regulations is practically acceptable to underwriters of the other provinces. It is known, however, that British manufacturers have practically no chance of securing the United States market because of the refusal of the Chicago laboratories to approve their products.—*Reuter* (Ottawa).

The Electrical Contractors' Conference at Scarborough.

We have received at the moment of going to press a copy of the preliminary programme of the Second Annual Conference of the Electrical Contractors' Association Allied Associations, which takes place on June 22nd, 23rd and 24th next. We shall refer to the matter more fully next week.

South African Contract Regulations.

The *Board of Trade Journal*, dated January 20th, contains extracts from the Tender Board Regulations for the Union of South Africa (Railways and Harbours excluded), and from the Rules for the Purchase of Government Supplies. These appear to offer no special preference to British manufacturers, but South African manufacturers and merchants receive first consideration in the awarding of contracts, other things being equal. The document referred to can be inspected by interested British firms at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

British Companies Underquote Continental Competitors.

The Johannesburg correspondent of *The Times* says that gratification is expressed in local business circles that the British tenders for the erection of the new Johannesburg municipal gasworks are lower than the foreign offers. Of the eight tenders, only five are complete offers to build the plant and structure, and these complete tenders range from £153,160 to £266,968. The firms who have tendered are Bruce Peebles and Co., Ltd., Edinburgh; Drake's, Ltd., Halifax; Woodall-Duckham Vertical Retort and Oven Construction Co. (1920), Ltd., London; West's Gas Improvement Co., Manchester; Julius Pintsch, Ltd., Germany; Francke Werke A.G., Germany; Aug. Klonne, Germany; and the Skoda Works, Ltd., Prague. The tenders will probably be submitted to a consulting engineer.

A Manchester Power Efficiency Exhibition.

Textile and Industrial Exhibitions, Ltd., 121, Deansgate, Manchester, is organising a Power Efficiency Exhibition to be held at the City Hall, Manchester, from June 22nd to July 2nd. The exhibition will include machinery, apparatus, and precision instruments designed to secure power economies, and it is claimed to be the first of its type.

New French Telephone Company.

It is reported from Paris that the Société de Téléphone Grammont has been formed by the Etablissements Grammont with the participation of the General Electric Co., Ltd., and an American company. The share capital is 18,000,000 fr., and the object is to carry out the orders given to the parent French company in connection with the conversion of the Paris network to automatic working.

The Irish Radio Import Duty.

Mr. J. J. Walsh, the Postmaster-General of the Irish Free State, said in a recent speech that it was impossible to abandon the import duty upon radio apparatus. The Government intended to spend a large amount upon the development of broadcasting, including the erection of a station at Cork in the near future and a high-power station later, and it relied upon the duty as well as licence fees to meet the expenditure. There was no justification for making those who were not listeners pay for the amusement of those who were.

Mullard Window Displays.

The Mullard Wireless Service Co., Ltd., has arranged three different window displays for the use of retailers of its radio valves. One of these is illustrated herewith; it



A Mullard Window Display.

makes a feature of "Radio for the Million," a publication which the company has brought out. Retailers who wish to avail themselves of these displays are asked to give particulars of the size of their windows and the dates upon which the displays are required. If necessary, a professional window dresser is sent to arrange the window.

Another Birmingham Exhibitor.

The lists of exhibitors at this year's British Industries Fair which appeared in our issue of January 14th, contained the names of firms whose products were directly of interest to our readers. There are many others who are connected with the electrical industry by parts of their business. Such are Messrs. H. H. Vivian & Co., Ltd., who intend to show at Birmingham, *inter alia*, condenser tubes, busbar and strip copper, &c.

The Ideal Home Exhibition.

This year's Ideal Home Exhibition is to be held at Olympia, W., from March 1st to 28th. The General Electric Co., Ltd., informs us that it intends to make a special display of "Magnet" domestic appliances.

Rumoured Continental Electrical Agreement.

Rumours continue to be circulated concerning a scheme for the formation of a working community between German, French, and Belgian electrical concerns, in the matter of international contracts. Discussions between the firms in the last two countries are said to have already led to the drawing up of "guiding lines" for joint action. On the other hand, the A.E.G. and the Siemens group do not appear to have been definitely approached in the matter.

Calendars and Diaries.

We have received from Messrs. SINCLAIR, PAGET & Co., LTD., New Inn Yard, Shoreditch, E.C.2, a wall calendar with boldly-figured monthly sheets.

What is, we suppose, one of the last but by no means the least of the pocket diaries for 1927 to reach us from electrical firms is that received from Messrs. J. H. TUCKER & Co., LTD., of King's Road, Tyseley, Birmingham. It is an excellent case, with receptacles for all kinds of things, and the diary and note-book portion is particularly useful to business men.

We have received from Messrs. W. G. BEAUMONT & SON, of Priory Works, Bow, E.3, a copy of their large year book and desk diary for 1927—bound in cloth, and illustrating some of the chimneys, steel buildings, bridges, &c., which they have painted or repaired.

Trade Announcements.

MESSRS. NEWTON BROTHERS (DERBY), LTD., state that owing to the rapid expansion of their manufacturing department it has become desirable for them to be allied with certain large manufacturing interests of a kindred nature, and the scope of their activities will be considerably increased. Although they have found it necessary to form themselves into a public company to meet the new conditions, the control and management of the business remain the same. The contracting and retail department of the business conducted from the St. James's Street premises has been taken over by Mr. C. A. Newton, who is carrying on the business under the style of C. A. Newton & Co. All outstanding contracts which are in course of execution by that department will be taken over by C. A. Newton & Co., and will be carried out by the same staff, with Mr. G. F. Nuttall as manager. Mr. C. A. Newton retains his seat upon the board of the limited company.

THE DEVON ELECTRIC LAMP CO. has opened new showrooms at 29, King Street, Tavistock, and will be pleased to receive catalogues and factors' quotations for all electrical fittings, lamps, and accessories.

MESSRS. SINCLAIR, PAGET & Co., LTD., New Inn Yard, Shoreditch, E.C.2, have recently enlarged their works and have commenced making battery-charging switchboards.

THE AUTOCAR ELECTRICAL EQUIPMENT CO. has taken over an additional building at 115, Old Street, E.C.1, and its Mitchell Street premises are being retained solely as a workshop. Telephone numbers: Clerkenwell 5470 and 7318.

MESSRS. GREENWOOD & Co. have opened electrical showrooms at Prince's Crescent, Bare, Morecambe.

MESSRS. ALEXANDER & Co., 266, Windmill Road, Ealing, W.5, have been appointed sole British agents for the radio and electrical products of Messrs. H. Constable & Co., Paris.

It is announced that, in order to cope with the demand for its radio specialities, the FELLOWS MAGNETO CO., LTD., of Park Royal, N.W., is giving up the manufacture of magnetos.

New showroom premises at 4, Northampton Street, Dover, have been opened by Mr. C. O. CLARK, electrical engineer and contractor, of the East Kent Radio and Electricity Works, Mill Road, Deal.

MESSRS. G. E. WALLIS & SONS, LTD., electrical engineers, of 30a, High Street, Ashford, Kent, have taken over the electrical department of Messrs. C. Hayward & Son, of 18, New Street, Ashford. Messrs. Hayward will continue their radio department.

MESSRS. WELLS & Co., of 23-27, High Street, Bedford, have taken over the electrical staff of Messrs. Kilpin & Billson, of High Street, Bedford. They are equipping showrooms and workshops for this department of the business.

The CENTRAL RADIO STORES on January 22nd opened premises at 51, London Road, Bromley, Kent.

MR. C. H. H. KENWORTHY has opened an electrical engineering business at Bank Street, Herne Bay.

New Catalogues and Lists.

MESSRS. JAMES MCMILLAN & Co., Clun House, Surrey Street, W.C.2.—A pamphlet describing a portable telephone instrument for line testing made by the A.S. Elektrisk Bureau, Oslo.

THE RADIO COMMUNICATION CO., LTD., 34-35, Norfolk Street, Strand, W.C.2.—List No. X.1,226, illustrating and describing the company's radio direction finder equipment.

THE TELEGRAPH CONDENSER CO., LTD., Norwich House, Southampton Street, W.C.1.—Catalogue No. 51, describing "T.C.C." static condensers for power-factor correction. Examples of actual installations are depicted.

MR. ALAN WRIGHT, 124, Chancery Lane, W.C.2.—A pictorial pamphlet explaining the construction and operation of Film cooling towers, which are made by the company of that name.

MESSRS. STEWART, THOMSON & PATRICK, LTD., 10 & 12, Hart Street, Liverpool.—A stock list of d.c. and a.c. motors, ranging from 1 to 130 h.p., &c.

THE STONEBRIDGE ELECTRICAL CO., LTD., Victoria Road, North Acton, W.3.—Leaflet No. 95/1, containing an illustration of and notes upon one of the company's universal precision instruments for various kinds of tests.

THE BEKO LAMP CO., LTD., 5, Finsbury Square, E.C.2.—A price list of "Beko" electric lamps and a separate net trade price list.

THE RELIANCE TELEPHONE CO., LTD., 12-13, Henrietta Street, W.C.2.—An illustrated folder advertising the company's automatic intercommunication systems.

FRANCIS LAMP LOCKS, LTD., 83, Pall Mall, S.W.1.—A priced and illustrated pamphlet detailing the construction and use of the company's lamp locks.

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—Leaflet R.7335-2, containing illustrations and details of a number of "B.T.-H." radio receiving sets, and the "R.K." loud speaker; and Leaflet R.7432-2, dealing with the company's l.f. transformers, giving performance curves. Both publications are priced.

MESSRS. SMITH & COVENTRY, LTD., Gresley Iron Works, Manchester.—Two well-illustrated publications describing, respectively, a boring, facing, and recessing machine for electric motor frames, and plano-milling machines.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—A three-colour window poster and a booklet advertising "Cosmos" valves. The booklet gives details, illustrations and prices of ten types with a table summary.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—A descriptive pamphlet (B.C. 4352) containing illustrations and details of "Gecophone" h.t. radio battery eliminators for d.c. and a.c.

ELECTRIC FANS, LTD., 53-54, Royal Mint Street, E.1.—An illustrated price list of d.c. and a.c. exhaust fans, regulators, &c.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—A series of illustrated descriptive pamphlets dealing with auxiliary-current limit switches, truck-type switchgear, earthing resistances, outdoor oil-immersed circuit breakers, switch fuses, and metal-clad compound-filled switchgear.

THE MULLARD WIRELESS SERVICE CO., LTD., Denmark Street, W.C.2.—A series of illustrated and priced pamphlets dealing with "P.M." radio valves.

MESSRS. G. CUSSONS, LTD., The Technical Works, Lower Broughton, Manchester.—An illustrated booklet dealing very thoroughly with the construction and use of the "Scholes" bomb calorimeter.

Bankruptcy Proceedings.

H. A. MILLS, 1, Lorne Villas, Old Windsor, Berks., electrical engineer, &c.—The first meeting of creditors was held recently at 29, Russell Square, W.C.1. The statement of affairs showed liabilities of £452, against assets of £177, leaving a deficiency of £275. Debtor attributed his failure to lack of capital and depression in trade. He commenced to trade without capital in December, 1923, and his wife assisted him. In 1926 he borrowed £200, which he used in the business, and he undertook that the loan was to be secured on the book debts due and to become due. At the date of the receiving order, however, there had been no proper assignment, and no notice had been given to the book debtors, and there was thus no effective charge. Debtor stated that he had carried on business from the commencement with difficulty owing to lack of capital, and a few months ago his wife was taken ill, and he was, therefore, deprived of her services. His creditors began to press him in October last, and an execution was levied on December 18th, 1926, when he decided to file his petition. He became aware of his position in January, 1926. The case, being a summary one, was left with the Official Receiver as trustee of the estate. The following are creditors:—

	£		£
Condor Lamp Co.	... 28	Times Electric Co.	... 55
Filling & Son, W.	... 26	Supra Electrical Co.	... 24
Meares, L. V. N.	... 187		

A. J. CULLUM, 8, Church Street, Diss, Norfolk, motor and electrical engineer.—The public examination of this debtor was held on January 14th, at Ipswich. The statement of affairs showed gross liabilities of £180, and a deficiency of £135. Debtor commenced business in 1922 on his own account without capital. Most of the trade done was repair work, but the profits had never been sufficient to meet the charges. The examination was adjourned.

H. BEBBINGTON, electrical engineer, Cestrian Street, Bolton.—This debtor appeared at Bolton Bankruptcy Court on January 19th for his public examination. Debtor estimated his deficiency at £79. He was formerly in business, and after his wife's death he received a claim for the payment of £108 which he thought had been repaid by his wife during her lifetime. Apart from this amount he owed less than £2. The examination was closed.

J. G. SANDELL, electrical contractor, 20, Hart Road, Dorking.—Receiving order made January 18th on creditor's petition.

F. A. HARTLEY and R. HARTLEY (F. A. Hartley & Son), electrical engineers, 98, Katherine Street, Ashton-under-Lyme, F. A. HARTLEY (separate estate), and R. HARTLEY (separate estate).—Last day for proofs for dividend, February 5th. Trustee, Mr. F. Murgatroyd, Official Receiver, Byrom Street, Manchester.

W. C. RHODES (L. J. Palmer & Co.), electrical engineer and contractor, 141, Newspaper House, Corporation Street, Birmingham. Trustee, Mr. C. Hoult, Official Receiver, 191, Corporation Street, Birmingham, released January 11th.

H. WILSON, electrical contractor, &c., 1057, Grangefield Avenue, Thornbury, Bradford.—Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford, released January 11th.

C. E. F. PARKER, electrical engineer, Greendale, Privett Road, Gosport.—Second and final dividend of 5s. in the £ and 4 per cent. interest, payable at the Official Receiver's offices, 87, High Street, Portsmouth.

Company Liquidations.

CLEARTRON RADIO, LTD.—A meeting of creditors was held at the Institute of Chartered Accountants, Moorgate Place, E.C., on January 26th.

NATIONAL WIRELESS CORPORATION, LTD.—First meeting of creditors and contributories, February 1st, at Carey Street, W.C.

Private Arrangements.

NEUTRON, LTD., wireless accessory manufacturers, Sentinel House, Southampton Row, W.C.—In response to a circular letter issued by Messrs. Booth, Anderson & Co., C.A., of 40-43, Norfolk Street, W.C., a meeting of the creditors was held on January 24th, at the Holborn Restaurant. The circular stated that at a meeting of creditors held on November 26th last the creditors resolved that Messrs. M. D. Booth and T. H. McArthur should represent them on the board to watch the interests of the creditors in connection with the proposals put forward for the discharge by the company of its indebtedness over a period of twelve months. There appeared to be little possibility of the scheme in the form in which it was presented to the meeting of creditors being proceeded with. Mr. Booth occupied the chair, and said that the position had changed materially from that disclosed at the meeting held last November. Messrs. P. G. Marr, Ltd., the second debenture holders, had not taken any steps to jeopardise the position of the company, but they had come to the conclusion that Neutron, Ltd., was no longer of any interest to them for the purposes which they originally intended, namely, the development of their own valves, and the crystal business. Furthermore, Messrs. Marr stated that the business done by the company, in their opinion, did not warrant their acquiring control. Messrs. Marr had, however, made a new proposal for the discharge of the indebtedness to the creditors out of future profits, but he (Mr. Booth) did not consider that he was in a position to accept or reject what was, in fact, an entirely different proposal. The necessary finance to meet wages, &c., during the past few weeks had been provided in part from the sale of crystals in the ordinary course of business, and in part by purchases of crystals made for cash by Messrs. P. G. Marr, Ltd., and Mr. Wolsey, at a price much below that charged to the distributors. He was informed that those crystals could be re-purchased by the company at the same price. A receiver had been appointed by Mr. Bennison, the first debenture holder. Furthermore, the company had sent out a notice convening an extraordinary general meeting for the purpose of liquidation. The proposal of Messrs. Marr was that they should provide for the re-financing of Neutron, Ltd., and the discharge of the creditors' claims out of future profits. So far as he was aware, Messrs. Marr were not prepared to give up their security. Mr. Booth said that if the company was re-financed and had a proper selling organisation it should make very handsome profits. There was some possibility of an order which might bring in a profit running into £1,000 or £2,000. The statement of affairs which was submitted by the solicitor to the company at the previous meeting showed assets of £3,391. The liabilities consisted of debentures for £300 and £3,150. The unsecured trade creditors' debts were scheduled at £4,271. Mr. Latham thought that it would be better if the company was wound up, and a resolution to that effect was carried.

J. W. NUTTALL, electrical and wireless engineer, 668a, Liverpool Road, Ainsdale.—A meeting of creditors was held recently, when it was reported by the debtor that his trade liabilities amounted to £111, while he valued his assets at £82, leaving a deficiency of £27. The debtor stated that he commenced business about two years ago without capital, and one of the creditors provided him with the necessary stock. He attributed his present position to lack of trade and keen competition. He was unable to give any accurate information as to the turnover. The creditors decided that the debtor should be requested to approach his father with a view to making a cash offer, it being intimated that if a composition of 5s. in the £ was forthcoming it would be accepted. The debtor undertook to do this, and also to make efforts to dispose of the business as a going concern. It was decided that no further steps should be taken by the creditors for a fortnight.

Recent Contracts.

The important scheme of the Bristol Corporation for the construction of a large power station at Portishead has received the approval of the Electricity Commissioners, and the City Council has sanctioned the placing of contracts. The main contract for the construction and initial equipment of the station is to be placed with Messrs. Vickers, Ltd. The whole of the electrical plant, comprising the turbo-alternator sets complete with condensers and auxiliaries, and the transformers and switchgear, will be supplied by the Metropolitan-Vickers Electrical Co., Ltd., as sub-contractors. The scheme was planned by Mr. H. Faraday Proctor, city electrical engineer. It provides for a power-station of an ultimate capacity of 280,000 kW, to be built at Portishead, on the Bristol Channel, about seven miles from the city. The first section of the station, on which work has now commenced, will be initially equipped with two 20,000-kW main turbo-alternator sets. Provision will be made to transmit the whole output at 33,000 V to the Corporation power station at Feeder Road, Bristol. The contracts include the necessary transformers and switchgear for feeding the transmitted power into the existing 6,600-V distribution network. Each of the generating sets will consist of a two-cylinder turbine of 20,625 kW maximum continuous capacity and 16,500 kW economical rating, driving at 3,000 r.p.m. a three-phase, 50-cycle alternator of equivalent capacity at 11,000 V and 0.8 power factor, and also a 625-kW house-service alternator generating at 550 V. A three-phase, 25,000-kVA group of single-phase transformers will be permanently coupled to each main alternator for stepping up the pressure to 33,000 V for transmission. The main 33,000-V switchgear will consist of 13 units of the metal-clad type, each unit having a guaranteed breaking capacity of 750,000 kVA. The station boards will also include 45 smaller metal-clad units for the supply circuits of the station auxiliaries. At the Feeder Road power station similar step-down transformers will be installed.

The new sets mark the advance which is being made in the development of generating plant for operation at 3,000 r.p.m., while the boiler pressure of 325 lb. per sq. in. conforms with the increasing preference for pressures over 300 lb. Special arrangements will be made for the taking of the condenser cooling water from the Bristol Channel.

Among the orders recently received by Messrs. John I. Thornycroft & Co., Ltd., are two for omnibus chassis from the Bombay and Rangoon Tramway Companies. They are also supplying a number of wagons for the Buenos Aires Great Southern Railway.

The General Electric Co., Ltd., has received an order from the London Electric Railway for the complete motor and control equipments for 64 motor-coaches and 48 trailer coaches. This is the fourth consecutive order received from the London Electric Railway Co., and the total quantities of equipment ordered from the G.E.C. now comprise motors and control equipment for 159 motor-coaches, 78 driving trailer coaches, and 103 trailer coaches. Each motor-coach equipment comprises two 240-b.h.p. motors (one hour rating), 575 V, together with complete "all electric" contactor-type control gear.

The Birmingham Fair.

We have given so much attention to the arrangements for the forthcoming British Industries Fair that it might be supposed that there would be little more to say until the opening date, but many interesting things were said at a luncheon at the Savoy Hotel, on January 19th, which we should like to report had we the space to spare. The event was organised with the object of expressing the exhibitors' appreciation of the support given to the Fair by the Government and of its appropriation of £25,000 for the second year in succession toward the cost of advertising the Fair. The principal toast, "His Majesty's Government," was given by Sir Hugo Hirst, Bart., who referred to the legislative record of the present Government and to the efforts made to assist and even safeguard British industries. He hoped that the appropriation of £25,000 per annum for the Fair would continue. Sir Hugo carried us back to the days when the Board of Trade was the subject of widespread criticism amongst business men. Well do we recall the days when, for instance, the speaker, having occasion to visit the Board on an electrical matter, searched for two hours before he found the particular department to deal with it—namely, the Fisheries Department! Or, as a further example, the occasion when he inquired for statistics of our imports of electric lamps and found that gas, oil, arc, electric, and all other kinds of lamps were classified as "lamps." Sir Hugo contrasted that state of things with the greatly increased efficiency of the department and its officials to-day, and directed traders' attention to the large store of knowledge that was available at the Board's offices and the readiness with which it was given to those requiring it. He paid a high tribute to Sir Philip Cunliffe-Lister, M.P., the President of the Board of Trade.

Sir Philip, in responding, referred to Sir Hugo Hirst as a very prominent representative of the Birmingham Fair, a great manufacturer, a great salesman, a great Imperial trader, and a great public servant. On behalf of the Government, he congratulated all parties upon the success of the coming Fair. He spoke highly of the work of the committees, and said that the success of the 1927 Fair was based on the cumulative efforts of those who had stood by it in good and bad times. During the coming year business people should keep the next Fair

well to the fore in their correspondence with overseas buyers. The cry "Buy British Goods!" had become a national determination in this country. We must sell British goods in new markets. World trade was expanding as the world settled down, and we must increase our share of that expanding trade. Other countries had yet to tread the path that we had trod back to financial stability. The one thing wanting was salesmanship. We required Peace, Progress, and Trade—that was the Government policy. The speaker went on to allude to the Government policy with regard to China.

Other speakers included Mr. G. C. Vyle, the president of the Association of British Chambers of Commerce, who proposed "The Organisers of the Fair," seconded by Sir Charles Higham, and Sir William Clark, Comptroller-General of the Department of Overseas Trade, Col. H. J. Walduck, the president of the Birmingham Chamber of Commerce, and Mr. T. R. Martin, the chairman of the Birmingham Fair Management Committee. Among other interesting points mentioned by Mr. Martin was a statement to the effect that for the first time the Birmingham section of the Fair would include a complete power house—a co-operative exhibit to which 30 leading firms had contributed.

Electrical Advertising.

Messrs. E. Brook, Ltd., of Empress Works, Huddersfield, whose enterprise in the electric motor manufacturing business has already been referred to in our pages and is well known in the trade, have hit upon an ingenious means for announcing the further reduction in the prices of their motors which came into force on January 1st. A discreetly folded list bears on the outside the words, "It is said," which compel one to open and read further, and the story continues with a still unfinished sentence, "the modern electrical Press," so then we eagerly turn over to find what new thing there is to be said about *us*. Unfolding again, we find that it is no new thing at all, for it has been said occasionally by some quite elementary users of the Press that some journals "contain too many adverts." It may be true of *some* journals—indeed, it surely is, for we wonder why they contain any at all—who is to blame for that? All of Messrs. Brook's interesting ingenuity is intended to induce the reader to turn over again to see the announcement referred to above, and after he has done so, to see other advertisements in the ELECTRICAL REVIEW and certain other journals which are named. We appreciate the compliment, but lest anybody should be led astray by the suggestion that there is too much advertising in the technical Press, we would suggest that he should, when he has opportunity, watch the absorbing interest with which the advertising pages of the ELECTRICAL REVIEW are studied in the offices, trains, club lounges, and homes that he frequents, or when he travels abroad he should call at the consular offices and chambers of commerce and learn how those pages are carefully scanned by overseas buyers to find out the names of the best *British* makers of electric motors and other products. He might even find it interesting to keep lonely vigil outside places where the REVIEW is sold and note the feverish haste with which the proud possessor turns to what are known as "The Smalls"; or to enter some important offices of which we know where the "Official Notice" advertisements of new contracts are searched before the pages have even had a chance to get dry or cold. As a matter of fact, the manufacturer learns much and the buying sections of the profession and industry much more from the careful study of the advertised doings of the trade. The buyer is the last man to complain about the number of announcements put before him; perhaps he is more impressed by one than by another because he is susceptible to brightness, originality and strength in design, but we are anxious that our advertisers should all appear at their best—that is why we have organised advertising competitions. The distribution of a heavy paper may be inconvenient to those who publish it, but who ever heard of a reader complaining that he received too much for his money? He needs a good and complete paper, and for the production of such, in the best interests of the trader, it is essential that it should contain as many announcements as possible from the manufacturers and traders who have goods to sell. We have never heard it argued against the motor Press or the society and fashion papers that there were too many advertisements; indeed, on the contrary, we know that these pages are studied as closely as any part of the paper. So the things concerning which it is written "*It is said*" are sometimes neither new nor true. There used to be some trade publications published containing advertisement sheets only; there are still many publications in which manufacturers waste a considerable part of their advertising allocation for reasons which have nothing to do with real "business-getting." When the trade makes its effective announcements, between one set of covers, which convey the complete truth regarding the course of productive and trading activity to the real buyers everywhere, it gets results, and it no longer remarks about things that are *said*, but states with confidence those things which it *knows*.

Book Notices.

"Aluminium Facts and Figures."—A useful little book, issued by the British Aluminium Co., Ltd., containing a wealth of information concerning numerous products of aluminium, including electrical conductors and cables. Most of the data given are in table form, and the authorities are given for the values under physical properties of aluminium. Aluminium alloys are also dealt with, and various processes appertaining to the preparation of certain articles are described, as are also a number of parts or accessories, such as collector bows for electric railway overhead track work, and numerous sections with their applications.

"Overhead Transmission Lines." Publication No. 193 of the British Aluminium Co., Ltd.—This little book should prove of great value to all those interested in the construction of overhead transmission lines. Much information and many technical data are given upon the actual lines and the accessories. Some interesting illustrations are given of lines in various parts of the world.

"Treatise on Thermodynamics," by Dr. M. Planck, translated by Mr. A. Ogg. Third edition. Pp. xiv+297. London: Longmans, Green & Co., Ltd. Price 15s. net.

Amongst new books published by the D. Van Nostrand Co., New York, is one on "High-Tension Line Practice," by E. V. Pannell, and one on "Household Refrigeration," by H. B. Hull.

"These Hundred Years" is the title of an inspiring oration delivered by Sir Gregory Foster at University College, University of London, reviewing the history of the college, of which the centenary is to be celebrated this year. It has been issued in the form of a brochure, price 1s. net, by the University of London Press, Ltd.

Circular No. 312 of the U.S.A. Bureau of Standards.—United States Government Master Specification for Matting, Rubber, for use around Electrical Apparatus or Circuits not exceeding 3,000 V to Ground. Price 5 cents.—This pamphlet contains the detailed official test requirements for electrical protection mats in the United States.

Bulletin of the British Cast-Iron Research Association. No. 15, January, 1927.

The 1927 volume of "Sell's Telegraphic Address Directory," which is now in the press, will, we are informed, be in an altered form and less bulky than in the past.

Social Events.

The social club connected with the Ayrshire Electricity Board held a successful supper and dance at Kilmarnock last week; Mr. W. C. Bexon, engineer and manager presided. Replying to the toast of "The Employés," Mr. Bexon said that last year their revenue was £194,782, and he hoped, with the operation of the coal clause, they would increase it to a quarter of a million this year. He was satisfied that in the near future there would be a great increase in the consumption of electrical energy.

The staff of Messrs. Ernest F. Moy, Ltd., held its annual dinner on January 15th. The guests included the Mayor of St. Pancras, representatives of electricity supply authorities, and many others. Major C. G. Fox was in the chair, and accepted, on behalf of the board, from the staff and employés a portrait of the late Mr. E. F. Moy, the founder of the company, to whose memory a toast was drunk. A souvenir matchbox bearing a miniature portrait of Mr. Moy was given to everybody present.

On January 21st the annual staff dinner of the Osram-G.E.C. Lamp and M.O. Valve Works was held at the Café Royal, Regent Street. As usual, Mr. C. Wilson occupied the chair, and among those present were Sir Hugo Hirst, Bart., and Mr. C. C. Paterson. After an excellent dinner and the loyal toast, Mr. T. Oldbury proposed the toast of "The G.E.C.," and mentioned the confidence which existed between the directorate and the staff. Sir Hugo Hirst replied in an optimistic manner. Mr. H. C. Wilson proposed the health of the guests, and recalled that the original Osram staff dinner was held in 1895; three or four of those who attended that function were present that evening. Mr. C. C. Paterson, in reply, said that he was glad to be associated with the General Electric Co., Ltd. In that organisation all that was best in initiative found encouragement. Mr. S. Rentell, one of those who were present at the 1895 dinner, replied on behalf of the Press. Mr. E. R. Grant proposed the health of the chairman, to whom, he said, the success of the lamp works was mainly due. Mr. Wilson briefly responded, and stressed the importance of research and the development of the social side. A concert followed, the entertainers being Messrs. E. C. Holmes, L. Richards, H. Herrick, G. O'Hagan, P. Albert, and Miss Rita Barnaby.

The fifth annual staff dinner of Messrs. Francis Polden & Co., Ltd., was held at the Old Bell Restaurant, Holborn, E.C., on January 15th, when one hundred people sat down to an excellent dinner under the chairmanship of Mr. F. C. Polden, the managing director. The speeches and toasts were interspersed with singing, and were followed by a dance.

The General Electric Co., Ltd., announces the following events in connection with its Witton Engineering Works:—Annual Hockey Club dance, January 29th; and annual exhibition, Photographic Club, January 31st.

The staff and friends of the Igranic Electric Co., Ltd., held their annual fancy dress carnival at the Café Dansant, Bedford, on January 14th. There were over 500 guests, the majority of whom were in fancy dress, exhibiting a wide variety of taste and fancy. During the dancing, community singing was indulged in by those present. The dress parade was a gorgeous spectacle, and the decisions of the judges were highly applauded. Eighteen prizes, presented by members and friends of the company, were distributed by Mrs. A. H. Curtis, the wife of the general manager.

For Sale.

By order of the joint receivers and liquidators of Messrs. Eastwood, Swingler & Co., Ltd., iron founders, engineers, &c., in voluntary liquidation, Messrs. Richardson & Linnell will sell by auction on March 8th, at St. James' Sale Rooms, Derby, the freehold property of about 13 acres, situate at Osmaston Road, Derby, formerly used as engineering, &c., works, with the workshops and machinery. Shipley Urban District Council invites offers for two 1,000-kW turbo-alternators, with condensing plant, and two 20,000-lb.-per-hour Babcock & Wilcox water-tube boilers, with chain-grate stokers.

Shoreditch Borough Council Electricity Department invites offers for the dismantling and removal of two 1,500-kW d.c. turbo-generating sets. Messrs. Leopold, Farmer & Sons will sell by auction on February 16th, at the London Auction Mart, 155, Queen Victoria Street, E.C., the modern manufacturing premises known as Arden Works, Pixmore Avenue, Letchworth, with vacant possession. Fuller, Horsey, Sons and Cassell, will sell by auction on February 15th and following day, at the Baltic Exchange, engineers' machine tools, electric motors, &c. (See our advertisement pages to-day.)

German Engineering Workers' Wages Demand.

A delegate meeting of Mannheim metal workers has decided to give notice of denunciation of the present wages agreement and to demand advances of 15 per cent. for skilled and 20 per cent. for unskilled workers. Mannheim is one of the chief centres of German engineering and motor manufacture.—*Reuter* (Mannheim).

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.	Price Jan. 25th.	Fortnight's inc. or dec.
a Acid, Oxalic ... ... per lb.	5¾d.	...
a Ammoniac, Sal ... ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£13 10s.	...
a Sulphur, Commercial ... ... ,,	£9 10s.	...
a ,, Roll ... ... ,,	£9 10s.	...
a Soda, Chlorate ... ... per lb.	3½d. to 3¾d.	...
a ,, Crystals ... ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots... ... ... per ton.	£107 to £112	...
b ,, Wire ... ... per lb.	1/6 to 2/-	...
b ,, Sheet ... ... ,,	1/8 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—		...
Grade I ... ... per ton net.	£255	£7 dec.
Grade II ... ... ,, ,,	£180	£4 dec.
Grade III... ... ... ,, ,,	£96	£2 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	9⅝d.	½d. dec.
c ,, Tubes (solid drawn) ... ,,	11¾d. to 1/-	½d. dec.
c ,, Wire, basis ... ... ,,	9½d.	½d. dec.
c Copper Tubes (solid drawn) ... ,,	1/0½	½d. dec.
c ,, Bars (best selected) ... per ton.	£90	£2 dec.
c ,, Sheet ... ... ,,	£90	£2 dec.
c ,, Rod ... ... ,,	£90	£2 dec.
d ,, (Electrolytic) Bars ... ,,	£63	10s. dec.
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ,,	£74 15s.	...
d ,, ,, H.C. Wire per lb.	9 7/16 d.	1/16d. inc.
f Ebonite Rod ... ... ,,	2/3 to 2/6	...
f ,, Sheet ... ... ,,	2/3 to 2/6	...
n German Silver Wire ... ... ,,	2/2	...
h Gutta-percha, fine ... ... ,,	8/-	...
h India-rubber, Para fine ... ... ,,	1/4½	½d. dec.
i Iron Pig (Cleveland No. 3.) ... per ton.	122/6	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English pig ... ... ,,	£28	£1 dec.
g Mercury ... ... per bot.	£17 10s.	...
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	...
p ,, ,, rolled strip & sheet ,,	1/2½	...
p ,, ,, wire... ... ... ,,	1/3¾	½d. dec.
o Platinum ... ... per oz.	£23	...
d Silicium Bronze Wire ... ... per lb.	10½d.	...
r Steel, Magnet, in bars ... ... ,,	7½d.	...
n Tin, Block (English) ... ... per ton.	£291 to £291 10s.	£6 dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew Ltd
n P. Ormiston & Sons.
o Johnson, Matthey & Co. Ltd
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Under date January 22nd, Messrs. James Forster & Co. reported:—"Arrivals of lead show a tendency to decrease, and, apart from warehouse stocks, there is not too much metal available for early delivery. Demand from consumers this week has been quieter, but a steady consumption of lead is going on. The future is still rather obscure. The weak spot in the position is on the Continent, but last week a better demand was reported from Germany. The price is now at the lowest point touched for four years, and consumers would be well advised to cover their future requirements at the present level of prices."

Lighting and Power Notes.

Bedford.—Electricity Agreement.—The Electricity Committee has recommended that an agreement be entered into with the Ampthill Urban District Council regarding a supply of electricity to Ampthill, the cost being estimated at £8,750.

Bristol.—Loan.—The City Council is to apply for sanction to a loan of £31,165 for the laying of two additional cables from the Feeder Road power station and the erection of a substation to meet the increased demand for electricity in the Bristol East district.

Bury St. Edmunds.—Opposition to Bill.—The Town Council has decided to oppose the Bill being promoted by the East Anglian Electric Supply Co., Ltd., on the ground that one of the clauses would prevent the Corporation from supplying houses on the extended boundaries, and might also prevent it from supplying new streets with electricity for public lighting.

Continental.—Sweden.—The change-over from gas to electric lighting of the streets of Gothenburg, which was first commenced in 1922, has now been completed, this city being the first large town in Scandinavia to make such a complete change.

Austria.—Negotiations have been proceeding for some time past between the Vienna City Council and the Austrian works with the object of extending the municipal electricity works in Vienna. Orders of the value of about 50,000,000 schillings are to be given chiefly to the Siemens-Schuckert, Brown-Boveri, and the A.E.G.-Union companies.

Fleetwood.—Ice-Producing Plant Supply.—Extensions to a local ice-producing plant, at present worked by steam power, are contemplated, and the company is in negotiation with the Urban District Council with a view to obtaining a supply of electricity. New generating plant for the Council's station has been ordered for several months, and immediate delivery is now promised of the new 2,400-kW set.

Glasgow.—Wiring Scheme.—The Corporation electricity manager has submitted a report to the Electricity Committee regarding a supplementary scheme for the wiring of houses. The scheme, which is similar to the hire-purchase scheme at present in operation, is that there should be no initial payment on the installation being fitted up, and that the cost of the wiring should be spread over a period of 10 years, the effect of which would be that the quarterly payments would be less than half the payments under the 3-year system, but that there would be a greater total sum to pay in 10 years for interest and maintenance charges. The Property Owners' and Factors' Association has intimated that it would support generally any applications by tenants to wire premises, and is willing to co-operate with the department to ensure wiring agreements being taken over by succeeding tenants. The Committee has recommended that the scheme be adopted.

Supply to Housing Estate.—A letter from the Clyde Valley Electrical Power Co., relative to the provision of an electricity supply to the Corporation's Shettleston housing estate, has been considered by the Housing Committee. The estimated cost of overhead lines is £805, and of underground mains, £3,540. The Committee has recommended that the underground system be adopted.

Hawarden.—Electricity Extensions.—The Electricity Committee has had under consideration the second instalment of its electricity scheme, as submitted by the Council's consulting engineers (Sir Douglas Fox & Partners). Part of the scheme was approved, and the engineers were requested to revise the parts relating to Broughton and Bretton. The villages of Cymmau, Ffrith and Tryddyn were considered too small and too remote from any existing overhead line to warrant inclusion in the scheme.

India.—Madras Hydro-Electric Schemes.—It is reported that Messrs. Merz & McLellan, consulting engineers to the Indian Railway Board, who were asked to report on the Madras hydro-electric schemes, with special reference to railway electrification in South India, state that while the speeding-up of the hydro-electric programme is essential in view of the lack of fuel near the industrial areas of the south, it would be better to make a beginning in the areas immediately round about the source of power and gradually educate public opinion as to the utility of electrification. They do not recommend the extension of electrification to Madras for the time being, because the rates would be prohibitive owing to the cost of transmission. In these circumstances, the Government of Madras proposes to appoint a committee of officers to tour the area concerned and obtain definite undertakings from consumers of power. As soon as the committee completes its labours, the Government will formulate its policy and place the facts before the Legislative Council.—*Reuter's Trade Service* (Bombay).

Irish Free State.—Limerick.—At a recent meeting of the Electricity Committee, the revised draft agreement with Messrs. Siemens-Schuckert for a temporary supplemental supply of electricity from the Shannon works was submitted by the City electrical engineer and approved by the Committee.

Kingussie.—ELECTRICITY SCHEME.—The Town Council has under consideration an electricity scheme for the burgh, and at a recent meeting it was stated that a local company would be formed in the event of the Council's negotiations with the Grampian Electricity Supply Co. proving unsuccessful. In the meantime the Grampian Company has Parliamentary powers to supply electricity to the district, and it is understood that a commencement will be made with its scheme by August next.

Leeds.—LOAN SANCTIONED.—The Corporation has received sanction to a loan of £500,000, which includes provision for the cable-laying and linking-up which will be necessary in connection with the projected new generating station at Kirkstall.

WIRING OF SMALL HOUSES.—The Corporation has approved a recommendation of the Electricity Committee to adopt a scheme of assisted wiring and to operate the clause of the Electricity (Supply) Act for the wiring of premises and sale of appliances.

Lowestoft.—INQUIRY.—The *East Anglian Daily Times* reports that Col. T. C. Ekin, on behalf of the Electricity Commissioners, held an inquiry at the Town Hall on January 18th, into the applications of the Corporations of Lowestoft and Yarmouth, and the Southwold Electricity Supply Co., for Special Orders authorising them to supply electricity in certain areas of Norfolk and Suffolk. Lowestoft Corporation was also applying for sanction to a loan of £53,000 for extensions to its generating station. It was stated that Lowestoft Corporation was prepared to withdraw its application in respect of the Southwold area, and would raise no objection to the Southwold Company's application. A conference was then held between the representatives of the two Corporations, as a result of which Col. Ekin was informed that they had come to an agreement which would obviate all opposition to their applications for extensions to their areas of supply, and would involve the withdrawal of the Lowestoft Corporation's application for sanction to extend its generating station. An agreement had been entered into for the Yarmouth Corporation to provide Lowestoft with a supply of electricity in bulk. The proceedings were then closed.

London.—ST. PANCRAS.—The Borough Council has received sanction to the borrowing of £2,341 for switchgear at the Grafton Road sub-station, and £36,365 for the following purposes:—Mains and services, £25,406; meters, £8,078; wiring installations (for hire), £402; domestic appliances (for hire), £2,479. The Electricity Commissioners have requested the Council to furnish additional particulars in connection with its application for £20,090 for machinery.

ST. MARYLEBONE.—The Electric Supply Committee has recommended that application be made for sanction to loans of £8,000 and £12,000 for mains and services, respectively.

HACKNEY.—The Finance Committee has recommended to the Borough Council that application be made for sanction to a loan of £85,000 as working capital.

Norwich.—OPPOSITION TO BILL.—At a meeting of the City Council, on January 18th, it was decided to oppose the Bill promoted by the East Anglian Electric Supply Co., Ltd., to confer further powers on the company relative to the supply of electricity in the counties of Essex, Norfolk, and Suffolk.

LOANS.—Application is to be made for sanction to loans of £4,500 for the provision of trunk mains to Wymondham, Wroxham, and North Walsham, and £1,800 for transformers and switchgear.

Padiham.—WIRING OF SMALL HOUSES.—The Housing Committee of the Urban District Council has decided to have the new Council houses wired for electric lighting.

Palestine.—THE RUTENBERG SCHEME.—The Jerusalem correspondent of *The Times* reports that the Government has issued the Order for the expropriation of the land required at Jisr el Mejamie for the construction of the dam, power house, and other buildings connected with the Rutenberg scheme for damming the Jordan just south of its exit from the Sea of Galilee for the purpose of providing electricity for the whole of Palestine.

Preston.—LOAN.—The Corporation Electricity Committee has considered a resolution to apply for sanction to borrow £87,000 for the erection of overhead transmission lines between Preston and Blackpool. The Electricity Commissioners have intimated that application for borrowing powers for such work should be made by the Corporations responsible in each case. The Corporation will therefore apply for sanction to borrow £45,775, the estimated cost of the Preston section of the line.

ELECTRICITY SUPPLY.—Within the next few days, the Corporation will inaugurate a supply of electricity to Longton, Hutton, and Howick, distribution being by the overhead system. From the power station electricity will be transmitted by underground cables along the banks of the River Ribble, thence by overhead lines to the transformer station at Longton, and to two other sub-stations. The h.p. lines were erected by Callender's Cable & Construction Co., Ltd., and the l.p. lines by the Corporation. A large number of applications for a supply has been received, and many of the houses have already been wired.

Preesall.—LOAN.—The Urban District Council has applied for sanction to the borrowing of £1,100 for wiring installations and domestic apparatus to be let on hire.

Rawtenstall.—EFFECT OF COAL DISPUTE.—At a meeting of the Town Council on January 20th it was announced that, despite the heavy increase in costs consequent upon the coal dispute, there would be no increase in electricity charges. The advanced price of coal has cost the Corporation approximately £14,000, but a portion of this has been recovered through the coal clause in the contracts with power consumers.

Skegness.—ELECTRICITY SUPPLY.—The Urban District Council has decided not to accept the offer of the Skegness Electricity Supply Co., Ltd., to supply electricity for the bathing pool, orchestral piazza, and the boating lake at 9d. per kWh for lighting and 6d. per kWh for power, but has decided to install its own plant.

Southend-on-Sea.—LINKING UP STATIONS.—The Corporation Electricity Committee has received a report from the electrical engineer, together with estimates for the linking up of the Leigh, London Road and Thorpe Bay power stations. He recommended that the three stations be connected by 11,000-V h.p. mains, and that two 1,000-kW rotary convertors be installed at Leigh and London Road stations, and one of 500-kW capacity at Thorpe Bay station, together with the necessary switchgear, the estimated cost of the scheme being £50,800. The Committee submitted the report to the Electricity Commissioners, and were advised that the size of the mains should be increased from .2 sq. in. to .25 sq. in. The additional cost of .25-sq. in. mains is estimated at £2,000, and the Committee has recommended that application be made for sanction to the inter-connection scheme, and to a loan of £52,800 to cover the cost of the work.

CONSULTING ENGINEER.—The Town Clerk has notified the Committee that he has retained Mr. W. M. Selvey, consulting engineer, to advise the Corporation upon the future supply of electricity in the borough and neighbouring areas.

Sunderland.—ELECTRICAL DEVELOPMENT.—Since the completion of the scheme for laying mains in every street of the borough at Sunderland and the establishment of the hiring and hire-purchase system of lighting installations, new domestic consumers are being added rapidly by the electricity department, and already in the first nine months of the financial year the previous record number has been passed. Many new electrical contractors' showrooms have been opened. The electricity department is now beginning to feel the benefit of the revival of work in the Wear shipyards.

Swansea.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to carry out mains extensions at a cost of £1,250.

PURCHASE OF COOKERS.—The Committee is to purchase 500 electric cookers at a cost of £6,000 for the houses on the Morriston estate.

HEATERS FOR THE MARKET.—The Committee has arranged for the installation of electric heaters at the market stalls.

United States.—ELECTRICAL DEVELOPMENT.—According to *Power*, one of the largest power expansions so far carried out or planned in the greater Pittsburgh area will be undertaken in the near future as a result of the placing of a second contract for a 48,500-kVA turbo-generator to be installed at the Colfax Station of the Duquesne Light Co. by the Byllesby Engineering and Management Corporation. This is the most important plant operated by the Duquesne Light Co., which ordered the two large sets from the Westinghouse Electric and Manufacturing Co. The first order was placed several months ago. In addition to the two turbo-generators, which will have a combined output of approximately 120,000 h.p., the contracts call for two steam condensers of 62,500 sq. ft. each, as well as a 100,000-kVA bank of transformers to operate at 84,300 V. Included in the auxiliary equipment are 26 circuit breakers, 10 of which set a record for this type of apparatus. These, which are said to have the largest interrupting capacity of any breakers ever built, are rated at 2,650,000 kVA at 11,000 volts. Including the main generating units and all auxiliary equipment, the two contracts call for a total outlay of approximately $2,000 000. At the present time there are in operation at the Colfax Station four turbo-generators, totalling 210,000 kVA. When installed next year the two additional units will raise the generating capacity to approximately 300,000 kVA.

West Riding.—ELECTRICITY BILL.—Reporting upon the Yorkshire Electric Power Bill, the West Riding County Council states that many new powers are sought, the chief of which is to apply for Special Orders to supply electricity in bulk outside the company's limits of supply. Under its existing powers the company can only supply electricity for lighting to authorised distributors, and cannot, except in special circumstances, supply it direct to consumers, but if the powers now sought are granted, it will be able to apply for an Order for the distribution of electricity for lighting in any district in which a Special Order is not already in operation. The views of the District Councils' Association have been invited.

Wrotham (Kent).—PROPOSED ELECTRICITY SUPPLY.—The Urban District Council has received a communication from Mr. T. Stevens, of Lincolns Inn Fields, London, asking, on behalf of a client, whether the Council proposed to develop any scheme of electricity supply for the district, and, if not, whether it would support the establishment of a company to carry out a scheme. The matter has been referred to a committee for consideration and report.

Tramway and Railway Notes.

Bradford.—OPPOSITION TO BILL.—Since the approval by a ratepayers' meeting, on January 14th, of the Corporation's Parliamentary Bill for powers to extend its railless-car and motor'-bus services within and without the city, considerable opposition has been raised. Three petitions to be presented in Parliament against the Bill will be (1) from the Bradford Chamber of Trade, Property Owners' Association, and motor-'bus and transport proprietors' associations; (2) the Yorkshire (Heavy Woollen District) Tramways Co.; and (3) a combination of 'bus proprietors already serving areas outside the city which are affected by the Corporation's proposed extended 'bus routes. Several urban and parish councils in the Wharfedale area are opposing the Bill, and the West Riding County Council has declared its intention to oppose it unless terms are come to with the Corporation.

Continental.—SWITZERLAND.—Work on the electrification of the Federal Railway between Puidoux and Rupperswil has been completed, and the electrical supply for the line was inaugurated on January 18th. Electricity is supplied at a pressure of 132,000 V.

The electrification work on the section of the railway between Feldkirch and Buchs in the Tyrol which is being jointly worked by the Swiss and Austrian State Railway authorities has recently been completed, and is now in operation.

ITALY.—A contract has been signed at the Ministry of Communications for the construction of hydro-electric plants in the Borbera Valley to supply electricity to the Piedmont, Ligurian, Lombard, and Emilian group of railways. The contract is the result of an agreement arrived at between the State Railways, the provincial administration of Alessandria, and the Società Elettrica Interregionale Cisalpina, of Milan. The scheme includes the construction of a large artificial lake with a capacity of 160,000,000 cu. m. The lake will yield, by means of two falls of an aggregate height of 220 metres, about 20,000 h.p.—*Reuter's Trade Service* (Milan).

Croydon.—ABANDONMENT OF TRAMWAY.—At a meeting of the Borough Council, on January 24th, it was decided to cease working the Addiscombe tramway route after March 31st next. The track is worn, and complaints as to its condition have been received. The estimated cost of reconstruction was £50,000.

Increase of Charges.—The Minister of Transport has made Orders under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, authorising certain fare changes by the following tramway and light railway authorities:—The Corporations of Kirkcaldy, York, Maidstone, Colne, Haslingden, Burton-on-Trent, Accrington, Barrow-in-Furness, Preston, Burnley, Luton, Dundee, and Gloucester, the Urban District Councils of Pontypridd, Barking Town, and Aberdare, and the Kidderminster and Stourport Electric Tramways Co., Norwich Electric Tramways Co., Scarborough Tramways Co., Musselburgh and District Electric Light and Traction Co., Ltd., Bath Electric Tramways Co., Hastings Tramways Co., Dundee, Broughty Ferry and District Tramways Co., Llandudno and Colwyn Bay Electric Railway, Ltd., Llanelly and District Electric Supply Co., Ltd., Cheltenham and District Light Railway, and London United Tramways, Ltd. These Orders will remain in force until December 31st next.

India.—RAILWAY ELECTRIFICATION.—According to *Indian Engineering*, the G.I.P. Railway has decided to erect an independent power station in connection with its scheme to electrify the lines between Bombay and Igatpuri and Bombay and Poona. The site has been chosen at Kalyan. The cost of building and equipping the station is estimated at Rs.100 lakhs, of which Rs.90 lakhs will be spent on generating plant and transmission lines. The order for these will be placed in England through the High Commissioner for India.

London.—"UNDERGROUND" DEVELOPMENTS.—The Underground Group has issued a report, giving details of the progress made on its undertakings during the past year, and works in progress or contemplated during the current year. The most important contribution during 1926 was the extension of the City line from Clapham Common to Morden, and the linking up of the Hampstead and City railways between Charing Cross and Kennington. Approximately 16,000,000 passengers have been carried on these extensions since their opening in September last. Lifts at various stations were replaced by escalators, and there are now 61 escalators in use. A number of ticket and change-giving machines were introduced, and passimeters have superseded the old type of booking office at eight stations. New rolling stock included 194 cars, most of which were required for the Morden line service. A general scheme for remodelling the existing C.L.R. rolling stock was commenced, and a few of the reconditioned cars are now in use on this line. On the tramways a new type of car was introduced, fitted with upholstered cross seats, and 46 of these cars were put into service during the year on the M.E.T. and L.U.T. systems. During the present year the reconstruction of Bond Street, Blackfriars, and Temple stations will be completed, and additional escalators installed at a number of stations. There will be 72 escalators in operation by the end of the year. Extensions of the Acton works will be completed during the year, another 25 new cars will be put into service, and all the 300 remodelled cars on the C.L.R. and Hampstead lines will be completed. New tramcars are to be put into service, and an entirely new type of tramcar, of which details will shortly be announced, is to be introduced.

STOKE NEWINGTON.—The Borough Council has received a letter from the chief general manager stating that, having regard to all the circumstances existing at the present time, the London & North-Eastern Railway Co. does not contemplate electrifying the Liverpool Street-Enfield line in the immediate future.

Swansea.—MUMBLES LIGHT RAILWAY.—The Corporation Tramways Committee is urging the Swansea Improvements and Tramways Co. to proceed with the electrification of the Mumbles railway as soon as possible.

United States.—RAILWAY ELECTRIFICATION.—The Electric *Railway Journal* states that the Chicago, South Shore, and South Bend Railroad is to carry out improvements to its system during the present year at an approximate cost of $2,000,000, which will include new cars, construction, and other extensions of facilities. Work carried out during 1926 included the changing-over from a.c. to 1,500-V d.c., the construction of eight sub-stations, four of which are mercury-arc rectifier stations, and the reconstruction of the overhead system.

Telegraph and Telephone Notes.

Italy.—SWEDISH TELEPHONES.—Mr. Piltz, principal of the undertakings of the L. M. Ericsson Co. in Italy, states that progress is being made not only in connection with the concession company in the South of Italy, but also with the Società Ericsson Italiano, which was formed in Genoa last year. The area of the concession comprises a district in the south about a line drawn between Naples and Rome, and since the company took over the concession in July, 1925, the number of subscribers has increased from 17,700 to 20,376 last October. The Genoa company has also obtained contracts for deliveries for the other four concession districts.

Radio at Sea.—RECORD SHORT-WAVE TRAFFIC.—The Cunard liner *Carinthia*, which is at present engaged on a round-the-world pleasure cruise from New York, has just achieved record-breaking commercial communication between ship and shore. When off Cape Leeuwin, Australia, she worked with the New Brunswick station, New Jersey, owned by the Radio Corporation of America, at a distance of nearly 12,500 miles. Before leaving this country, the vessel was fitted with a special short-wave transmitting and receiving installation manufactured by Messrs. Siemens Bros. & Co., Ltd., Woolwich, at the request of the shipowners. The apparatus was specially designed for the ship, and arrangements were made in the installation to permit tests to be carried out with a view to ascertaining the most favourable arrangements and most appropriate wave-lengths. A special single-wire aerial was erected to which the transmitter was inductively coupled, but arrangements were also made so that the ship's main aerial could be employed as an alternative. The transmitter has a wave range of from 25 to 50 metres and employs a specially-constructed 500-watt anode dissipation (intermittent rating) valve, capacity-reaction being employed to control the oscillations. The necessary high-voltage can be obtained either as rectified a.c. from the vessel's long-wave continuous-wave transmitter, or from a specially-designed d.c./d.c. high-voltage machine installed underneath the operating table. Low-voltage for the filament is obtained either from the long-wave c.w. transmitter or from a special winding on the machine referred to above. The whole of the transmitting gear is mounted in a wooden case, which is metal lined for screening purposes. The receiver consists of a simple single-valve circuit thoroughly screened. Special precautions have been taken to minimise any local effects, *e.g.*, the operator manipulating the tuning devices. The instrument covers a range of from 10 to 100 metres, and can be coupled with the ship's low-frequency amplifier in order to intensify signal strength, if necessary. Through the co-operation of the British Post Office, arrangements were made for traffic to be worked through its research station at Dollis Hill, and the Radio Corporation of America also arranged for messages to be transmitted from and received at its stations at New York and San Francisco. During the Christmas season the *Carinthia* despatched 700 greetings by wireless direct to the Radio Corporation's American stations when the vessel was approaching New Zealand, at an average distance of about 10,000 miles. She is the first British vessel to handle commercial messages on short waves (*i.e.*, under 100 metres) with a British Post Office station.

Turkey.—TELEPHONE CONCESSION.—An agreement has been made between the city of Smyrna and the L. M. Ericsson Co., granting a concession for 35 years for the installation and operation of a telephone service in Smyrna and the surrounding district. A special company with a capital of about $212,000 has been formed, says *Commerce Reports*, with the city and the company as shareholders. The first telephone station, which will be automatic, will begin with 2,000 lines, to be enlarged later to 10,000.

Venezuela.—WIRELESS-TELEGRAPHY.—The Government has bought about 118 acres of high-lying land for a radio-telegraph station in the Cutia sub-division of the Federal District (population 140,000), at a cost of 600,000 bolívares (1 bolívar = 9½d.)—*Reuter's Trade Service* (Caracas).

Radio Notes.

Australia.—DISPUTE OVER ROYALTIES.- Wireless dealers in Melbourne and Sydney have formed a co-operative company to contest the demands of Amalgamated Wireless (Australasia), Ltd., which claims a royalty on apparatus covered by 145 patents.—*Reuter* (Melbourne).

Austria.—NEW STATION.—It is understood that the official inaugural ceremony of the Klagenfurt station, wave-length 272.7 metres, will take place on January 30th; this is claimed to be one of the best relay transmitters in Europe.

Germany.—NEW STATION.—The official inauguration of the Langenburg station took place on January 15th, the programme being broadcast from Cologne and relayed from the new station.

POWER RATING.—According to *World Radio*, though the power and range of all the following German stations remain unaltered, their transmitting strength will from now onwards, in accordance with the agreement recently concluded at Geneva, be stated as follows:—

	Wave-length.	Old kW figure.	New kW figure.
Koenigswusterhausen	1,300	10	8
Frankfurt (Main)	428.6	10	4
Hamburg	394.7	10	4
Leipzig	365.8	9	4
Münster	241.9	3	1.5

The low-power stations, Elberfeld (468.8 m.), Bremen (400 m.), Hanover (297 m.), Dresden (294 m.), Dortmund (283 m.), Cassel (272.5 m.), Kiel (254.2 m.), and Gleiwitz (250 m.), hitherto represented by 1.5 kW, will now have each 0.7 kW. Langenberg will have 25 kW, instead of 60 on the old basis.

Licences.—STEADY INCREASE.—The number of licences issued for the use of broadcast receiving sets is still increasing. The total on January 1st was 2,179,000, representing an increase of 48,000 during December, 1926.

Poland.—LICENCES.—The Commercial Secretary at Warsaw (Mr. R. E. Kimens) has forwarded to the Department of Overseas Trade statistics from which it appears that, although the number of licences increased from 4,977 in 1925 to 34,556 in 1926, the number of dealers in, and manufacturers of, wireless plant decreased from 269 to 239, indicating that Poland has also experienced the usual process common to the initiation of a wireless industry, in that numbers of small firms which had gone into the business lacking both experience and capital, have not been able to withstand even favourable conditions.

South Africa.—STATION TO CLOSE DOWN.—It is officially announced that JB, the Johannesburg broadcasting station, is to close down on the 31st inst.—*Reuter* (Johannesburg).

Mr. I. W. Schlesinger has offered, on behalf of African Theatres, Ltd., to undertake the management of a new company to control wireless broadcasting in the Union. This is considered by many to be the only possible solution of the existing financial problem, says *The Times*. Mr. Schlesinger's offer envisages broadcasting as a national concern. The next move therefore lies with Cape Town and Durban, where the other broadcasting stations of the Union are situated. There is some doubt whether they are willing to fall into line, but negotiations are in progress between the three stations and the Minister of Posts and Telegraphs. It is evident that the most stringent regulations affecting the sale and use of apparatus should be laid down, and that the strongest possible measures should be adopted by the Government to eliminate unlicensed listeners before broadcasting can be placed on a really satisfactory basis in that country.

Santo Domingo.—NEW STATION.—A broadcasting station, the first of its kind in the Dominican Republic, is shortly to be erected at Monte Cristy in accordance with plans adopted by the Minister of Promotion and Communications. A preliminary grant of 30,000 dollars has been provided for in the 1927 Budget for the installation of a 1,000-watt station. Broadcasting is to be used for literary, scientific, and other educational purposes, and as a means of propaganda for commercial, agricultural, and sanitary measures.—*Reuter's Trade Service* (Santo Domingo).

Wave-lengths.—MORE CHANGES.—On Sunday, January 23rd, the B.B.C. indulged in another re-shuffle of station wave-lengths, those affected being enumerated below:—

Station.	Old wave-length, metres.	New wave-length, metres.
Birmingham	491.8	326.1
Bournemouth	326.1	491.8
Bradford	254.2	252.1
Edinburgh	294.1	288.5
Hull	288.5	249
Stoke	288.5	249
Dundee	288.5	249
Swansea	288.5	249

The 249-m. wave is the international common wave-length.

Several Continental stations, besides those in this country, have changed and exchanged wave-lengths for test purposes recently.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Armthorpe (Yorkshire).—February 15th. Education Department. Electric lighting installation at new school. Education Committee, West Riding County Hall, Wakefield.

Argentina.—BUENOS AIRES.—March 15th. Ministry of Marine. Machinery in connection with the extension of electrical generation (involving the enlargement of two existing power stations and the construction of two new ones) at the Naval Base, Puerto Belgrano. (B.X. 3140.)*

March 24th. Department of Navigation and Ports. Electric cranes, pumps, &c. (A.X. 4087.)*

Australia. — MELBOURNE.—March 14th. City Council. 6,600-V, 3-phase switchgear. (B.X. 3138.)*

March 8th. Postmaster-General's Department. Induction coils and registers. (B.X. 3136); testing instruments (B.X. 3132.)*

March 1st. Accumulators and plates. (B.X. 3170)*; motor-generator sets. (B.X. 3172.)*

March 7th. State Electricity Commission of Victoria. Paper-insulated lead-covered control cable. (B.X. 3137.)*

March 14th. D.c. switchgear and accessories. (B.X. 3131.)*

SYDNEY.—March 9th. New South Wales State Railways. Two sets of electric overhead travelling crane equipments. (A.X. 4103.)

Belfast.—February 5th. Electricity Department. One induction motor-driven vertical type centrifugal pump. (January 21st.)

February 18th. Electricity Department. Twelve months' supply materials, including electrical accessories, lamps, carbon brushes, cables, &c. (See this issue.)

Bristol.—February 18th. Electricity Committee. Coal and ash-handling plant, and railway sidings; circulating-water screening plant. (See this issue.)

Clacton.—February 2nd. Electricity Department. Two 1,125-b.h.p. Diesel oil engines, direct coupled to 750-kW, 3-phase alternators; two 750-kW alternators, two rotary-convertors, and e.h.p. switchgear. (January 21st.)

Douglas.—February 28th. Corporation. 3½ miles of e.h.p. cable, two synchronous motor alternators. (January 21st.)

Dundee.—February 21st. Electricity Department. Two water-tube boilers with superheaters, economisers, mechanical stokers, and coal-handling plant. (See this issue.)

Eastbourne.—February 21st. Electricity Department. E.h.p. cable, static transformers, and e.h.p. switchgear. (See this issue.)

Edinburgh.—February 14th. Electricity Supply Department. E.h.p. and l.p. switchgear, e.h.p. and pilot cables. (January 21st.)

January 31st. Corporation. Structural steel work for extension of turbine house, Westbank, Portobello generating station City architect.

Greenock.—February 2nd. Corporation. Electric lighting installation at eight tenements (48 apartments). Schedules from Public Works Office.

Huddersfield.—February 19th. Town Council. Electrician's work at maternity home, Greenhead Road. Borough Architect, 26, Ramsden Street.

Ilford.—February 1st. Electricity Department. 660-V, l.p. paper-insulated cables. (January 21st.)

Leeds.—February 18th. Electricity Department. Twelve months' supply of stores, including cables, mains boxes and fittings, jointing and insulating materials, &c. (See this issue.)

London.—LONDON COUNTY COUNCIL.—January 31st. Electrical installation at the Hornsey Rise housing estate (approx. 1,100 wiring points). (January 21st.)

HAMMERSMITH.—February 16th. Electricity Department. Twelve months' supply of stores, including several electrical items. (January 21st.)

SHOREDITCH.—February 23rd. Electricity Department. One 1,500-kW automatic sub-station converting equipment and one 20-ton electrically-operated overhead travelling crane. (See this issue.)

Macclesfield.—January 31st. Rural District Council. Electric generating plant to supply 24 houses at Gawsworth, consisting of engine, battery, switchboards, cable, small motor and pump; wiring for electric light installation, including lamps and meters. Mr. Geo. Clayton, architect, 4, Wellington Street, Stockport.

Manchester.—January 31st. Electricity Department. Two electrically-driven circulating-water pumps, piping, &c. (January 14th.)

January 31st. 12,000 yd. of 3-in. weldless steel spigot and faucet tubes; street lanterns. Mr. H. C. Lamb, chief engineer and manager, Electricity Department.

February 4th. One 1,500-kW and one 750-kW motor convertors, with switchgear. (January 21st.)

New Zealand.—AUCKLAND.—March 22nd. Harbour Board. Electric motors, gearing, shafting, and control gear for the operation of vehicular and passenger gangways at the New Devonport Ferry Wharf. (A.X. 4102.)*

WELLINGTON.—March 4th. Poverty Bay Electric Power Board. Switchgear and transformers. (B.X. 3160.)*

Peterborough.—February 28th. Electricity Department. One 12,000-kW turbo-generator, with foundations, condensers, air and extraction pumps, air cooler, oil cooler, and pipework, e.h.p. switchgear, coal-handling plant, &c. (See this issue.)

Portsmouth.—Electricity Department. Coal-handling plant. (See this issue.)

Salford.—February 4th. Electricity Committee. Steelwork for electricity showrooms, Chapel Street. Mr. C. Swain, architect, 12, Exchange Street, Manchester.

South Africa.—JOHANNESBURG.—February 10th. Municipal Council. Electric cable. (B.X. 3130.)*

Spalding.—February 26th. Urban District Council. 28 sets of centrifugal pumps (for sewage pumping), including electric motors, automatic starters, floats, valves, pipes, &c. Mr. C. F. Murphy, Lloyd's Bank Chambers, Morpeth.

Stoke-on-Trent.—February 9th. Electricity Department. Steam and water piping, valves, &c., constructional steel work, platforms, crane gantries, &c. (January 7th.)

Static transformers, sub-station switchgear. See this issue.)

Tilbury.—February 12th. Urban District Council. H.t. underground cables, l.p. distribution mains, house services, transformers, h.p. and l.p. switchgear and conversion of public street lamps. (See this issue.)

Torquay.—Electricity Department. Two vertical circulating-water pumps for Newton Abbot power station. (January 21st.)

Uruguay.—MONTEVIDEO.—March 2nd. State Electricity Works. Lead fuse wire, silver fuse wire, switches, cable end boxes, compound and insulating type. (B.X. 3159.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Blackpool.—Housing Committee.

Wiring 112 houses on the "J. & P." wiring system.—R. Darbyshire, Ltd.

Brighton.—Lighting Committee. Accepted:—

Turbine with Metropolitan-Vickers alternator and Vickers, Ltd., condenser (£53,840).—Richardsons, Westgarth and Co., Ltd.

Tramways Committee. Accepted:—

120 tons steel girder tram rails (£1,329).—Cargo Fleet Iron Co., Ltd.

Douglas (I. of M.).—Electricity Committee. Accepted: 400 tons fuel oil (92s. 6d. per ton).—Anglo-American Oil Co., Ltd.

Glasgow.—Corporation. Recommended:—

Installation of electric lighting in Govan Registration Office.—J. Cunningham.

Electrical installation at Possil housing scheme (£1,723).—R. J. Sinclair.

Tramways Committee. Recommended:—

Lead-covered cable.—Standard Telephones & Cables, Ltd.; Hackbridge Cable Co., Ltd.

Government Contracts.—The following contracts were placed by various Government departments during December, 1926:—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).

Aluminium sheets.—British Aluminium Co., Ltd.
Battery fittings.—Chloride Electrical Storage Co., Ltd.
Junction boxes.—Hawkers, Ltd.; Pinnacle Switchgear, Ltd.; General Electric Co., Ltd.
Electric cable.—Enfield Cable Works, Ltd.; General Electric Co., Ltd.; Macintosh Cable Co., Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephone and Cables, Ltd.; British Insulated Cables, Ltd.
Cells.—General Electric Co., Ltd.; Edison Swan Electric Co., Ltd.
Electric heating elements.—Credenda Conduits Co., Ltd.
Table fans.—General Electric Co., Ltd.
Insulating materials.—Connollys (Blackley), Ltd.; Ioco Rubber & Waterproofing Co., Ltd.; McBean & Co
Electric lamps.—General Electric Co., Ltd.; British Thomson-Houston Co., Ltd.; Edison Swan Electric Co., Ltd.; Siemens & English Electric Lamp Co., Ltd.; Metro-Vick Supplies, Ltd.
Micanite.—Micanite & Insulators Co., Ltd.; Mica and Micanite Supplies, Ltd.; Mica Products, Ltd.; R. Whiffen, Ltd.
Motor-generating set.—Harland Engineering Co., Ltd.
Motors.—Laurence Scott & Co., Ltd.
W/t transmitters and keys.—Gambrell Bros., Ltd.
W/t valves.—Mullard Radio Valve Co., Ltd.; General Electric Co., Ltd.; Edison Swan Electric Co., Ltd.
Copper wire.—Ward & Goldstone, Ltd.; Connollys (Blackley), Ltd.; Concordia Electric Wire Co., Ltd.; British Insulated Cables, Ltd.
Enamelled copper wire.—British Insulated Cables, Ltd.
X-ray apparatus.—A. E. Dean & Co.

WAR OFFICE.

Aluminium ingot.—British Aluminium Co., Ltd.
Submarine cable.—Standard Telephones & Cables, Ltd.
Petrol-electric crane.—Ransomes & Rapier, Ltd.
Electric light conduit and fittings.—General Electric Co., Ltd.
Generating sets.—W. H. Dorman & Co., Ltd.

AIR MINISTRY.

Inert batteries.—Siemens Bros. & Co., Ltd.
Storage batteries (Henlow).—Hart Accumulator Co., Ltd.
Dynamometer.—Laurence Scott & Co., Ltd.
Switch boxes.—Plessy Co. (1925), Ltd.

POST OFFICE.

Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Ericsson Telephones, Ltd.; Peel-Conner Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.
Telegraph apparatus.—Creed & Co., Ltd.
Testing, protective and miscellaneous apparatus.—T. Watson.
Telephone cabinets.—W. A. Collins, Ltd.
Cable.—British Insulated Cables, Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; General Electric Co., Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Standard Telephones & Cables, Ltd.; Union Cable Co., Ltd.
Joint-box castings.—General Foundry & Eng. Co., Ltd.
Loading coils.—General Electric Co., Ltd.
Ebonite.—Sterling Telephone & Electric Co., Ltd.
Flameproof wire.—Macintosh Cable Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; British Insulated Cables, Ltd.; Elliotts Metal Co., Ltd.; R. Johnson and Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith and Co., incorporated in the London Electric Wire Co. & Smiths, Ltd.
Replacing battery, Grimsby automatic telephone exchange.—D.P. Battery Co., Ltd.
Manufacture, supply, drawing-in and jointing cable (Dewsbury-Wakefield).—British Insulated Cables, Ltd.
Telephone exchange equipment.—Buckhurst, Worcester: General Electric Co., Ltd. Fforestfach (Swansea multi-exchange area), Dunlop Rubber Co., Ltd. (S.W.): Siemens Bros. & Co., Ltd. Sub-contractors: Small Electric Motors, Ltd., for dynamotor. Kay, Son & Co., Ltd. (E.C.), Rochdale: Standard Tele-

phones & Cables, Ltd. Sub-contractors: Chloride Electrical Storage Co., Ltd., for batteries, Crompton and Co., Ltd., for machines. Morrison & Co., Ltd. (Glasgow), Illustrated London News and Sketch, Ltd. (W.C.), Bristol Corporation, W. S. Crawford, Ltd. (W.C.), Crabtree & Co., Ltd. (Walsall), G. & R. Dewhurst (1926), Ltd.: Relay Automatic Telephone Co., Ltd.

Telephone repeater equipment, G.P.O. (South).—Standard Telephones & Cables, Ltd.

Telephone repeater station power plant (Glasgow).—Newton Bros. (Derby), Ltd.

CROWN AGENTS FOR THE COLONIES.

Battery materials.—Siemens & General Electric Railway Signal Co., Ltd.

Telephone switchboard.—Relay Automatic Telephone Co., Ltd.

Train-lighting equipments.—J. Stone & Co., Ltd.

H.M. OFFICE OF WORKS.

Wiring Edinburgh Castle.—A. & J. Morgan, Ltd.

Hamilton.—Town Council. Accepted:—

New switchboard at the burgh electricity works.—Metropolitan-Vickers Electrical Co., Ltd.; cables (£1,229), Edmundson's Electricity Corporation.

Hythe (Kent).—Town Council. Accepted:—

Tenders in connection with the erection of 68 houses:—

Wiring and fittings (£377).—Flack & Johnson.

Cable work (£238).—Folkestone Electric Supply Co., Ltd.

Irish Free State.—DUBLIN.—Commissioners of Public Works.

Heating and electric lighting installation, Ballyconnell House Preparatory College.—Haden's Engineering Co., Ltd.

Vacuum cleaning plant, Custom House, Dublin.—A. H. Masser (Sturtevant Eng. Co., Ltd.).

Extension of electric lighting at the Phœnix Park Ordnance Survey Office.—Handley & Robinson, Ltd.

—Irish Builder and Engineer.

Controller of Stores (Posts and Telegraphs).

Bell sets.—Siemens Bros. & Co., Ltd.

Bells (telephone).—Phœnix Telephone and Electric Works, Ltd.

Cable.—W. F. Dennis & Co.; W. T. Henley's Telegraph Works Co., Ltd.; Victor Zorn (C. J. Vogel, Coepenick).

Electric torches.—Edison Swan Electric Co., Ltd.

Generators (telephone).—Peel-Conner Telephone Works.

Indicators (telephone).—Phœnix Telephone and Electric Works, Ltd.

Insulators, various.—W. F. Dennis & Co.; Litholite Insulators, Ltd.; Goerz Bros. and Kellie (Ireland), Ltd.; General Electric Co., Ltd.

Telephone jacks.—Phœnix Telephone and Electric Works, Ltd.; Ericsson Telephones, Ltd.

Telephone keys.—Sterling Telephone and Electric Co., Ltd.

Monophones, various.—Theodore Gary & Co.

Valves (wireless).—General Electric Co., Ltd.; Marconi (Ireland), Ltd.

Wireless parts.—Marconi's Wireless Telegraph Co., Ltd.

Wire.—Concordia Electric Co., Ltd.; Hayward Co.

—Irish Electrician.

Dublin United Tramways Co.

Traction lamps.—Edison Swan Electric Co., Ltd.

London. — METROPOLITAN WATER BOARD. — Works Committee. Two steam-driven electric generators (one 100 kW and one 50 kW), switchboard, piping, &c., for Kempton Park pumping station:—

E. S. Hindley & Sons	£2,135
Ashworth & Parker. (Accepted.)	**2,283**
W. H. Allen, Sons & Co., Ltd.	2,480
James Howden & Co., Ltd.	2,486
Mather & Platt, Ltd.	2,554
Browett, Lindley & Co., Ltd.	2,549
Belliss & Morcom, Ltd.	2,749
E. Reader & Sons, Ltd.	2,750
Peter Brotherhood, Ltd.	2,792
General Electric Co., Ltd.	2,848

SHOREDITCH.—Electricity Committee.

Electrical installation at Horner House (£1,124).—Electrical Installations, Ltd. (in place of tender of Messrs. Toy & Winslow, £1,042, withdrawn).

STEPNEY.—Electricity Supply Committee.

20 tons pitch (£141).—Gas Light & Coke Co. (Accepted.)

50 cast-iron chambers, frames and covers (£142).—E. and F. Wright. (Accepted.)

Fifty 2-way t c/c disconnecting boxes (£105).—Universal Electrical Mfg. Co. (Recommended.)

Six 1,500-kW motor-convertors and switchgear for sub-stations:—

Ateliers de Constructions Electriques de Charleroi. (Recommended.) ...	**£14,900**
Metropolitan-Vickers Electrical Co., Ltd. ...	52,199
English Electric Co., Ltd.	52,839
General Electric Co., Ltd.	56,367
British Thomson-Houston Co., Ltd.	61,090
Bruce Peebles & Co., Ltd.	67,137

AIR MINISTRY.

"Mazda" metal-filament lamps.—British Thomson-Houston Co., Ltd.

Preston.—Electricity Committee. Recommended:—

Transformer equipment for sub-stations (£4,188); fuses and fittings (£1,000).—English Electric Co., Ltd.

Sheffield.—Electricity Committee. Accepted:—

Three e.h.p. feeder switches and alteration to existing equipment at Neepsend generating station (£4,025).—A. Reyrolle & Co., Ltd.

Tramways Committee. Accepted:—

500 steel tramcar tires (£1,706).—Vickers, Ltd.

Southend-on-Sea. — Electricity Committee. Recommended:—

Meters (£3,227).—Chamberlain & Hookham, Ltd.

Tynemouth.—Electricity Committee. Accepted:—

Six lots of cable.—Macintosh Cable Co., Ltd.

Feeder pillar.—British Insulated Cables, Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, January 28th. London. 7.30 p.m. "Design of High-Pressure Sub-Stations." Mr. C. E. Atkinson.

Friday, February 4th. "Theory of the Gyroscopic Compass." Mr. F. R. Jackson.

Physical Society.—Friday, January 28th. Imperial College of Science, S.W.7. 5 p.m. Ordinary meeting.

Birmingham Electric Club.—Friday, January 28th. Grand Hotel. 7 p.m. Presidential address.

Institution of Engineering Inspection.—Friday, January 28th. Royal Society of Arts. 7.30 p.m. "Manufacture and Uses of Arsenical Copper." Mr. J. Taverner.

Electrical Society of Glasgow.—Tuesday, February 1st. 30, Gordon Street, Glasgow. 7.30 p.m. "Electric and Hydraulic Lifts." Mr. J. H. Meacock.

National Association of Supervising Electricians.—Tuesday, February 1st. Junior Institution of Engineers. 7.15 p.m. "Possibilities of Development of Water Power in Great Britain and Ireland." Mr. G. L. Addenbrooke.

Paisley Association of Electrical Engineers.—Tuesday, February 1st. Town Hall. 7.30 p.m. "Street Lighting." Mr. J. E. Adam.

Roentgen Society.—Tuesday, February 1st. 32, Welbeck Street. 8.15 p.m. Ordinary scientific meeting.

Institution of Mining Engineers.—Wednesday, February 2nd. Institution of Mechanical Engineers, London. 11 a.m. Annual general meeting.

Institution of Electrical Engineers.—Thursday, February 3rd. London. 6 p.m. "Some Recent Advances in A.C. Measuring Instruments." Lieut.-Col. K. Edgcumbe and Mr. F. E. J. Ockenden.

(Wireless Section).—Wednesday, February 2nd. London. 6 p.m. "The Purpose and Design of Broadcast Receivers." Mr. C. F. Phillips.

(Mersey and North Wales (Liverpool) Centre).—Wednesday, February 2nd. University Club. 7 p.m. Annual dinner.

(Scottish Centre, Students' Section).—Wednesday, February 2nd. Royal Technical College, Glasgow. 7.30 p.m. Discussion.

(North-Western Students' Section).—Tuesday, February 1st. Milton Hall, Manchester. 7.30 p.m. "Alternating-current Bridge Methods." Mr. F. W. Fryer.

(South-Midland Centre, Wireless Sub-Section).—Wednesday, February 2nd. University, Birmingham. 7 p.m. "Transatlantic Telephony." Lt.-Col. A. G. Lee.

Edinburgh Electrical Society.—Thursday, February 3rd. Royal Scottish Society of Art. 8 p.m. "Country Distribution." Mr. J. S. Thomson.

Diesel Engine Users' Association.—Friday, February 4th. Discussion on "Report on Heavy Oil Engine Working Costs for 1925-26."

Institution of Mechanical Engineers.—Friday, February 4th. London. 7 p.m. "Engineering Salesmanship." Mr. W. Reavell.

Royal Institution.—Friday, February 4th. "Wireless Transmission and the Upper Atmosphere." Prof. E. V. Appleton.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, February 5th. Annual dinner at Cox's Café, Cardiff.

Notes.

Lecture.

Professor Cramp, of the Electrical Engineering Department of the Birmingham University, who spoke on the subject of cheapening the domestic electricity supply in a mid-day address at the Birmingham Y.M.C.A. on January 19th, gave practical examples of supplying heat through floors for offices, and through stoves which received the heat during the night and gave it off during the day. The principle underlying this cheap supply was that the current must be on during certain hours only, and this was operated, in practice, by automatic switching arrangements. He suggested that consumers ought to ask to be allowed to take electricity for domestic purposes at a very low rate during those hours when the generators were not loaded up.

The Batti-Wallahs' Society.

The Society attains its 21st birthday this month, and the Committee hopes to make 1927 a notable year in celebration of the event. On Tuesday, February 1st, at the Engineers' Club, an informal supper and concert will be held. An additional item is that Past-president M. S. Chambers will emerge from retirement to crack the "Jokes in the Bayeux Embroidery." On Wednesday, February 16th, a luncheon will be held at the Hotel Cecil, when Sir Duncan Watson will address the members on "The Prospects of the Electrical Industry." On Tuesday, March 22nd, the annual dinner will be held at the Hotel Cecil, and this year it will include only one or two short speeches and will be followed by dancing till midnight.

Fatalities.

At the Philadelphia power station of the Newcastle-on-Tyne Electric Supply Co., Ltd., on January 15th, Wilfred Henry, an electrician's mate, received a fatal shock. According to the evidence at the inquest, Henry was testing lamps in the indicator box when one failed to light. It seemed as if he had attempted to remove the lamp and that one of his fingers had come in contact with a live terminal. There was a burn on the middle finger of the right hand. The current was at 250-V pressure. A doctor was of opinion that death was due to cardiac arrest caused by electricity passing through the man's body. A verdict of "Accidental death" was returned, and the company's representative promised to bring before the notice of the company a suggestion by the Electrical Inspector of Factories that when the box was being dealt with in future the current should be cut off.

A verdict of "Accidentally electrocuted" was returned at an inquest at Redcar on January 17th on John Joyce, who was killed at the works of Messrs. Dorman, Long & Co., Ltd. It was stated that the deceased was the driver of an electric crane which ran on the ground level and conveyed steel ends from one part of the mill to another, where they were picked up by an overhead crane. The driver of the overhead crane said that he left his machine to look for the electrician, as he was having trouble with the motor. In his absence Joyce got on to the top platform of the overhead crane, a position of great danger on account of the live wires which ran only about five feet above. He next saw Joyce hanging by both hands from a live wire; he must have closed the main switch to set the crane in motion. It was stated that it was no part of Joyce's duty to drive the overhead crane.

The death took place on January 11th, as the result of injuries received in a motor-cycle accident, of Mr. Norman Arthur Wallis, who was on the staff of Mr. Featherstone, electrical engineer, of Ashford, Kent.

The death occurred recently from injuries received in a motor-cycle accident of Mr. Maurice W. Billcliffe, aged 25 years, who was an assistant shift engineer at the Kingston-on-Thames Corporation electricity works.

Meter Engineers' Technical Association.

At the fifth general meeting of the above Association, held at the Lighting Service Bureau, London, on January 21st, Mr. W. Casson read the second part of his paper on "The Testing of Large-Capacity Meters *in situ*." An interesting discussion followed, in which the practice of *in situ* testing was generally approved.

The first annual dinner of the Association was held at the Engineers' Club, London, on January 22nd, when the chair was taken by Mr. G. F. Shotter, president of the Association. Some 90 members and visitors were seated. "The Meter Engineers' Technical Association" was proposed by Capt. J. M. Donaldson, M.C., M.I.E.E. (North Metropolitan Electric Power Supply Co.), who paid a tribute to the president for the work he had done for the North Metropolitan Co. By means of a rough estimate of the number of electricity meters installed throughout the country, he showed the great amount of work that was done in connection with their manufacture and maintenance. Many meters had been on circuit for over 20 years, and he did not believe they were O.K. He thought the time would come when all meters would be "taken off the wall" after a definite period. In Montreal, where he had spent some time on meter testing, no meter was installed for a period of longer than five years. It was asserted that too much was expected from the electricity meter; but they all expected their watches to be accurate within a minute per day. It was up to the Association to tell the manufacturers to buck up. Although he felt that an association of that sort was bound to come, he would like to see it affiliated with the Institution of Electrical Engineers, which would add to its strength.

Mr. Shotter, in reply, referred to the work that had been done by the hon. sec. of the Association, Mr. Geo. D. Malcolm, during the first stage of the career of the M.E.T.A. The total membership of the Association was now 134, including several members abroad. It was officially recognised by the British Electrical Standards Association, and had a member sitting on a committee of that body. He asked for the full co-operation of all members and the sympathy of the electricity supply authorities and the Press. Mr. E. W. Hill, hon. assistant secretary, proposed "The Visitors," and in a humorous speech referred to the formation of the Association and its work to date.

Mr. W. C. P. Tapper, M.I.E.E. (Stepney), said that it would be necessary to ask the B.E.S.A. soon to set up a committee to standardise associations. He paid a tribute to Mr. Malcolm for the excellent work he had done at Stepney in redesigning the test room. The meter work of a large undertaking was no light task. In referring to his work some years back at Brighton, on the old copper-sulphate meters, he thought it a good thing that there were only 400 instead of 4,000 of those meters.

Mr. P. W. Tucker (ELECTRICAL REVIEW) replied on behalf of the electrical Press wishing the Association success in the future. Mr. Knowles (Evershed & Vignoles) proposed "Absent Members." Items by specially-selected entertainers during the evening added to the enjoyment of the proceedings.

Electrical Association for Women.

A course of six evening lectures is being given at the Lighting Service Bureau, London, from January to April, which began on Wednesday, January 26th, with an opening lecture by Mr. J. W. Beauchamp, M.I.E.E., on the "History and Economics of Electricity Supply." On Tuesday, February 8th, Mr. W. E. Bush will deal with "Electric Light in the Home and in the School." On Friday, February 18th, household engineering and efficiency tests will be the subject, handled by Mrs. Christine Frederick (U.S.A.). On Wednesdays, March 9th and 23rd, simple household repairs, and electric power appliances in the home, will be discussed, and on April 6th, Mr. T. Settle (who has recently returned from America) will lecture on women's place in the American electrical industry. All the lectures will be of a practical nature, and are designed to help those women who are engaged in teaching or instructing other people regarding the uses of domestic electrical appliances.

A Kipling Society.

A society is being formed to study the works of Mr. Rudyard Kipling—"the most patriotic, virile, and imaginative of writers"—and has already gained enthusiastic support. Arrangements are in progress for holding the inaugural meeting. Particulars can be obtained from the hon. secretary *pro tem.*, "Kipling Society," The Milestone, Bath Road, Slough.

The Electricity Supply Rifle League.

The following are the results for the latter part of 1926:—Division 1: Central A, 580; County A, 578. County A, 573; St. James' 545. City A, 575; St. James', 535. City A, 576; County A, 573. Central A, 16 points; City A, 9 points; Shoreditch A, 7 points; County A, 6 points; St. James', 0 points.

Division 2: Shoreditch B, 539; Hackney, 534. Central B, 570; Hackney, 525. Central B, 564; County B, 545. B. and K., 572; Central B, 562. City B, 569; County B, 537. County B, 543; Shoreditch B, 540. B. & K., 573; Shoreditch B, 529. B. & K., 559; County B, 547. County B, 554; Hackney, 504. City B, 20 points; B. & K., 18 points; Central B, 16 points; County B, 8 points; Hackney, 2 points; Shoreditch B, 2 points; K. & K., 0 points.

The hon. secretary, Mr. E. Mathews, 18, Lower Clapton Road, E.5, would be glad to hear of clubs that would like to join in the tourney, in connection with the metropolitan electricity supply undertakings.

Educational.

EAST LONDON COLLEGE (UNIVERSITY OF LONDON).—A course of six lectures on "Short Electric Waves" treated experimentally—ranging from 200 metres down to 1 metre—will be given by Mr. J. H. Morrell, M.A., of the Electrical Laboratory, Oxford, on Mondays, at 6 p.m., commencing February 7th. The fee for the course is 10s. 6d.

Appointments Vacant.

Probationary assistant telegraph engineers, for the Governments of the Gold Coast and Nigeria; assistant electric car shed superintendent (£680), for the Buenos Aires Western Railway, Ltd.; meter fixer for Buxton Corporation Electricity Department. (See our advertisement pages to-day.)

Institution of Electrical Engineers.

FARADAY MEDAL.—The Council of the Institution has made the sixth award of the Faraday Medal to Prof. Elihu Thomson, of Boston, U.S.A., honorary member of the Institution, who is well known as one of the pioneers in the development of electrical engineering.

MEMBERSHIP.—The list of newly-elected members and transfers from one grade to another, which was adopted at the ordinary meeting of the Institution on January 20th, contained the names of no fewer than 497 candidates.

SOUTH-MIDLAND STUDENTS' SECTION.—Mr. G. L. E. Metz, presiding at a meeting last week, declared that the water-

power resources of this country, if fully developed, would be capable of a continuous output equal to approximately one-half the present total output throughout the country by steam stations. Water power could not, however, be considered a serious competitor of coal in the production of electricity at present, as the location of these water-power resources in the north and west was remote from any large industrial centres, and transmission costs, together with heavy capital charges upon storage lakes, &c., offset the advantages of having no fuel costs.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

SIR ANDREW RAE DUNCAN has been appointed to the post of Chairman of the Central Electricity Board. The Minister of Transport issued an official announcement to this effect on January 20th. Sir Andrew, who is 42 years of age, was born in Ayrshire, and after graduation at Glasgow University, he practised as a solicitor as a partner in a firm which specialised in industrial affairs (Biggart, Lumsden & Co.). In this capacity he gained a wide experience of the shipbuilding, engineering, and auxiliary industries. On the reorganisation of the Shipbuilding Employers' Federation and the removal of its headquarters to London, he became secretary of the Federation. He was appointed by Sir Joseph (now Lord) Maclay as secretary of the Merchant Shipbuilding Advisory Committee under the Shipping Controller during the war. In 1919 Mr. Lloyd George appointed Sir Andrew Coal Controller, and he relinquished that office at the end of 1920 on the formation of the present Mines Department. Since 1920 to the present time he has acted as vice-president of the Shipbuilding Employers' Federation. *The Times* states that he has directed the activities of that Federation with conspicuous success during the difficult years of the depression.



Elliott & Fry] [*London.*

Sir Andrew Rae Duncan,
The Chairman of the Electricity Board.

Among his other appointments, Sir Andrew Duncan has acted as Chairman of the Advisory Committee of the Coal Mines Department since 1920, Chairman of the Royal Commission to inquire into the coal industry in Nova Scotia, 1925, and Chairman of the Royal Commission to inquire into grievances of the Eastern Maritime Provinces of Canada, 1926. He recently returned from a three months' stay in Canada in connection with the last appointment. Sir Andrew has also acted as a member of the Royal Commission on National Health Insurance, of the Civil Service Arbitration Tribunal, and of courts of inquiry into labour disputes.

One newspaper report states that the remaining seven members of the board will be appointed before the reassembly of Parliament, which has been fixed for February 8th, and that the chairman will take up his duties as soon as his colleagues have been appointed.

MR. L. MACKINNON, who has been appointed to the position of general manager of the Glasgow Corporation Tramways, entered the service of the Corporation in 1887, so that he has completed 40 years' service. He was first employed in the City Cleansing Department, and in 1892, when Mr. Young was appointed first general manager to prepare for the taking over



Mr. L. Mackinnon,
General Manager, Glasgow Corporation Tramways.

of the city tramways by the Municipality on July 1st, 1894, he appointed Mr. Mackinnon as private clerk and secretary. He was therefore associated with the preparatory work and was successively manager's clerk, assistant traffic superintendent, chief of the purchasing and contracts department, traffic manager, and deputy general manager. Thus he has passed through many grades of the service, and has seen the transition from horse to electric traction and other developments. On many occasions during the absence of the former general manager (Mr. Dalrymple), he has had full control of the undertaking. Mr. Mackinnon was educated at the Glasgow High School and the Royal Technical College, Glasgow.

MR. D. POWELL, charge engineer at the Dover Corporation Electricity Works, has secured an appointment at the Wimbledon Electricity Works at £345 per annum.

The Hull Corporation Electricity Committee has recommended that the salary of Major BELL, the electrical engineer, be increased from £1,108 to £1,500.

MR. A. S. BLACKMAN, general manager and engineer of Sunderland Corporation Electricity Department, has gone on three months' leave of absence, with salary, granted him last year by the Council on his completion of 20 years' service with the Corporation and as a mark of appreciation of the able manner in which he has discharged duties connected with the large extensions of recent years.

MR. W. F. FERRIS received from his colleagues of the English Electric Co., Ltd., at Stafford, a gold watch and gold pencil at a dinner on January 14th. He will shortly be taking up duties for the company in Australia.

The German Elektrotechnische Verein has awarded to Dr. ADOLPH FRANKE, the president of the Siemens & Halske Gesellschaft, Berlin, the Siemens-Stephan Memorial Plate. This is the Union's highest award, and is granted every five years to the person who is considered to have rendered the greatest service to electrotechnical progress in general and to the Union in particular. Dr. Franke has been associated with the Siemens & Halske Co. for 40 years, and is known for his work in connection with high-frequency measurement apparatus for telephony and radio work.

MAJOR G. FETHERSTONE, D.S.O., M.C., has resigned his position as Trade Commissioner at Cape Town, with effect from the end of the current month, to take up a business appointment. Major Fetherstone has been at Cape Town for seven years, and was formerly at Sydney, N.S.W.

MR. J. E. KINGSBURY has changed his office address from Serjeant's Inn to 82, Victoria Street, Westminster, S.W.1. Telephone No.: "Victoria 1225."

The *Financial Times* records that Mr. GEORGE A. PIRELLI, who recently resigned his appointment as Italian Consul-General, has been elected Chairman of the Italian Chamber of Commerce in London.

MR. J. W. NEEDHAM, electrical engineer, has left Rosyth Dockyard to take up a similar post at H.M. Dockyard, Simonstown, South Africa. His successor at Rosyth is Mr. J. C. UGLOW, who has just returned from Gibraltar.

MR. HOWARD A. LEWIS, director and sales controller of Kelvinator of Canada, Ltd., and director of the Electrical Refrigeration Corporation, of Detroit, was to arrive from America on Friday last. He will remain in Europe for a few weeks dealing with matters connected with automatic electric refrigeration, and his address will be 30-35, Drury Lane, W.C.2.

The Dover Corporation has granted a month's leave of absence to the borough electrical engineer owing to illness.

MR. H. P. STOKES, manager and engineer of the Plymouth Corporation Tramways and Transport, is confined to bed as a result of a motor accident.

The marriage took place at Glasgow, on January 19th, of Mr. JOHN W. TORRANCE, partner in the firm of J. W. & R. Torrance, electrical engineers, of Hamilton, and Miss MARY BURNS GRANT.

It is proposed to advance the salary of Mr. F. A. BOND, the borough electrical engineer of Battersea, from £1,250 to £1,300.

Brighton Corporation Lighting Committee has promoted Mr. G. EVERETT, senior shift engineer, to be sub-station superintendent at North Road.

MR. R. A. MALLETT, M.C., sales manager to, and a director of, the Norman Electrical Co., Ltd., was married on 15th inst. at Chelsea to Miss GERALDINE GORDON.

The *South African Mining and Engineering Journal* reports that the Government of the Union of South Africa has made the following appointments to the Electricity Control Board:—Mr. H. PIRON (chairman), *vice* Sir Robert Klotze; Mr. C. MULLINS (Chief Inspector of Machinery), *vice* Mr. C. H. Hearn; and Mr. C. W. H. LANSDOWN (legal adviser), *vice* Mr. L. G. Nightingale.

Obituary.—MR. W. WATTS.—The death took place on January 15th, at the age of 72 years, of Mr. Walter Watts, who was for a number of years, until his retirement about three years ago, on the engineering staff of the Brighton Corporation Electricity Works at Southwick.

MR. G. L. SCOTT.—The death occurred on January 16th, at the age of 77 years, at Sevenoaks, of Mr. George L. Scott, who had been an Associate of the Institution of Electrical Engineers since the year 1901.

MR. A. W. BURCHARD.—The *Daily Mail* reports that Mr. Anson W. Burchard, chairman of the International General Electric Co., and a director of the British Thomson-Houston Co., Ltd., died recently from heart failure.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Electrical Refrigerators and Appliances, Ltd.—Private company. Registered in Edinburgh on January 15th. Capital, £3,000 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, manufacturers of and dealers in tramway, electrical, galvanic and other apparatus, &c. The first directors are:—F. T. Land, Coniston, Woodvale Avenue, Giffnock, Renfrewshire, nail and hardware merchant; T. A. C. Land, Mayfield, Bridge of Weir, Renfrewshire, nail and hardware merchant. Qualification, 100 shares. Secretary, T. A. C. Land. Registered office, 120, Bothwell Street, Glasgow.

Lockett, Lloyd & Statham, Ltd.—Private company. Registered January 15th. Capital, £2,000 in £1 shares. Objects: To acquire the business of electric light and power contractors, carried on by H. Lockett, J. B. Lloyd, and A. Statham, at Green Lane, Wilmslow, Cheshire, as Lockett and Lloyd The permanent directors are:—H. Lockett, Beech Lane; J. B. Lloyd, Thornlea, Lacey Green; A. Statham, Macclesfield Road (all Wilmslow electric light and power contractors). Qualification of permanent directors, 500 shares; of other directors, 100 shares. Solicitors: Lingards, Sutton, Elliott & Co., 24, Fountain Street, Manchester. Registered office, Green Lane, Wilmslow, Cheshire.

W. L. Gray, Ltd. — Private company. Registered January 19th. Capital, £750 in £1 shares. To adopt an agreement with W. L. Gray and to carry on the business of electricians, manufacturers, generators, accumulators, and suppliers of electricity, &c. The first directors are:—W. L. Gray, 9, Victoria Parade, Muswell Hill, N.10, gentleman; Capt. H. J. Round, M.C., "Westfield," Colney Hatch Lane, N.10, engineer. Qualification, £20. Remuneration as fixed by the company. Secretary: E. Nicholas. Solicitors: Sewell, Edwards & Nevill, 35, Bucklersbury, E.C.4. Registered office: 9, Victoria Parade, Muswell Hill, N.10.

Wm. F. Thacker, Ltd.—Private company. Registered January 17th. Capital, £1,000 in £1 shares. Objects: To carry on the business of plumbers, electricians, electrical and radio engineers, &c. The directors are:—W. F. Thacker, "Govan," Manchester Road, Haslingden, sanitary and electrical engineer (permanent governing director and chairman); Mrs. E. A. Thacker, same address. Qualification, 10 shares. Solicitors: Evans & Cotton, Haslingden, Bacup and Rawtenstall. Registered office: 20, Blackburn Road, Haslingden.

Western Wireless and Electrical Co. (Salisbury), Ltd.—Private company. Registered January 19th. Capital, £1,500 in £1 shares. Objects: To acquire the business of a wireless and electrical engineer now carried on by A. G. Williams at 33, Fisherton Street, Salisbury, as the Western Wireless and Electrical Co. The permanent directors are:—A. G. Williams, 98, Fisherton Street, Salisbury; H. A. Dinnage, 33, Fisherton Street, Salisbury. Qualification, 100 shares. Solicitors: Trethowan & Vincent, Salisbury.

Hungerford and District Electricity Supply Co., Ltd.—Registered as a "public" company on January 21st. Capital, £10,500 (10,000 6 per cent. cumulative participating preference shares of £1 each and 10,000 ordinary shares of 1s. each). Objects:—To carry on at Hungerford (Berks.) and elsewhere the business of an electric power and supply company, to adopt an agreement with the Hungerford Electric Light and Power Co., and to acquire the business, undertaking, and rights belonging to that company. The minimum cash subscription is £7. The directors are:—S. W. Albright, J.P., High Street, Hungerford; H. Smith, 73, Fellows Road, N.W.3, electrical engineer; and C. L. de Wilde Reader, "The Elms," Orford, Suffolk, electrical engineer. Qualification, £100. Remuneration as fixed by the company. Solicitors: Ward & Melliar Smith, 35, Queen Victoria Street, E.C.4.

Official Returns of Electrical Companies.

Presteign Electric Co., Ltd.—Memorandum dated December 30th, 1926 (annexed to debenture dated September 25th, 1924), to secure £1,000 and also all sums paid by the guarantors on behalf of the company under a guarantee dated October 4th, 1926, charged on the company's undertaking and property, including uncalled capital. Holders: A. M. Wilson, The Moor, Presteign; and others.

Rhayader Electric Light and Power Co., Ltd.—Capital, £2,000 in £5 shares. Return dated November 4th, 1926. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Radio (Hove), Ltd.—A. C. Gillman, of 103, Cannon Street, E.C.4, was appointed receiver and manager on January 6th, 1927, under powers contained in instrument dated October 2nd, 1925.

Leeds Radio Services, Ltd.—Capital, £2,500 in £1 shares. Return dated November 30th, 1926. 1,227 shares taken up. £1,227 paid. Mortgages and charges, nil.

Rangoon Electric Tramway and Supply Co., Ltd.—Satisfaction to the extent of £9,711, on June 3rd, 1926, of debenture stock dated February 1st, 1906, December 22nd, 1908, November 5th, 1913, and January 25th, 1924, securing £250,000. (Notice filed January 12th, 1927.)

E. Powell, Ltd.—Mortgage dated December 31st, 1926, to secure £1,225, charged on 39, High Street, Tunbridge Wells. Holders: W. C. Cripps and F. S. Harries, Tunbridge Wells.

Macintosh Cable Co., Ltd.—Satisfaction in full on December 31st, 1926, of debentures dated January 29th and March 19th, 1902, securing £6,500.

Dartnoor Electric Supply Co., Ltd.—Capital, £2,000 in 10s. shares. Return dated November 4th, 1926. All shares taken up. £2,000 paid. Mortgages and charges: £4,000 at 4½ per cent.; £3,950 at 6 per cent.; £3,550 held by bank as collateral security.

Weald Electricity Supply Co., Ltd.—Particulars filed of £100,000 debentures authorised December 15th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £50,000.

C. J. Thursfield & Co., Ltd.—Mortgage debenture dated January 8th, 1927, to secure £1,000 charged on the company's undertaking and property, present and future. Holder: B. Park-Hughes, 173, Church Lane, Handsworth Wood.

Electrical and Chemical Ebonite Co., Ltd. — Particulars filed on January 12th, 1927, of £8,500 debentures authorised by resolutions of April 12th and May 17th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Ilfracombe Electric Light and Power Co., Ltd.—Satisfaction in full on December 31st, 1926, of mortgage dated September 10th, 1924, securing £10,000.

Lewis, Thomas & Sons, Ltd.—Debenture dated January 5th, 1927, to secure £1,000, charged on the company's undertaking and property, including uncalled capital. Also mortgage of same date and collateral to the above debenture charged on certain land and premises in Tregaron, Cardigan. Holder: D. L. Doughton, Hengwm Clarach, Cardigan.

Teignmouth Electric Lighting Co., Ltd.—Debenture dated January 11th, 1927, to secure £12,500, constituting a specific mortgage and charge on freehold and leasehold properties at Teignmouth, Kingsteignton, Shaldon, and Bishopsteignton, and a floating charge on the remainder of the company's undertaking and property, present and future, including uncalled capital. Holder: H.M. Treasury Solicitor.

City Notes.

County of London Electric Supply Co., Ltd.

Meetings of holders of the company's first and second 4½ per cent. debenture stock are to be held on February 17th to consider proposals for the exchange of their holdings for Government securities. To the first debenture holders the company offers £115 of the new 4 per cent. Government Consolidated Loan in exchange for each £100 of 4½ per cent. debenture stock, and to the second debenture holders £112 10s. of the new 4 per cent. Government Consolidated Loan for each £100 of 4½ per cent. debenture stock. This offer will give the first debenture holders 2s. per cent. more than they are receiving at present, and the second debenture holders will receive the same rate of interest which they are now receiving (4½ per cent.), but it must be borne in mind that the first debenture stock is redeemable at £115, while the second debenture stock is redeemable at £105 (both at the company's option). The chief advantage of the offer arises, however, from the value of the new Government loan which, in both cases, considerably exceeds the present market value of the first and second debenture stock.

S. Smith & Sons (Motor Accessories), Ltd.

The annual meeting was held on January 20th. Mr. W. Henderson-Cleland, M.C. (chairman), who presided, said that the net profit for the past year was £73,336. The directors had decided to make an issue of 400,000 7½ per cent. cumulative preference shares of £1 each at par. With the proceeds it was intended to repay the company's indebtedness to the banks and other debenture holders, and cancel the debentures. The interest on borrowed money during the past year amounted to £30,500. Out of the profit £62,000 had been placed to reserve (making £140,000), and they proposed to pay a dividend of 7 per cent. on the preferred ordinary shares. The amount which stood to the credit of the reserve represented earnings on behalf of ordinary shareholders not distributed. As soon as circumstances permitted, the reserve would be distributed in cash or capitalised form between the two classes of ordinary shareholders. The company's position was sound, and the future prospects were good. The amount hitherto paid as debenture interest would be sufficient by itself to cover the dividend upon the new shares. The report and accounts were adopted, and at subsequent separate meetings the issue of the new preference shares was approved.

The prospectus was issued later. The shares will rank in priority to other classes for dividend, and for repayment in the event of a winding up. The dividend is cumulative.

Shanghai Electric Construction Co., Ltd.

The directors announce that although the profits of the past year fully warrant the payment of a second interim dividend of 4 per cent., they have decided to postpone payment in view of the unsettled state of Shanghai, which resulted in a suspension of tramway services on January 18th. The first interim dividend was 4 per cent., paid in October last.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159, and they have all been ordered to be officially quoted:—

American Telephone and Telegraph Co.—$10,483,900 capital stock.

Brompton and Kensington Electricity Supply Co., Ltd.—58,496 ordinary shares of £1 each fully paid, Nos. 292,301 to 350,796.

General Electric Co., Ltd.—111,670 ordinary shares of £1 each fully paid, Nos. 2,141,976 to 2,253,645.

Montreal Tramways Co.—$2,217,000 Series "B" 5 per cent. general and refunding mortgage sinking fund gold bonds, due April 1st, 1955, Nos. C1 to 310 ($100), D1 to 372 ($500), and M1 to 2,000 ($1,000).

Traction and Power Securities Co., Ltd.

The report for the past year shows a net revenue of £56,802, to which is added £28,748 brought forward, making £85,550. After paying interim dividends there remains a balance of £68,810. From this it is proposed to transfer £10,000 to reserve, to pay the final preference dividend, and one of 10 per cent. on the ordinary stock, making 14 per cent. for the year (as against 13 per cent.), leaving £29,771 to be carried forward. During the year there was issued a further £146,023 of 4½ per cent. debenture stock. It is proposed to change the title of the company to "Traction and General Investment Trust," and a resolution to effect this will be presented at the annual meeting on February 1st.

Companies Struck Off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Bennetts (Electrical Engineers), Ltd.
Bloom's (Wireless), Ltd.
City of Wells and District Electricity Supply Co., Ltd.

Marconi's Wireless Telegraph Co., Ltd.

The directors announced last week that the report of the investigations carried out by the company's auditors and Sir Gilbert Garnsey had been presented to them. It is their intention to consider the report at once, and to call a meeting of shareholders at the earliest possible moment, to lay proposals before them.

Dublin United (Electric) Tramways Co., Ltd.

The directors recommend the payment of a dividend on the preference stock at the rate of 6 per cent. for the half-year ended December 31st, 1926, and a final dividend on the ordinary stock at the rate of 7 per cent. per annum (making 5½ per cent. for the year). They also propose to set aside £55,000 for renewal of track; £5,000 for overhead line, standards and cables; £3,500 for power-station plant, and to carry forward £15,188.

Shropshire, Worcestershire and Staffordshire Electric Power Co.

An extraordinary meeting is to be held on February 4th for the purpose of considering a resolution empowering the directors to issue the balance (250,000) of the company's "A" ordinary shares of £1 each.

Columbia Gas and Electric Corporation.

Quarterly dividends of $1.50 per share on the 6 per cent. preferred stock and of $1.25 per share on the no-par-value common stock have been declared.

Enfield Cable Works, Ltd.

An interim dividend of 5 per cent. actual has been declared on the ordinary shares, as in 1926.

Stocks and Shares.

MONDAY EVENING.

THE investment markets of the Stock Exchange have received a powerful stimulus from the success attendant upon the issue of the new 4 per cent. Consolidated Loan. Although subscriptions received allotments in full, the demand for the new stock has been so considerable as to cause the price to hold a useful premium. Stags have done well out of their speculation. The effect is highly advantageous to investment stocks and shares of all kinds. The Bank Rate is expected to be lowered in the Thursday of this week. It has stood at 5 per cent. since December 3rd, 1925. Such gilt-edged securities as London Power 5 per cent. debenture have now reached a price-level at which the return on money invested at to-day's quotations is barely 5 per cent. And the demand for stock continues to be insatiable, despite the expectation of increased taxation in the spring Budget. The gravity of the Chinese news imposed a halt upon undue exuberance.

Normally, the idea of a rise in income-tax serves to direct attention to those stocks and shares the dividends upon which are paid net. We could never quite see why this should be the case, but the fact remains, arguing lack of intelligence in the inquirer who wonders why. The Eastern quartette of cable companies pays the dividends, on its ordinary capital, free of tax. The average yield is now £5 13s. per cent., equi-

valent to a shade over 7 per cent. on the money, with a 4s. tax. There are not many well-secured ordinary shares which return as much as those in the Eastern group, and it is not unreasonable to look for a rise in their prices.

Oriental Telephone and River Plate Telephone shares are also in receipt of what is termed tax-free dividends. A gain of 1s. 6d., to 23s. 6d., has accrued to Venezuela Telephones. The preference strengthened to 24s. No assignable cause being offered for the advance, speculation occupied itself with shrewd guesses as to the likelihood of a resumption of negotiations for purchase of the company's undertaking. The last minute breaking-off of a similar arrangement some months back is still fresh in the memory of everyone interested. Curiosity awaits developments with lively attention. Telephone Manufacturing are easier at 7s. 10½d.

The Metropolitan Railway dividend announcement is due on Thursday in this week. A year ago the company paid 3 per cent., making 5 per cent. for 1925. Last July, however, the interim dividend of 1½ per cent. was 10s. per cent. less than that for the corresponding half-year. The District Railway also paid 1½ per cent. as an interim dividend last August, which was unchanged from the year before. The ordinary stocks of both companies have lost a point, and Underground £1 shares drooped to 13s. No serious hope is entertained of a dividend, yet, on the last-named, British Electric Traction stocks maintain their prices.

Bournemouth and Poole ordinary have been stirring again, and a little demand led to 1/16 rise, at 60s. 9d. The dividend declaration comes next month, but the present hardness is explained by references to renewed hopes of the undertaking being acquired by one or other (or both) of the Corporations named in the company's title. There may, however, be a sounder reason than this for the support rendered by purchasers of the shares. The Egham and Staines report is due shortly, and, on the basis of the 7½ per cent. dividend in each of the last three years, the shares yield £6 16s. 9d. at the present price of 22s. 3d. Sevenoaks Electric new ordinary shares are available at 21s. 3d. free of stamp and fee—which saves threepence per share—and have partial dividend falling due in June. The company paid annually 7 per cent. in 1925 and 1926; the current yield, at this rate, is £6 11s. 9d. per cent. Midland Counties ordinary, now at 21s. 3d., will have a full year's dividend to come in March; last year the company paid 6 per cent. Newcastle-upon-Tyne Electric ordinary are easier this week at 20s; there is some doubt as to whether, in view of last year's coal stoppage, the usual full 7 per cent. dividend can be expected in March. Llanelly ordinary received a 5 per cent. dividend for 1925. The price stands at 16s. 6d., at which a 5 per cent. dividend will give £6 1s. 3d. per cent. on the money. Shropshire Electrics are 1/16 up at 26s. 3d. on the decision of the board to issue 250,000 "A" ordinary shares. Edmundsons and Urbans both yield a shilling or two under 6 per cent. There is a little business doing in the ordinary shares of the Atlas Light and Power Company—the old Argentine Light and Power—and the price is 15s. 6d. middle.

Brussels has taken a violent fancy again to Brazilian Tractions, and, with Montreal also a supporter, the price rose 6 to 118. The advance has been consistent since the board notified its intention to oppose amalgamation in any form with certain other concerns. The preferred are strong at 108. Other Brazilian tramway issues are a good market, on the view that Brazil may be able to re-institute her sinking-fund in the early future.

London electricity supply shares are steady, but uninteresting. No change of any consequence has occurred in the price-list. Of the debenture stocks, South Londons are 1 higher at 97. The appointment of Sir Andrew Rae Duncan as Chairman of the Central Electricity Board has been received with favour. Sir Andrew was at one time Coal Controller, and subsequently had a good deal of experience in connection with coal-mining matters. Shanghai Electrics fell ⅛ to 38s. 9d. because of the present trouble in China. Shareholders in electric supply companies will observe with quiet attention that the Gas Light and Coke Company has reduced its dividend to £5 0s. 8d. per cent., against £5 2s. in the previous year.

Marconis touched 17s., to react to 15s. upon the announcement that the long-expected report is about to be handed to the sub-committee appointed to consider it.

Mexican utility issues remain dull, the Light and Power preferred, with a gain of 1, being the only shares in the group to show firmness. The U.S. Secretary of State at Washington has stated his belief that arbitration should be employed for the settlement of the dispute between America and Mexico. Amongst "dollar" stocks, Montreal Light has risen 4 points to 74½. Shawinigans are down to 277½. The Traction and Power Securities Company has decided to change its name to the Traction and General Investment Trust. The dividend of 14 per cent. on the ordinary stock is 1 per cent. higher than that of a year ago.

The Enfield Cable Works has announced an interim dividend of 5 per cent., the same as before, and the price of the shares is unchanged. British Aluminium shares are dull. Telegraph Constructions have gone up to 29¾. The manufacturing group is quiet, but attracts a fair amount of business. Rubber shares move within narrow limits. Engineering and the iron-coal division are disposed to harden, by reason of the cheery business outlook foreshadowed by various authorities in their recent speeches.

Share List of Electrical Companies.

	Nom.	Dividend. 1924.	1925.	Price Jan. 24 1927.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£1	14	14	60/9	+1/3	4 12
Brompton Ordinary	1	10	10	25/-	—	5 12 0
Charing Cross Ordinary	1	15	15	25/-	—	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	25/-	—	5 12 0
City of London	1	15	15	2⅛	—	... ...
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/6	—	5 12 4
County of London	1	15	15	27/6	—	... ...
do. do. 6% Pref.	1	6	6	23/-	+6d.	5 4 4
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	30/6	—	6 11 2
Kensington Ordinary	1	15	15	24/-	—	5 16 8
Lancs. Light and Power	1	7½	7½	24/-	—	6 2 5
London Electric	1	10	10	24/-	—	5 17 8
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	26/-	—	5 7 8
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary	1	7	7	20/-	—1/8	7 0 0
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	24/-	—	5 16 8
South London	1	15	15	24/6	—	6 8 0
South Metropolitan Pref.	1	7	7	1¼	—	6 8 0
Urban Ordinary	1	4	7	1⅝	—	5 17 11
do. 6 % Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	24/6	—	5 14 3
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	1	8	8	27/6	+6d.	5 16 5
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	70	—	5 14 4
Metropolitan	,,	5	5	64	—1	7 16 4
do. District	,,	8½	8½	57	—1	6 2 10
Underground Electric	£1	Nil	Nil	13/-	—6d.	Nil
do. do. Income	Bonds	6	6	104	—	*5 15 8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	101½	—	5 18 3
do. Def.	,,	1½	1½	25½	+½	5 18 10
Automatic Telephone	1	3	10	2⅝	—	3 12 9
Chili Telephone	5	5	6	6½	—	4 12 4
Cuba Sub. Ord.	10	5	5	7	—	7 5 6
Eastern Extension	10	10	10	17⅝	—	*5 13 4
Eastern Tel. Ord.	Stock	10	10	174½	—	*5 14 7
Globe Tel. and T. Ord.	10	10	10	18¾	—	*5 6 8
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	22	20	27	—	7 8 2
Indo-European	25	8⅓	10	47½	—	*5 5 10
Marconi	1	10	Nil	15/9	—1/-	... ...
Marconi-Marine	1	10	7½	1⅝	—1/16	6 6 4
Oriental Telephone Ord.	1	12	12	2⅛	—	*4 18 4
United R. Plate Tel.	5	8	8	8⅜	—	*4 15 6
Western Telegraph	10	10	10	17	—½	*5 17 8
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	5	5⅓	5⅓	2 13/16	—1/16	9 15 6
do. do. 2nd Pref.	5	6	6	2⅝	—	10 8 8
do. do. 5% Deb.	Stock	5	5	70½	+2	7 1 10
British Electric Traction Ord.	,,	7	8	144½	—	5 10 9
do. do. 6% Pref.	,,	6	6	109	—	5 10 1
Brazil Traction	100	4	5	118	+6	4 4 9
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	+2	5 11 9
do. do. Preferred	,,	96/-	136/9	121½	—	*5 3 11
do. do. Deferred	,,	129/5	8	152½	+1	*5 4 11
do. do. Deb.	,,	4½	4½	80½	+1	5 5 7
London & Sub. Trac. 5% Pref.	1	2½	Nil	7/-	—	Nil
London United Tram. Deb.	Stock	4	4	42½	—	9 8 4
Mexico Trams, 5% Bonds	—	5	5	64	—½	7 12 0
Mexican Light Common	100	Nil	Nil	32½	—	Nil
do. Pref.	100	Nil	Nil	77½	+1	Nil
do. 1st Bonds	—	5	5	63½	—	7 17 6
Yorkshire (West Riding)	1	5	—	12/6	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	12	13	58/9	—	4 16 8
British Aluminium Ord.	1	5	10	48/9	—9d.	4 2 0
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 18 8
British Insulated Ord.	1	15	15	70/-	—	4 5 9
Brush Ord.	1	10	10	26/9	—	7 9 4
Callenders	1	15	15	8½	—	4 5 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	84	—	5 19 1
Electric Construction	1	10	10	31/3	—	6 8 0
Enfield Cable Pref.	1	7½	7½	1¼	—	6 6 4
English Electric	1	5	Nil	15/-	—	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	28/6	—	5 10 8
do. Ord.	1	5	7½	31/6	—	4 15 3
Henley	1	16	20	4⅜	—	4 11 4
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1	—	*5 0 0
Johnson & Phillips	1	10	17½	2 1/16	—	5 19 1
Met.-Vickers Ord.	1	8	8	26/9	—	5 19 8
do. Pref.	2	8	8	2 5/16	—	6 18 4
Siemens Ord.	1	7½	7½	1 3/16	—	4 16 0
Telegraph Construction	12	20	10	29¼	+½	*4 0 8

*Dividends paid free of Income Tax

Britain's Foreign Electrical Trade.

Statistics and Comparisons.

HAVING received the Board of Trade returns for December last, we are now in a position to review the course of foreign electrical trade during the whole of 1926. Dealing first with the December figures, we note that although the export total was lower than in the preceding month, it was above that for the last month of 1925. As compared with November, there was a fairly general decrease; only four items rose in value, but these increases were more than counterbalanced by several large falls in other classes. The machinery section was about £90,000 down, and insulated wires and cables were also considerably lower in value. In comparison with December, 1925, the position was altered; the increases predominated, and there were only two notable decreases, one of which was in the case of submarine cables—that ever-varying item.

Imports were slightly higher than in November, although the decreases were equal in number to the increases. The most notable rise was in unenumerated electrical machinery (over £57,000), while batteries and accumulators showed the greatest decline. In the main, the comparison with December, 1925, shows similar results, but although unenumerated machinery was again the leading item so far as increases were concerned, batteries and accumulators recorded a substantial rise, and the greatest fall was in telegraph and telephone apparatus.

In both comparisons, re-exports for December showed increases, the outstanding items being rises in unenumerated goods and apparatus and telegraph and telephone apparatus.

Electrical Exports and Imports during December, 1926.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Dec., 1926.	Inc. or dec. as compared with Nov., 1926.	Inc. or dec. as compared with Dec., 1925.	Electrical imports for Dec., 1926.	Inc. or dec. as compared with Nov., 1926.	Inc. or dec. as compared with Dec., 1925.	Electrical re-exports for Dec., 1926.	Inc. or dec. as compared with Nov., 1926.	Inc. or dec. as compared with Dec., 1925.
Electrical goods and apparatus (unenumerated)	£190,030	— £2,160	+ £33,554	£122,666	— £2,613	— £8,159	£9,932	+ £3,360	+ £4,290
Insulated wires and cables ...	295 608	— 41,938	+ 42,194	56,518	— 1,135	— 17,641	469	— 80	— 192
Glow lamps	46,713	— 14,109	+ 6,424	41,856	— 3,479	+ 4,915	1,165	— 634	+ 740
Arc lamps and parts	725	+ 61	— 278	3,803	+ 2,535	+ 2,285	6	+ 3	— 6
Batteries and accumulators ...	104,527	+ 10,055	+ 29,390	67,178	— 34,825	+ 16,650	2,400	+ 1,978	+ 1,856
Meters and instruments ...	27,534	— 9,226	— 694	25,928	+ 6,036	+ 3,161	162	— 197	— 1 537
Carbons...	3,034	+ 1,328	+ 1,914	11,491	+ 1,800	+ 2,229	17	+ 1	— 437
Electrical Machinery—									
Electrical machinery (unenumerated)	259,556	— 28,278	— 41,479	145,790	+ 57,782	+ 43,484	7,698	+ 555	— 107
Railway and tramway motors	49,288	— 20,499	+ 3,538	—	—	—	—	—	—
Other motors and generators .	202,847	— 34,069	+ 5,214	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	7,387	— 256	— 1,713	800	+ 477	+ 575	—	—	— 30
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	73,802	+ 12,052	+ 11,008	11 871	+ 1,078	— 2,694	8	— 32	— 56
Submarine telegraph and telephone cable...	13,717	— 3,333	— 44,520	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	259,629	— 60,452	+ 42,433	52,968	— 12,635	— 17,968	7,130	+ 3,474	+ 1,718
Totals	£1,534,397	— £190,824	+ £86,985	£540,869	+ £14,991	+ £26,837	£28,987	+ £8,428	+ £6,239

Turning to the annual statistics, it will be observed that there was a definite improvement last year as compared with 1925. Exports rose in value by £636,764, while imports fell by £422,743. Thus the trade balance in our favour (ignoring re-exports) rose from £12,010,216 to £13,069,723—over £1,000,000.

In the export section, cables were responsible for the largest alterations. Insulated wires and cables increased in value by £681,148, while submarine telegraph and telephone cables declined by £771,715. Apart from these, the two most important changes were increases of £295,325 in telegraph and telephone apparatus and £220,410 in unenumerated electrical goods. The decreases, with the exception of submarine cables and railway and tramway motors (£58,141), were all of very small proportions.

With regard to imports, the outstanding feature of the year was a fall of £345,857 in the case of telegraph and telephone apparatus; this overshadowed the other decreases, although some of these were of substantial proportions (*e.g.* glow lamps £91,209). There were only two notable increases, the greater occurring in the case of unenumerated electrical machinery (£68,222).

The re-export list shows decreases mainly and a resultant fall of £24,804 in the total. As in the case of imports, unenumerated machinery showed the greatest rise, and telegraph and telephone apparatus the greatest fall.

Radio apparatus is not shown separately in our figures, but this was dealt with at length in a recent issue of the *Wireless Trader*. Our contemporary's figures show that there was a slight decrease in 1926 as compared with the previous year in the exports of radio apparatus and valves. The totals for the two years were respectively £1,266,384 and £1,289,749, a fall of £23,365. Re-exports were also lower, the value being given as £35,263, as against £45,338.

The curves which accompany these notes require little explanation. The first illustrates the course of our electrical exports during the years 1925 and 1926. In the former year the monthly fluctuations were not very

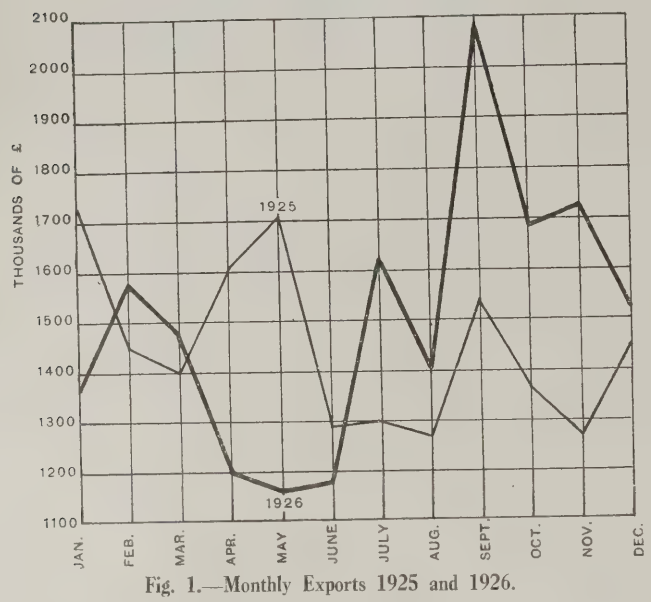


Fig. 1.—Monthly Exports 1925 and 1926.

great and the peak was reached in May. This month is usually a good one from the export point of view. In 1926, the variations were violent ones, and on account

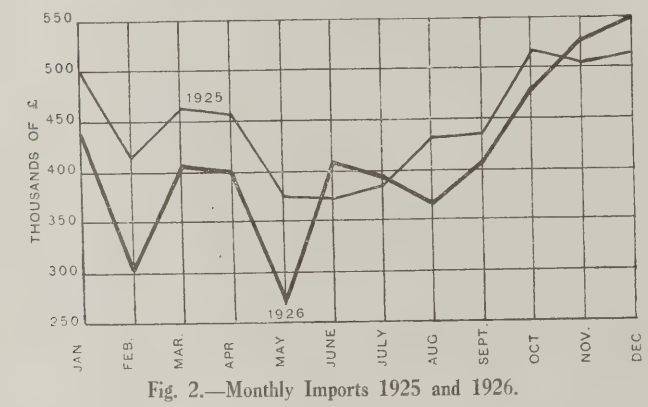


Fig. 2.—Monthly Imports 1925 and 1926.

of the general strike May was the poorest month. It is noteworthy, however, that in eight months out of the twelve, the 1926 figures were above those of the corresponding figures for the previous year. The import curves (fig. 2) reveal the reverse; for eight months the 1926 imports were below those for the corresponding months of 1925. With the exception of the large fall in May last year, and the reaction in June, the two curves are very similar. Fig. 3 deals with three leading export items; for convenience, the term "insulated wires and cables," has been made to include non-submarine telegraph and telephone cables. Submarine cables exhibit too abnormal fluctuations to be included in the figures. In two of the curves, the general strike period is very apparent; but in the case of unenu-

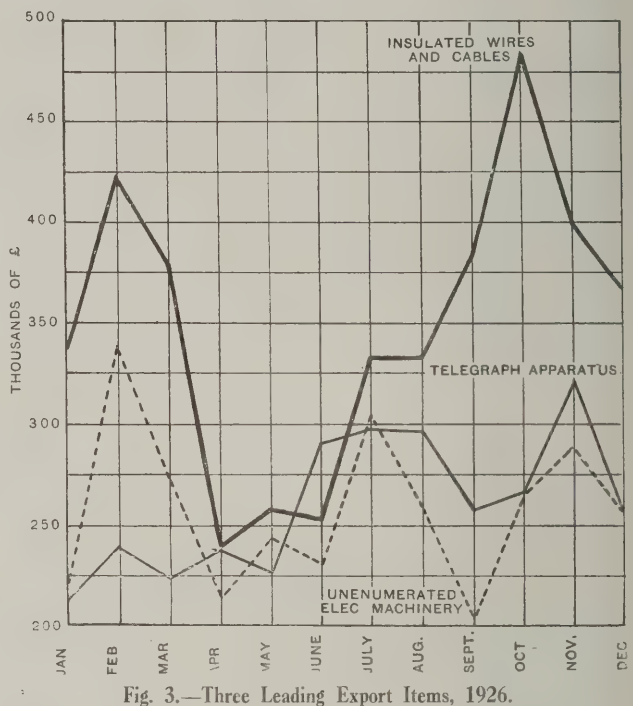


Fig. 3.—Three Leading Export Items, 1926.

merated electrical machinery, a slight improvement occurred in May, and the lowest level was reached in September. Insulated wires and cables, after falling a little from the May figure, rose rapidly up to October, but there was a rather sudden fall in the last two months of the year. The general level of telegraph and telephone apparatus exports was higher during the latter half of the year, the peak being reached in November.

Electrical Exports and Imports during 1925 and 1926.

	Exports.			Imports.			Re-exports.		
	Electrical exports, 1925.	Electrical exports, 1926.	Inc. or dec. in 1926 as compared with 1925.	Electrical imports, 1925.	Electrical imports, 1926.	Inc. or dec. in 1926 as compared with 1925.	Electrical re-exports 1925.	Electrical re-exports 1926.	Inc. or dec. in 1926 as compared with 1925.
Electrical goods and apparatus (unenumerated) ...	£1,825,255	£2,045,665	+£220,410	£1,186,731	£1,212,094	+ £25,363	£87,392	£73 395	—£13,997
Insulated wires and cables	2,665,445	3,346,593	+ 681,148	611,357	598,129	— 13,228	16, 87	15,117	— 1,070
Glow lamps	510,831	50 ,758	— 10,073	426,231	335,022	— 9 ,209	8 3 0	12,270	+ 3,960
Arc lamps and parts ...	16,312	9,634	— 6,678	16,025	21,457	+ 5,432	2,137	1,838	— 299
Batteries and accumulators	973,252	1,0 4.473	+ 41,221	637,860	652,718	+ 14 858	12.510	12,348	— 162
Meters and instruments ...	365,843	388,781	+ 22,938	270,468	219.389	— 51.079	11,351	7,994	— 3,357
Carbons	23,417	18,306	— 5,111	101,536	93,559	— 7,977	2,306	1,416	— 890
Electrical Machinery—									
Electrical machinery (unenumerated)	3,061,520	3,100,399	+ 38,879	1,084,559	1,152,781	+ 68,222	66,838	81,749	+ 14,911
Railway & tramway motors	545,632	487,491	— 58,141	—	—	—	—	—	—
Other motors and generators	2,155,179	2,229,180	+ 74,001	—	—	—	—	—	—
Switchboards (not telegraph or telephone) ...	88,155	84,782	— 3,373	1,784	2,127	+ 343	1,408	68	— 1,340
Telegraph and Telephone Cable and Material.—									
Telegraph and telephone wires and cable (not submarine)	705,357	823,290	+ 117,933	186,483	151,866	— 34,617	8,371	4,425	— 3,946
Submarine telegraph and telephone cable	1,601,401	829,686	— 771,715	—	7,006	+ 7,006	—	—	—
Telegraph and telephone instruments and apparatus...	2,831,331	3,126,6 6	+ 295,325	835,680	489,823	— 345,857	70,706	52,092	— 18,614
Totals	£17 368 930	£18,005,694	+ £636,764	£5,358,714	£4,935,971	— £422,743	£287,516	£262,712	—£24 804

Fig. 4 exhibits companion curves to those in fig. 3, upon the same scale, showing two further important export items. The heading "motors and generators," includes railway and tramway motors. The curve for these reached its lowest point in June, but made a rapid recovery, and after a slight set-back, continued upward until November, after which it fell to about the January level. The exports of unenumerated electrical goods showed smaller variations, and reached their nadir in May. The last set of curves (fig. 5) deals with the leading classes of imports, and here again the term "insulated wires and cables" includes non-submarine telegraph and telephone cables. All three curves reached low levels in May, but that showing unenumerated electrical machinery fell lower at two periods of the year. In all cases there was a swift recovery from the effects of the general strike, followed by a reaction and a further rise.

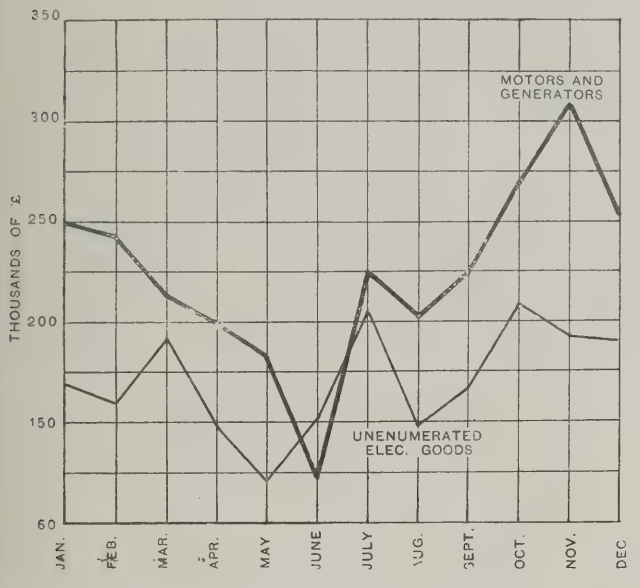


Fig. 4.—Two Leading Export Items, 1926.

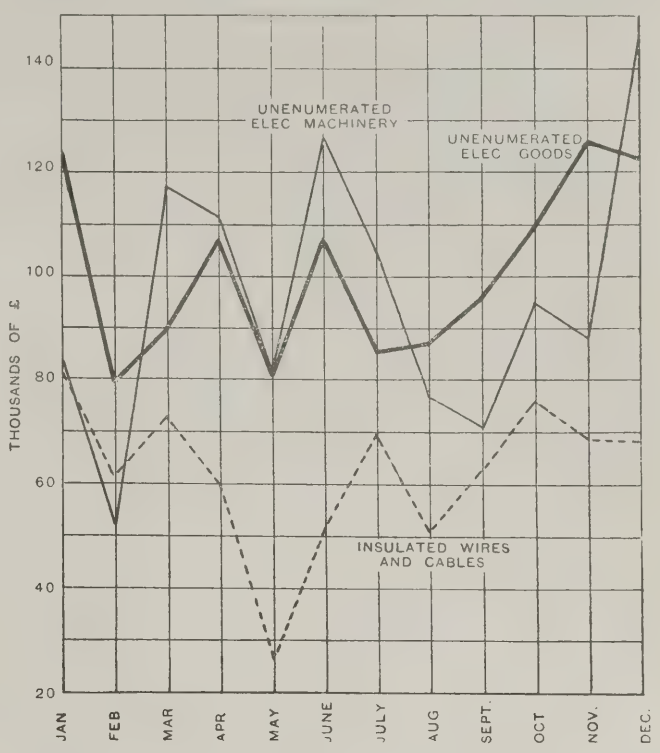


Fig. 5.—Three Principal Classes of Imports.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

(*Continued from page* 110.)

George Kent, Ltd.

Although not definitely electrical, the Kent rotary steam meter will appeal to power engineers, being of novel design. It consists of a fan which is driven round by steam passing through a shunt circuit, the speed of the fan being kept low by a damping chamber. The drive is taken out through a magnetic gland to a counter which reads direct in pounds of steam. The materials of which this meter is made are carefully chosen so as to withstand the corrosive action of steam, and we understand that meters of this pattern have been in use for 12 months without any loss of accuracy; they are essentially suitable for small mains.

Crompton & Co., Ltd.

The "Alltest" instrument, which was exhibited for the first time last January, has had improvements made to it, and the S.M.S. pattern hygrometer has been modified also; it depends for its action on the weight of a hygroscopic body attached to a gravity movement which operates a pointer that moves across the scale, which is calibrated to read from 0 to 100 per cent. humidity. The housing consists of a standard 6-in. dial instrument case, except that gauze sides are provided to allow of the easy entry of the outside atmosphere, which is, of course, essential to the correct reading of the indicator. An entirely new and improved pattern of single-phase, dynamometer type indicating wattmeter, wound for a current of 5 amperes and for any pressure range up to 150 volts, was shown for the first time. The current range, of course, can be extended in the usual way by means of current transformers, and the pressure range by means of external resistances.

The National Physical Laboratory has carefully tested these instruments, and a most satisfying report indicates that the instruments are absolutely independent of change of frequency or power factor. In addition, standard laboratory and test-room apparatus was shown.

Mullard Wireless Service Co., Ltd.

A complete series of "PM" receiving valves was on view; also low-impedance rectifiers for battery eliminators; high-power valves, including the metal-glass and silica types; and the Holweck molecular pump. Amongst the miscellaneous items was a selection of wire-wound anode resistances and grid leaks, and a piece of resistance wire carrying a continuous current of 8 mA. A short-wave oscillator was on view, employing two Mullard DO/40 valves, oscillating on a wavelength of 2.5 metres under working conditions. Two inductances were used, consisting of simple loops of wire joining in one case the anodes of the two valves, and in the other case the two grids; the mid-point of the anode loop was connected to the high-voltage supply, and the mid-point of the grid loop was connected through the grid-leak to the filament. The high-voltage supply was approximately 500 volts, obtained direct from a transformer. The oscillatory current was indicated by a single-turn loop of copper wire forming a circle of 6 in. diameter and including a condenser consisting of two copper plates 5 in. × 3 in. and about $\frac{3}{8}$ in. apart; a small pea lamp in this circuit was kept glowing by the oscillatory circuit. Visitors were able to observe the electron emission of a "PM" filament: a test board was so arranged that, on pressing a push button, the electrical circuits for heating the filament and measuring the total emission were completed; it was thus possible to observe the large emission from these very dull-filament valves. The company also showed one of its low-power rectifiers (the DU/10) working on a resistive load from the alternating-current mains at a voltage of 200, which was transformed to 4 volts for heating the filament; a d.c. output of about 70 mA at 70 volts was obtained, and the total input was roughly 12 watts, less than the power consumed by one average electric lamp connected to the domestic mains, the output being sufficient for running an average 3- or 4-valve receiver.

M.O. Valve Co., Ltd.

This exhibit showed considerable advances in technique and general design of the thermionic valves which the company manufactures. New patterns have been described in our pages recently, one of the latest being illustrated elsewhere in this issue, and finished products were to be seen on the stands of the company's selling agents. The displays embraced practically every type of valve, transmitting, receiving, and rectifying, which is marketed under the Marconi and "Osram" names, as well as some experimental types probably destined to be included in the wide range at a later date. Manufacturing apparatus and machines were shown; also various valves designed specially for operation at high frequencies, and a low-frequency oscillator was seen operating at approximately one cycle per second, showing cyclic variation of oscillatory current, &c.

Nalder Bros. & Thompson, Ltd.

The well-known "N.C.S." and "Ideal" electrical measuring instruments and protective relays were on view, including flame-proof instruments suitable for use in fiery mines; also rotary synchroscopes, circuit breakers, the "Ohmer" insulation testing set, current and potential transformers, and the Turner efficiency indicator, which is a combination of venturi meter and wattmeter for ascertaining the performance of steam turbo-alternators. We hope to say more about the company's latest developments in a later issue.

Dubilier Condenser Co. (1925), Ltd.

This large display included a variety of types of radio condensers and resistances. For smoothing in conjunction with thermionic-valve rectifiers, condensers of considerable capacity are required, capable of withstanding high d.c. voltages; they are fitted with safety spark-gap and discharging resistance to dissipate the energy of the discharge, and are supplied in two main types, the smaller being fitted in wax-filled wooden boxes, while the larger types are in oil-filled steel tanks. The latter type is also employed when the smaller units are required for operating in tropical climates.

The "Duwatcon" variable condenser is specially constructed to overcome the gap in the tuning range which exists when an ordinary type is used in the aerial circuit as a series-parallel condenser. The "Ducon" is a device which enables the electric lighting wires of flats, &c., to be used with safety for the reception of broadcast and other signals. The "Duvolcon" unit employs the same type of resistance as the "Duvarileak," but is intended for use as the means of controlling the volume of sound from a loud-speaker, or, alternatively, as a means of controlling reaction in a radio receiver. The "Dubrescon" protects the valves of a receiving set from destruction by accidental contact with the h.p. pins of the valve-holder or wrong connections, and a simple wavemeter for general experimental work utilises a neon lamp as resonance indicator, thus eliminating the risk of burning out the indicating lamp by excessive coupling to the oscillation circuit.

A compact arrangement of condensers in a metal box for eliminating radio interference due to sparking on dynamos, motors, &c., should be useful, while the "Hiloten" apparatus for supplying all the current required to operate a radio-receiver by direct connection to ordinary electric lighting mains is made in two models: one for use on d.c. and the other on a.c. circuits; this apparatus provides 6 volts with current up to 1.5 amps. and two or more h.p. voltages, one at least of which is continuously adjustable.

Siemens Bros. & Co., Ltd.

The Company's exhibits included a drum-type temperature recorder, which consists of a millivoltmeter calibrated as a temperature indicator, and recording mechanism driven by clockwork. The indicating pointer is fitted with a stylus near its outer end, which swings beneath a chopper bar that is depressed every minute, thus causing the pointer stylus to press down on the chart paper, and the successive dots, lying close together, give a graphical record of the temperature variations. With this arrangement the pointer swings perfectly freely, and there are, therefore, no errors due to friction. The recorder may be calibrated for use with either distance thermometers or thermo-electric pyrometers.

The temperature indicators shown were all of the moving-coil type, with a high internal resistance, so that variations in the resistance of the thermo-couples and connecting leads have little effect on their readings. They may be divided into two classes, namely, precision indicators and base-metal indicators. Often several thermometers or pyrometers are used in conjunction with a single indicator, and in such cases the indicators are combined with selector switches, which are of the press-button type, arranged in a circle; any thermometer or pyrometer may be instantly connected to the indicator by pressing the corresponding button. In the case of thermometer outfits, each selector switch has, in addition, one press-button marked "test," which is required for periodically testing the battery voltage; the necessary battery is contained in the switch case. A simple potentiometer for measuring the e.m.f. of thermo-couples has the following advantages:—It is substantially made and carefully calibrated; there is no mirror galvanometer, and therefore all readings can be taken in broad daylight. It can be easily and rapidly adjusted, and has five ranges, the change from one to the other being made by a simple movement of a lever switch; the accuracy of the apparatus is high, and the ammeter and indicator may be easily and rapidly checked against one another and against a standard cell; resistance of the thermo-couple and its leads does not affect the results when the "null method" is used.

Everett, Edgcumbe & Co., Ltd.

A wide range of electrical measuring instruments was, as usual, exhibited by this firm. Of the "Omni-Range" portable-current transformer a "precision" model is now available. The ratio and phase curves, fig. 16, for such a transformer, as designed for use with sub-standard wattmeters, &c., indicate that the change of ratio from rated current down to one-tenth of rated current is less than 0.1 per cent., and the phase displacement only about 2 minutes; even with a burden of as much as 20 volt-amperes, the ratio error does not exceed 0.2 per cent., or the phase displacement 7 minutes at any point within the range; such figures are believed to be unique. A 44-kilovolt bar-type current transformer was exhibited for a full-load current of only 120 amperes, in which the ratio error was no more than ½ per cent. and the phase displacement less than 90 minutes at any current down to one-tenth of full load. A current transformer having characteristics such as these enables power measurements to be made with accuracy, and yet has all the advantages of the straight-through construction.

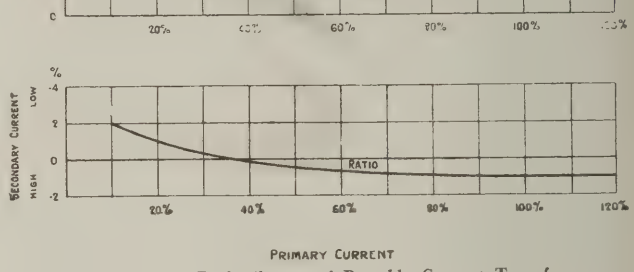


Fig. 16.—Phase & Ratio Curves of Portable Current Transformer.

The phase sequence indicator shown measured only 3 in. across, and consisted of a miniature three-phase motor provided with a rotating disk, which carries an arrow-head showing the order of phase sequence according to its direction of rotation; three spring jaws have merely to be clipped on to the three points to be investigated, and it can at once be seen whether the voltages are coming up in the right order. The windings on these instruments are such that they can be used on any voltage likely to be met with in practice, and those who have endeavoured to check the connections of a two- or three-element wattmeter, or of a power-factor meter, without the help of such an instrument will recognise how useful it will be.

A very compact testing set was exhibited which, although embodying two instruments only, enables a.c. current, voltage, and power to be measured. When a knob marked "amps" is depressed, the pointer indicates the amperes passing; when another knob marked "volts" is depressed, the pointer indicates the voltage between the terminals, and the wattmeter readings are independent of the position of the "volts" and "amps" press switch. These sets are available for single-, two-, and three-phase measurements at any frequency, and measure only 14 in. × 10 in. × 6 in.

Adam Hilger, Ltd.

In addition to optical devices, apparatus for X-ray crystallography and spectrography was exhibited, and also piezo-electric quartz oscillators for controlling radio-transmitters. The demonstration apparatus comprised an oscillating circuit with mounted crystal attached by flexible leads and an auxiliary generator, both of which were tuned to nearly the same frequency (6,666 kilo-cycles per second); the two circuits were loosely coupled together, and the difference in frequency gave rise to the beat note heard.

Weston Electrical Instrument Co., Ltd.

Dynamometer-type laboratory standard instruments with an accuracy of at least 1/10 of 1 per cent. either in d.c. or a.c. circuits of any frequency up to 133 cycles per second form very valuable transfer instruments from d.c. to a.c., and permit a.c. readings to be taken with a great degree of accuracy. Other items included fan-shaped d.c. switchboard instruments and regular type round and sector patterns; also a group of rectangular instruments for a.c. switchboards: the reduced space occupied is the principal feature of this design, and the pleasing appearance and bold scale are noteworthy features.

A new radio panel voltmeter 2 in. in diameter for use upon receiving sets is supplied in single and double ranges of exceptional sensitivity for such small instruments, namely, 125 ohms per volt; they are of the permanent-magnet pivoted

moving-coil construction. A new radio voltmeter, known as the "Pin Jack" and high-range stand are designed so that a radio panel may be fitted with jacks which are connected permanently to the filament terminals; the voltmeter can then be plugged into the pin jacks to measure the voltage at the filament terminals, the instrument having a range of 6 volts and a sensitivity of 125 ohms per volt. By plugging the instrument into the high-grade stand provided, an additional range of 200 volts is obtained for the measurement of anode voltage.

Stonebridge Electrical Co., Ltd.

Besides such items as universal precision instruments, multi-range current transformers and recording power-factor meters (all portable), electrostatic voltmeters for pressures up to 400,000 V are marketed for continuous insulation check, and are frequently combined with an electrical distance indicator on the main switchboard.

An electrical distance indicator and recorder of angular displacement, which is independent of supply pressure variations, has a continuous scale, and employs no step resistances, is suitable as an indicator of the position of turbine valves, discharge and throttle valves, switches, automatic discharge apparatus, water sluices, for indicating fluid level and flow, radio goniometers, &c. Movement is transmitted through suitable gearing to a small spindle projecting from the case of the transmitter; in the latter the magnetic field of a moving coil produces an e.m.f. which influences the position of the moving-coil system in the receiver instrument definitely and continuously, and by suitable regulation of the field current, angles smaller than 90 deg. can be amplified on the indicating instrument to the full available scale angle of 90 deg. For angular displacements of more than 90 deg. reduction gearing (spur, or worm wheels) are inserted between the coupling spindle of the transmitter and the object the angular displacement of which is to be measured, in order to reduce the latter on the transmitter to 90 deg.

Creed & Co., Ltd.

Besides the Murray multiplex printer for Government telegraph and Press service, the Company had a direct printer (start-stop system) on view, which should be of interest to large engineering and other concerns in that it offers, it is claimed, more efficient service than the telephone for intercommunication purposes. It is suitable for the direct communication of telegrams between large business houses and the nearest head telegraph office, thus effecting great economy in time, and it is also suitable for communication between offices and works, or between distant departments. The direct printer has advantages over the telephone, some of which are: A printed record is made of each message at both the transmitting and receiving ends of the line; in the case of transmitted figures, confusion cannot arise between fives and nines, &c. Messages are automatically received on the machines, and remain there until they can receive attention. Telephone messages often arrive when the person at the receiving end is in the middle of other important work, leading to delay, confusion, forgotten messages, or illegible writing, if the message is recorded hurriedly by hand. The printer can be installed in the noisiest workshops, where telephone messages could not be heard, and the apparatus is also ideal for railway telegraphy, and is soon to be installed for one of the largest British railways, we understand.

M-L Magneto Syndicate, Ltd.

Portable peak-voltage measuring devices were shown designed for use particularly when peak values take the form of impulses of relatively short duration, as compared with the time intervals which separate them. Under such conditions the energy available at the moment of occurrence of the impulse is usually small, and it is important that the capacity and energy consumption of the measuring apparatus shall be reduced to a minimum, so as to avoid disturbing the characteristics of the circuit to which it is connected. Two forms of apparatus were exhibited: one suitable for impulsive peaks up to 300 volts, the other for from 2,000 to 15,000 volts. Both forms employ in the first instance a two-electrode rectifying valve and a small condenser charged through the valve to the maximum voltage occurring in the circuit to which it is connected, and the voltage across the condenser is then measured in the first type of apparatus by sharing the charge of the small condenser with a larger one, which controls the grid potential of a three-electrode valve. Measurement of the current in the plate circuit with a definite plate potential gives the grid potential, and hence the potential to which the condenser has been charged. In the second type of apparatus the condenser is shunted by a calibrated spark gap between two brass balls 20 mm. in diameter; one of the balls is fixed, the other adjustable through the medium of a cam fixed on a shaft, which also carries a graduated dial; by suitably shaping the cam, even calibration of the dial is obtained. Each type of apparatus is mounted in a wooden case about 9 in. cube, which also contains the accumulator for heating the filament, and in the first type of apparatus a small motor generator for supplying the plate current.

(*To be continued.*)

High-Voltage "S.L."-Type Cables.

33,000-Volt Cables with Metal-sheathed Cores, each of which is Separately Lead-covered.

By P. DUNSHEATH, O.B.E., M.A., B.Sc., M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

DURING the past few years the use of 3-core cables for voltages higher than about 22,000 has introduced new and uncertain factors into the field of underground electric transmission; 33,000-volt cables have caused a good deal of anxiety to cable manufacturers and cable users, and the failures which have occurred have involved both sides in financial loss, besides introducing too frequent interference with the continuity of supply on large systems.

The outstanding feature of the breakdowns is the long period which elapses after the cables have been brought into use before failure occurs; the majority of the failures occur during times of light load on the cables. Various explanations have been advanced, but the most probable one seems to be closely associated, though not identical, with that which was first advanced by Hochstädter and supported by more recent investigators. Hochstädter attributed the failures to tangential electrical stresses in the outer layers of the core dielectric; impregnated paper has a higher electric strength in a direction perpendicular to the surface than along the surface, and this would seem to justify the tangential-stress theory, which, however, is not quite sufficient to explain what occurs. It is a common experience, for instance, in examining a piece of cable which has failed under the conditions stated, to find a large proportion of the length still in perfect condition, with no sign of deterioration, although the tangential stresses, on the theory named, must be the same throughout.

If we supplement the tangential-stress theory by considerations of the ionisation of air, or other gas, in a space within the dielectric under stress, then we approach more nearly to an explanation which will cover the recorded phenomena. In other words, if the dielectric is subjected to tangential stresses at a point where the space which should be filled with oil contains air instead, then an electrical discharge may occur over the surface of the paper which will result in the slow destruction of the paper fibres and ultimate total failure of the cable.

The presence of spaces devoid of insulating compound between the cores of a 3-core cable may be accounted for by one or more of the following reasons:—(1) Faulty mechanical construction; (2) imperfect impregnation; (3) distortion and separation of the cores by mechanical stresses during laying; and (4) separation of the cores by thermal expansion during heating under load.

Several suggestions have been made for the design of a 3-core cable in which this destructive action could be pre-

vented. In 1914 Hochstädter took out a patent for covering the individual cores with a tightly-adhering conducting film, so as to level up the distribution of potential in the direction of the layers; later he protected the manufacture of a perforated metallised paper for use as the conducting film, and many cables have been made in which the impregnation has been carried out after the application of this type of coating.

In comparing the relative merits of plain 3-core cables and those with metal-sheathed cores for use at a working pressure of 33,000 volts, it must be admitted that, as regards reliability in operation, the metal-sheathed type has many advantages and practically no disadvantages. The advantages may be summarised as follows:—

(1) The long-time failures experienced on plain 3-core cables have been found to originate in core-to-core faults, not between core and earth; the metal-sheathed-core cable has a larger core-to-core thickness for a given diameter of cable than the plain 3-core type.

(2) The presence of the metal sheath prevents direct core-to-core faults, and in case of failure from any cause the breakdown takes place to earth, which is an advantage from the operation point of view; the fault current can be limited by earth resistance in the neutral.

(3) The electric stress is uniformly radial in all parts of the dielectric and consequently normal to the surface of the paper.

(4) The whole of the dielectric subjected to stress is homogeneous; there are no wormings or packings in the electric field.

(5) Separation of the cores by mechanical distortion of the cable, or by thermal expansion, cannot introduce voids into the dielectric under stress; should the cores become separated from one another by a small fraction of an inch from any cause whatever, the conducting sheath moves with the core, and the space that is formed is outside the field and out of contact with the dielectric.

(6) The metal sheaths facilitate the carrying of the heat away from the centre of the cable, which is the hottest and, therefore, the most dangerous part.

The only practical disadvantage that can be advanced against the metal-sheathed-core cable is that it has a slightly higher inductive capacity than the plain 3-core type. On modern systems, however, this is not a serious point, as the charging current on no-load helps to neutralise the magnetising current of large connected transformers, and on load the leading current is soon lost in connected plant with lagging power factor.

(1) In the S.L. type large-diameter lead tubes are avoided: in view of the plastic nature of lead and the necessity for bending, this results in a better mechanical construction; for a given overall diameter of cable, a given amount of bending results in less distortion of the lead sheaths in the S.L. type than in the other forms of metal-sheathed-core cables.

(2) Owing to the greater mass of metal surrounding the individual cores, the cooling effect and consequently the current-carrying capacity is greater for the S.L. type than for the others.

(3) For use in hilly country, where there may be a considerable head of oil in the cable, the S.L. type with its small-diameter lead sheaths and absence of worming spaces filled with oil has obvious advantages; the whole of the oil inside the lead sheath of the S.L. type of cable, being in contact with the laminated dielectric, is less liable to flow than when it is not so supported as in the non-S.L. type.

(4) The S.L. type makes possible the use of longitudinal steel reinforcing strands, or pilot cables, in the scores between the cores and outside the dielectric.

(5) The S.L. type permits of freer impregnation; each core is impregnated separately, instead of all three cores with their wormings being treated together as in the non-S.L. type.

To illustrate the mechanical advantages of the S.L. cable, a length with the section shown in fig. 1 passed unharmed through a bending test that would have ruined a non-S.L. cable of the same overall diameter. The standard B.E.S.A. test is 6 turns round a barrel 12 times the diameter of the cable, but the S.L. cable was bent the standard number of times backwards and forwards on a barrel only 9 times its own diameter, and the resulting distortion was negligible; a length of plain 3-core, 33-kV cable subjected to the same test suffered considerably. The S.L. type was then subjected to tensile tests, and on a 7-yard length, the three cores being gripped at one end and the three strands at the other, a pull of 1½ tons was required to withdraw the strands. In another test the reinforcing strands were gripped at both ends, the cores being left free, and a pull of 4 tons applied for 15 minutes; the cores did not suffer in any way, showing no sign of corrugation or distortion.

A disadvantage claimed against the S.L. type of cable is the presence of undesirable currents in the lead sheaths, owing to their enclosing the separate conductors and being cut by the rotating magnetic flux. The sheaths may be insulated from one another, in which case it is sometimes

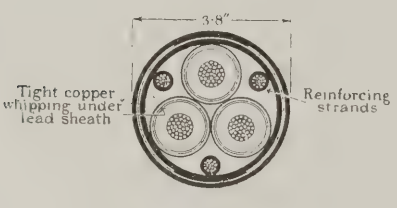


Fig. 1.—SL Steel-Tape-Armoured Cable with Reinforcing Strands.

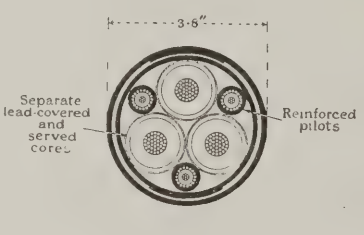


Fig. 2.—SL Steel-Tape-Armoured Cable with Armoured Pilots.

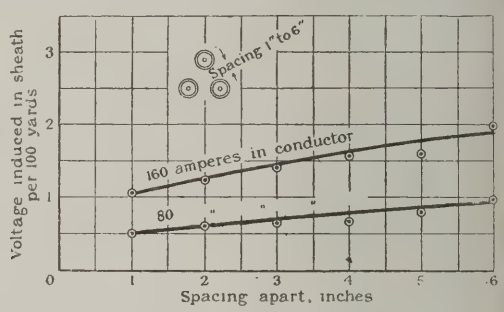


Fig. 3.—Induced Voltage in Sheaths of Three Single-Core Cables.

The various types of metal-sheathed-core cables can be divided into (*a*) cables with a common lead sheath over the assembled cores which are laid up before the impregnation process is carried out, and (*b*) cables in which the individual cores are dried, impregnated and lead-covered before being laid up; this type has no enclosing lead sheath over the assembled cores. The claims of the second type of cable (the S.L. type) for use on 33,000-volt systems were first advanced by the author in a discussion before the Institution three years ago, and since that date he has carried out extensive experiments to resolve certain questions of supreme importance in deciding on the suitability of this type for general use.

Figs. 1 and 2 illustrate two designs of S.L. cable. In the former, three separately lead-covered cores are laid up together with packings to a circular formation for taking the two coats of steel-tape armour with beddings and servings. In order to give the cable longitudinal strength while retaining the maximum flexibility, three steel reinforcing strands are laid up in the spaces between the cores as shown. In the second design, shown in fig. 2, advantage has been taken of the opportunity which this construction affords of housing pilot cores under the one common armouring with the main cores and inside the reinforcing strands. Another feature of importance illustrated in the first figure is the employment of a tight whipping of copper tape over the core papers immediately under the lead. This provides mechanical support to the papers, strengthening the cores and keeping them circular without depending on any restraining effect of the lead tube.

Briefly the relative merits of S.L. and non-S.L. metal-sheathed-core cables can be studied by stating the advantages and disadvantages of the first over those of the second:

stated that dangerous voltages may exist between them, resulting in sparking across and pitting of the lead. If they are bonded together, the circulating currents cause loss of energy and by their heating effect reduce the current-carrying capacity of the cable. It is shown that the voltages generated are very small, that they can be suppressed by bonding the three sheaths together at the ends, that when the sheaths are bonded in this way the sheath losses are negligible, and that the presence of the separate sheaths, instead of increasing the temperature-rise and cutting down the current-carrying capacity of the cable, has the opposite effect to a very marked extent.

In the first investigation three lengths of single-core lead-covered cable were laid parallel to one another on a wooden floor supported by wooden blocks in triangular formation at various distances apart up to 6 in. The induced voltages observed between two lead sheaths at the near end with the far ends bonded for various distances apart are plotted in fig. 3. It will be seen from the actual measured voltage in the sheaths that if three such cables were laid up closely to form a 3-core cable of the S.L. type and the sheaths left unbonded, except at one end, the voltage generated in the individual sheaths would have a value not more than 0.5 volt per 100 yards for every 100 amperes flowing in the main conductor. For 100 amperes in the main conductor the total sheath loss would be about 20 watts per 100 yards; expressed as a percentage of the copper loss, this amounts to about 3 per cent. (*To be concluded.*)

Discussion in London.

Mr. C. J. Beaver initiated the debate by referring to the causes of cable breakdown, remarking that the tangential stress itself was within the factor of safety of the dielectric, the real

danger being the presence of air in the cable. The author had described methods of construction, not manufacture; the "English thing" to have done would have been the examination of methods of preventing the occlusion of gas, his main point being that whatever risks were associated with cables at the lower voltages were increased as the dielectric was increased in thickness. Another way of attacking the problem, which was not new, however, was to pass the sheets of paper individually through the impregnating machine and then cut them up and apply them to the cable in the treated form: each piece and every part of the paper was thereby subjected to the same treatment, and that method allowed of the use of the most suitable compound for impregnation. The next inquiry was how to apply the paper to the cable so as to exclude air? They did that by submerging the whole cable in a bath of impregnating compound while the insulation was being applied: that was an efficient method, and the constituency of the liquid determined the separation of the layers of paper. He laid stress on the dielectric properties because the author had not mentioned them. Economic considerations influenced matters considerably, and the exercise of care was accordingly needed so as not to allow oneself to be carried away by comparisons.

Major A. M. TAYLOR thought figs. 8, 9, and 10 were particularly instructive. From fig. 8 with direct current the temperature of the copper conductor was only 37 deg. C. at 300 amperes, and with a 50-cycle alternating current it was 30 deg. C. at the same current. The mean sheath temperature, however, was 31 deg., as against 28½ deg. with d.c., a rise of 2½ deg., possibly due to the eddy-current losses in the lead sheathing. He suggested that there was a discrepancy between figs. 8 and 9 which indicated that one must only regard those temperatures as rough approximations. On the other hand, the results in fig. 10 which gave a conductor temperature of 50 deg. C. at the same current as before, and a sheath temperature of 23 deg. C., were a most eloquent testimony to the better dissipation of the heat from the copper in the "S.L." cable, as compared with that of an ordinary plain 3-core cable. For an equal conductor temperature of 35 deg. the relative carrying capacities were: plain 3-core cables 227 amps., "H" type 240 amps., "S.L." type 263 amps., from which, according to Dunsheath's experiments, the "H"-type cable had an advantage in current-carrying capacity of 6 per cent. The author's conclusions as regarded the greater dissipative capacity of the "S.L." cables would appear to be warranted by fig. 11, which showed that the "S.L." cable passed 16 per cent. more current (34½ per cent. more heat) than the plain 3-core cable, and 9½ per cent. more current (20 per cent. more heat) than the "H"-type cable. From which it would appear that the heat dissipative capacity of the Henley cable was no less than 34 per cent. in excess of that of the plain 3-core cable. The author had not done full justice to the single-core cable, because he had not put the two lead sheaths in immediate contact; his losses were far in excess of those that would actually occur, deduced from Prof. W. Cramp's formula. However, taking his figures, he made out an advantage of 6 to 8 per cent. on the cost in favour of the "S.L." cable. The speaker believed that it was possible to obtain 25 per cent. more current-carrying capacity out of single-core cables than the author had assumed, which would turn the balance the other way. The employment of 66,000-volt single-core cables at Paris and Newcastle appeared to be quite satisfactory.

Mr. S. W. MELSOM thought the paper a difficult one to discuss. It might be divided under three headings: conjecture, theory, and experiment. They had had enough of the first already, except that the author had hardly pointed out all the factors which influenced cable failures. Tests on cables immersed in water would not indicate the results obtainable when they were buried in soil. How far was the increased current-carrying capacity due to the "intersheath" and how far to difference in dimensions? That was a point on which figures were required. With regard to sheath losses, he agreed with the author's remarks.

Mr. T. N. RILEY expressed surprise that the author had referred to thermal and mechanical characteristics only, and not to electrical ones, for electrical tests were the only ones which revealed the true conditions. Initially perfect impregnation did not settle the matter, as it did not obviate the effects of expansion and contraction on cooling. He differed violently from the author's comparison of "SL" and "H" type cables: when laying-up 3 cores they underwent very severe handling, and the steel-tape armouring which held the 3 cores together bore on one point of each only, so that it was not a good mechanical arrangement. He agreed that better cooling resulted, but it was only 2 per cent., which figure was within the experimental error margin. In hilly country, "SL" cable would have no real support against hydraulic pressure, since again only 3-point support was provided. Although the arithmetic might be simple, there was considerable controversy as to which was the correct method of calculation. Major Taylor's sympathy, he hoped, would not take too practical a form, because there were two ways of making high-voltage cable: one was to make it precisely similar to 11,000-volt cable, and hope for the best, while the other involved spending some money on research in the factory before commencing to manufacture.

Mr. J. K. WEBB referred to sheath circuit losses and Prof. W. Cramp's analysis of the subject. The fierce integral in the author's formula could not be solved, but Prof. Cramp had worked out an example for the worst case, and he found that if the figure "3" were substituted for it the result would be adequate. The divergence between the author's and Dr. Cramp's formulæ was important.

Mr. F. C. RAPHAEL said that he had finished reading the paper strongly in favour of it; the author had done much to reassure them. With regard to longitudinal sheath currents, however, if a fault occurred at one end of the cable would it not be just possible for the cable to be stripped for some length?

Mr. E. BOWDEN thought it a great step forward to have heard it admitted that all was not well with high-voltage cables. Now that they were coming out into the open England might regain her leading position as a cable manufacturer. Impregnation did not present any real difficulty; if any were experienced, it could be got over. If the cores did separate when heated under load, that occurrence could never be avoided altogether; the facts of distortion by mechanical stresses during laying, and the separation of the cores by thermal expansion must be faced. The remedy was to let them distort, and therefore to keep the cores apart: most problems were solved by experience. He had a natural prejudice against internal pilot wires, as it was obviously desirable that the protective devices should be kept as far away as possible from the cables they were intended to safeguard.

Mr. A. RUSHTON was of the opinion that the sheath losses in "SL" cable were low because of the presence of the copper whipping under the lead sheath (figs. 1 and 2). He compared heating curves, drawing attention to a 2 or 3 deg. difference of temperature, and asked whether it might be due to test errors.

The PRESIDENT (Dr. W. H. Eccles), on account of the lateness of the hour, asked others who had intended to speak to send their contributions to the discussion in writing for publication in the I.E.E. *Journal*, and then called upon the author to reply.

Mr. P. DUNSHEATH, remarking that he must be brief, said that all agreed, of course, that the less air was permitted to remain in a cable the better; but when stresses were discussed, he disagreed with most speakers. Who knew what the stresses in a 3-core cable really were? No one knew. The copper tape was applied for certain reasons, but it did not affect the losses. Concerning Mr. Raphael's question, if an "SL" cable failed under large out-of-balance conditions, the same conditions would prevail as those experienced in Paris, and they had had no trouble there. The sheath current was very small in comparison with the conductor current. He agreed that if the figure "3" could be substituted as suggested in the formula, it would be a step forward. Regarding the accusation of indulgence in conjecture, the paper showed that he had supported most of his statements by facts.

Magnetic Testing of Wire Rope.

In a publication issued by the U.S.A. Bureau of Standards, Technologic Papers, No. 315, April, 1926 (10 cents), some details are given of the research work which has been carried out by the Bureau on the testing of wire hoisting rope by magnetic analysis. The investigation has been of a fundamental nature, consisting of a study of the magnetic properties of steel wire of the kind used in the manufacture of wire rope, and the effect on them of deterioration due to various causes, such as stress, wear, and fatigue. The work did not result in the development of a magnetic device for testing purposes, although much experimental apparatus was used. Certain definite results were obtained, however, which have an important bearing on the subject.

The Electrodeposition of Rubber.

Last year, Dr. S. E. Sheppard, of the Eastman laboratories, published the first announcement of his success in the electrodeposition of rubber. On October 28th there was formed at Akron the American Anode, Inc., by the B. F. Goodrich Co., the Eastman Kodak Co., and Anode Rubber Company, Ltd., of Great Britain, for the purpose of manufacturing rubber articles in America under processes patented by Dr. Paul Klein, of Budapest, and Dr. S. E. Sheppard and Dr. L. W. Eberlin, of the Eastman laboratories. The processes involve methods of compounding, milling and vulcanising rubber.

"Under the new processes," one expert said, "the principle involved is the deposition of rubber on the anode of an electric circuit, the anode serving as a mould or form. Methods of suspending compounded ingredients in the latex electrolytic solution also have been perfected and patented, as well as means for maintaining a constant concentration of the mixture."

It now is possible actually to rubber-plate moulds of any shape with rubber of tissue-paper thinness to several inches thick, Goodrich experts say. Arrangements already are being made with insulated wire makers to use the new process in insulating electric wires more speedily and with a far stronger coating.

Rubber bands no thicker than a thread have been manufactured under the new process, and have been found to be so much stronger than ordinary bands as to defy breaking by the bare hand. Other articles, such as thin tobacco pouches, gloves, and hot water bottles, similarly have been found to possess far greater strength and resiliency.—*Science*.

According to *Nature* of January 22nd, it is understood that the Dunlop Rubber Co. has acquired the British rights.

A Large Electrical Export Organisation.

The General Electric Co.'s Facilities and System.

OCCUPYING as it does a leading position among exporters of electrical merchandise, the General Electric Co., Ltd., has built up a very efficient organisation for dealing with the shipping of goods to overseas destinations. In the early days of the company, although the export business was not large, the special arrangements which were necessary led the company to place that branch of its activities in the hands of a special staff. This in itself increased export business, for customers found that their



Fig. 1.—A Large Shipment of G.E.C. Products.

orders were attended to with accuracy and dispatch. Another aid to such business was the circulation of the Company's complete bound catalogue, which was soon recognised as the electrical buyers' *vade mecum*. In the course of a few years the overseas trade has reached gigantic proportions; a concrete example of this development is depicted in fig. 1, which shows a recent shipment to Australia by the steamer *Jervis Bay*. This comprised no fewer than 646 packages destined for various cities of the Commonwealth. Fig. 2 shows the large export depôt at Magnet Wharf, Silvertown, which is most conveniently situated for the dispatch of goods to any of the London docks. Spacious as this depôt is,



Fig. 2.—The Magnet Wharf Export Depôt.

however, it can only deal with a small proportion of the goods exported from the G.E.C. factories, and large shipments are sent daily straight from the works to outgoing steamers. Recently 150 tons of mining machinery for Canada was thus shipped from Liverpool in one lot. This was part of an order for two electric winders (2,450 and 1,400 h.p.), which was obtained in the face of American competition.

Magnet Wharf has every facility for handling large shipments. It possesses a convenient frontage on the Thames and a large railway siding, and is in a position to handle traffic between British ports. Every consignment from the depôt to the docks is accompanied by a special representative with experience in handling the goods, which ensures their arrival in first-class condition.

The Electrical Contractors' Association.

Annual Dinner.

ON January 18th, the Electrical Contractors' Association (Inc.), the N.E.C.T.A., Ltd., and the National Federated Electrical Association, held their annual dinner at the Trocadero, W. There were about 240 members and guests, including many leaders of the electrical industry, and Mr. H. J. Miles (president) occupied the chair.

Col. WILFRID ASHLEY, Minister of Transport, was the principal guest, and in proposing the toast of "The Allied Associations and Honorary Officials," which he professed not to comprehend, he said that during the past two years he had enough of electricity. Now, happily, the Electricity (Supply) Act had been passed and he was sure that it would be considered an excellent measure. Whatever they thought of it they should endeavour to make the best of it, as good citizens, for it was the law. He was very glad that the contractors and municipalities had arrived at an agreement with regard to the sale of fittings, &c. A continuance of the dispute would have led to nothing. After all, their differences were not really so great as was supposed; the main object of both parties was to serve the public. The agreed clause was fair alike to contractors, municipal authorities and consumers. The Government had not rushed into the Electricity Bill without great consideration. The question of reorganisation of the electricity supply industry had already been studied and reported upon by previous committees, but the Government appointed a further businesslike committee to deal with the matter, and that committee's findings, with one important exception, had been adopted practically as they stood. The Act was not a Party measure, as had been proved by the opposition to it of some of the Government's own supporters. The Government was satisfied that the Central Electricity Board, when functioning, would do much for the industry. He had received many letters offering the writers' services to the Government; one gentleman's qualifications were the successful organisation of Scout jamborees. He hoped to announce the names of the chairman and the board shortly. Apart from the generation of electricity, however, merchandising, propaganda and selling had to be improved, for they were of equal, if not greater, importance. The electrical industry had still something to learn from the gas industry, which knew how to push its wares very successfully. If the new Act cheapened electricity and the contractors did their part in development, we would soon be able to look the whole world in the face. Electricity should not be a rarity but a commonplace in the home. In conclusion, Col. Ashley referred with approval to the work which was being carried out by the Electrical Association for Women.

Mr. H. J. MILES responded to the toast and said that although the Association had done important work in the past quarter of a century, there was much more important work ahead. Contractors had found that union was strength, and so had other branches of the electrical industry. It had been the endeavour of the E.C.A. to bring all these branches together in order to discuss problems which affected them all. The conferences which had led to the formulation of the "agreed clause" had done a great deal to further that object. The agreed clause was not the only outcome of the conferences; they had also brought about a feeling of co-operation and goodwill which did not exist before. Mr. J. Y. Fletcher had said that the E.C.A. had raised its status in the eyes of all branches of the industry, especially the I.M.E.A. From being a business conducted separately by individuals, electrical contracting had grown to be a national industry, and their Association had to face that altered state of affairs. They realised that their prosperity was bound up with that of other sections of the industry and that they could not play a solitary part. They stood at the dawn of a new electrical era, and, he hoped, a new industrial era. Prosperity could only be attained by negotiation, compromise and goodwill. While the speaker agreed that wiring costs had to be reduced, he said that it was of no use providing a full installation, however cheaply, if the price of energy was not such as to enable the consumer to use it. So long as the present competition among contractors prevailed, the public had no cause for fear, but they must be upon their guard against shoddiness. He hoped that the Commissioners would be able to afford a little time to deal with that question. He believed that all responsible contractors would welcome compulsory wiring regulations. At present, however, the E.C.A. could not pin its members down to the I.E.E. Rules while others were allowed to do as they liked. A good and safe installation need not be more costly, however. He thought that supply engineers would find it difficult to reconcile the cost of hiring schemes with a low energy cost. Such schemes should be confined to the larger appliances and the smaller houses, and should only be run on a paying basis. It had been asked why the Association had not a membership of five or ten thousand, as there were understood to be that number of contractors in the country. His reply was that the Association was only open to honest men possessing reasonable resources and qualifications. He urged manufacturers to be careful in their dealings with so-called electrical contractors.

Mr. T. E. ALGER proposed the health of "The Guests."

He said that there was an insistent call for standardisation, but that was impossible without regulations. He considered that safety in the home was of greater importance than safety in factories and mines. He referred to the presence of Mr. P. J. Hannon, M.P., a staunch supporter of private enterprise, and Sir Hugo Hirst, and congratulated Sir Duncan Watson upon his knighthood. The Association was particularly glad to welcome Messrs. Phillips, Robinson and Cramb as representing the I.M.E.A. Mr. Alger paid special tribute to Mr. D. N. Dunlop (B.E.A.M.A.), who had presided over the conferences between the contractors and municipal authorities, and had rendered excellent service.

Sir HUGO HIRST, Bt., in reply, said that although the General Electric Co., Ltd., now had many large departments, it still kept in close touch with contractors through its domestic appliance business, and he welcomed the agreement which had been come to. The future depended to a great extent upon the skill and enterprise of electrical contractors. The latter did not always have sufficient capital to finance big developments, but in conjunction with the supply authorities important work could be carried out.

Mr. P. J. HANNON, M.P., who also replied to the toast, expressed his disappointment at the fact that Col. Ashley had not announced the names of the Central Electricity Board. Although he had opposed the Bill during its passage, he thought that it was now the concern of every citizen to make the Act a workable instrument of progress. It was part of the work of the contractor to cultivate public opinion so as to realise the utmost benefits of the Act. Referring to the manufacturing side, Mr. Hannon said that during 1926 we imported electrical goods to the value of £3,000,000. If our electrical industry had been properly safeguarded against unfair foreign competition, more work would have been available for the industry. Although a protagonist of private enterprise, he recognised that municipal supply authorities had done valuable work.

Mr. R. W. L. PHILLIPS, who also made a response, expressed his appreciation of the work done in the cause of agreement by Messrs. Alger, Cramb and Dunlop.

Mr. W. R. RAWLINGS proposed the toast of "The Electrical Trades Benevolent Institution," and Mr. J. Y. FLETCHER replied.

The proceedings concluded with a toast to the chairman, proposed by Mr. H. J. GALLIERS, to which Mr. Miles briefly responded.

Institution of Electrical Engineers.

Annual Dinner of the North-Western Centre.

THE annual dinner of the North-Western Centre was held on January 18th, at the Midland Hotel, Manchester, the chairman of the Centre, Mr. W. J. Medlyn, presiding. About 270 members and friends were present, and the guests included Dr. W. H. Eccles (president of the I.E.E.), the Lord Mayor of Manchester (Alderman J. H. Swales), the Mayor of Salford (Alderman J. Rothwell), Viscount Wolmer, M.P. (Assistant Postmaster-General), Mr. E. A. Radford, M.P., Mr. E. B. Fielden, M.P., Dr. S. L. Pearce, Col. T. F. Purves, Sir Benjamin Longbotton, and Sir Edwin Stockton.

The toast of the "Cities and Trade of Manchester and Salford" was proposed by Viscount WOLMER, who said the election of Mr. Medlyn to the chairmanship of the Centre was much appreciated as an honour conferred on the Postal Service. The Postmaster-General recognised that it was his duty to do all that lay in his power to help the development and increase the prosperity of British trade, but he was restrained by the shackles put on the Post Office by the Chancellor of the Exchequer. A return to the penny post would give a great impetus to trade, but after the disastrous experience of 1926 that was not within the range of practical politics, and the business community would be well advised to ask instead that the Post Office should give a better service. Earlier and later deliveries of letters would be more beneficial to British trade than the restoration of the penny post, and would cost a great deal less.

The Post Office was giving a vastly better telephone service than existed before the war. During the last few years a notable improvement had been made in the trunk system, and the network of underground cables which this country possessed was not surpassed in any other quarter of the world. It had rendered our telephonic system more nearly immune from weather disturbance than any other system elsewhere. Then there had been the amazing development of telephony across the Atlantic. At present that was confined to communication between London and New York, but it was hoped that within a very short time the Department would be able to put Manchester in telephonic communication with any part of America. Critics had said that such telephonic conversations were likely to be overheard, but their engineers were working at a system which, it was hoped, would result in secrecy.

Cheaper inland telegrams could not be granted, but the development of the beam system had brought the Dominions into much closer touch with this country, and would result, he believed, in a cheaper service and in a greater facility of communication, which must be reflected in the prosperity of British trade.

He expected that further improvement would be made in the telephonic system during the next few years. The Department was building in Salford the largest automatic telephone exchange in the country. This would supply Manchester and Salford with an automatic service second to none in Great Britain.

The toast was replied to by the LORD MAYOR OF MANCHESTER and by Mr. E. B. FIELDEN, M.P., who said that he sat on the Committee which examined the Electricity Bill before it became an Act last session. He had to inquire into the conditions of the supply of electricity, and he was satisfied that Manchester was second to none in that respect. Looking forward to the future, it seemed to him the greatest problem would be transportation in view of the way in which the suburbs of Manchester were growing.

In proposing the toast of the "Institution of Electrical Engineers," Mr. E. A. RADFORD, M.P., said it was very pleasant to be able to refer to any branch of British industry—engineering in particular—as being in a state of prosperity, and that could be said of electrical engineering in the Manchester district.

Dr. W. H. ECCLES, president of the Institution, replied to the toast. He said that of the 13,000 members of the Institution nearly 2,000 were in the North-Western Centre. In the area over which they were distributed were great power stations and factories which made the district a microcosm of the whole electrical industry. There was a saying, "What Manchester thinks to-day England will think to-morrow." To a large extent the saying was true in electrical affairs. About a dozen years ago a Manchester firm partially electrified the Southern Railway, and the same firm had now another large order for that railway company. Manchester was electrifying railways in other parts of the world, for instance, India, at a great pace, but he noticed that it was not doing much in the way of electrifying its own railways. He hoped it would not be long before the whole of the British railways were electrified; the full advantages of electrification could not be got until everybody used electricity. In the Barton station, Manchester had the most efficient generating station in Europe, almost in the world. The number of export orders taken in the last few weeks gave promise of a very rosy future; they were the reward of scientific design and of that untiring energy which appeared to be native to the district. The coal stoppage was over, the Electricity Act was on the Statute Book, and the prospects before electrical engineers, especially in the North-Western Centre, were brighter than they had been for some time.

The toast of "Our Guests" was proposed by the CHAIRMAN, and responded to by Mr. B. MOUAT JONES, principal of the Manchester College of Technology, and Dr. H. Levinstein, president of the Manchester Literary and Philosophical Society.

The Manchester Lighting Service Bureau.

Since the opening of this Bureau in October last a steady programme of lectures has been carried out. Up to date there have been eight lectures, with a total audience of four hundred. These have consisted of the Illumination Design Course, similar to that held in London, and also lectures to the Electrical Contractors' Association, the Electrical Association for Women, and the Electricity Committees of several municipal undertakings in the area. Outside the Bureau there have been thirteen lectures, with a total audience of seven hundred. These lectures have been given to Chambers of Trade, the Mill Managers' Association, and general bodies of the public in Blackburn, Liverpool, Southport, Chorley, Glazebury, and Newchurch. In addition to these, the Bureau provided some demonstrations at the recent electrical exhibition held at Padiham under the auspices of the Lancashire Electric Power Co. A large number of lectures have been arranged to take place both inside and outside the Bureau during the next two or three months. The Electrical Association for Women has arranged to visit the Bureau on a number of occasions, and other audiences will include the Manchester Retail Traders' Association and the Rotary Club of Manchester.

Glasgow Corporation Tramway Supply Account.

At a recent meeting of the Glasgow Corporation Electricity Sub-Committee on Finance, the manager submitted an account against the tramway department, amounting to £8,742, for electricity supplied during the period of the coal dispute, based on the price of coal during that period, which the manager of the tramway department had declined to pay, contending that an equivalent quantity of electricity should be supplied to the electricity department by the tramway department. The manager of the electricity undertaking explained that it would take the tramway department over two years to supply an equivalent quantity of electricity. It was decided that a sub-committee of the tramways should confer with a sub-committee of the Electricity Committee on the matter.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

THE tendency of modern practice is to dispense with accumulators and dry batteries and to derive the power required to operate broadcast radio-telephone receivers entirely off the domestic electricity mains. Should the supply be d.c., no great difficulties are met with, but an a.c. supply present another problem. The anode, or valve-plate, circuit can be energised effectively by means of a "high-voltage" battery eliminator connected to the house mains, which rectifies a.c. in sufficient quantity for the purpose; but a rectifier to provide an adequate output of rectified and "smoothed" a.c. for filament heating would need to be large. It is, of course, possible to connect the filament directly to a.c. mains through a suitable transformer, but such an arrangement often introduces an objectionable hum in addition to the difficulty of obtaining stable grid-bias voltages.

The Novel "KL.1" Valve.

We have received samples of a new valve that has been designed to overcome the difficulties referred to. It is made by the M.O. VALVE CO., LTD., and is marketed under the Marconi and "Osram" names, being an entirely new departure which makes it possible for almost any receiver to be



Fig. 1.—The "K.L.1" Valve with Indirectly-heated Filament.

modified to run entirely off a.c. mains. It is the product of considerable research, and uses a new principle in that the actual filament is not the cathode, and it is not connected electrically to the circuit of the receiver itself. It is operated through a step-down transformer, the primary winding of which is connected to the a.c. mains, without any rectifying or smoothing circuit, and develops a high temperature. To obtain a sufficient supply of heat, the energy consumption has to be approximately seven watts; allowing for a drop in the windings of the transformer, it may be assumed that one kWh of electricity will suffice for 100 hours working. Fig. 1 shows that the electron-emitting cathode (which is surrounded by the grid and anode in the usual manner) takes the form of a small cylinder coated with highly emissive material, which contains within it a "heater element" that is connected directly to the transformer secondary winding. There is no connection between the cathode and "heater element," the former being heated by radiation, thereby acquiring a sufficient degree of temperature to enable it to provide a large electron flow. By this method, with a suitable circuit, all traces of a.c. "hum" are eliminated, it is claimed, and the cathodes of a number of these valves may be joined together in a set to form a common return lead for any number of grid-bias valves, without any fluctuation in grid voltage, such as would be caused by the filament of an ordinary valve if it were connected directly to a.c. supply mains.

In addition to these main advantages of the indirectly-heated cathode valves, scope is afforded by the nature of their internal construction for improved characteristics: internal resistance can be reduced if the cathode and grid diameters are nearly equal; with ordinary filaments it is impossible to do this, but in the KL.1 valve, owing to the cylindrical cathode, a very large surface area is exposed for electron emission, and the above ratio is much nearer unity than it can possibly be in an ordinary valve. This makes the new valve very efficient, and at the same time capable of high amplification without distortion, it is claimed. Several seconds elapse before the valve starts functioning after switching on the heater current; conversely, it continues to amplify for quite a noticeable time after switching off, which phenomenon is due to the time taken for the cathode to reach a sufficient temperature to enable it to emit electrons.

The method of connecting up the new valve is quite simple and straightforward; the cathode is joined to a small terminal on the metal cap, fig. 1, and the two "filament" pins, which are connected to the heater element, require to be wired to the low-voltage secondary winding of a transformer of suitable ratio, fed directly from the a.c. supply mains; a special transformer is obtainable for the purpose, which also feeds the a.c. rectifier for energising the anode. The electrodes are placed at an angle as shown in fig. 1 to prevent the heat emerging from the cylindrical cathode (which is closed at the top, but open at the bottom) from impinging

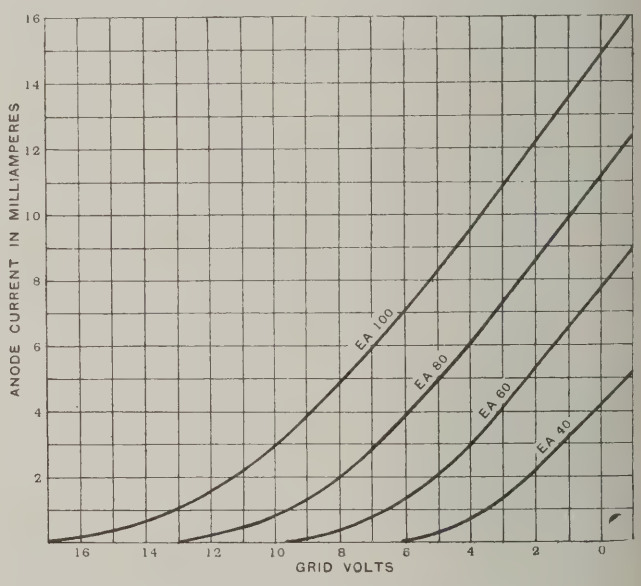


Fig. 2.—Characteristic Curves of the New Valve.

on the pinched foot of the valve. The small disk at the end of the horizontal wire is the "getter"; except for a small patch near the disk, the glass bulb is clear.

The KL.1 valve is suitable for use (1) in h.f. amplifiers when some form of stabilised circuit is employed; (2) as a detector in conjunction with a grid-leak and condenser; and (3) in all stages of transformer- and choke-coupled l.f. amplifiers. Curves of an average KL.1 valve are reproduced in fig. 2; owing to the very large cathode area, the characteristics of the valve are good, and the normal slope of the curve is 1.36 mA per volt, which is very high for a four-volt valve. The impedance is low, being only 5,500 ohms, and at the maximum anode voltage of 100, six volts grid-bias is required. Other data are: heater voltage, 3.5 V; heater current, 2 A; and the amplification factor is 7.5. It is satisfactory to know that the new valve is a British invention.

A Crystal Set Achievement.

By means of a 6-ft. box kite used by Dr. Ellison at the Armagh Observatory, Ulster, for experiments on atmospheric electricity, an unusual reception feat was recently accomplished. Shortly after noon on January 3rd, while the kite was flying at a height of 2,500 ft., the observers received smart shocks from the steel piano wire to which the kite was attached, and strong cracking sparks were drawn from it. The wire was attached to an iron post and earthed, and then connected to a No. 1 crystal receiving set made by the Brownie Wireless Co., which humble instrument enabled the North American broadcast radio-telephone stations to be heard loudly and with ease.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

19,793. "Electric switches." F. B. Cox. August 6th, 1925. (Addition to 249,232.) (262,488.)

21,833. "Apparatus for the purpose of eliminating or reducing interference from atmospheric disturbances during the reception of wireless telegraphic or telephonic signals." J. K. Hele. September 1st, 1925. (Cognate application No. 15,485/26.) (262,496.)

22,029. "Manufacture of vitreous containers for electric lamps, thermionic valves, and the like." A. Emerson, jun. September 3rd, 1925. (262,498.)

22,076. "Telephone systems." Siemens & Halske Akt.-Ges. and K. Hartmann. September 3rd, 1925. (262,499.)

22,244. "Telephone exchange systems." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). September 5th, 1925. (262,505.)

22,332. "Switch apparatus for use with telephonic receivers." M. Graham and A. Graham (executors of A. E. Graham, deceased). September 7th, 1925. (262,507.)

22,563. "Automatic switches for use in telephone or the like systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). September 9th, 1925. (262,513.)

22,742. "Electric switchgear." British Thomson-Houston Co., Ltd., and H. Trencham. September 11th, 1925. (262,521.)

22,917. "Secondary batteries." J. Stone & Co., Ltd., and A. H. Darker. September 14th, 1925. (262,528.)

23,072. "Bushes, glands and the like for protecting, sealing and bonding electric cables and the like." F. A. Ross. September 16th, 1925. 262,532.)

23,120. "Supersonic heterodyne receivers." Igranic Electric Co., Ltd., and A. H. Curtis. September 16th, 1925. (262,533.)

23,208. "Electric switches, such as used in automatic telephone systems." Siemens Bros. & Co., Ltd., and H. E. Humphries. September 17th, 1925. (262,534.)

23,212. "Electric furnaces." J. K. B. Raeder and Aktieselskabet Raeders Elektro-Glasovn. September 17th, 1925. (262,535.)

23,321. "Electric heaters or vaporisers for use in vaporising the charges of internal-combustion engines." L. E. Aske. September 18th, 1925. (262,540).

23,589. "High-frequency thermionic valve." Dr. S. Loewe. September 23rd, 1924. (240,455.)

23,846. "Electrochemical processes and apparatus for the extraction of copper and zinc from ores." H. S. Mackay. September 24th, 1925. (Cognate application 27,731/25.) (262,546.)

25,876. "Control systems for electrical apparatus, such as motors." C. T. Scarf, C. H. Last and Metropolitan-Vickers Electrical Co., Ltd. October 16th, 1925. (262,553.)

26,069. "Thermionic valves." H. G. P. Rees and Cleartron Radio, Ltd. October 19th, 1925. (262,555.)

26,760. "Type-printing telegraph receivers." F. McKay. October 26th, 1925. (262,561.)

26,827. "Thermionic valves or electron-discharge tubes, particularly for wireless signalling." Dr. L. A. Levy. October 27th, 1925. (262,563.)

27,528. "Apparatus for providing current for wireless receiving sets from standard electric supply mains." E. K. Cole. November 2nd, 1925. (Cognate application 3,165/26.) (262,567.)

27,882. "Radio signalling systems." Marconi's Wireless Telegraph Co., Ltd. November 6th, 1924. (242,653.)

28,326. "Electric heat radiators." J. C. Vines. November 10th, 1924. (242,679.)

28,884. "Method of reducing inductive disturbances in submarine cables." Dr. U. Meyer. November 15th, 1924. (243,025.)

30,813. "Electric lamps." J. Y. Fletcher and T. J. Sack. December 5th, 1925. (262,593.)

31,215. "Electrical testing." G. F. Shotter. December 10th, 1925. (262,598.)

32,464. "Electric motors." H. Wade (Mills Novelty Co.). December 23rd, 1925. (262,603.)

1,450. "Electric switches." F. B. Cox. October 19th, 1925. (262,698.)

16,081. "Display apparatus of the moving and changing type." F. Pink. June 22nd, 1925. (262,835.)

18,973. "Vibratory systems." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). July 25th, 1925. (262,839.)

20,770. "Electric protective systems." Electrical Improvements, Ltd., and L. C. Grant. August 19th, 1925. (Addition to 216,924.) (262,843.)

22,698. "System of transformation and transmission of electrical energy, applicable, for example, in telephony and telegraphy." G. Musso. September 11th, 1925. (262,847.)

23,084. "Electric furnaces, ovens, and other heating chambers." N. E. North. September 16th, 1925. (262,859.)

23,308. "Power-operated propelling rams for railway or tramway systems." A. G. Kershaw and Westinghouse Brake and Saxby Signal Co., Ltd. September 18th, 1925. (262,867.)

23,342. "Apparatus for electrically indicating or measuring the level or variations of the level of a liquid." C. F. Bornmann. November 20th, 1924. (243,318.)

23,440. "Apparatus for transmitting or reproducing sound." S. G. Brown. September 19th, 1925. (262,869.)

23,473. "Wall-boxes for electrical switches." J. B. Tucker. September 21st, 1925. (262,871.)

23,507. "Modulating system for high-frequency signalling." Standard Telephones and Cables, Ltd., and E. M. Deloraine. September 21st, 1925. (262,872.)

23,633. "Electrical terminals or connectors." J. J. Rowe. September 22nd, 1925. (262,877.)

23,684. "Electron-discharge tubes." Siemens-Schuckertwerke Ges., and R. G. Berthold. September 24th, 1925. (262,879.)

24,408. "Paper insulation for electric cables and the like." Felten and Guilleaume Carlswerk Akt.-Ges. May 8th, 1925. (251,931.)

24,459. "Electric switches." A. C. Wynne. October 1st, 1925. (262,882.)

24,958. "Lead-in tube for wireless apparatus." F. C. Rushton. October 7th, 1925. (262,885.)

25,064. "Electrical terminals." R. C. Turner. October 8th, 1925. (262,887.)

26,181. "Electric switches." English Electric Co., Ltd., and F. N. Linstow. October 20th, 1925. (262,892.)

26,666. "Electric switches." Cable Accessories Co., Ltd., F. H. Reeves, and A. Crawford. October 24th, 1925. (262,895.)

28,878. "X-ray tubes." F. Dessauer. November 16th, 1925. (262,906.)

29,180. "Sockets for holding electric lamps or the like." R. F. Baerman. November 19th, 1925. (262,907.)

29,437. "Telephone transmitters and receivers." M. Graham, E. Graham (legal representatives of E. A. Graham, deceased), and L. H. Paddle. November 21st, 1925. (262,910.)

29,921. "Dirigible headlights for vehicles." T. C. Holliday. November 26th, 1925. (262,915.)

30,567. "Distribution boards for use with wireless receiving sets." W. H. White. December 3rd, 1925. (262,923.)

31,483. "Electric switches." G. C. Lundberg, P. A. Lundberg, and G. Pegg. December 14th, 1925. (262,936.)

31,531. "Electrical indicating apparatus." H. C. Widlake. December 14th, 1925. (262,937.)

31,522. "Telautography or photo-telegraphy." H. C. Batholomew. December 17th, 1925. (262,943.)

32,915. "Machines for making bobbins for electric batteries." H. Wade (Yale Electric Corporation). December 30th, 1925. (262,960.)

1926.

109. "Ventilation of dynamo-electric machines." English Electric Co., Ltd., and F. A. Youngmark. January 2nd. 1926. (262,611.)

1,686. "Supports for electric resistances." H. H. Berry. January 20th, 1926. (262,620.)

2,139. "Wireless receiving apparatus and circuits therefor." A. E. Ball. January 25th, 1926. (262,623.)

2,867. "Apparatus capable of indicating distortion or degree of impurity of wave form of an alternating current." A. Graham, M. Graham (legal representatives of E. A. Graham, deceased), and W. J. Rickets. February 1st, 1926. (262,626.)

7,597. "Electrical ignition devices for internal-combustion engines." R. Bosch Akt.-Ges. June 4th, 1925. (253,076.)

14,688. "Signalling apparatus adapted for giving warning in the event of variation or breakdown in electric circuits." Compagnia Italiana dei Segnali. June 10th, 1925. (253,545.)

15,406. "Wireless telegraphy and telephony." Marconi's Wireless Telegraph Co., Ltd. June 19th, 1925. (253,934.)

17,032. "Brush gear, especially for electric meters and the like." International General Electric Co. Inc. July 7th, 1925. (255,070.)

20,612. "Means for cleaning the dust-depositing surfaces of electric gas-purifying chambers." Siemens-Schuckertwerke Ges. August 21st, 1925. (257,283.)

21,540. "Light projectors." British Thomson-Houston Co., Ltd. September 1st, 1925. (257,933.)

24,054. "Electric resistances for heating elements or the like." General Electric Co., Ltd., A. Kinnes, and J. L. Rycroft. September 29th, 1926. (262,696.)

24,202. "Electrical miners' or like safety lamps." F. Weissenfels. November 23rd, 1925. (261,718.)

25,651. "Means for detecting an earth leakage in high-tension cables." Akt.-Ges. Brown, Boveri et Cie. October 14th, 1925. (259,979.)

901. "Electric wire attachments." A. E. Chapman and C. R. Cook. January 12th, 1926. (262,968.)

1,902. "Electric controllers." International General Electric Co. Inc. January 22nd, 1925. (246,494.)

2,424. "Wireless receiving apparatus using current from the supply mains." W. E. H. Humphrys. January 27th, 1926. (262,979.)

2,651. "Process and installation for producing, simultaneously or successively, light of different colours by means of a discharge tube having positive column light." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 9th, 1925. (247,180.)

4,888. "Method of and means for balancing cables and land lines provided or not with compensating leads and earth cables." H. Tinsley and D. C. Gall. February 19th, 1926. (262,991.)

6,799. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. March 11th, 1925. (249,133.)

7,835. "Oscillating electric fans." N. W. Gilbert, H. C. E. Jacoby, and A. E. Jabet. March 22nd, 1926. (Cognate application 21,418/26.) (263,003.)

7,932. "Television." C. Baxter. March 23rd, 1926. (263,005.)

9,599. "Electrical power-transmission systems." British Thomson-Houston Co., Ltd. April 18th, 1925. (250,938.)

11,714. "Electric arc welding apparatus." British Thomson-Houston Co., Ltd. May 4th, 1925. (251,672.)

12,104. "Process for the production by electrothermic means of aluminium silicon alloys practically free from carbide." Metallbank und Metallurgische Ges. Akt.-Ges. May 12th, 1925. (252,160.)

12,824. "Electric storage batteries." W. B. Stone. May 19th, 1926. (263,024.)

13,326. "Electric power-transmitting systems." British Thomson-Houston Co., Ltd. May 26th, 1925. (252,721.)

15,263. "Electro-responsive switching devices." British Thomson-Houston Co., Ltd. June 22nd, 1925. (253,923.)

15,740. "Apparatus for sealing wire supports in a glass rod for use in electric lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 25th, 1925. (Addition to 230,431.) (254,311.)

16,232. "Electric heating elements, particularly adapted for cooking ranges and the like." A. J. H. Haddan (Moffats, Ltd.). June 28th, 1926. (263,045.)

17,454. "Apparatus for electrodeposition." International Copperclad Co. August 5th, 1924. (Divided application on 238,230.) (255,113.)

19,130. "Magnetic materials." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). August 18th, 1925. (Divided application on 20,702/25.) (263,059.)

19,505. "High-frequency electric signalling apparatus." Westinghouse Electric and Manufacturing Co. August 6th, 1925 (256,641.)

29,855. "Electric protective systems." Electrical Improvements, Ltd., and L. C. Grant. August 19th, 1925. (Addition to 216,924. Divided application on 20,770/25.) (263,074.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 19th :—

Mellodyne. No. 472,378. All goods in Class 8, but not including loud speakers.—Pollock Bros., 6, Exchange Street, Jedburgh, Scotland.

Majestic (lettering and design). No. 474,235. Class 8. Parts and accessories of radio-telephonic apparatus.—Grigsly-Grunow-Hinds Co., Chicago, U.S.A. (British representatives: White, Langner, Stevens & Parry, 88-90, Chancery Lane, W.C.2.)

Neutrosonic. No. 474,786. Class 8. Instruments and apparatus for use in connection with radio-telegraphy and telephony.—Igranic Electric Co., Ltd.

Petrix. No. 474,894. Class 8. Primary batteries, electric accumulators and parts thereof.—A.F.A. Accumulators, Ltd., 9a, Diana Place, Euston Road, N.W.1.

Mosma. No. 476,054. Class 13. Electric lamps (ordinary).—Moss, Mackay and Co., Ltd., 80, Cannon Street, E.C.4.

Magnet, No. 474,039, and Magnet (design only), No. 474,040. Class 50 Fuse boxes and casing for electric cables, electric insulating material, filaments for lamps (non metallic), &c.—General Electric Co., Ltd.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

BARNET.—49 houses, various sites, for R.D.C.; Arthur Cole, Ltd., Luton.
BARNSLEY.—Waterworks (£350,000); borough waterworks engineer.
BARROW.—Art gallery; Literary Committee of Corporation.
BEDDINGTON CORNER (SURREY).—Conversion of works, New Road, into radio valve factory, for Messrs. Mullard.
BENTLEY (YORKS.).—48 houses; U.D.C. surveyor.
BERWICK-ON-TWEED.—Kinema, café, and shops, Hide Hill; W. Alfred Schofield, for Berwick Theatre, Ltd.
BIDEFORD.—32 houses, Handley Cross, for the T.C.; clerk to the Council.
BIRKENHEAD.—Dock extension scheme for the Mersey Docks and Harbour Board.
BLACKPOOL.—100 houses, South Shore site; Edmondson and Colwell.
BOURNEMOUTH.—Drainage scheme and outfall works (£140,000); borough engineer.
BRADFORD.—New schools (first year programme of a three years' scheme); Bolling Hall secondary (£76,000); Swaine House secondary (£2,250); new Macmillan boys' school (£12,750); elementary schools—Thornbury (£1,050), Bierley (£650), Swaine House (£800); director of education, Town Hall.
CANADA (TORONTO).—Large general store, for the Hudson Bay Co. (several million dollars).
CHIPPENHAM.—Secondary school, for Wilts. E.C.; county architect, Trowbridge.
COVENTRY.—Boiler plant scheme (£12,460), with pumps, &c., for the B.G.; Edwards & Shaw, engineers.
CREWE.—Town central improvement scheme, High Street and Exchange Street; borough engineer.
DERBY.—Laundry (£39,000), for the Midland Co-operative Laundries' Association; secretary, Langley Mills.
DONCASTER.—58 houses at Grange Lane, Rossington, for R.D.C.; W. R. Crabtree, surveyor, Nether Hall. Courthouse, &c. (£20,000); West Riding Standing Joint Committee.
DOUGLAS (I.O.M.).—68 houses, Olympia Estate; J. E. Teare, Corporation architect. Alteration of premises, North Quay; Corlett, Sons & Cowley, Ltd.
ECCLESFIELD (W. YORKS.).—School, Ecclesfield High Green; West Riding County Education Department, County Hall, Wakefield.
ECCLES (LANCS.).—Bazaar premises, Church Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.
EXETER.—102 houses, Buddle Lane; J. Laing & Son, Ltd.
FALMOUTH.—Theatre for Harris Bros.; W. C. R. Corfield.
FARNHAM (SURREY).—Additional 52 houses, for the U.D.C.; surveyor.
FORFAR.—Nurses' quarters at Infirmary (£7,000); Provost Lowson, convener, Extensions Committee.
GLASGOW.—Housing scheme on 200 acres at Carntyne; housing director.
GOOLE.—Railway and wharf; Thorne Colliery and Pease and Partners, Ltd., Darlington.
GOSPORT.—Town wharf reconstruction; borough engineer.
GRAVESEND.—Heating sanatorium, for the T.C.; J. G. Bennett, architect, 4, Woodville Terrace.
HARROGATE.—150 Corporation houses, at Devonshire Place; C. E. Rivers, borough engineer, Municipal Offices.
HAYES.—Extension, Gramophone Factory; Wallis, Gilbert and Partners, architects.
HEMSWORTH.—280 houses; R.D.C. surveyor.
HUDDERSFIELD.—Secondary school at Honley; West Riding Education Committee.
INVERNESS.—Additional 100 houses, for the T.C.; burgh surveyor.
KINSLEY (YORKS).—76 houses; Hemsworth U.D.C. surveyor.
LEEDS.—Works, Elland Road, for W. H. Holdsworth, Tallow and Grease Refining Co., Swillington.
LEIGH (LANCS.).—Adapting Pennington Hall as library and museum; borough engineer.
LONDON (WEST HAM, E.).—Extensions, Goodmayes mental hospital, for the T.C.; borough engineer.
(E.C.).—Alteration, City of London School; A. G. Scott, for School Committee.
(CAMDEN TOWN, N.).—Rebuilding Royal Veterinary College (£85,000); Sir John McFadyean, principal.
(REGENT'S PARK, N.W.).—Block of all-electric flats on Abbey Lodge site, Hanover Gate; Ernest Yates, 37, New Bond Street, W.1.
(ST. JOHN'S WOOD, N.W.).—Block of flats, Abbey Lodge site, Park Road; J. Murray, 11, Suffolk Street, W.
(ST. PANCRAS, N.W.).—Tuberculosis dispensary; borough engineer.
LONDON—(*cont.*)—
(BERMONDSEY, S.E.).—Factory for Crosse & Blackwell, Grimscott Street; Messrs. Joseph's.
(LEWISHAM, S.E.).—Kinema, J. Rayman, managing director of the Prince of Wales Playhouse.
(S.W.).—Reconstruction of Oddenino's restaurant, Regent Street (£250,000); Sir Lindsay Parkinson & Co., Ltd.
(BALHAM, S.W.).—Church, Balham High Road; J. S. Watkins. Fifty-five houses, Park Hill Estate; Swain and Selly.
(FULHAM, S.W.).—Additions, Western Hospital, Seagrove Street; W. J. Marston & Son.
(PUTNEY, S.W.).—Additions, Putney Hospital; H. Simmons Bros. L.C.C. school, Magdalen Road; Halliday & Greenwood, Ltd.
(TOOTING, S.W.).—80 houses, Furzedown Estate; E. Clarke and Sons.
(WESTMINSTER, S.W.).—Theatre, Denman Street; E. Laurillard.
(MARBLE ARCH, W.).—Kinema (corner of Edgware Road and Oxford Street); C. Aish, architect.
LONGBENTON.—30 houses, Benton site; U.D.C. surveyor.
LUTON.—Works extensions, Teagrave, for Electrolux, Ltd.
MANCHESTER.—Bazaar premises (five-storey building), Piccadilly, for F. W. Woolworth & Co., Ltd., Kingsway, London.
MIDDLESBROUGH.—Technical college; Education Committee.
NEWBURY.—80 houses; borough engineer.
ORMSKIRK.—Housing scheme (90), for the R.D.C.; R. Rosbotham, surveyor.
QUARRY BANK.—Housing scheme (75), for the U.D.C.; surveyor, Stevens Park.
RADCLIFFE (LANCS.).—Housing scheme (42), Outwood Road, for the U.D.C.; surveyor.
RAMSGATE.—Houses (100), for the T.C.; Grummant Bros., builders, Grange Road.
RICHMOND-ON-THAMES.—Houses, for the T.C.; builders, Craig & Mace, 208, Windsor House, Victoria Street, S.W. (35), and A. W. Folsham, 37, Sheen Road (28). Twenty flats, for the British Legion Poppy Factory, Ltd.; D. Wood, architect. Corporation housing scheme (63); Messrs. Cory & Cory and Mr. R. Dixon.
ROTHERHAM.—Technical and art schools, and four elementary schools (£140,000), for the borough E.C.; director of education.
SEDGLEY.—Sewage scheme and pumping plant (£29,000); W. Willcox, for the U.D.C.
SHEFFIELD.—Fire station, Rockingham Street (£42,000); city engineer. Waterworks (£160,000); water engineer.
SOUTHEND.—Kinema for Warrior Square Picture Theatre, Ltd.; Barles, Harris & Collings, architects.
STAFFORD.—Further 58 houses, Tithe Farn Estate; W. Plant, borough engineer.
STOCKTON.—Isolation hospital; borough engineer.
STRETFORD.—Extensions, cable shop, Warwick Road North; W. T. Glover & Co., Ltd. Warehouse and offices, Talbot Road; Crittall Manufacturing Co., Ltd. 84 houses, Hancock Street; U.D.C. surveyor.
SWANSEA.—Reconstruction of flour mills, Beaufort Dock; Weaver & Co., Ltd. Isolation hospital, Hellhouse (£84,000); borough architect. Reconstruction High Street Railway Station; G.W.R.
THORNE (YORKS.).—Houses (98), for Leadley, Firth and Whittington, Ltd.
TOTTINGTON (LANCS.).—Housing scheme (72), for the U.D.C.; surveyor.
TROWBRIDGE.—Conversion of Adcroft House into hospital; Cottage Hospital Committee.
URUGUAY (MONTEVIDEO). — Proposed National Freezing Works ($3,000,000); State Executive.—*Reuter's Trade Service* (Montevideo).
WAKEFIELD.—Deeds registry, Bond Street (£10,500); J. R. White, county architect, West Riding.
WALLASEY.—Motor-'bus garage; borough engineer.
WATH-UPON-DEARNE (YORKSHIRE). — 108 houses for U.D.C. at West Melton; Tennant & Smith, architects, Ropergate Chambers, Pontefract.
WHITWOOD.—Mining institute (£40,000); Miners' Welfare Committee and West Riding Education Committee.
WOLVERHAMPTON.—Completion of joint technical college (over £100,000); J. A. Warren, Director of Education.
WORSLEY (LANCS.).—Additional housing scheme (50), Walkden estate, for the U.D.C.; surveyor.
WREXHAM.—Additional 100 houses, for the T.C.; borough surveyor.

The

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THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

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Contents:

	PAGE
Reflections on the Commissioners' Report	161
Electrical Progress in the United States	162
Expert Witnesses	162
Modern Electrical Measuring Instruments, by C. L. Lipman (*illus.*)	163
Electricity Supply Tariffs, by Professor W. Cramp (*concluded*)	165
Tests for Resultant Economy	167
Unemployment during 1926 (*illus.*)	168
Legal	169
Correspondence—	
Wattmeter Calculations	169
Power Supply for Wireless Sets	170
River Water—or Cooling Towers?	170
Electrical Activity at Trafford Park (*illus.*)	171
Business and Industrial Notes	172
Lighting and Power Notes	177
Tramway and Railway Notes	179
Telegraph and Telephone Notes	179
Radio Notes	180
Contract Information	180
Forthcoming Events	182
Notes	182
Institution Notes	185
Our Personal Column	185
Financial Section—	
New Companies Registered	186
Official Returns of Electrical Companies	186
City Notes	187
Stocks and Shares	187
High-Voltage "S.L."-Type Cables, by P. Dunsheath (*illus.*) (*concluded*)	189
A Large Cable Armouring Machine (*illus.*)	190
The Physical Society's Exhibition (*concluded*)	191
Electrical Notes from Canada	192
New Electrical Devices, Fittings and Plant (*illus.*)	193
Industrial Electric Heating	194
Domestic Refrigeration	195
The Telephone Service	196
Electric Floodlighting	197
Reviews	198
Published Specifications	199
Trade-Mark Applications	199
New Work for Contractors	200

Reflections on the Commissioners' Report.

THE Electricity Commissioners' Annual Report, besides satisfying mild curiosity as to the progress of the industry and providing an additional volume for the office library, may fittingly serve as a stimulus to fruitful thought. The mind of the Commissioners is more or less reflected therein, and a sagacious eye roving over the pages should be able to gather more than one point to turn to account.

Provincial electricity supply companies, for instance, may profitably ruminate on the question of extension of tenure touched upon in the Report. The Commissioners point out that many of the early Provisional Orders will expire in the course of the next few years, or be purchasable by a local authority at some early date. The London Companies have, of course, set their house in order and secured a very satisfactory long lease. It now remains for the provincial companies to follow suit, and similarly stabilise their position. And this would apply not merely to companies which have Orders on the brink of expiry, but also to any others which are within measurable distance of an option, since a party *in extremis* is not always in the best position to bargain. Extension of tenure will be, as is pointed out in the Report, a bargain mainly on the basis of a sliding scale of price and dividend. A company operating under the scale would, of course, exchange speculative possibilities for stability, and have to rely for increased dividends mainly on the extension and development of business. Under the old régime, there was, in many cases, a strictly limited outlook in this direction; but with the possibility of cheap bulk supply under the schemes of the existing Acts and the new Electricity Act, there is a very favourable prospect for many companies to expand, since they will be able to devote their whole available capital to immediately remunerative distribution, instead of having to provide plant which is always in advance of demand. Moreover, the fact, as shown in the present and previous Reports, that the Commissioners favour extensions of supply areas into surrounding districts, has an impor-

tant bearing on the future of many provincial companies. A perusal of the notes in the Report on the Special Orders granted should wake up all companies to consider their position, as there is a very energetic roping-in of unappropriated areas going on. This is shown in the Report by the figures given for the Electricity Districts. In eight districts alone, since 1920 powers have been granted for distributing areas for over 2,000 square miles. The unoccupied areas were shown in the series of maps which we published last year for the express purpose of assisting those who contemplated development of this kind.

Non-statutory undertakings should see a red light in the Commissioners' remarks under the heading "General Observations." Referring to the numerous cases in which public supplies of electricity in villages and small towns are being given by undertakings without statutory powers, the Commissioners gently intimate that such non-statutory undertakings may be ignored, where circumstances require it, and statutory powers may be given to some other undertaker over their area of supply. It might be politic, therefore, for non-statutory authorities to take the warning to heart and regularise their position by applying for Special Orders. It will be remembered that some years ago the Commissioners tried to induce them to do so by simplifying the procedure and cheapening the cost of obtaining the Order.

Undertakers who have not made up their minds on the question of subscribing to the Electrical Development Association may set their minds at rest over the scale of contributions by a perusal of the Commissioners' approving comments.

A glance at the proceedings reported with regard to the Trade Facilities Acts, where it will be seen that only nine applications were made for loans, shows that either the small companies were lethargic in enterprise or else capital was freely forthcoming in the usual way. In the case of Unemployment Grants, the requirements have been tightened up; it must be shown that the need is exceptional, and that the work would not be put in hand in the ordinary course for a considerable period. Consequently the applications for grants for electricity schemes have practically ceased.

Undertakers interested in "fringe" supply will be glad to have the elucidation given in a special case quoted by the Commissioners, where it was ruled that for premises partly in and partly outside the statutory area, supply means "delivery at the consumers' terminals," so that if these are inside the area, the undertaker can ignore the fact of part of the premises being outside that area. This case was reported in our columns a year ago.

An interesting section headed "Mutual Assistance: Bulk Supplies" gives an analysis of the growing number of bulk supplies taken and arranged for, and the figures displayed ought to supply their quota of persuasion to those conservative undertakers who still hold pathetically to the ideal of a self-contained undertaking, irrespective of advantageous outside help.

Electrical Progress in the United States.

The feast of statistics which is annually provided for its readers by the *Electrical World* is always interesting to electrical men on this side of the water, if for no other reason than that it arouses their envious admiration. From the electrical point of view the United States is particularly fortunate in that it is abundantly provided with coal and water-power, that the gas industry never secured the lead which it possesses in European countries, and that the Legislature has not laid its paralysing hand on electricity supply, so that electrical undertakings have been free to till a fertile field untrammelled by the barbed wire of statutory restrictions and limitations of area. That progress should be rapid under such favourable conditions was inevitable: but that comparisons should be instituted between it and the state of electrical affairs in this country, where the conditions are fundamentally different, was very unfair, without the added injustice of using false premises. However, we are confidently assured that when the Central Electricity Board gets to work we shall soon make up for lost time.

What we have to aim at is indicated by our contemporary's jubilant head-line: "A $20,000,000,000 Industry." We read that the total capital invested in the various branches of the electrical industries in the United States is now 19,500 million dollars—say 3,900 million pounds—that the annual gross revenue is about 1,187 millions, and that the new capital annually invested is 314 millions sterling. These are colossal figures, and indeed represent "an industrial development of unparalleled magnitude in commercial history." Electricity supply accounts for an annual gross revenue of 337 millions sterling; the energy generated amounted to 68,732,000,000 kWh last year. The telephone service deals with 70 million calls daily. Electric railways (including tramways) carried 14,400 million passengers on 40,000 miles of track. Manufacturers of electrical equipment employ 400,000 persons, and do a gross annual business estimated at about 475 millions sterling.

The energy sold to consumers for lighting, power, &c., in 1926 was estimated at 55,468 million kWh, or 470 kWh a head. This is still somewhat short of the 500 kWh which was freely but erroneously quoted as attained in 1924. About one-third of it was generated by water-power. Over 68 million people—58 per cent. of the population—are living in electrically lighted dwellings.

Expert Witnesses.

In a case which is now proceeding in the Chancery Division, Mr. Justice Tomlin has made some observations relating to expert evidence which are of interest to those who employ, as well as to those who are called upon to act as, expert witnesses. The action before the learned judge involves an inquiry into the flooding of certain mines in South Wales. The case bristles with technical and scientific questions which the parties, naturally enough, desire to have properly explained to the Court, but having regard to the length of the suit (it has already been before the Court for about six weeks), the learned judge expresses the opinion that he must limit the number of expert witnesses to be called on either side. He pointed out that if suitors were always to be entitled to call an unlimited number of experts, two evil consequences would follow. In the first place, the hearing of a cause would be unduly prolonged—to the prejudice of other litigants who were waiting to be heard; and in the second place, it would load the dice in favour of the wealthy litigant who could call the greatest number of experts. He has, therefore, made a rule for himself to the effect that, except in special circumstances, two expert witnesses only will be allowed. This will not, of course, prevent any witness to fact being called. The distinction between an expert witness and a mere witness to fact may occasionally be somewhat hard to draw; but generally speaking an expert witness may be said to be one who merely expresses a scientific or other opinion on a given set of facts or circumstances. There is probably no kind of dispute in which the technical witness is of greater importance than that in which electrical questions come up for discussion. Even the phraseology of the profession is baffling to the mere lawyer; and the duties of the expert begin long before a case comes on for hearing in Court. When a technical dispute arises, solicitor and counsel have each to be taught enough "electricity" to enable them to advise their client, and if litigation ensues it may be that the judge will have to be taught the elements of the subject. But it is manifest from what has taken place before Mr. Justice Tomlin that one learned judge at any rate does not want to have his Court overcrowded with scientific witnesses.

Modern Electrical Measuring Instruments.

A Review of Recent Developments and Improvements in connection with Electrical Indicating and Recording Instruments, and Protective Relays.

By C. L. LIPMAN.

AMONGST the articles that appear in the technical Press, the subject of electrical instruments appears to have been somewhat neglected. The development of this branch of electrical engineering has been very marked in the last few years, and in no part of it have greater improvements been made than in connection with protective relays.

Indicating Instruments.

In the case of indicating instruments, little alteration in the active principles has taken place. The permanent-magnet moving-coil instrument is used for direct current, the moving-iron type for a.c. and d.c., the dynamometer type for a.c. and d.c., the induction type, and the electrostatic, hot-wire, and thermal types for a.c., the two last named being particularly suitable for high-frequency circuits.

Dealing first with moving-coil ammeters of the shunted type, important points have been the standardisation of the voltage drop (75 millivolts) and the drilling of the shunt ends. The length of scale has been considerably increased in these instruments as made by all the leading makers, and some years ago the Record Co. introduced an instrument designated as "Cirscale," in which the angular deflection was practically the same as in induction instruments, namely, about 270 deg. of arc.

In the case of moving-iron instruments, which are very largely used on account of their robust and simple construction, and are the type most largely employed on a.c. switchboards, many important improvements have been introduced. The scale-length of these instruments has been materially increased, so that the length of scale is equivalent to the diameter of the dial. "Long-scale" moving-iron instruments have been developed by Messrs. Record, Martin & Furderer, Nalder Bros., and others; in the case of the Record instrument, the "floating iron" principle is employed. A further development of the "long-scale" moving-iron instrument has been made by Messrs. Nalder Bros., & Thompson, Ltd., which differs from the above-described designs, in that it employs two sets of iron; it is suitably damped, and owing to its simple construction is not liable to oscillate on fluctuating loads.

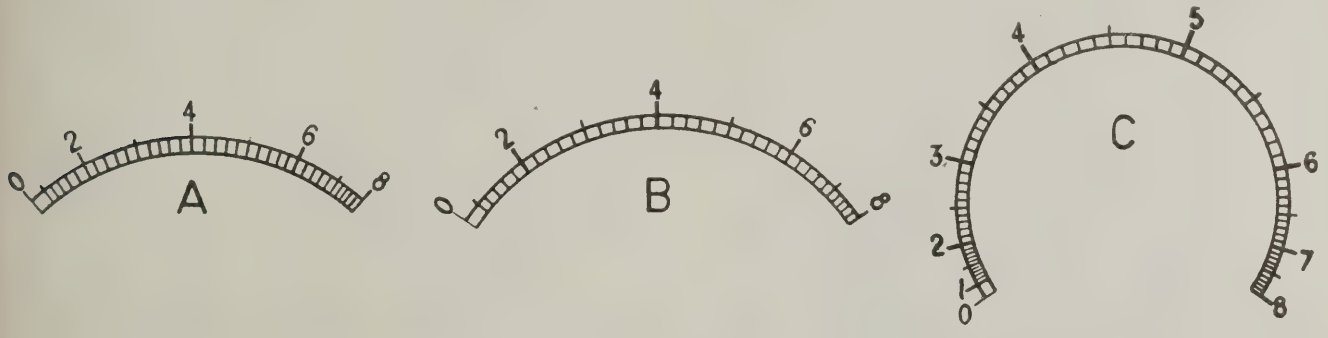
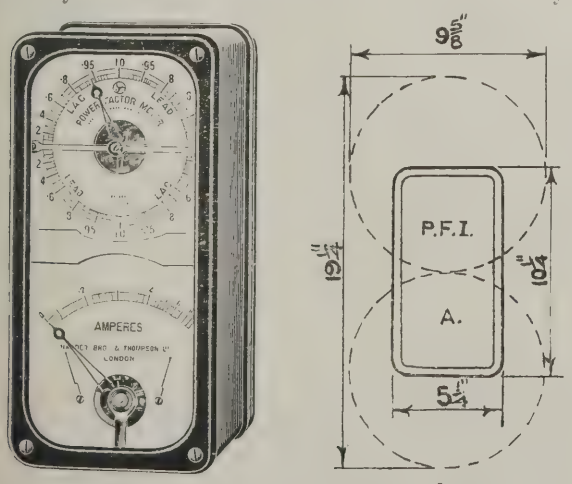


Fig. 1.—Three Stages of Development of Moving-iron Instruments, 8-in. Dial Size.

In the Martin & Furderer type, the angular deflection is about 220 degrees. In this type the damping is electromagnetic, and the instrument is reasonably dead-beat. This instrument employs the scroll-type repulsion iron, but in that it gives a larger angular deflection it is a successful development of the type originated many years ago by Nalder Bros. & Co., Evershed and Vignoles, Hartmann & Braun, and more recently by the Weston Co.



a. *b.*

Fig. 2.—Combined Power-factor Indicator and Ammeter.

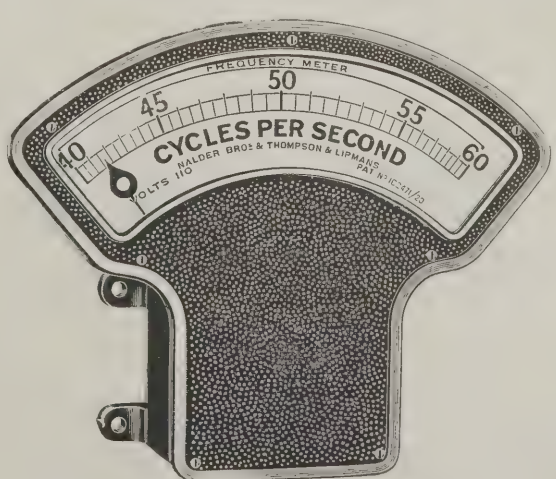


Fig. 3.—Sector-type Deflectional Frequency Meter.

Fig. 1 illustrates the three stages of development of the moving-iron instruments of the 8-in. dial size; for convenience of comparison, one size of instrument is shown: (A) shows the original scale length of about 6 inches, (B) the "Hyper-scale" or "Super-scale," as these are called, in contradistinction to the shorter scales, and (C) the long-scale type.

Apart from the improvements introduced in the instruments themselves, a new style of case has been pro-

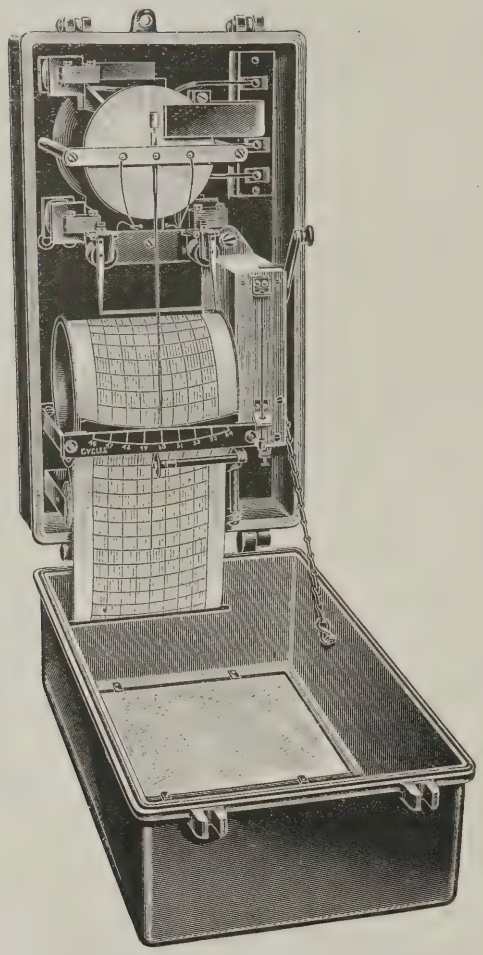


Fig. 4.—Recording Frequency Meter, Tapping Inker.

duced. This is square or rectangular in form, and in many cases leads to great economy in switchboard space. Fig. 2*a* shows the general arrangement of a power factor indicator and ammeter combined. Fig. 2*b* illustrates the space that would have been occupied had two round instruments been employed. This design is particularly suitable for use in the control rooms of large electricity

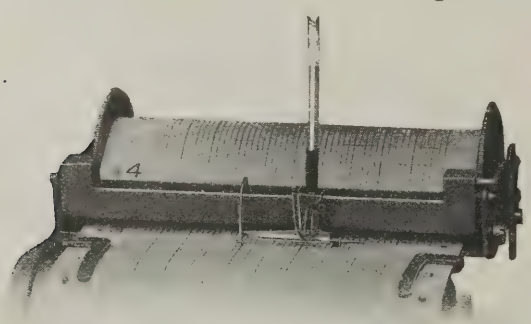


Fig. 6.—Method of Obtaining Rectangular Co-ordinates.

supply undertakings, where space is an important factor.

In the case of 3-phase systems, it is often convenient to fit three ammeters in one rectangular case. A complete line of such instruments has been developed by Nalder Bros. & Thompson Ltd., and by the Weston Electrical Instrument Co.

Single instruments or combination instruments are made in rectangular cases. There has been considerable demand for the following combinations:—

Power-factor meter and ammeter,
Wattmeter and ammeter,
Wattmeter and voltmeter.

Besides ammeters, voltmeters and wattmeters, new types of power-factor meters, frequency meters, and synchroscopes have been devised. Originally frequency meters were mainly of the resonance or vibrating-reed type; now deflectional frequency meters are generally employed. They possess the advantage that they are easier to read from a distance, and the disadvantage of the actual frequency to be measured lying between two reeds, thus reducing the amplitude, is avoided.

Fig. 3 illustrates a sector-type deflectional frequency meter.

Recording Instruments.

Considerable developments have also taken place in chart recording or "graphic" instruments.

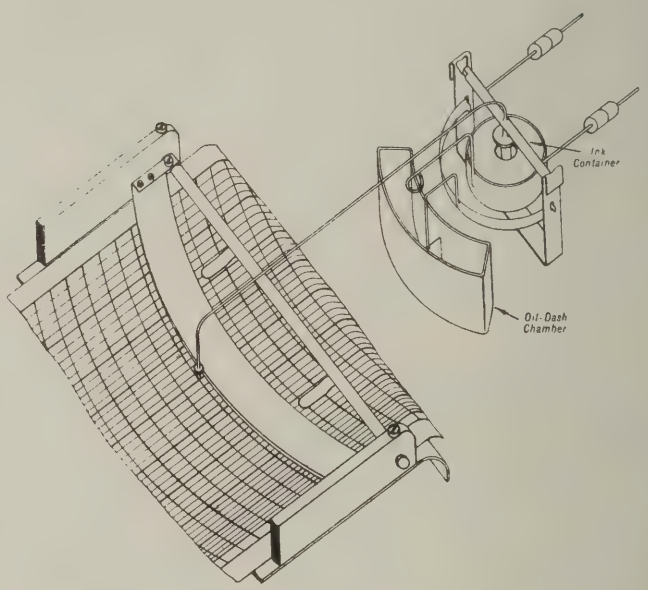


Fig. 5.—Tube-type of Pen Arm.

In addition to recording ammeters, voltmeters, and wattmeters, the details of which are well known, power-factor indicators and frequency meters have been introduced. Combination instruments are also obtainable for such purposes as feeder logs, &c., multiple pen

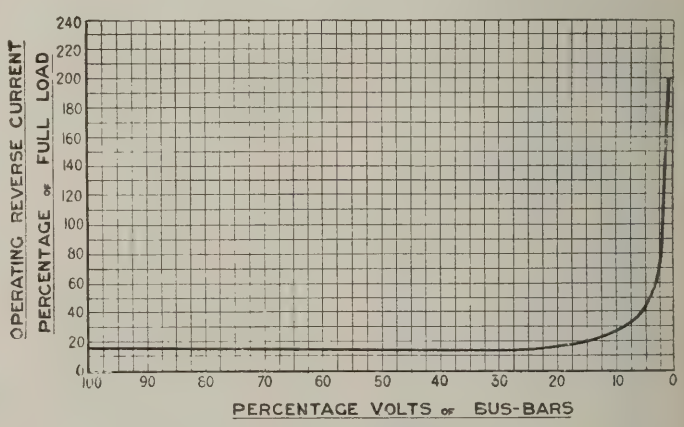


Fig. 7.—Relay Characteristic Curve.

recorders for telephone work, and revolution recorders or speed indicators, which generally consist of a magneto generator and a recording voltmeter.

Recorders have been specially adapted for fitting to electric trains, and a special system of cradle mounting has been devised which protects the instruments from the effects of excessive vibration. These recorders give valuable information, and tend to promote the efficient and economical running of the trains.

With regard to the method of marking the chart, the original method was to fix a pen at the end of the pointer

arm. The disadvantage of this method lies in the fact that errors due to the variation of the amount of ink in the pen can never be wholly eliminated. Various methods of getting over this difficulty have been adopted by different makers, amongst which the following serve as examples:—

A tapping mechanism by which the chart is inked at regular intervals. The inking device consists of a short length of fine tube fixed to the end of the pen arm, one end of which moves in a trough, at the back of which is an inking pad; the other end taps on the chart at regular intervals, generally ¼ or ½ minute, and is depressed on to it by a bar actuated by an electromagnet, thus (simultaneously) causing the ink to flow in the tube from the pad and making a dot on the chart. If the time intervals are sufficiently short, the record differs little from a continuous line.

The advantage of this method of inking is that the pen is not continuously in contact with the chart, and thus "pen to paper friction" is eliminated. This ensures accuracy, and is particularly valuable in the case of instruments wherein the forces are necessarily small, as in recording frequency meters and power-factor indicators. Fig. 4 illustrates a recording frequency meter embodying these features.

Another type of recording instrument which also gets over the error due to variation of ink in the pen was originally introduced by the Esterline Company of Indianapolis, and has since been further developed in this country by Messrs. Everett, Edgcumbe & Co., Limited, and others. In this type the pen arm consists of a fine tube which is normally full of ink, one end moving in a vessel containing the ink and the other end over the chart; the error due to variation of the amount of ink is thus eliminated. Fig. 5 illustrates the general arrangement of such a recorder.

With regard to charts, there has been little alteration in these in the last few years. Generally speaking, the hour, or time, lines are curved. Some time ago a recording instrument was patented by Murday, and is manufactured by Messrs. Evershed and Vignoles, which gives rectangular co-ordinates. Fig. 6 illustrates the method by which rectangular co-ordinates are obtained.

Protective Relays.

The problem of the protection of electrical plant, feeders, etc., against faults or abnormal conditions is of growing importance at the present time. The success of any protective scheme depends largely on the reliability and suitability of the relays employed.

The trend of development in the design of modern protective relays is along the line of making the operating element of the relay more sensitive and stable, and the tripping part more robust and reliable.

Sensitive relays permit lower fault settings to be obtained, are more accurate in calibration, and at the same time consume a smaller amount of volt-amperes for their working.

The development of super-sensitive relays enabled known and well-tried protective schemes to be extended and applied to modern extra-high-pressure systems, on which bushing-type current transformers of limited ampere-turns are invariably installed. Messrs. Nalder Bros. & Thompson, Limited, in particular, amongst others have developed a complete line of super-sensitive relays suitable for all forms of protection and for all purposes.

Protective relays are generally classified according to the functions they perform, or according to the principles on which they are constructed.

Most of the "over" and "under" current or voltage relays at present in use are of the electromagnetic or of the induction type, and a large proportion of these are fitted with some form of time-delay device.

Amongst directional relays the reverse-current relay is perhaps the most important. Until recently this class of relay has been manufactured by various makers in the dynamometer type, and has been arranged to give a characteristic curve approximating to that illustrated in fig. 7.

The dynamometer-type relay is in process of being superseded on account of the excessively high volt-ampere consumption under normal conditions. The total consumption of the current element at 5 amperes and the voltage element at 110 volts 50 cycles generally exceeds 100 VA.

In the most modern development of reverse-current relays, an almost negligible amount of power is required for their working; they give the same performance curve as shown in fig. 7, and operate with greater reliability, particularly in the region of low voltage. This feature is of the greatest importance in cases where the relay has to operate from bushing transformers.

A new class of protective relay is now coming to the front termed the "impedance relay." The time of operation of this is directly proportional to the impedance or the distance from the relay to the point of short circuit.

In order to prevent interruption of supply due to a sudden surge or high-frequency transient effect occurring on the system to be protected, special forms of anti-surge relays have been designed and are manufactured by various firms. Messrs. Nalder Bros. and Thompson, Limited, have also developed a series of special relays such as frequency and power-factor relays and automatic synchronising relays.

Electricity Supply Tariffs.

Some particulars of the various deferred-payment agreements and electric light and power tariffs in force at Basle, Switzerland.

By Professor W. CRAMP.

(*Concluded from page* 127).

It is difficult to compare this power tariff with a straight m.d. system, but instances will show how low are the terms. For example, an engineering works might have a load factor of 20 per cent. and an m.d. of 1,000 kW. The price on the Basle basis would be 0.86d. per kelvin; most English undertakings would charge at least 1.2d. I was recently instructed to negotiate the supply of electric power to a works requiring four million kelvins per annum, with an estimated load factor of 50 per cent. and power factor of 80 per cent. The best terms I could obtain were £5 5s. per annum per kVA of m.d., plus 0.35d. per kelvin, the basis price of coal being 6s. 6d. per ton. The coal clause was at the rate of .033d. per 1s. per ton. This tariff for the load in question, and with coal at 12s. 6d. per ton, works out at 0.91d. per kWh. The corresponding charge in Basle would be *at the most* 0.68d. No more need be said.

The foregoing are normal tariffs; but to attract the householder and tradesman alike, and to improve their own load factor, the Swiss supply authorities hold out all manner of special temptations. Some of these are annual charges without meters, as, for instance, B (9), (10), &c., below; others involve the use of special time meters and switches.

I.—Special Tariffs with Meters.

B (4) *Electricity for Cooking.*—(*a*) If the householder has adopted the double tariff under B (2) above, and has connected his cooker to the lighting system, then each month as many kelvins are reckoned on the lower tariff as are shown on the higher. All beyond these are supplied at 10 cents (0.96d.) in winter, and 8 cents (0.768d.) in summer. The kelvins per month for cooking must not be less than 10. This is an exceedingly cunning device, since it first tempts the householder to reduce his demand during peak hours and then to cook during off-peak hours, and moreover to cook more in summer than in winter. It may be commended to English supply authorities.

(*b*) The householder may rent a special meter for his cooker at about 1s. per month. He then gets energy for cooking from 6.30 to 9 a.m. and from 4.30 to 8 p.m. at 25 cents (2.4d.); and during other hours at 8 cents (0.768d). Who would cook by gas if we had such a tariff here?

B (5) *Electricity for Bakers' Ovens.*—Bakers' ovens are evidently a coveted load in Switzerland, and moreover some of these are equipped with an alternative system of heating. Tariffs are provided for each kind, and the period of energy supply is from 10 p.m. to 7 a.m. and from noon to 1.30 p.m. The following are the prices of energy:—(*a*) Electric bakers' ovens, from October 1st to March 31st, 4 cts. (0.38d.) per kelvin; from April 1st to September 30th, 3 cts. (0.3d.) per kelvin; (*b*) bakers' ovens with alternative methods of heating, from October 1st to March 31st, 3 cts. (0.3d.) per kelvin; from April 1st to September 30th 2 cts. (.19d.).

If the annual consumption per rated kW connected falls below 45 fr. (36s.) for class (*a*) or 35 fr. (28s.) for class (*b*), the difference must be made up. For class (*b*), however, there is a further provision to the effect that the annual minimum is reduced in the ratio of the number of days on which energy is at the disposal of the baker to the total number of days in a year. This seems to me to be a particularly generous concession.

B (6) *Electricity for Industrial Heating during the Day Time.*—This includes laundry irons, apparatus for drying hair or for coffee machines, and other trade devices. The basis is a double tariff like B (2) above, and the same hours are adopted, but the prices are:—(*a*) Less than 1,500 kelvins p.a.: upper rate 55 cts. (5.3d.), lower rate, summer, 8 cts. (0.768d.), lower rate, winter, 10 cts. (0.96d.). (*b*) More than 1,500 kelvins p.a.: upper rate 20 cts. (1.92d.), lower rate, summer, 8 cts. (0.788d.), lower rate, winter, 10 cts. (0.96d.).

The minimum is 84 fr. (67s. 6d.) per kW per year, and if the yearly demand exceeds 2,000 kelvins, the consumer has the option of adopting the ordinary power tariff (see B (3) above).

To simplify wiring for such installations, the purchaser may have his lighting connected to the same meter, except in those cases where the lighting load during the off-peak hours is likely to be large compared with the heating load, as, for instance, in public houses. This concession, however, does not hold if the power tariff is chosen.

B (7) *Electricity for Window Display and Advertisements.*—For this purpose a double tariff (with the appropriate meter) is offered. The terms are:—From 6.30 to 9 a.m. and from 4.30 to 7 p.m., 55 cts. per kelvin (5.28d.); all other hours, 15 cts. (1.44d.).

The object of the tariff is obvious, and since few such installations would be likely to be required from 6.30 to 9 a.m., the terms are more advantageous than at first sight appears. The supply authority is willing to provide an automatic clock-controlled switch which closes each day at dusk. The circuit can also be controlled by hand, so that the owner can switch off when he pleases. The hire of the automatic switch costs 1.5 fr. (1s. 2½d.) per month.

B (8) *Electricity for Heat Storage Systems.*—This is encouraged in certain cases for the heating of rooms, &c. The current heats a storage system (*e.g.*, special floors or panels) during the night, and these keep the rooms warm during the day. The tariff is 4 cts. (.384d.) per kelvin, with a minimum of 45 fr. (£1 16s.) per annum per kW connected. Such a system may have two "heats." The larger may be three times the smaller, and automatically brought into use from Saturday midday until Sunday evening. For this period the charge is 2 cts. (.19d.) per kelvin! A single heat system may also be used during these extended hours at 4 cts. (.38d.) per kelvin.

II.—Annual Tariffs (No Meter Reading).

B (9) *Electricity for Small Boilers.*—The conditions for the supply, on deferred payment, of two sizes of boiler have been quoted above, A (2). Now either of these sizes may be connected through an automatic switch to the mains, so that current is on from 10 p.m. to 7 a.m. If this is done, then the householder pays an inclusive charge of only 4 fr. (3s. 3d.) per month for the 30-litre boiler and 6 fr. (5s. 10d.) per month for the 50-litre size. Imagine a good continuous hot-water supply for a small house at £3 10s. per year! An additional switch will enable these boilers to be used continuously from Saturday midday until Sunday evening at a monthly charge of 1 fr. (9.6d.) for the smaller and 1 fr. 25 (1s.) for the larger.

B (10) *Electricity for Lighting Premises in General Use.*—Provided metal-filament lamps are used, the charges are as follows:—For lamp c.p. of 16, 25, 32, and 50, the annual charges for energy per lamp are 8 fr. (6s. 5d.), 12.5 fr. (10s.), 16 fr. (12s. 10d.), 25 fr. (£1).

B (11) *Electricity for Lighting Staircases, Corridors, Sign Boards, &c.*—For these purposes the supply authority offers a time switch which automatically closes at dusk and opens at 9 p.m. After this time the light can be switched on by a push-button at the house-door, or the doors of the various flats. Having thus been switched on, the light remains on for three minutes, and then is automatically extinguished. Of course, the latter arrangement is omitted in the case of signboards. The following table gives the annual charges for different numbers of metal-filament lamps, inclusive of rent and maintenance of the time switch:—

Metal-filament lamps connected.	Candle-power of each lamp. Sixteen.		Twenty-five.		Thirty-two.	
	Frs.	Shillings.	Frs.	Shillings.	Frs.	Shillings.
1	36	29	36	29	36	29
2	36	29	47	37.6	56	44.6
3	46	37	62.5	50	76	61
4	56	45	78	62.5	96	77
5	66	53	93.5	75	116	93
6	76	61	109	87	136	109
7	86	69	124.5	104	156	125

These figures are increased by 20 per cent. if the light is kept continuously burning until 10 p.m., and a further 10 per cent. is added for any further time up till midnight. Payments are half-yearly, and as a precaution against cheating, new lamps must be obtained from the electricity works.

There is little doubt that such a tariff as this would tempt many a landlord of flats, especially in London.

B (12) *Electricity for Bells and Door Opening.*—Finally a tariff is provided for a purpose little known in this country. It is very common abroad not only to have electric bells for the outer doors of offices and flats, but also to have a device whereby the latch can be withdrawn and the door opened by remote control from within. For these purposes the electricity authority allows special transformers and provides a special tariff. The transformer must conform as regards construction to the rules of the supply authority, and the

no-load power must not exceed 1 watt. The following is the tariff:—

Cost of energy per annum.

	Bells only.		Bells and door opening.	
	Frs.	Shillings.	Frs.	Shillings.
House of 8 rooms	3	2.4	5	4
House with more than 8 rooms...	5	4	6	4.8
Buildings of maximum 3 flats ...	4	3.2	6	4.8
Buildings of more than 3 flats ...	5	4	7	5.6

How gladly would the English householder get rid of the nuisance of his bell batteries for 3s. a year!

Principle of the Tariffs.

In the preceding paragraphs I have emphasised the benefit to the consumer arising from the very low tariffs, but these are only possible *because time switches improve the load factor.* The principle underlying this improvement is the combination of two rates with a time switch. This is very different in its effect from the two-part tariff. It definitely discourages the consumer from taking power except during those hours which best suit the supply authority, and it achieves the result by a liberal use of time switches. To meet these conditions, the consumer's apparatus must embody the principle of energy storage, entailing the equivalent of the gas-holder. The difference between the gas supply and the local storage system is that in the latter case the consumer pays for his share of the storage required, and for his share only; but he pays for it in a shorter period.

Supply authorities to whom I have mentioned this plan invariably reply with Lieut.-Col. W. A. Vignoles: "Expenditure on meters is unproductive, and should be kept down to the bare minimum." In Switzerland this is not the case. An economic rent is charged for the meter and time switch, and the business becomes profitable. The consumer does not object because the benefits accruing to him are usually out of all proportion to this rent; and if they are not, he can adopt some other tariff. The general effect of the whole policy is shown in the "Jahresbericht des Elektrizitätswerke Basel."

The load factor, though high in 1916, is now higher than would exist in any but the most favourable electrochemical industry, such as the manufacture of carbide of calcium or of carborundum. It is higher than that of some flour-mills. This result, it is claimed, has been brought about by fostering that load which is generally considered to be the worst, *viz.*, the domestic load; and the method of approach is in principle that of local energy storage in the form of heat, rendered possible by engineering initiative in the design of heaters and boilers and of time switches, combined with appropriate tariffs.

Conclusion.—The lessons to be drawn from the foregoing analysis are two. First, it is evident that Swiss engineers, combining their well-known faculty for reliable time-mechanism with the modern necessities of electricity supply, have produced a wonderful series of automatic time switches, which can be supplied at a relatively small cost and can be used even on 6,600-volt circuits. By means of these switches and the principle of energy storage, they are able to offer electrical power at very low rates, far below those in this country, which rates are framed in such a way as to increase the station load factor. It seems clear that we also should adopt similar expedients as rapidly as possible.

Secondly, the electricity authority goes out of its way to be of service to the consumer—especially the small consumer. This policy is clearly shown in the deferred-payment systems for wiring and apparatus, and the many discriminating tariffs for various loads; but it is even more evident in the consideration given to such apparent trifles as bells and door-opening appliances. Surely there is a lesson here also for us—a lesson which is very appropriate at a time when the E.D.A. and the E.L.M.A. are conducting a campaign to advertise the use of electricity. The best possible advertisement for electricity supply is that which results from a meeting between A and B on their way to town in the morning, when A casually remarks: "I arranged a month ago to put such and such an apparatus on the new tariff. It's saving me pounds a year!"

Tests for Resultant Economy.

The Calculation of the ultimate gain resulting from the heating of boiler-feed water by means of steam "bled" from the main Turbines.

By "ESSAYE."

POWER station engineers generally are well aware that considerable economy, in operation, may be obtained by the heating of the boiler feed-water by means of steam "bled" from one or more stages of the main turbine units. That the operating cycle is thereby improved is unquestionable. If, say, 5 per cent. of the total heat in the steam delivered to the turbine is returned, by means of a "bleeder" heater, to the condensate (feed water), it is obvious that 5 per cent. less heat transfer will be required in the boiler plant.

In most stations, however, this will not mean a 5 per cent. reduction in the fuel bill, and the question that arises is: How much of this saving will ultimately be realised?

First, then, the steam consumption of the turbine will necessarily be somewhat increased, due to the "bleeding" of some of the steam before all the turbine stages have been passed. Secondly, where the innovation of "bleeder" heating is made in a station in which the usual large economisers have already been installed, it will be apparent that the higher inlet water temperature to these economisers will render the water unable to extract the same amount of heat from the gases as heretofore. The consequent rise in the gas outlet temperature will, therefore, result in a decrease in the percentage efficiency of the boiler and economiser as a whole.

As the composition and lay-out of the boiler plant must have a largely varying effect on the overall saving, the writer will confine these notes to the problem as met with in a station where economisers only are installed in the flues. The following calculations are therefore put forward as being a simple and straightforward means of arriving at the ultimate gain in such a station. The data for these have been obtained from a great number of turbine and boiler tests taken in a large

modern power station, and the accuracy of these tests is as great as is possible.

The following is the method stated briefly:—

The total steam consumed by the turbine in one hour was obtained from two similar tests, first without "bleeding," and secondly with "bleeding." In each case a figure of 5 per cent. (representing boiler make-up) was added, and the resultant gave the total steam demand from the boilers. The two different feed temperatures (at the economiser inlet) were also noted.

From the boiler tests the evaporation figure, *i.e.*, lb. of water (actual) evaporated per lb. of coal, was obtained for the two different feed temperatures. Then, by dividing these "evaporation figures" into their corresponding steam demand, the total coal required in each case was obtained. The overall gain due to "bleeder" heating was then easily obtained on a percentage basis.

The following are the actual test figures obtained:—

	Without bleeding.	With bleeding.
Load in kW	18,000	18,000
Turbine steam consumption (1 hr.), lb.	188,856	191,160
Total steam demand, lb. ...	198,299	200.718
Temperature of feed, deg. F.	91	150
Evaporation figure, lb. ...	8.182	8.617
Coal required, lb.	24,238	23,300

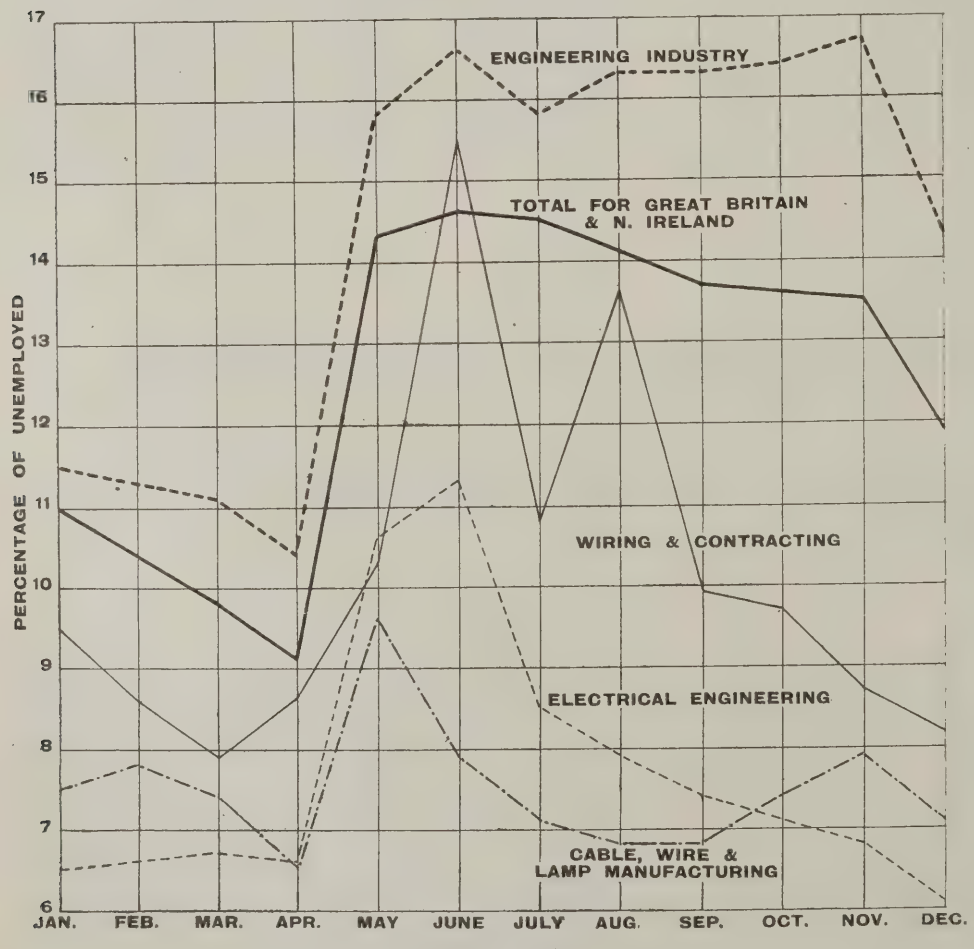
The difference of 938 lb. represents an overall gain due to "bleeder" heating of 3.78 per cent. The figures in the table have been corrected for the inevitable small dissimilarities which occurred in the tests.

Unemployment during 1926.

The Favourable Position of the Electrical Industries in a Troubled Year.

As was indicated in the foreign trade tables which appeared in our last issue, while British exports generally were very badly affected during 1926 by the industrial troubles which marred the year, electrical exports continued to progress, and were in excess of those of 1925. Even in the months affected by the general strike and its aftermath, all sections of the electrical industry compared well with other industries.

If further testimony is needed, the curves which accompany these notes will provide it. For the particulars from which they are prepared we are indebted to the *Ministry of Labour Gazette*. The statistics of general unemployment are based on the returns of the Employment Exchanges, and these (as well as the others dealt with) are for Great Britain and Northern Ireland. The percentages are derived from the total number of insured persons as at July, 1925 (11,892,000), for the first six months, and from the total as at July, 1926 (12,041,000), for the latter half of the year. This change of basis also occurred in the individual industries, necessitating the use of percentages rather than numbers.



Unemployment during 1926.

Dealing with the curve showing the state of unemployment as a whole, it will be seen that during the first quarter of the year the percentage fell at a regular rate from 11 to just over 9. Then came the general strike and the commencement of the coal stoppage, which sent the figure up to 14.3 per cent. In June it went slightly higher, and then gradually fell until December, when it made a sudden descent, which continued during January. The level of unemployment in the engineering industry as a whole was above the general figure during the whole of the year, and for the greater part experienced similar fluctuations; the improvement towards the close of the year was very marked. The curve indicating the state of employment in the electrical engineering industry stands out in marked contrast to the others. Commencing at 6.5 per cent., it kept well below the general and engineering figures, and at its highest (in June) was only 11.3 per cent., when the national figure was 14.6 per cent., and that for the engineering industry was 16.6 per cent. The section least affected by the industrial upheaval in May was the

electric cable, wire and lamp manufacturing group. Unemployment in this section went to 9.6 per cent. in May, but there was a swift recovery, and the position remained comparatively satisfactory until October and November, when there was a rise to 7.8 per cent. In common with the other groups, however, there was a decided improvement in December, and the final position was better than at the beginning of the year. The most violent fluctuations occurred in the wiring and contracting industry. Opening in a satisfactory manner, the percentage of unemployment rose enormously in April, May and June, and after a great improvement in July, again went up. In September there was another large fall in unemployment, and this was maintained at a slower rate for the rest of the year.

To afford the reader some idea of the magnitude, as distinguished from the proportion, of unemployment in the groups with which the curves deal, we may give the actual numbers upon which the last points of the curve are based; these are as follows:—General, 1,431,840; engineering industry as a whole, 143,503; electrical engineering industry, 4,686; electrical wiring and contracting, 1,141; and electric cable, wire and lamp manufacturing, 6,274.

Legal.

British Thomson-Houston Co. Litigation.

IN the Chancery Division, on January 28th, Mr. Justice Astbury granted an injunction until the trial of the action, the British Thomson-Houston Co., Ltd., against Green & Co., Leeds, restraining the defendants from infringing plaintiffs' letters patent relating to the gasfilled lamp. The defendants did not appear.

His LORDSHIP also granted an injunction *ex parte* in the case of the British Thomson-Houston Co. against P. M. Braidwood, Barnet, restraining the defendant from infringing plaintiffs' leading-in wire patent and the gasfilled patent. Leave was given to serve defendants with notice of motion for February 4th.

Mr. Trevor Watson appeared for the plaintiff company in both cases.

The West Yorkshire Electric Co. and Mr. J. G. Ritchie, of Leeds, were defendants to a motion before Mr. Justice Tomlin, in the Chancery Division on January 28th, by the British Thomson-Houston Co., Ltd., which claimed an injunction restraining alleged infringements of its leading-in wire and gasfilled lamp patents.

Evidence was read that a dozen lamps were bought by an agent of the plaintiff company at the back door of the defendants' premises, Mr. Ritchie producing them from a cellar.

Mr. RITCHIE denied that he had done anything wrong, and he asked for time to consider the plaintiff company's evidence.

His LORDSHIP adjourned the motion for a week for this purpose, but continued in the meantime the *ex parte* injunction restraining the defendants from parting with any infringing lamps still in their possession.

A Wiring Contract Dispute.

IN the Mayor's and City of London Court, before the Common Serjeant, Sir H. F. Dickens, K.C., on January 25th, a claim was made by Messrs. Margolis Fulberg & Budd, electrical engineers, 163, Wardour Street, against Mr. C. T. Colpitts for £41 15s., balance due in respect of electrical wiring and fittings supplied to a flat at 53, Lancaster Gate. The defendant admitted in respect of alterations to wiring a sum of £23 15s., also £21 15s. of which total of £45 10s. a sum of £40 had been paid, leaving a balance of £5 10s. The plaintiffs' case was that they were engaged by the landlord of the premises at 53, Lancaster Gate to do electrical wiring work when arranging for the house to be converted into a number of flats. That job was practically completed at the time the contract in the present case was made. Before that contract, plaintiffs had fitted certain of the electric wiring for the installation to lath and plaster partitions which were afterwards condemned. The defendant, a tenant of one of the flats, agreed with the plaintiffs to carry out alterations to the wiring. In the course of carrying out that work, the lath and plaster partitions were demolished, and breeze slab partitions re-erected in their place. In carrying out the defendant's instructions, the plaintiffs said, the flat had to be entirely rewired. It was also much more difficult to deal with a breeze slab partition than with one of lath and plaster. The defendant contended that some of the work claimed for by the plaintiffs was not necessary.

Mr. COLPITTS said that he did not know anything about scrapping the lath and plaster partitions in the building, and replacing them by breeze blocks. He had told the plaintiffs' representative, when the partitions were pulled down, that he (witness) would have to pay for re-instating the electrical wire, but he was never told that the flat would have to be rewired throughout. He put the amount he was liable for at £23 15s.

Mr. R. F. HAYDEN, F.S.I., considered that the cost of work rendered necessary by the removal of partitions was £20 5s., and for sinking switch boxes into breeze blocks he thought £3 10s. would be sufficient.

Mr. F. FIELD, manager of the electrical department of Messrs. Sims & Sims, electrical engineers, Gloucester Gate, said that in his opinion £20 was the cost of work rendered necessary by the alterations in the partitions. For ordinary slip tube installation work, whether chased into walls or not, a normal price would be 22s. per point, but for first-class screwed barrel work the price was 30s. to 32s. per point.

The COMMON SERJEANT said that the plaintiffs had failed to satisfy him that the work which they did was necessary, or that the price of £2 10s. per point was reasonable. He found that the sum allowed by the defendant of £23 10s. was the outside price to charge, and therefore the amount which had been paid was sufficient. Judgment was entered for the defendant, with costs.

Damages Awarded Against the Cork Tramways Company.

IN the Circuit Court at Cork, before Judge Kenny, on January 26th, Mr. A. P. Morgan, proprietor of the Cork Motor 'Bus Services, sued the Cork Electric Tramways and Lighting Co., Ltd., for £100 for damage to one of his 'buses, by reason of negligence and the reckless driving of one of the company's cars, and for consequential loss suffered owing to the collision. There was a counter-claim for £1 16s. 10d. in respect of damage to the tramcar, in the collision with the 'bus. After hearing the evidence at great length, Judge KENNY said he was satisfied that the collision with the 'bus was due to the negligence of the tramcar driver. He was strongly of the opinion that the driver of the tramcar did it maliciously, but he certainly did it negligently, and therefore the defendant company was liable for £35 damages. Judgment was given for that amount with costs and expenses. The counter-claim was disallowed.

Alleged Fraudulent Use of Electricity.

IN the Falkirk Sheriff Court, last week, a local licence-holder was charged at the instance of the Corporation with fraudulently altering the index of an electricity meter and preventing it from registering the quantity supplied, and fraudulently using 71 kWh of electricity. He pleaded "Not guilty," and evidence was heard at great length, the witnesses including Mr. T. M. Climie, the burgh electrical engineer, and Mr. R. J. Taylor, superintendent of the testing laboratory of Glasgow Corporation. For the defence it was denied that there was any interference with the meter. The Sheriff adjourned the case until February 7th.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Wattmeter Calculations.

Referring to the objections raised by your correspondent, Mr. D. Robertson, under the numbers which he gave them:—

1. In order to allow for the power consumed by the volt-coil "by simple subtraction," it is obviously necessary also to know the p.d. across the volt-coil, which is the same (in this case) as the load voltage, and Mr. Robertson, under (4) states quite correctly that this "is very troublesome, even when possible." It appears, therefore, as if he refutes his own argument.

2. This again depends on knowing the load voltage, and thus comes under the same heading as the above.

3. It is not desirable to allow the coils of a precision wattmeter to attain a 50-degree Centigrade temperature rise, necessary to produce the 20 per cent. change in resistance mentioned by Mr. Robertson, and in any case, the figure refers to *an error in an error*, and so is less formidable than might appear.

4. It is somewhat difficult to see in what sense this statement applies to the one method more than the other, seeing that the end of the current-coil to which the volt-coil is connected has no bearing whatever on the difficulty or otherwise of measuring the load voltage.

5. It would hardly be thought necessary to point out that figs. 1 and 3 are theoretical circuit diagrams, and do not supply the information regarding the precise disposition of the leads which Mr. Robertson appears to extract from them. Apart from that, he does not appear to have noticed that currents heavy enough to warrant consideration of contact resistance are specifically ruled out in the first paragraph of the article, as the errors in question are then negligible.

As pointed out in the article, the accuracy of the graphical corrections was not allowed to depend on mere theory, but was

carefully checked by experiment with standard apparatus representing a large variety of conditions. It is not always appreciated that in work of this kind the introduction of any ordinary form of a.c. voltmeter or ammeter completely alters the circuit conditions, and that therefore methods legitimate in general electrical practice do not apply.

Blackheath, *January 25th*, 1927. **Marcus G. Scroggie.**

Power Supply for Wireless Sets.

I was very much interested in the letter published by you, dated January 15th, from Mr. A. O. Griffiths, the more particularly as my own experience has been entirely different to his.

I changed over from so-called "dry batteries" to an accumulator six months ago. Under advice I was careful to have my accumulator recharged frequently, and at the end of four months I came to the conclusion that I preferred the dry battery, which gave me no trouble from recharging, and which, when exhausted, I was able to renew at a moderate expense.

I am satisfied in my own mind that a dry battery is cleaner, freer from trouble, and less expensive than an accumulator for the high-voltage supply.

Enfield, *January 24th*, 1927. **E. Rowbotham.**

I have read the letter of "Interested" in your issue of January 28th. It is a little difficult for me to reply adequately to this letter, for its writer does not commit himself to definite statements. He *thinks* that some statements of mine should be challenged: he *thinks* that the human ear . . . . . should be the final judge: *to his mind* his apparatus is distortionless, &c. Of course, he is entitled to his opinions, whatever they may be, but, since he has published them, perhaps I may be permitted to discuss them.

I will take first his statement: " . . . I am now using instruments which, to my mind, give absolutely distortionless reproduction of both speech and music. . ." As I have said, it is not for me to discuss the state of "Interested's" mind: I can only deal with facts. Putting aside the extreme improbability that there ever has been or ever will be an "absolutely distortionless" receiver, let me ask "Interested" on what facts or tests he bases his opinion?

Has he had the opportunity to take these instruments up to Savoy Hill, and listen to the performance with an instantaneous change-over to its reproduction on his set? If not, any claim for complete absence of distortion is simply ridiculous.

It is probable that about the nearest approach to distortionless reproductin at the present moment is the set at the South Kensington Museum, which has been built regardless of space and expense: but I know that its designer will be the first to admit that some distortion still exists in it. In fact, most of the distortion can be calculated from the circuit diagram.

Again, in his opinion "that the human ear, provided it be competent, must be the final judge as to whether a broadcast receiver is distortionless or not," he begs the whole question, for it is a fact undisputed by those who have studied the subject that there is no record of any human ear being competent in this sense. All the tests which have been made go to show that even at the easy task of judging the strength of a pure note, when the strength is changed instantaneously (the easiest test of all), the ear can hardly ever detect a change of less than 10 *per cent.*, and that the ear passes as correct complex sounds of which some components may be proved to be 50 *per cent.* below their proper amplitude.

Certainly the ear is the final judge as to *whether certain reproduction pleases that ear's owner*: but that is a totally different matter, which I have not discussed in my contributions.

It is notorious that some people prefer a distorted reproduction; for example, many prefer their music made "mellow" by having the high harmonics cut down. But since there is no hope of forecasting in advance what the majority will prefer, I have always gone on the principle that the nearest possible approach to a true reproduction is the best thing to offer.

It appears to me that "Interested" shows such a complete lack of appreciation of what "distortionless reproduction" really is that it is unnecessary for me to discuss the methods by which he claims to have achieved it.

P. K. Turner.

Blackheath, *January 29th*, 1927.

For an amateur my experience has been a fairly extensive one; I have had several sets and many different types of valves, and have used both dry batteries and accumulators for h.p. Many months ago I finally discarded the latter as being far too messy and troublesome. I am now a confirmed believer in the dry battery, as no attention at all is necessary for months on end, and in 90 per cent. of the sets used it is certainly less expensive in operation.

Where a few enthusiasts go wrong is in changing their valves for the modern high emission power valves; these are, no doubt, excellent in their way, but in my opinion the extra running costs are not compensated for by the little advantage obtained.

If you must have these, see that a dry battery of ample proportions is used. You do not expect to run an 80-h.p. car with the same petrol consumption as that taken by the more modest "ten." Apply the same reasoning when you select your high-voltage dry batteries.

Your correspondent himself condemns the use of accumulators in his second paragraph.

London, *January 25th*, 1927. **R. S. Stanley.**

River Water—or Cooling Towers?

In his letter in your issue of January 28th, 1927, Mr. R. J. Kaula doubts if the values assigned to vacua in the article on "River Water—or Cooling Towers?" could be substantiated by calculations. If the values assigned to the basis of vacua in the article, namely, an average recooled water temperature of 75 deg. F., and an average river water temperature of 50 deg. F., are admitted as being reasonably accurate values, then Mr. Kaula may find his doubt removed if he will refer to fig. 2 in the book on "Condensing Plant," the joint authors of which are R. J. Kaula and I. V. Robinson. The values assigned in the article to vacua corresponding to given inlet temperatures are based upon the results of tests on many makes of modern condensing plant by the writer, and fig. 2 in Mr. Kaula's book gives values substantially in accordance with those in the article. The differences between the values given by fig. 2 in the book referred to, and those assigned in the article are too small to affect the main issue.

In passing, Mr. Kaula comments that the article neglects to make any allowance for the power required to pump the circulating water to cooling-tower level, and states that this power will be practically 1 per cent. of the steam consumption of the main unit, thus implying that there is a debit of 1 per cent. against the cooling-tower station on this account. It needs little consideration to show that that is not the case. There is a difference in the circulating-water quantities in the two cases, for which due allowance was made in the article in assigning the values of vacua, and if this difference of water quantity is taken into account, the difference in the power taken by the circulating pumps falls to about 0.5 per cent. as a maximum. In most practical cases, owing to reasons outside our present scope, the difference would be less than this maximum value of 0.5 per cent. This point was investigated when writing the article, and the writer arrived at the conclusion that the difference in pump power for most comparative cases would be of the order of about 0.3 per cent., with a maximum value of 0.5 per cent. It was therefore deemed to be not worth while introducing this detail, for, if it were introduced, then to do full justice to both cases it would be necessary to compare relative capital and running costs, and it was desired to keep all reference to costs out of the article.

Mr. Kaula points out that the half-load figures in fig. 1 prove that practically the whole of the theoretical gain can be achieved, given a correctly designed low-pressure end. The writer would point out that the corollary to this is that to achieve the same result at full load would necessitate increasing the low-pressure blade area by about 90 per cent.—practically double. At the present time turbine designers find it impracticable to do this in a commercial turbine.

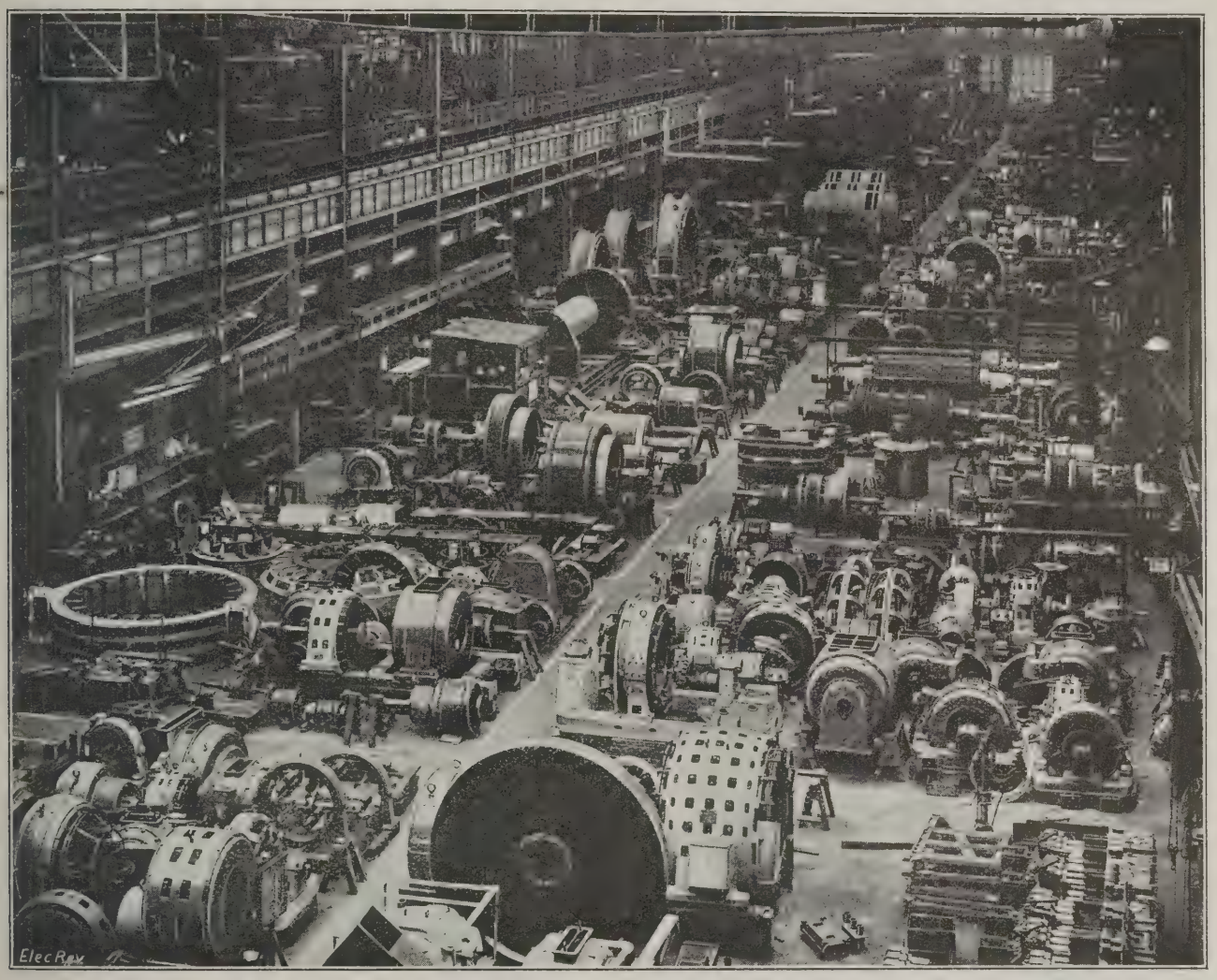
Mr. Kaula states that turbine builders all over the world are prepared to guarantee their ability to build turbines which will utilise the heat energy efficiently down to 0.9 in. Hg., and even below. If the word "relatively" were inserted before "efficiently," the writer could agree, but would point out that this is not the same thing as guaranteeing a definite gain accruing from lowering the terminal pressure from, say, 1.8 in. Hg. to 0.9 in. Hg. abs., which is the basic requirement from the point of view of the article. The writer makes bold to state that no such guarantee has ever been given in this country for modern plant. It may, or may not, be news to Mr. Kaula that if a prospective turbine purchaser drew up a turbine guarantee schedule calling for guaranteed steam consumptions at, say, 0.9 in. Hg. and also at 1.5 in. Hg., then not one of the turbine builders in the B.E.A.M.A. would give such a guarantee. The writer has tried to obtain such a guarantee, and every firm in the B.E.A.M.A. has refused to give it. The writer does not infer that turbine builders do not know the value of altered conditions—they obviously must know, or they could not give their ordinary guarantee—but the writer does believe that they are not particularly anxious that the purchasers should know the true value of conditions. The remedy is in the hands of the purchasers and consists in following the example of the writer by determining these values for themselves.

The article did not state or imply that turbine builders, as a body, were mistaken in the results they could obtain for given conditions, as inferred by Mr. Kaula; to do so would obviously be absurd. Neither did it state or imply that the results presented could not be improved on in the future. Bleeding the turbine for feed heating will tend to increase the difference between the two cases. The article presented the case as it stands to-day, and made no speculations to what the position would be years hence. As realised by Mr. Kaula, the article stands or falls by the test results given in fig. 1. To disprove the results arrived at in the article, it is necessary to produce authentic test results, showing immensely improved performance *at full load* over the range of vacua assigned. Mr. Kaula produces no such results, but merely a blind faith in the ability of turbine builders. The writer prefers to put his faith in reasonably accurate test results.

Stoke-on-Trent, *January 28th*, 1927. **J. N. Waite.**

Electrical Activity at Trafford Park.

MUCH has been said recently regarding the greatly increased volume of business that is receiving the attention of British electrical and allied manufacturers. The accompanying picture will convey more readily than many written paragraphs the real state of affairs at one big factory at Trafford Park. It shows the large electrical aisle at the works of the Metropolitan-Vickers Electrical Co., Ltd. The photograph speaks eloquently of the large amount of work in progress in the shop, and also to some extent indicates the size of the aisle, though we have not been able to include the full view of the galleries. At the time of the Manchester Civic Week we gave some notes regarding the big work that was in hand at this factory (see Elec. Rev., October 15th, 1926). Since that time we have recorded the placing of many further large contracts with the company for railway electrification and other operations.



The Electrical Aisle at the Metropolitan-Vickers Works at Trafford Park.

Among the latest orders received by the company is one for electric winding equipment to be installed at the Bedlay Colliery, which is part of the important group of collieries, coke-ovens, and ironworks of Messrs. William Baird and Company, Coatbridge, near Glasgow. The winder will be of the a.c. geared type, with a motor of 280 h.p., operating at 570 r.p.m., and driving through double helical single-reduction gear, giving a speed of 61.8 r.p.m. on a cylindrical drum of 10 ft. 6 in. diameter. The depth to be worked is 1,188 ft., and the winder is to deal with a gross load of about two tons during the sinking operations, and a net load of one ton when carrying men when the shaft is put into work. The equipment will include a Metropolitan-Vickers liquid controller with automatic accelerating gear, and pillar-type switchgear; a Lilly overwind and overspeed device will be fitted. The mechanical parts and equipment for oil braking will be supplied by Messrs. Robey & Company, Ltd. The consulting engineers for the installations are Messrs. Stevenson & McCuffie, of Glasgow. It is of interest to note that the group of collieries and works of Messrs. Wm. Baird & Co. generates its own electric power at the Company's main station at Gartsherrie, which is equipped with two 3,000-kW Metropolitan-Vickers turbo-alternator sets. From this station power is transmitted at 11,000 volts to Bedlay and the collieries and works in the Kilsyth area. Metropolitan-Vickers electric winders are already in use at collieries on the system.

Sir P. Nash on the Electrical Industry.

Sir Philip Nash lectured on January 25th to the Metropolitan-Vickers College Apprentice Association, consisting of over 100 men selected from the principal universities at home and abroad. He said that in less than 100 years over £750,000,000 had been invested in the electrical industry by this country alone, and to-day there was hardly any phase of modern life that did not materially benefit from the extended use of electricity. In 1880 the largest electric generator was of 60-kW capacity, and to-day a single unit generator of 60,000-kW capacity was at work, and designs had been made for a set of 200,000-kW capacity. He anticipated that for this country alone over 30,000,000-kW capacity of turbines, generators, transformers, and motors, besides switchgear, would be required as a result of the developments expected to result from the new Electricity Act. Referring to the Metropolitan-Vickers Company, he said that more than half of its business came from abroad, and that much apparatus for export had to meet more onerous conditions than those met with in this country. He looked to the apprentices to fit themselves to play their part in maintaining the progress of the industry, and strongly advised them to develop the human side by studying very carefully their duty to each other and to the workmen.

Business and Industrial Notes.

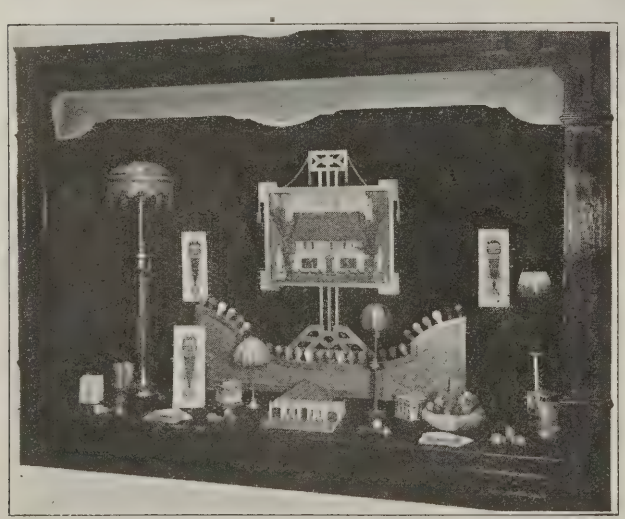
The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

The official report for the week ended January 29th states that the Sheffield demonstration house was opened by the Lord Mayor, and a full electrical page with photograph of the house appeared in the *Sheffield Daily Telegraph* on January 25th. The Leicester demonstration house has been a great success; the average daily attendance has been 300, and a large number of genuine inquiries have been made and actual orders have been received for wiring houses. Bristol is considering running two demonstration houses in the suburbs, and another will be opened at Bath on February 7th. Competition books are being distributed and tramcar advertising is taking place in Douglas, Isle of Man. Southport is making preparations to increase the amount of campaign publicity. Bradford, as a result of a special window display, has increased the number of applications for competition booklets. A special window display in a London contractor's window has produced the following results:—Applications for competition book from commencement of campaign until January 24th, 12; during five days ended January 31st, 280. The display is of a very simple character, and particulars will be sent to any supply undertaking or contractor upon application to the E.D.A., 15, Savoy Street, Strand, W.C.2. On all hands there is evidence that immediate and good business is accruing as a result of the booklet applications. Very satisfactory reports are also coming to hand with regard to the amount of business being done and inquiries being received at the demonstration electric houses.

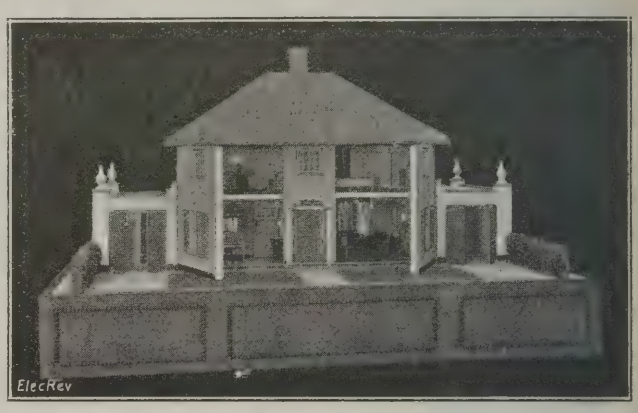
The total number of visitors to Glasgow demonstration house during the first week was 4,126. Owing to the stormy weather experienced in Glasgow during last week, only about 2,100 people attended. It will interest organisers to know that a telephone has been installed free of charge, and free insurance was also given by the Ocean Accident and Guarantee Corporation. Four transparent posters have been put on every tramcar in Glasgow. Apart from the Wolverhampton Exhibition referred to below, an electrical exhibition was opened on January 31st, at the new showroom of the Corporation Electricity Department, Paisley.

One of the most active centres in the campaign is the North-East Coast area, to which these notes have made frequent reference. An illustration of one phase of the work being done in that area is reproduced herewith. It shows a special window display arranged by the Newcastle-upon-Tyne Lighting Service Bureau. The poster depicting the prize house is the dominant feature, and a model of the house is also given prominence. These are supported by lamps and cartons of various makes and colours, while the actual employment of electric lamps is exemplified by four different standards. Copies of the competition booklet also appear.



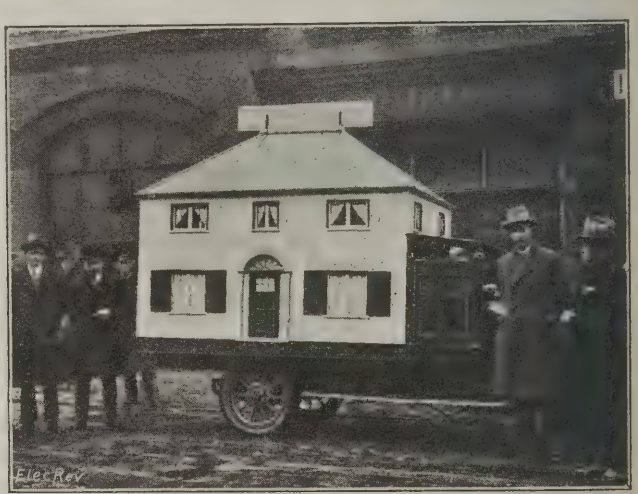
A Newcastle Lighting Service Bureau Window.

In our last issue we reported that Headquarters had had a model of the prize house constructed and fitted for exhibition in the provinces. We are now able to reproduce a photograph of the model, from which it will be seen that a great deal of work has been put into it. The model should certainly stimulate public interest in the competition and inculcate a desire to be the possessor of such an excellent residence.



A Model of the Prize House.

Another model house is being used by the Birmingham Circle. It is fully equipped for electric lighting and heating, and, in the hands of a capable demonstrating staff, it is to tour Birmingham and suburban districts for a period of several weeks. It is mounted on a motor lorry, and will be flood-lighted at night. The scheme was discussed at a special meeting of chairmen and officials in the South Midlands Area of the Campaign, which was held at Dale End, Birmingham, last week, Mr. R. A. Chattock presiding, and it was decided that after a period of service in Birmingham and district the model house should be loaned out to other circles at a nominal charge. The Birmingham Committee also has in view the opening of about five more demonstration houses in various parts of the city in the near future, and the beneficial results of the previous houses was referred to by Mr. Chattock at the meeting mentioned above. The Campaign is being warmly supported by the Wolverhampton Corporation, which is collaborating with local traders in an exhibition; a special meeting under the auspices of the Electrical Association for Women was held during the exhibition, at which Lady Bird presided and Mr. V. W. Dale (E.D.A.) lectured.



A Model Prize House at Birmingham.

A further, illuminated, model of the house appears in the window of the Ludgate Hill showroom of the City of London Electric Lighting Co., Ltd.

The Hendon Electric Supply Co., Ltd., conjointly with the Hendon Circle, is organising an electric house. The house will be fully furnished, and electrically equipped throughout. The General Electric Co., Ltd., has undertaken to supply a large number of fittings and appliances. It is intended that this demonstration house shall be open for a period of three weeks, but this period may be extended if the circumstances warrant. It is proposed to erect a special two-way electric sign on the house—which will be readily seen from the railway—in order to draw attention to it.

An electrical exhibition, promoted by the Wolverhampton Corporation Electricity Department, with the co-operation of local contractors, was held at the Baths Assembly Rooms last week. At the opening ceremony on January 27th there were present the Mayor (Alderman F. A. Willcock), Sir Robert Bird, M.P., and Mr. G. R. Thorne, M.P., the first-named declaring the exhibition open.

Mr. Ernest Morgan, the Wolverhampton borough electrical engineer, who presided, referred to the assistance of the electrical contractors, and said that the exhibition was almost entirely domestic in its appeal, because the industrial world had learnt the benefits to be derived from the use of electrical energy years ago.

The Mayor said that Wolverhampton had one of the finest power stations in the country, and the aim of the Corporation was to supply current to consumers at as cheap a rate as possible. The exhibition would demonstrate what could be saved by the use of electricity in the home. Sir Robert Bird, M.P., remarked that Wolverhampton had already taken steps to do what the Electricity Act was out to do for other parts of the country. Mr. G. R. Thorne, M.P., also spoke.

During the three days the exhibition, which proved of great interest, was well attended by the public. The following contractors co-operated in the display:—Messrs. Coley and Swinnerton, H. Cooper, W. H. Podmore, C. Gordon Smith, H. H. Speke, Smith & Bellhouse, E. Wilson, and the Midland Electric Power Installation Co.

An Effective Advertising Van.

The accompanying illustration shows one of the new type of delivery vans recently put on the London streets by the MULLARD WIRELESS SERVICE CO., LTD. These are examples of an effective method of impressing a company's name and



A New Mullard Delivery Van.

product upon the minds of the public. The idea is, of course, not entirely novel—one or two electric lamp makers already have vans of this type in service—but that does not lessen its value as a propaganda medium.

Social Events.

The staff of Le Carbone held its annual dinner on January 21st, at the Boulogne Restaurant, London. A concert and dance followed, which were very much enjoyed by a large party.

A whist drive and dance were held on January 27th, at the Parade Café, organised by the Bradford Corporation Electricity Department. About one hundred of the staff and friends attended. Alderman and Mrs. Longley were present, and the alderman presented the whist prizes. After supper, conducted by Mr. C. E. Allsopp, the company took part in community singing.

The annual dinner of the Engineering Staff Association of the Fife Electric Power Company was held at Dunfermline on January 27th, when Mr. T. C. Hunter, chairman of the Association, presided.

On January 28th 50 couples attended the annual dance of James Scott & Co., electricians, Dunfermline.

The annual Bradford Corporation Tramwaymen's concert took place on January 26th, at the Eastbrook Hall, and was attended by a very large audience. The Deputy Lady Mayoress of Bradford (Mrs. David Walker), the chairman of the Tramways Committee (Mr. Irvine Smith), and the general manager of the tramways (Mr. R. H. Wilkinson) were among those present. The artistes were Miss Mavis Bennett (soprano), Miss Enid Cruikshank (contralto), Mr. Dennis Noble (tenor), of the British National Opera Company, Mr. Frank Webster (baritone), Miss Almena Marshall (flautist), Miss Belle Davidson (violin), and Mr. Charles Stott, accompanist and organist.

The second annual dinner of the staff of the West Gloucestershire Power Co., Ltd., was held at the Swan Hotel, Lydney, on Saturday, January 22nd. The general manager and chief engineer, Mr. H. S. Ellis, was in the chair, supported by Mr. M. F. Carter, Supt. Shellswell, and other guests. Mr. M. F. Carter, of Newnham, proposing a toast to the company, said that the company's area of supply was some 600 square miles, in which it had made steady and satisfactory progress. The chairman, in replying, referred to the substantial progress made during the past year in spite of the industrial trouble in the country. During the evening Mr. Ellis presented (on behalf of the whole of the employés) a leather expanding suitcase to Mr. G. A. Harrison, district engineer, who has resigned, having obtained a position abroad. The concert included the first performance of the company's Amateur Dramatic Company.

The British Industries Fair.

Many new matters of interest will be seen at the Birmingham section of the Fair this year. As we have reported, an additional area of 120,000 sq. ft. has been enclosed at Castle Bromwich, and some hundreds of workmen are engaged on the installations for lighting, heating and power for exhibitors' use. A "perfect boiler house," one of the principal exhibits in the new Steam Power Section, alone occupies 15,000 sq. ft. Among the working exhibits will be the "cheapest power pump in the world," single- and three-phase motors with special high-torque rotors of a type not previously made in this country, electric drills of special design for use in confined situations, automatic electro-plating plant, electro-medical appliances which have hitherto been imported, apparatus for the critical matching of colours and for testing their "fastness," and the manufacture of electrical porcelain from the raw clay to the finished article. The domestic side will also be well represented, and we are promised "gas and electric fires with no visible metalwork"; an "electric kettle which reduces the boiling time to half that of other kettles, while using less current"; and "new electric geysers with interlocked switchgear, absolutely foolproof, however careless the user."

Ideal Homes Exhibition at Norwich.

Considerable interest is being aroused in Norwich and district in the Ideal Homes Exhibition which has been arranged to take place at Norwich from February 8th to 19th, inclusive. It is hoped that an appreciable stimulus will be given to the idea of electricity in the home as a result of it throughout the Norwich area. Messrs. Mann, Egerton & Co., Ltd., are making a special display, and the General Electric Co., Ltd., is supplying that company with a complete range of "Magnet" household electrical appliances, together with "G.E.C." fittings, for this purpose.

For Sale.

Norwich Corporation Electricity Department has for disposal three Babcock & Wilcox drum marine type boilers, each 27,000 lb. per hour capacity, fitted with chain grate stokers, B. & W. oil-burning apparatus with pumps, heaters, &c., and one induced-draught fan and motor. Reigate Corporation Electricity Department has for disposal surplus generating plant installed at the Electricity Works, Wray Common Road. Ilford Corporation Electricity Department invites offers for the dismantling and removal of two 500-kW, d.c., Willans-English Electric generating sets, condensing plant, switch panels, &c. Edinburgh Corporation Electricity Department invites offers for 55 tons of battery plates, 11 tons sheet lead, and 7 tons peroxide of lead. Mr. H. J. Shaw will sell by auction on February 9th and following day, at 13, High Holborn, W.C., various wireless and electrical trade stocks and plants. By order of the liquidator of Seagull, Ltd., Mr. G. R. Lightfoot will sell by auction on February 11th, at 5, Newcastle Place, Edgware Road, W., the lease, plant, stock, &c. (See our advertisement pages to-day.)

Chinese Notes.

The Eastern Radio Supply Co. recently commenced business at 6, Pu An Lee, Rue Colbert, Shanghai. It deals in all kinds of radio supplies and manufactures minor accessories.

The Shanghai-Paoshan Electric Co. is being organised with a temporary office at A112, Peking Road, Shanghai. The company has a capital of $1,500,000, and intends to construct street-car lines to connect the Shanghai and Paoshan districts.

Electrical Plant for Mexico.

The National Irrigation Commission, appointed to inquire into existing plant and the provision of future electricity works, mainly for irrigation purposes, in northern Mexico, has presented its report to the Government. It is understood that it contains strong and unanimous recommendations for the expenditure of further large sums on development over a large area. If the report is acted upon, a strong demand will arise for construction material and electrical plant and equipment, stocks being at present unusually low. In view of the present relations between Mexico and the United States it is thought that British manufacturers of electrical machinery having representatives on the spot would have a good chance of securing orders, apart from the particular favour with which British manufactures are regarded in Mexico.—*Reuter's Trade Service* (Mexico City).

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Recent Contracts.

In connection with the large contract awarded by the Southern Railway to the Metropolitan-Vickers Electrical Co., Ltd. (*vide* Electrical Review, December 31st, p. 1076), the latter company has given an order to the Westinghouse Brake and Saxby Signal Co., Ltd., for 232 motor-driven air compressors and a similar number of air-pressure governors for use in the motor coaches which the Metropolitan-Vickers Co. is supplying.

Among the orders recently executed by the Chloride Electrical Storage Co., Ltd., is one for six large batteries, each consisting of 114 cells for six locomotives at a mine in Chili, high up in the Andes. The climate is a trying one; no rain has fallen in that part of the country for hundreds of years. The company has recently shipped to another South American customer 13 locomotive batteries consisting of 100 cells each.

Civic Week at Fulham.

The Fulham Borough Council is organising a Civic Week to be held from February 5th to 12th. During the week there will be held at the Town Hall lectures, concerts, and an exhibition of local arts and crafts. At the Public Baths an Industrial Exhibition is being arranged; this will be opened by the Lord Mayor of London. The stalls will be arranged and supervised by Fulham manufacturers and producers, and the Electricity Department has taken a large stall, on which it is setting up a dining room, bedroom, and kitchen. In the last compartment electric cooking demonstrations will be given twice daily.

Calendars and Diaries.

We have received from the Enterprise Manufacturing Co., Ltd., Grape Street, Shaftesbury Avenue, W.C.2, a calendar bearing a humorous illustration and monthly date sheets.

The 1927 calendar of Messrs. Petters, Ltd., Yeovil, has a large sheet for each month bearing illustrations of examples of the company's engines and generating sets.

The principal feature of a calendar received from the Consolidated Pneumatic Tool Co., Ltd., 170, Piccadilly, W.1, is a picture of a "Little Giant" portable electric drill. There are monthly date sheets, each of which bears a calendar for the previous and succeeding months.

Trade Announcements.

Mr. Oscar Beabey, late manager of Messrs. Troup, Curtis and Co., Ltd., Liverpool branch, has started in business and will trade as O. Beabey & Co., electrical and general engineers, 13-15, Carlton Street, Liverpool. He asks for copies of catalogues.

The London office address of Messrs. Ransomes, Sims and Jefferies, Ltd., as from February 7th, will be Dashwood House, 69, Old Broad Street, E.C.2. Telephone No.: "London Wall 2422."

The Walsall Hardware Manufacturing Co., Ltd., has opened a new store at 20, New Street, Leicester, where a full range of its conduits, ironclad switchgear, &c., will be stocked. Mr. J. Lea is in charge.

New Catalogues and Lists.

British Electric Lamps, Ltd., Spencer Hill Road, Wimbledon, S.W.19.—An illustrated pamphlet advertising "Maxtrip" tubular lamps and a leaflet dealing with candle lamps. Both are priced.

Mr. Percy Pitman, 25, Victoria Street, S.W.1.—A detailed and illustrated description of the Pitman automatic deflector for the speed regulation of impulse turbines, hydro-electric plant, &c.

Messrs. J. W. Brooke & Co., Ltd., Adrian Works, Lowestoft.—A folder describing the new "Dominion" 5-7-h.p. motor-boat engine.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publication No. 305A, illustrating numerous examples of "English Electric" locomotives for industrial purposes. A general description is also included.

Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C.2.—Leaflet No. 1061, containing an illustrated description of a 500-W fixed wavelength telephone set for operation by unskilled telephonists.

Messrs. A. P. Lundberg & Sons, 477-489, Liverpool Road, Holloway, N.7.—List S 30, containing illustrated details and prices of plug connectors, adaptors, and accessories.

Higgs Motors, Witton, Birmingham.—An illustrated catalogue of a.c. and d.c. motors for industrial purposes. Full specifications and prices are given.

Messrs. Crompton & Co., Ltd., Chelmsford.—List No. A.12, dealing in some detail with "Tru-Wat" three-phase autosynchronous motors for power factor improvement. Fully illustrated.

The Visco Engineering Co., Ltd., 162, Grosvenor Road, S.W.1.—A brief description of the "Visco" air filter and a list of electricity supply authorities, manufacturers and others who have installed these filters.

Mr. J. S. Plumtree, 90-91, High Holborn, W.C.1.—A standard list of motors and dynamos made by the Electrical Power Engineering Co. (Birmingham), Ltd.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet O.S.4347, illustrating and describing the floodlighting of the Hearts of Oak Benefit Society building, Euston Road, N.W.1, carried out with G.E.C. projectors, which are also described.

Messrs. Herbert Morris, Ltd., Loughborough.—A coloured illustrated folder advertising the company's gravity conveyors.

The Sun Electrical Co., Ltd., 118 & 120, Charing Cross Road, W.C.2.—Two illustrated and priced folders dealing, respectively, with domestic appliances and electro-medical apparatus.

Messrs. Vlies & Benson, Ltd., 1, Brazennose Street, Manchester.—Pamphlet 201A, describing equipotential surface cables made by the Forges et Ateliers de Constructions Electriques de Jeumont.

Bankruptcy Proceedings.

W. H. Dickson and A. J. Solomon, Tavistock Street, Devonport, electrical and radio engineers.—The public examination of these debtors should have taken place at Plymouth Bankruptcy Court on January 28th, but only Dickson put in an appearance, he stating that he had not seen his partner since Christmas. The Official Receiver (Mr. A. N. F. Goodman) said that the business was bought from a man named Kingdon, who absconded, and apparently Solomon had now absconded, while he (the Official Receiver) was the principal creditor by virtue of his position as trustee in the bankruptcy of Kingdon. The statement of affairs showed liabilities of £388, and a deficiency of £270. Dickson stated that in 1925 he answered an advertisement by Kingdon for a partner. The latter wanted him to invest £500 in the business, but he put in £200 only, and became a traveller instead of a partner. Solomon was also employed in the business, and the two of them later took an option to purchase it, each agreeing to find £250. They exercised their option, agreeing to become equal partners, but the only money received by Kingdon was £50 from debtor and £10 from Solomon. Kingdon then became bankrupt and absconded. Subsequently debtor paid the Official Receiver, as trustee in Kingdon's bankruptcy, a further £150. The business was unsuccessful. The case was adjourned until February 25th, the Official Receiver stating that if Solomon did not appear on that date it would be necessary to adjourn the examination *sine die*.

R. P. Reeves, trading as the Luxray Spotlight Projector Co., 5, Say's Corner, North Quay, Great Yarmouth, electrician.—The adjourned public examination of this debtor was fixed to be held recently at the Town Hall, Great Yarmouth, but he did not attend. It was stated that the liabilities amounted to £1,041, and there was a deficiency of £954. The registrar directed that the case should be adjourned with leave to the Official Receiver to apply for a warrant if necessary to secure debtor's attendance.

S. T. Hosken, radio accessories manufacturer and factor, 153, Fleet Street, E.C.—This bankrupt, who failed in May, 1925, applied on January 28th to Mr. Registrar Francke for an order of discharge. The Official Receiver reported that the probable debts amounted to £953 and the assets had realised £66. The applicant commenced business in March, 1923, and attributed his insolvency to bad trade, insufficiency of profits to cover expenses and loss in connection with a periodical. The discharge was suspended for one year on statutory grounds.

P. W. Horne (Horne Bros.), electrical engineer, 260, Linthorpe Road, Middlesbrough.—First and final dividend of 6¾d. in the £, payable February 10th, at the Official Receiver's offices, 80, High Street, Stockton-on-Tees.

J. G. Sandell, electrical contractor, 20, Hart Road and Ansell Road, Dorking.—First meeting February 9th, at 29, Russell Square, W.C. Public examination February 17th, at the County Court, Croydon.

H. Milnes (H. Milnes & Son), plumber and electrical engineer, 6, Trinity Street, Huddersfield.—Last day for proofs for dividend February 28th. Trustee: Mr. A. Pontefract, 6, New Street, Huddersfield.

A. F. Webb, electrician, Ashdown, Regents Road, formerly of 102, Duke Street, St. Helens.—Last day for proofs for dividend February 12th. Trustee, Mr. E. D. Symond, Official Receiver, 11, Dale Street, Liverpool.

J. G. Scott, electrical engineer, late of 5, Blackwood Place, Leven.—Meeting of creditors at County Buildings, Cupar, February 7th. Agent, Mr. I. W. McInnes.

Company Liquidations.

Cleartron Radio, Ltd., wireless manufacturers, London and Birmingham.—A meeting of creditors was held on January 26th, at the Institute of Chartered Accountants, E.C. The chair was occupied by Mr. C. A. Worssam, 9, Bedford Row, W.C., the liquidator in the voluntary liquidation of the company. The chairman read a balance sheet which showed liabilities of £133,700, including share capital £55,000 and debentures £30,000.

The liquidator reported that the company was registered on July 29th, 1925, with a nominal capital of £55,000. The sale and purchase agreement provided mainly for the acquisition of the British and Colonial rights, excluding North and South America, in a valve, and the goodwill and effects of a valve business carried on at Birmingham, whilst there was a factory which was to be equipped for an output of 10 000 valves a week. The consideration payable to the vendor (Mr. Carlisle) was £20,000, payable as to £10 000 in preference shares and £10,000 in cash. The vendor also had an option for the subscription at par of 50,000 deferred shares, which

was exercised, and a further option to subscribe to any fresh capital. It was further provided that there should be a deposit with the company of 10,000 shares in an American concern so that any dividends payable on the stock should be available for Cleartron Radio, Ltd. He understood that the shares were now in the possession of the company. The vendor was to be the managing director for a period of three years. All the shares in the company were subscribed for in cash, except the £10,000 worth allotted to the vendor, with the result that the company received £45,000 in cash. The vendor was apparently liable to equip a factory capable of an output of 10,000 valves a week, but it was not clear whether that was done. At any rate, that number of valves was never produced in any one week. In December, 1925, the company agreed to purchase the European rights in the valve for £20,000. It had paid £11,000 of that amount. Negotiations took place between Mr. Carlisle and the company regarding the claim of £9,000. That claim was to be reduced, but the company was to waive any claim it might have against Mr. Carlisle in respect of any non-equipment of the factory up to the capacity of 10,000 valves a week. The liquidator said he understood that that arrangement was not actually carried out, and there was some doubt as to whether the rights in the valves had been assigned to the company. In addition to the valves, the company entered into agreements for the purpose of acquiring other rights and processes. Last October the company entered into an agreement with another concern to purchase the rights in the "Lodge" set for £6,000. As far as he could gather £1,500 was paid. In May, 1926, the board agreed to the taking over of an additional factory in Birmingham at an estimated cost of £6,500. Presumably something like £4,000 was spent on the factory and equipment, and a deposit of £100 was paid on the land and buildings. In December, 1925, negotiations began with the object of the company being wound up and a fresh company formed with a capital of £50,000, to be later raised to £100 000, but the scheme fell through. The company started to manufacture valves in August, 1925. The sales from that date up to March of last year steadily progressed, but in April, 1926, they fell. In August last the company joined the British Radio Valve Manufacturers' Association, and that involved an increase in the retail prices, and less favourable discounts and terms to dealers and factors, and a royalty of 7 per cent. to the Marconi Company. In November last the company produced a new gasfilled valve, which went very well for a time. Last June the company's account at the bank was overdrawn, and by August £10,000 was owing. An overdraft of £15,000 was then obtained, which was guaranteed by some of the directors. Negotiations were then entered into with another bank, which advanced £30,000 on the security of a debenture over the company's assets. On December 28th last the bank appointed a receiver, and the directors then decided to go into voluntary liquidation.

The chairman agreed that on the figures appearing in the balance sheet there was a total deficiency of £35,000; he did not think that it was as much as £120,000. The unsecured liabilities were £58,000, and there would not be a penny for the unsecured creditors if the assets only realised £20,000, which included an amount of about £12,000 offered for the business. The offer for the business was from one of the guarantors.

Mr. Boult (Messrs. Wake, Wild & Boult) remarked that the most satisfactory way of dealing with the matter would be to present a petition, if any creditor would find the money. It was decided to confirm the voluntary liquidation of the company with Mr. Worssam as liquidator, whilst an advisory committee was also appointed, consisting of the representatives of Messrs. Bertram Day, Ltd., the London Press Exchange, Darling & Son, the Sterling Telephone & Electric Co., Ltd., and Brauen, Ltd. The principal creditors are:—

	£		£
Chloride Electrical Storage Co., Ltd. ...	537	Robinson, E. S. & H., Ltd.	947
Carlisle, A. H.	2.000	Sterling Telephone and Electric Co., Ltd. ...	803
Bertram Day, Ltd. ...	3,800	Darling & Son	645
London Press Exchange	1,902	Brauen, Ltd.	563
Magneto Syndicate, Ltd.	754	Plessy Co.	1,460
Melin & Co.	1,690	Davis & Co.	2,250
		Wolverhampton Box Co.	671

SPANISH & GENERAL WIRELESS TRUST, LTD.—A meeting of members is called for February 28th, at Marconi House, Strand, W.C., to hear an account of the winding up from the liquidator, Mr. S. Pears.

RADIO (HOVE), LTD.—Winding up voluntarily. Liquidator, Mr. A. C. Gillman, 103, Cannon Street, E.C. Meeting of creditors February 15th, at the liquidator's offices. Particulars of claims to the liquidator by February 28th.

The Belgian Telephone Reorganisation.

The *Industrie und Handelszeitung* (Berlin) states, on the authority of a Belgian official announcement, that the programme of reorganisation of the Belgian telegraph and telephone system has been settled in principle. It will take several years to carry out, and details will be made known shortly. In electro-technical circles in Belgium it is reported that it is intended to place contracts for fifty per cent. of the necessary material with German firms on reparation account.

The contracts which are likely to be placed in connection with this reorganisation and the great electrical projects of the French, Soviet-Russian and Turkish Governments have brought forward a suggestion from the United States electrical manufacturing industry that an international arrangement should be made by which this work should be shared. A representative of the Westinghouse Company is said to be visiting Europe in order to approach the French, Belgian, and German groups.

The Swedish Radio Trade.

Statistics forwarded to *Commerce Reports* by an American Consular officer show that during 1925 Sweden imported radio apparatus valued at 4,488,026 crowns, as compared with 2,993,445 cr. in 1924. Germany was the principal supplier (to the extent of 2,440,569 cr.), but Great Britain supplied apparatus to the value of 601,839 cr. During the same year Sweden exported radio goods valued at 439,918 cr. (as against 691,787 cr. in 1925). Norway was the principal customer (88,055 cr.), while Great Britain's share amounted to 13,902 cr.

Hungarian Foreign Electrical Trade.

According to the *Board of Trade Journal*, during the first eleven months of 1926 Hungary imported electrical machines and appliances valued at 7,876,000 gold crowns. During the same period the exports of similar products reached the value of 13,993,000 gold crowns.

Book Notices.

"Circuits for Building Radio Receivers." Pp. 48; illustrated and priced. London: Marconiphone Co., Ltd.—The object of issuing this publication No. 446 is to assist those who derive entertainment from building their own receivers; but no layout suitable for a cabinet has been included, as it is felt that the pleasure of construction is enhanced by the knowledge that the design is original. It is understood that since January 1st, 1927, the company has had 20,000 applications for the booklet, and that two editions have been exhausted; as the demand is still considerable a fifth edition of 10,000 copies has been put in hand—an interesting commentary on the liveliness of the interest taken in the subject at the moment, no less than on the instructiveness of the booklet itself.

"The Director System of Automatic Telephony," by W. E. Hudson. Pp. xi+156; figs. 72. London: Sir Isaac Pitman and Son, Ltd. 5s. net.

"Principles Underlying the Design of Electrical Machinery," by W. I. Slichter. Pp. v+312; figs. 152. Price 18s. 6d. net. "Elements of Heat-Power Engineering," by W. N. Barnard, F. O. Ellenwood, and C. F. Hirshfeld. Part I. "Thermodynamics and Prime Movers." Pp. xii+493; figs. 251. Price 22s. 6d. net. London: Chapman & Hall, Ltd.

"Makers of Science, Electricity and Magnetism," by D. M. Turner. Pp. xv+184; figs. 65. London: Oxford University Press, Humphrey Milford. Price 7s. 6d. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVI. No. 1. January, 1927. New York. Price $1.

"*Journal* of the Institute of Wireless Technology." Vol. I, No. 1. October, 1927. Price 5s.—The first number of this quarterly publication contains extracts from the rules of the Institute and the first membership list (56 names), besides three technical papers. The membership is steadily growing, which indicates that the Institution is proving to be of use.

"Faraday House Journal." Vol. XII, No. 2. Pp. xii+48.—The Lent term issue of this house organ, always of interest and not only to old students, contains an article on "The Existence of a Minimum Sparking Voltage" by the principal; other contributions include "Notes on the Phenomena of Arcing and Switching," by H. Rainford.

"The Elements of Radio-Communication." By O. F. Brown. Pp. viii+216; figs. 146. London: Oxford University Press, H. Milford. Price 10s. 6d. net.

"Circular of the U.S.A. Bureau of Standards," No. 17. "Magnetic Testing" (15 cents).—This publication briefly discusses the quantities and characteristics of magnetic materials and outlines the various methods used by the Bureau for magnetic testing.

"Technologic Papers of the U.S.A. Bureau of Standards," No. 325 (15 cents).—Simplified methods which have been devised for integrating the light output and efficiency curves of lamps derived as a result of the photometric measurements during life are outlined.

"Scientific Papers of the U.S.A. Bureau of Standards," No. 536 (10 cents).—This paper describes the development of a portable radio direction finder with only two controls, balancing and tuning, which operates over the frequency band from 90 to 7,700 kilocycles (3,300 to 39 metres).

An Electricity Committee and Dutch Cables.

At its meeting on January 24th the Salford Electricity Committee adopted a resolution that the whole of its members should visit Holland for the purpose of obtaining particulars as to wages, hours, and conditions of service of craftsmen and general workers in the electric cable-making industry in that country.

The Census of Industry.

It is stated that the work upon the returns sent in for the Census of Industry has been nearly completed by the Board of Trade. The first results are expected to be published in a week or two, and these will be followed by others at short intervals.

A General Utility Machine.

THE GENERAL ELECTRIC CO., LTD., announces that at the forthcoming Ideal Home Exhibition it intends to display an electrically-operated machine which will not only wash and iron clothes, but will mince meat, make sausages, and supply ice-cream, to say nothing of sharpening knives. We await further details with keen curiosity.

New Swiss-Bulgarian Company.

A company has lately been formed in Zurich with a capital of £200,000 and the title La Société pour Entreprises Electriques et Industrielles en Orient, to acquire an interest in the Société Bulgare d'Entreprises Electriques, Sofia, and the collieries at Pirin, Bulgaria.

American Electrical Vehicle Exports.

Only 93 electric motor vehicles, valued at £26,072, were exported from the United States during the eleven months ended with November last, as compared with 114, valued at £35,120, in the corresponding period of 1925.

Electricity in Bulgaria.

According to a recent French official report the electrical trade in Bulgaria dates back only for a few years, except, perhaps, in Sofia. At present, however, it is extending fairly rapidly. Several syndicates have been formed for exploiting the water power of the country, and these are now supplying electricity for lighting and factory use in a number of Bulgarian towns. The electrical equipment of mills and other industrial establishments has led to a considerable advance in the demand for electrical material, none of which is manufactured locally. The trade for the most part is confined to the sale of lighting material, heaters and domestic appliances only being within the scope of the rich families. There is, however, a small scope for hot plates, kettles and irons. The Germans have obtained a firm footing in the market, and have popularised copper or brass finish rather than nickel. Three to six months' credit is usually granted against draft, guaranteed by a bank of standing. The channels of advertisement are chiefly the newspapers and the curtains of theatres, kinemas, &c. Some of the more important rates of Customs duty are as follows:—

Dynamos, motors, transformers, fans, together with spare parts and accessories: (*a*) Above 25 kg. inclusive, 100 gold leva per 100 kg.; (*b*) below 25 kg., free of duty.

Electrical apparatus and spares:—(*a*) Telegraphic and telephonic, 800 leva per 100 kg.; (*b*) meters and measuring instruments, 300 leva per 100 kg.; (*c*) irons, hot plates and heaters, 200 leva per 100 kg.; other heating appliances, 600 leva per 100 kg.

Cables, 60 leva per 100 kg.; wire covered with silk, 200 leva per 100 kg.; wire covered with other textiles, 120 leva per 100 kg.; and wire covered with material other than textiles, 60 leva per 100 kg.

On articles used in electrical installations not elsewhere specified, such as switches, contacts, and sockets, 200 leva per 100 kg. is levied, while ordinary electric lamps pay up to 400 leva per 100 kg. In addition, 20 per cent. of the Customs duties should be added for local duties and about 5 per cent. for other small taxes.

(£1=45 leva, approx.)

Polish Tariff Reduction.

By an order made in February, 1926, and subsequent orders, a reduction of 80 per cent. was made in the duty upon certain machinery and apparatus imported into Poland if such articles were not made in that country. The *Board of Trade Journal* now reports that this concession is to be continued until June 30th next.

The Electrical Contractors' Conference at Scarborough.

In amplification of the announcement made in our last issue we print the following particulars regarding the Second Annual Conference of the E.C.A. Allied Associations which is to be held at Scarborough:—

Wednesday, June 22nd.—Meeting of the Council. Arrival of delegates; reception by the president, Mr. H. J. Miles, and Mrs. Miles; music and dancing.

Thursday, June 23rd.—Welcome by the Mayor; presidential address; annual general meeting; papers and discussions; smoking concert.

Friday, June 24th.—Papers and discussions; address by president-elect; garden party in Peasholm Park; ball.

Saturday, June 25th.—Golf, drives, &c.

The Conference fee will be the same as last year, namely, 25s., and hotel arrangements will follow the same lines. The Conference headquarters will be at the Prince of Wales Hotel, and the Conference meetings will be held at the Olympia, Scarborough. The Conference secretary is Mr. C. V. Fisher (chairman of the E.C.A., Scarborough Branch), 1, Harcourt Place, Scarborough; Conference treasurer, Mr. R. Robson, "Electricity House," Haymarket, Newcastle-upon-Tyne; members of the Conference Committee (in addition to the above), Messrs. E. M. Parsons, 38a, Brook Street, Hull; F. Greathead, 9, Huntriss Row, Scarborough; S. S. Paley, 129, Victoria Road, Scarborough; and J. G. Appleyard, 1, Hanover Road, Scarborough.

Wages in the Contracting Industry.

The National Federated Electrical Association states that in accordance with the existing wages agreements the net hourly rates of wages in the electrical contracting industry, as from the second pay-day in February until the first pay-day in June, will be as follows:—Grade A, 1s. 10¾d. (including travelling allowance); Grade B, 1s. 8¾d.; Grade C, 1s. 7d.; and Grade D, 1s. 5¼d. The new rates represent an increase of ¾d. per hour in the cases of Grades A, B and C, and ¼d. in the case of Grade D.

Swedish Electrical Industry in 1926.

A symposium of the views of Norwegian electrical concerns upon the conditions of the past year appeared recently in an official publication. In this the A.S. National Industri refers to the continued depression experienced during the year, stating that the uncertain exchange conditions and the economic difficulties of the public bodies, which form a large section of the company's customers, added to the burden. The efforts of foreign competitors, particularly the Germans, to capture the home market, caused prices to fall to a level just sufficient to meet production costs, and it was impossible to make reasonable provision for depreciation. The prospect for the current year is not viewed with hope, although the currency position has improved. A similar report is made on behalf of the telephone industry by the A.S. Elektrisk Bureau. This company states that the abnormal exchange situation, high taxation, and high wages, placed overhead expenses on too high a level. In spite of that the company was successful in securing two important home orders in the face of external competition. The radio industry, it is stated, placed its expectations from broadcasting on too high a plane, with the result that a number of firms were unable to meet their obligations. With one exception, the broadcasting stations (main and relay) were erected by foreign firms. Further broadcasting developments are expected to improve the business. The home industry has retained the lead in the supply of ordinary receiving sets. The electric heating and cooking apparatus industry is favoured with an extensive home market, and the experience thus gained has enabled Norwegian firms to compete favourably in the foreign field.

The Sydney Plant Contract.

As we have already reported, the Commonwealth Shipping Board has been restrained from manufacturing power plant for the Sydney City Council. The Council has now decided, in view of this, to place the order for mechanical draught plant (valued at £99,898) with the Clyde Engineering Co.

Unemployment in Germany.

The Berlin correspondent of *The Times* says that unemployment in Germany again increased during the first fortnight of the year. On January 15th the number of men and women unemployed was 1,834,000, as compared with 1,747,000 on January 1st.

Scottish Electrical Traders.

A large number of members were present at the annual general meeting of the Scottish Electrical Manufacturers' and Factors' Association, which was held on January 10th, at 13, Dundas Street, Glasgow, in the offices of Messrs. McMillan and Henderson, accountants to the Association. The secretary, Mr. H. C. McMillan, reported that there had been a large increase in membership during the year. The Status Inquiry and Debt Recovery Department had been well supported by the members. The Debt Recovery Department had been most successful, 96 per cent. of the debts handed in for collection having been recovered in full. Owing to the unique method of obtaining and circulating information amongst the members, their losses in insolvencies during the year were greatly reduced as compared with former years. With a view to consolidating the interests of the trade, the meeting recommended the benefits of membership of the Association to all manufacturers and wholesalers in England who were still outside it. Mr. Ames, of the British Electrical and Manufacturing Co., having served his tenure of office as chairman for the year, retired in accordance with the regulations of the Association, and he was heartily thanked for his services. Mr. A. F. Stevenson (the Macintosh Cable Co., Ltd.) and Mr. A. C. Ross (Falk, Stadelmann & Co., Ltd.) were unanimously appointed chairman and vice-chairman, respectively, for the current year. Mr. H. C. McMillan and Mr. P. S. McMillan were reappointed secretary and treasurer, and assistant secretary and treasurer, respectively. Mr. Laidlaw (Andrews & Co.) presided in the absence of Mr. Ames.

Australian Tariff Decisions.

The following classifications have been approved by the Commonwealth Tariff Board:—Tungsten disks and resistance alloys for use in the manufacture of electrical apparatus, Item 404; electrical contact clocks and mercury arc rectifiers (including transformers and switchgear), Item 415A; and remote control switches and switches operated by clockwork mechanism, Item 415A(2).

The Dinner of the Commercial Travellers.

The annual dinner of the Electrical Trades Commercial Travellers' Association is to be held on Friday next, February 11th, at the Holborn Restaurant, W.C., at 7.30 p.m.

New Australian Companies.

Philips Lamps (Australasia), Ltd., was recently registered in Sydney (N.S.W.) with a capital of £50,000, to carry on the business of manufacturers of and dealers in electric lamps, radio apparatus, &c.

Amplion (Aust.), Ltd., has been registered with a capital of £10,000 to carry on business as electricians, manufacturers, &c.

The Telephone Development Association.

The second annual meeting of this Association was held at Aldine House, Bedford Street, W.C.2, on Friday last, Sir Alexander Roger (chairman) presiding. In moving the adoption of the report, the chairman stated that the total revenue for the year under review amounted to £15,962, as compared with £8,964 in the previous year. Seventy-nine per cent. of that amount had been expended in widely differing forms of advertising and propaganda, and 15 per cent. had gone in administration costs. The membership of the Association had increased during the year from 54 to 95; there was, however, still considerable room for development. The direct advertising had produced inquiries respecting the telephone service from 19,200 residents in every corner of the country, and the Association's film had been exhibited at 52 kinema theatres. They had a contract with a company to flash messages every few minutes from an electric screen in Shaftesbury Avenue, and the Association's essay competition had proved very successful. With regard to the future, he felt fully justified in expecting to see a steady volume of orders coming to all, and a distinct acceleration in both the growth of demand and the rate of supply. The report and accounts were adopted, and the chairman, retiring directors, and auditors, were re-elected. At a subsequent extraordinary general meeting a resolution was passed modifying the articles of association, making future meetings yearly instead of half-yearly.

Fire.

Last week a fire broke out at the works of the Premier Electric Control Co., Harrow Road, N.W., causing considerable damage.

A Polyglot Wireless Pamphlet.

British manufacturers are constantly being reminded that printed matter distributed in foreign countries should, as far as possible, be in the languages of those countries. The Brownie Wireless Co. (of Great Britain), Ltd., has made a laudable attempt to meet this requirement in producing a booklet containing instructions for working its "No. 2" receiving set, which is printed in 16 different languages. These comprise not only all the European tongues (including Russian and what looks like Czech), but also Chinese, Japanese, and Arabic. The booklet is one of the most comprehensive in this direction that we have seen.

Unemployment.

There was a further decrease, 41,000, in the number of unemployed during the week ended January 17th. The total at that date was 1,391,000, as compared with 1,432,000 on January 10th, and 1,215,900 on January 18th, 1926.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, February 1st: No change in the prices of electrolytic copper.

Messrs. James & Shakespeare report, February 1st: Copper bars (best selected), sheet and rod, £88, £2 dec.; English pig lead, £28 5s., 5s. inc.

Messrs. Edward Till & Co. report, February 1st: India-rubber, Para fine, 1s. 4d., ¼d. dec.

Messrs. James Forster & Co., reporting on January 29th, stated:—"Closing prices yesterday were £26 16s. 3d. for January, and £27 2s. 6d. for April, against £27 7s. 6d. and £27 12s. 6d., respectively, at the end of last week. A flat tone was in evidence on Monday, when prices fell 10s. a ton, while a further 8s. 9d. was lost on Tuesday. There was then a rally of 7s. 6d. a ton. The general position is unchanged, with supplies ample and only a moderate demand. As far as the market is concerned the position is healthier. Realisation of speculative commitments has continued, and a short account been opened which will add strength to the market later on. This week's fall in values seems to be due more to sympathy with the weakness in other metals than to any change for the worse in the position, which, in fact, is improving. Stocks in this country are probably not more than 10,000 tons, which is only about a fortnight's normal supply."

Accumulator Makers' Association.

The annual dinner of this Association is to be held at the Savoy Hotel on Monday, February 21st, at 7 p.m. Mr. B. M. Drake, M.I.E.E., will preside.

Conditions in Brazil.

Commerce Reports states that Brazilian trade prospects have been improved by the projected stabilisation of the milreis at $0.125 and the subsequent adoption of a new currency unit, the "cruzeiro" (about four milreis). Transactions in electrical goods have recently indicated considerable improvement both as regards direct importations and sales from stocks. Two American companies have been awarded contracts for the electrification of the Paulista Railways. The radio business is said to be dull in Rio de Janeiro, but satisfactory in Sao Paulo.

The E.D.A. Annual Dinner.

The annual dinner of the British Electrical Development Association is to be held at the Savoy Hotel, London, on Thursday, March 17th. Tickets are 25s. each.

Opposition to Municipal Trading at Leeds.

The President of the Leeds Chamber of Commerce (Mr. J. R. Portway), who was re-elected last week for another year of office, expressed opposition to the Corporation's proposed extensive scheme of wiring houses and selling electrical fittings. He condemned the proposal as undesirable municipal trading, and hoped it would be strongly opposed in the city.

Lighting and Power Notes.

Australia.—CAIRNS (Q.).—According to *Tenders*, the Cairns Hydro-electric Board has received a report by Mr. P. A. W. Anthony in which he recommends the harnessing of the Barron Falls without delay. The cost of power plant is estimated at £180,000; transmission line and reservoir, £19,500; and line to Cairns, £3,000, making a total of £202,500.

Braintree.—POWER STATION BREAKDOWN.—The electricity supply for the town failed during a thunderstorm on January 27th. It was ascertained later that the power-station at Messrs. Lake & Elliott's, which supplies the town, had been struck and the plant temporarily put out of action. The fault was remedied during the day, and no great damage appears to have resulted.

Brightlingsea.—ELECTRICITY IN BULK.—The Urban District Council has decided to ask the County of London Electric Supply Co., Ltd., the East Anglian Electric Supply Co., Ltd., and the Colchester Corporation by what time they will be in a position to give a supply of electricity in bulk, and upon what terms.

Brighton.—LOANS.—The Corporation Electricity Committee is making application for sanction to loans to defray the cost of the following works:—One 6,000-kW turbo-alternator and accessories, £39,360; new reinforced concrete roadway, £5,000; steam turbine rotary feed pumps, £400; water softening plant, £962; 1,000-kW motor convertor, North Road, £10,220; extension of boiler plant and buildings, £64,966; switchgear for supply to Portslade, Southwick, and Shoreham, £690.

Continental.—NORWAY.—The budget proposals of the Government Water Power Department for 1927-28 contain a survey of the works carried out and still to be executed in connection with the State hydro-electric works which are being established on the Nore. The works are to be ready to supply electricity by July, 1928, and a sum of over 48,000,000 kr. has already been granted for the purpose. Contracts have been entered into for the delivery of 43,000 kW, and it is anticipated that the demand will reach 55,000 kW by the time the works are in operation. Consideration is now being given to possible extensions in the event of the demand further increasing.

AUSTRIA.—The Styrian Water Power and Electricity Co., of Gratz, has issued its report for 1925, in which it states that during the twelve months the main constructional work which has occupied nearly five years has been completed. The Teigit hydro-electric station and the long-distance transmission line to Gratz and the Gratz-Sud transformer station have been put into operation. The 60,000/100,000-V transmission line from Gratz to the North and the Murzzuschlag transformer station was put into operation early in 1926. During the year about 112 miles of 20,000-V transmission lines were erected in West, East and Northern Styria.

Coventry.—OPPOSITION TO ORDER.—The City Council has decided to oppose the application of the Leicestershire and Warwickshire Electric Power Co. for a Special Order authorising it to supply electricity in a large area in central Warwickshire, including parishes which the Corporation is seeking to include within its area.

Croydon.—CHANGE-OVER.—Having discussed with the Electricity Commissioners the question of alteration of the pressure of supply, the Corporation Electricity Committee has decided to seek an Order to enable it to change over the supply to consumers to 230 V as and when convenient.

WIRING OF SMALL HOUSES.—The Committee is preparing a scheme for the provision of electrical installations on the hire-purchase system, the work to be done by local contractors, and a sum of £10,000 is being allocated for this purpose.

LOAN.—Application is being made for sanction to a loan of £23,000 for electricity purposes.

Dunfermline.—GALE DAMAGE.—Serious damage was caused by the gale at the generating station of the Fife Electric Power Company, on January 28th, when two of the cooling towers fell and were completely wrecked. The staff was able to maintain a supply of electricity.

Eastbourne.—LOAN.—The Town Council on January 19th decided to apply for a Special Order to supply electricity to the parishes of Pevensey, Westham, and Hailsham. The estimated capital expenditure is £54,000.

Epsom.—Loans Sanctioned.—The Urban District Council has received sanction to the borrowing of £2,000 for wiring installations, and £2,000 for domestic apparatus to be let out on hire.

Falkirk.—Electrical Development.—The burgh electrical engineer reports that in 1926 the number of new consumers connected up was 339, and that the maximum demand during December was 2,800 kW, which was carried by the 3,000-kW set. At the present rate of expansion, by the winter of 1928 additional generating plant will be required, and it will be necessary to make provision for future requirements. A sub-committee has been appointed to take up the matter with the Electricity Commissioners.

Frickley (Yorks.).—Colliery Power Plant.—The *Manchester Guardian* states that the Carlton Main Colliery Co. has completed an electrical power plant costing £200,000. Four villages and three thousand houses will be supplied with electricity for lighting, householders being charged a flat rate allowing of unlimited consumption with a certain number of lights.

Glasgow.—Electrical Development.—The number of houses wired in November last under the Corporation Electricity Department scheme was 155, and appliances let out on hire 888. For December the figures were 124 and 499, bringing the respective totals up to 3,130 and 14,028.

Grays.—Loan.—The Urban District Council has applied for sanction to a loan of £4,000 for the purchase of a 750-kW rotary-convertor and transformer.

Fringe Order.—The Council has consented to the application of the County of London Electric Supply Co., Ltd., for a fringe Order to supply electricity to a new cement factory in the district. The company will pay £200 per annum provided the Order remains in force for 15 years.

Hornsey.—Loans.—The Electricity Committee is applying for sanction to loans of £20,000 for mains and £10,000 for services.

Horsham.—Electrical Development.—The Lighting Committee has received a report from the electrical engineer with regard to the extension of the Urban District Council's area of electricity supply, in which he states that the electrical requirements are outgrowing the present plant and system. He has suggested that the first consideration should be the complete reorganisation of the power station and the introduction of the a.c. system. Considerable capital expenditure would be involved, and for this reason he is of opinion that the services of an independent expert are desirable. The Committee has decided that Mr. W. M. Selvey, consulting engineer, be invited to report to the Council on the whole matter.

Ilford.—Loan Sanctioned.—The Electricity Committee has received sanction to a loan of £5,000 for the purchase of domestic apparatus to be let out on hire.

Electrical Progress.—The borough electrical engineer reports a steady increase in the hiring of installations, apparatus, &c. Hire agreements now number 4,754, and represent an additional installed load of about 8,000 kW.

India.—Calcutta.—According to the *Indian Engineer*, a supply of electricity from the new generating station of the Calcutta Electric Supply Corporation was given to Calcutta on December 22nd. This supply was given from the first of the three turbines to be started up. The other two sets already installed will be brought into commission as soon as they pass their tests. The new station is designed for an ultimate capacity of 150,000 kW, and there are installed there at present three sets, with a continuous rating of 7,500 kVA, each with the necessary boilers and auxiliary plant. This station is interconnected with the power station at Cossipore, the total capacity of installed plant in the two stations being 75,500 kW. The maximum load on the system up to the present time is 37,200 kW. In order to meet the constant demands for electricity, another 6,000-kW set has already been ordered for the southern station, which is expected to be in commission before the end of this year. Further additions are already under consideration for increasing the plant at both stations to meet the expected winter demands for 1928.

Irish Free State.—Limerick.—Dr. Sothman, technical engineering adviser to the Free State Government on the Shannon scheme, recently attended a meeting of the Corporation Electric Lighting Committee with reference to the question of a supplementary supply of electricity from Messrs. Siemens-Schuckert's power station at Ardnacrusha. He gave a brief outline of the scheme, and explained the system of overhead transmission cables. It is understood that when the way-leave agreements have been completed the work of the erection of standards to carry the transmission lines will be undertaken.

Lexden and Winstree.—Opposition to Scheme.—The Rural District Council is to oppose the application of Colchester Town Council for a Special Order to supply electricity in the district on the ground that only Dedham and a portion of Stanway are included in the proposals for the first two years. It is also considered that the maximum price, 11d. per kWh, is excessive.

Lincoln.—Electricity Scheme.—The Corporation Electricity Committee proposes to supply electricity in the south-west part of the town, which includes Moorland Park Estate, Swanpool, &c., the estimated cost of the scheme being £40,000.

Liverpool.—Electricity Supply.—Mains are to be laid by the Corporation to the housing estates at Crosby on similar terms to those for the Liverpool housing estates. Negotiations are proceeding for a bulk supply to Maghull.

Maidstone.—Electricity Supply.—The Rural District Council has decided to support the application of the Weald Electricity Supply Co., Ltd., for power to supply in part of the Council's area, provided that Hunton, as well as Staplehurst, Marden, and Yalding, are included in the Order.

Mansfield.—Electricity in Bulk.—As a result of the experimental running of the bulk supply of electricity from the Derbyshire and Notts. Electric Power Company, the Electricity Committee has recommended that the Council take the supply under the terms of an agreement already drawn up. It has been decided that the present plant shall be kept in commission and sufficient staff retained for the purposes of giving a supplementary supply.

Newcastle-on-Tyne.—Progress of Supply.—During the last 12 months 12,000 consumers have taken advantage of the Newcastle-upon-Tyne Electric Supply Co.'s hired wiring scheme for dwelling houses. Many villages are being supplied with electricity under this scheme and at Shildon nine hundred slot meters have been installed since last March. The company intends to survey and canvass the West Auckland district with a view to providing a supply, and the Parish Council has promised its support.

Ollerton.—Street Lighting.—The Parish Council has accepted the offer of the Butterly Colliery Co. for electric street lighting at £4 per lamp per annum, including maintenance.

Pembrokeshire.—Proposed Hydro-Electric Scheme.—The Works Committee of the County Council has recommended approaching the Government to consider a scheme for the construction of a barrage across the upper end of Milford Haven with the object of supplying electricity to the surrounding country.

Port Bannatyne.—Inauguration of Supply.—An electricity supply for the district was formally inaugurated by the vice-chairman of Bute County Council on January 21st.

Seaham Harbour.—Special Order.—The Ministry of Transport has confirmed the Urban District Council's Special Order, but with the addition of the "Northumberland" clause, which was asked for by the Seaham Harbour Gas Company. Under the "Northumberland" clause the Council is prohibited from drawing from the rates to meet any loss that might be incurred in the conduct of the proposed electricity undertaking.

Scunthorpe.—H.P. Cables.—The Urban District Council is to duplicate the h.p. cables at a cost of £2,842.

Shipley.—Change-over.—The Electricity Committee is to change over the supply of electricity in the Redburn district from d.c. to a.c. and erect a sub-station at Northcliff Woods at a total cost of £1,900.

South Africa.—Johannesburg.—The Town Council has decided to ask the Victoria Falls and Transvaal Power Co., Ltd., whether and at what time it will provide a partial supply of electricity to supplement the Council's own supply. The resolution has followed protracted negotiations with the Electricity Supply Commission, which some time ago reported against the Town Council's application to the Administrator for permission to erect a new power station at a cost of £500,000.

Southport.—Electricity Extensions.—Following an interview by the borough electrical engineer with the Electricity Commissioners regarding the Council's application for sanction to borrow £35,000 for electricity extensions, the Commissioners have intimated that the extension of the mains can be proceeded with, and that the requisite sanction will be given at an early date. With regard to the extension of plant, the Commissioners intimated that the Council should apply to Preston and Liverpool Corporations for their terms for giving a bulk supply, and if such a supply could be obtained on more economical terms then the Commissioners would not sanction any extension of plant. In the event of Preston and Liverpool being unable to give a bulk supply on economical terms, the Commissioners requested the electrical engineer to communicate with them again.

Special Orders.—Applications have been made to the Electricity Commissioners for a Special Order by Watford Corporation authorising it to supply electricity in certain parishes in the rural districts of Berkhamstead and Hemel Hempstead.

The Commissioners have submitted to the Minister of Transport for confirmation, a Special Order made by them authorising the Lancashire Electric Power Co. to supply electricity within the rural district of Leigh.

Stourport.—New Power Station.—Work on the new power station which has been erected by the Shropshire, Worcestershire and Staffordshire Electric Power Co. is now practically completed, and the plant is now undergoing extensive trial runs. The erection of overhead lines has been put in hand, and work is proceeding on a line to Tewkesbury, where several local industries are waiting for a supply. The new station is to be connected with the Birmingham Electricity Depart-

ment's service in order to cope with the increasing demand which is anticipated before the station which the Corporation is to erect at Hams Hall will be ready for service.

Tendring.—OPPOSITION TO ORDER.—At a meeting of the Rural District Council, on January 26th, it was decided to oppose the application of Colchester Town Council for a Special Order to extend its area of electricity supply on the following grounds:—(1) That the maximum price is excessive; (2) that the promoters do not propose to cover an adequate and reasonable area of supply within the first two years; (3) that the Colchester plant will not be ready to afford a supply for some considerable time; and (4) that by granting the Order, the Electricity Commissioners will be giving a monopoly of supply which might prove detrimental to the district, and prevent, or postpone, a supply being afforded by some other undertakers.

Tynemouth.—LOAN.—The borough electrical engineer (Mr. C. Turnbull) has submitted a report to the Electricity Committee in which he states that considerable developments are anticipated during the coming year. He has therefore recommended that application be made for sanction to a loan of £30,600 for the following purposes:—Sub-station at Cullercoats, £2,000; extension of Preston Village sub-station, £800; sub-station at Dock Road, North Shields, £1,700; supply to Commissioners' docks, £8,300; five transformers, £1,800; and cable extensions, £16,000.

Tramway and Railway Notes.

Bradford.—OPPOSITION TO BILL.—Wharfedale Rural District Council has decided to oppose the Corporation's Transport Bill, which includes a service along roads in the rural area which are considered unsuitable for such traffic.

PROPOSED ABANDONMENT OF TRAMWAY.—Councillor J. A. Guy has given notice to move at the City Council meeting on February 8th, that the Corporation's decision to renew the tramway track in Barkerend Road at an estimated cost of £23,000, be rescinded, and that the trams to Bradford Moor be replaced by a motor-'bus service.

Continental.—ITALY.—At a recent railway conference, held in Padua, it was announced that the Italian State Railway authorities had decided to commence the work of electrifying the railway between Bozen and the Brenner frontier early next year.

SWITZERLAND.—Good progress is being made with the electrification of the Winterthur-St. Gall-Rorschach section of the Swiss Federal Railways, and it is expected that it will be in operation by May next.

Edinburgh.—TRAMWAY EXTENSIONS.—A sub-committee of the Tramways Committee has recommended that steps be taken to obtain the necessary powers to extend the tramway to Farmilehead by Stenhouse Mills, Gorgie.

Increase of Charges.—The Minister of Transport has made Orders under the Statutory Undertakings (Temporary Increase of Charges) Act., 1918, authorising certain fare charges by the following tramway and light railway authorities:—The Urban Electric Supply Co., on its Camborne and Redruth, and Glossop Tramways, the Worcester Electric Traction Co., Ltd., the Bristol Tramways & Carriage Co., Ltd., South Lancashire Tramways Co., Swansea Improvements & Tramways Co., the Great Orme Tramways Co., Rawtenstall Corporation, and the Bexley and Dartford Urban District Councils.

Japan.—PROPOSED ELECTRIC RAILWAY.—It is reported that an electric railway from Inariyama station on the Government Central Line to Yawata is proposed. The chief promoter is Mr. S. Kamijo, member of the Nagano Prefectural Assembly.

London.—MORDEN STATION GARAGE.—The new garage at Morden station, the first of its kind in this country, has been completed, and was opened for business on January 31st. It has an area of 7,600 sq. ft., and will provide accommodation for 200 cars and cycles. Although it is intended primarily for the convenience of Underground passengers, it will be at the disposal of local residents. If the experiment is successful, it is probable that similar garages will be erected at other outlying terminal Underground stations.

Worcester.—PROPOSED ABANDONMENT OF TRAMWAY.—The *Birmingham Post* states that the Public Traffic Committee of the City Council has prepared a report which will be considered by the City Council in which it recommends, after the lease expires, the scrapping of the present tramway system, the removal of the track, and road reinstatement at a cost of £75,000. The Committee states that provisional terms have been arranged with the Birmingham and Midland Omnibus Co. to run an omnibus service in the city in substitution of the trams and a service to areas on the borders of the city. The committee considers that this method of transport is preferable to the Corporation's incurring a large outlay in acquiring omnibuses and garage accommodation of its own. It is suggested that an agreement should continue for 21 years.

Telegraph and Telephone Notes.

Australia.—"BEAM" RADIO-TELEGRAPHY.—Marconi's Wireless Telegraph Co., Ltd., has issued the following statement with regard to the "beam" radio-telegraph stations it has built on behalf of the British Post Office for communication between England and Australia, official seven days tests of which were recently carried out:—

"The tests . . . have demonstrated that the wireless link between the beam stations in England and Australia is capable of working at high speed each way for more hours than are called for in the terms of the contract with the Post Office, but defects developed during the tests on some of the auxiliary apparatus. The company has informed the Post Office that it requires further time to correct these defects, and it is therefore not applying to the Post Office to accept the stations until such defects are remedied."

Belgium.—REORGANISATION.—The Belgian telephone and telegraph reorganisation programme has been completed in its main lines and will extend over several years. It is expected in the Belgian electrical industry that half of the orders for the supply of material will be placed with German firms on reparations account. Government circles have suggested to the Belgian electrical industry the conclusion of a working agreement with German, and eventually other foreign, electrical undertakings for the reorganisation of the systems. The cost is estimated at 12,000,000 fr.—*Reuter's Trade Service* (Berlin).

Persia.—NEW RADIO SERVICE.—A general local and foreign wireless service was established at Teheran on January 28th for the first time.—*Reuter's* (Teheran).

The Telephone Service.—YORKSHIRE DEVELOPMENT.—We have received from Mr. T. B. Johnson, M.I.E.E., superintending engineer, North-Eastern District, Post Office Engineering Department, a copy of the annual report to the Telephone Advisory Committee, which shows that, in spite of industrial unrest, marked advance was made in all directions in 1926. New lines connected totalled 4,722, a net increase of 2,298, or 6 per cent.; the total number of lines was 38,119 on September 30th, 1926. In the Leeds area the satellite exchanges of Chapeltown, Headingley, Roundhay, and Stanningley have been converted from magneto to automatic working; at Halifax an automatic exchange, it is hoped, will be completed early this year, and at Wakefield the installation of automatic equipment is in hand. The Brighouse exchange is to be converted from magneto to central-battery working and transferred to new premises; at Dudley Hill and Low Moor new c.b. exchanges are in course of construction. At Keighley, Armley, and Sandal, and other places building has commenced for housing new automatic exchanges, and at a number of existing exchanges additional switchboard equipment has been installed. A rural exchange has been opened at Cracoe.

Considerable progress has been made in the provision of public kiosks throughout the district; there are over 200 actually available or on the point of completion. It is the intention to introduce in the near future "Hall multi-coin" boxes at kiosks and call offices connected to the larger exchanges. Calls effected during the year were as follows:—Trunk calls, 5,231,959; local and junction calls, 38,208,568; telegrams passed by subscribers by means of the telephone, 388,825. The value of private automatic exchange switchboards at subscribers' premises is being increasingly recognised.

During the year satisfactory progress has been made with the laying of trunk and local underground cables; the gross mileage of wire existing at the end of September was 202,895 miles, an increase of 22,184 miles.

The closing down of the generating station at the Leeds Head Post Office has been completed, and electric light and power are now obtained from the Leeds Corporation electricity works; the annual consumption is about 360,000 kWh. At the Leeds Head Post Office alterations have been carried out to provide room for a new repeater station to work in connection with the underground cable from London to Glasgow; the temporary station has a capacity of 43 repeaters, 35 of which are working, but the ultimate capacity will be approximately 1,000 repeaters.

NEW EXCHANGES.—At Lytham-St. Annes, on January 13th, a new telephone exchange was opened at the Post Office. The local Shipley exchange was transferred on January 15th from the old quarters at Saltaire Road to a new building of the Post Office in Otley Road.

The following are among the telephone exchanges completed by Siemens Brothers & Co., Ltd., Woolwich, during 1926:—

Automatic: Chesterfield, Edinburgh area (four exchanges), East Hartlepool, West Hartlepool, Morriston, Stavely, and Albion exchanges; Newmarket (Australia), Winnipeg West (Canada), Stratford (New Zealand), Cairo (Egypt), Port Elizabeth extension (South Africa), Baku (Russia), and also extensions to Grimsby, Swansea, and Sketty.

Manual: Bexley Heath, Camberley, Dumfries, Popesgrove, Seven Kings, Shipley, and Southend.

Radio Notes.

Australia. — Royal Commission. — The Commonwealth Government has decided to appoint a Royal Commission of Inquiry in Australia. In making the announcement, the acting Prime Minister said the question had been for some time engaging the attention of the Federal Government. The *personnel* of the Commission, which will be composed of experts, has not yet been announced; it will consider broadcasting within the Commonwealth, and will examine alterations suggested as desirable in policy and practice. The Postmaster-General said that the Government was following the steps of Great Britain, though on a smaller scale, as the Australian Commission would consist of only three members; everything, including a suggestion of Government control of broadcasting stations, would be determined according to the findings of the Commission.

Exhibition.—Such was the success of the radio exhibition held in Melbourne last year that it has been decided to hold another about next March or April. Larger accommodation has been secured in the Exhibition Building, Melbourne, and all interested in wireless are giving enthusiastic support.

Relay Stations.—Following the successful practice in Great Britain, the Melbourne broadcasting station (3 LO) is to erect relaying inland stations at three different centres, probably at Ballarat, Bendigo, and Sale, or Bairnsdale. One station will be provided in Gippsland, as there is a large population to be served in that area, and observations have shown that fading is worst there. The power used will probably be half that of 3 LO, which works on five kilowatts. —*Reuter's Trade Service* (Melbourne).

Finland.—New Station.—The wave-length chosen for the projected 25-kW station is 1,500 metres, and the Union Internationale de Radiophonie, Geneva, has drawn attention to possible difficulties on account of the fact that the Moscow station uses 1.450 m.

Haiti.—Since the commencement of broadcasting in August, 1926, the station at Haiti (call sign HHK), has received a large number of complimentary communications from listeners. It is a 1-kW station operating on a wave-length of 361.2 metres, and financial support is obtained by the Government in the form of appropriations to the Department of Public Works. Atmospherics give very little trouble in Haiti, and in winter are almost unknown, so that from November to March the reception of foreign stations is admirable. Station HHK is of "Western Electric" design, and was installed by the International Standard Electric Corporation.

Hungary.—New Station.—The Government has just substituted a 3-kW transmitter for the 2-kW plant on Csepel Island, says *World Radio*, and is also contemplating the erection of a 60-kW transmitter.

Japan.—New Station.—An order is said to have been placed for a 600-kW station, which will be ready in 1928, says *Eastern Engineering*. It is to be entirely the property of the Japanese Wireless Telegraph Co., an official concern enjoying the support of Parliament.

New Daventry Station.—Short-wave Plant.—A new station at Daventry, which is to operate at high power on a short wave-length, is being installed by the B.B.C. It is intended to supply an alternative service for users of crystal sets, and will utilise a power equivalent to that of 5XX. The masts are to be only 100 ft. high, and are to be built in sections, so as to facilitate their removal to another site if it is found to be desirable to do so. Experimental transmissions, which will be conducted out of the regular broadcast hours, are likely to begin in a few days' time.

South Africa.—State Control Probable.—The Johannesburg broadcasting company has received the following telegram from Mr. Madeley, the Minister of Posts and Telegraps:—"The general tendency in broadcasting is increasingly in the direction of public control. A private profit-making control would be a retrogressive step. I cannot therefore agree to sanction the transfer of the licence." This is regarded as an indication that the Government intends to take over control of broadcasting, says *The Times*, which has reason to believe that State control will be generally welcomed in the Transvaal, and the Free State and Durban will probably fall in willingly with the proposal. Cape Town may raise objections, but the Government will be able to assume control when the present licence expires.

Wave-lengths.—Correction.—In the list of new wave-lengths published last week it was stated that the Hull, Stoke, Dundee, and Swansea stations' wave-length was 249 metres; this figure is incorrect, as the stations named are now working on a common wave-length of 294 metres. We regret the transposition of the figures.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Armthorpe (Yorkshire).—February 15th. Education Department. Electric lighting installation at new school. Education Committee, West Riding County Hall, Wakefield.

Argentina.—Buenos Aires.—March 24th. Department of Navigation and Ports. Electric cranes, pumps, &c. (A.X. 4087).*

Australia.—Melbourne.—March 8th. Postmaster-General's Department. Accumulators and plates. (B.X. 3170)*; motor-generator sets. (B.X. 3172.)*

April 5th. Cordless switchboards. (B.X. 3184.)*

Sydney.—March 9th. New South Wales State Railways. Two sets of electric overhead travelling crane equipments. (A.X. 4103.)*

April 6th. One 7,500-kW turbo-alternator. (B.X. 3179.)*

Belfast.—February 5th. Electricity Department. One induction motor-driven vertical-type centrifugal pump. (January 21st.)

February 18th. Electricity Department. Twelve months' supply of materials, including electrical accessories, lamps, carbon brushes, cables, &c. (January 28th.)

February 8th. L.M. & S. Railway, Northern Counties Committee (Ireland). Twelve months' supply telegraph ironwork, wire, electric lamps, porous pots, &c. Mr. F. J. Martin, Stores Superintendent, York Road Station, Belfast.

Bexley.—Electricity and Tramways Department. One 1,400-kVA bank of Scott-connected transformers. Two 140-kVA single-phase induction regulators, e.h.p. and h.p. switchgear and cable connections. (See this issue.)

Bristol.—February 18th. Electricity Committee. Coal- and ash-handling plant, and railway sidings; circulating-water screening plant. (January 28th.)

Canterbury.—February 21st. Electricity Department. L.p. lead-covered and armoured feeder cables. (See this issue.)

Cardiff. — February 23rd. Electricity Department. Twelve months' supply paper-insulated cables. (See this issue.)

Croydon.—March 3rd. Electricity Department. 12,000 tons of coal suitable for use on chain-grate mechanical stokers. (See this issue.)

Douglas.—February 28th. Corporation. 3½ miles of e.h.p. cable, two synchronous motor alternators. (January 21st.)

Dundee.—February 21st. Electricity Department. Two water-tube boilers with superheaters, economisers, mechanical stokers, and coal-handling plant. (January 28th.)

Eastbourne.—February 21st. Electricity Department. E.h.p. cable, static transformers, and e.h.p. switchgear. (January 28th.)

Eccles.—February 12th. Electricity Department. Two 500-kVA, 3-phase oil-cooled transformers. Borough Electrical Engineer, Cawdor Street, Patricroft.

Egypt.—Cairo.—March 3rd. Ministry of Public Works. Two internal-combustion engines and accessories for the Egyptian Army Flour Mills, Tura, near Cairo. (A.X. 4187.)*

Harrogate.—February 28th. Electric lighting installation for St. Mark's Church, Leeds Road. Particulars from the Verger.

Huddersfield.—February 19th. Town Council. Electrician's work at maternity home, Greenhead Road. Borough Architect, 26, Ramsden Street.

Hull.—February 14th. Tramways Committee. Stores for 12 months, including car-lighting fittings, lamps, cable and switches, &c. General manager.

Inverlochy.—February 5th. Village Society, Ltd. Electrical installations in 100 houses. Messrs. Matheson and Mackenzie, surveyors, 197, St. Vincent Street, Glasgow.

Leeds.—February 18th. Electricity Department. Twelve months' supply of stores, including cables, boxes and fittings, jointing and insulating materials, &c. (January 28th.)

London.—HAMMERSMITH.—February 16th. Electricity Department. Twelve months' supply of stores, including several electrical items. (January 21st.)

SHOREDITCH.—February 23rd. Electricity Department. One 1,500-kW automatic sub-station converting equipment and one 20-ton electrically-operated overhead travelling crane. (January 28th.)

LONDON COUNTY COUNCIL.—February 14th. Electrical installation at the undermentioned schools:—Barrett Street Trade School Extension, Oxford Street, W., lighting, power, telephones, bells, &c.; County Secondary School, Eltham, S.E., lighting, power, telephones and bells; Crondall Street Elementary School, Shoreditch, lighting; Drayton Park Elementary School, Islington, lighting. (See this issue.)

H.M. OFFICE OF WORKS.—February 17th. Electrical accessories. (See this issue.)

METROPOLITAN ASYLUMS BOARD.—February 23rd. Carrying out the installation of electric lighting at Millfield, Rustington, near Littlehampton, Susesx. (See this issue.)

Long Eaton.—February 24th. Electricity Department. One 500-kW convertor set and one switchboard platform. (See this issue.)

Manchester.—February 15th. Tramways Committee. General stores, including electrical materials, &c. Mr. H. Mattinson, general manager.

New Zealand.—AUCKLAND.—March 22nd. Harbour Board. Electric motors, gearing, shafting, and control gear for the operation of vehicular and passenger gangways at the New Devonport Ferry Wharf. (A.X. 4102.)*

WELLINGTON.—March 4th. Poverty Bay Electric Power Board. Switchgear and transformers. (B.X. 3160.)*

April 26th. Public Works Department. Secondary battery for the Lake Coleridge scheme. (B.X. 3202.)*

Peterborough.—February 28th. Electricity Department. One 12,000-kW turbo-generator, with foundations, condensers, air and extraction pumps, air cooler, oil cooler and pipework, e.h.p. switchgear, coal-handling plant, &c. (January 28th.)

Portsmouth.—Electricity Department. Coal-handling plant. (January 28th.)

Spalding.—February 26th. Urban District Council. 28 sets of centrifugal pumps (for sewage pumping), including electric motors, automatic starters, floats, valves, pipes, &c. Mr. C. F. Murphy, Lloyd's Bank Chambers, Morpeth.

Stoke-on-Trent.—February 9th. Electricity Department. Static transformers, sub-station switchgear. (January 28th.)

Tilbury.—February 12th. Urban District Council. H.p. underground cables, l.p. distribution mains, house services, transformers, h.p. and l.p. switchgear and conversion of public street lamps. (January 28th.)

Torquay.—Electricity Department. Two vertical circulating-water pumps for Newton Abbot power station. (January 21st.)

Tynemouth.—Tynemouth Gas Co. 70-h.p. electric motor at gasworks.

Uruguay.—MONTEVIDEO.—March 2nd. State Electricity Works. Lead fuse wire, silver fuse wire, switches, cable end boxes, compound and insulating tape. (B.X. 3159.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia. — VICTORIA.—Postmaster-General's Department.
Switchboard and instrument jacks (Sch. C.80).—British General Electric Co., Ltd. (£490); New Systems Telephones Pty., Ltd. (£845); Phœnix Tel. & Elec. Works, Ltd. (£539).
Telephones and dials (Sch. C.105).—Phœnix Tel. and Elec. Works, Ltd. (£2,956); Ericsson Tel. Mfg. Co., Ltd. (£65,277); Siemens (Aust.), Ltd. (£17,003); British General Electric Co., Ltd. (£9,881); New Systems Telephones Pty., Ltd. (£1,012); Automatic Telephone, Ltd. (£15,783).

NEW SOUTH WALES.—Government Railways.
Storage battery for Randwick sub-station (£3,110).—Tudor Accumulator Co., Ltd.

—TENDERS.

Guildford.—Sewage Committee. Accepted:—
Pumping plant, &c., at Drummond Road pumping station (£650).—Worthington-Simpson, Ltd.

Hornsey.—Lighting Committee. Recommended:—
Electric lighting installation at 121 Council houses.—E. Wright & Co.

Hull.—Telephone Committee. Accepted:—
Wires and cables (£230).—General Electric Co., Ltd.

LONDON & NORTH-EASTERN RAILWAY.
Four electrically-driven hydraulic pressure pumps for pumping station, Hull.—Pulsometer Engineering Co.

Ilford.—Electricity Committee. Accepted:—
Cable (£2,385).—Union Cable Co., Ltd.
One e.h.p. feeder cubicle (£235).—Crompton & Co., Ltd.
Cable (£709).—Power and Lighting Cables, Ltd.

Irish Free State.—DUBLIN.—Dublin United Tramways Co., Ltd.
12 months' supply of Siemens vacuum lamps.—Siemens and English Electric Lamp Co., Ltd.

Leeds.—Tramways Committee. Accepted:—
Rail clips and bolts (£212).—Bayliss, Jones & Bayliss, Ltd.
Cables.—Greenwich Cable Works, Ltd., and W. T. Glover and Co., Ltd.

London.—BATTERSEA.—Electricity Committee. Accepted:—
Electric lift (£674).—Express Lift Co., Ltd.

ADMIRALTY.—Accepted:—
"Cosmos" flashlight lamps.—Metro-Vick Supplies, Ltd.

GREAT WESTERN RAILWAY CO.
Twelve months' supply of vacuum lamps.—Omega Lamp-works, Ltd.

LONDON COUNTY COUNCIL.—Highways Committee. Accepted:—
Four diaphragms for Westinghouse 8,000-kW turbine at Greenwich power station.—Metropolitan-Vickers Electrical Co., Ltd.
Steel bars (£1,100).—Lillieshall & Co., Ltd.
Gear wheels and pinions (£745).—Equipment & Engineering Co.
Steel axle bars (£835).—Steel, Peech & Tozer, Ltd.
Eight motors as spares (£2,140).—Metropolitan-Vickers Electrical Co., Ltd.
Nine armatures (£765).—English Electric Co., Ltd.
Repair of motor generators (net cost, plus 15 per cent., about £1,000).—English Electric Co., Ltd.

Manchester.—Paving Committee. Accepted:—
Motor for driving machinery.—Metropolitan-Vickers Electrical Co., Ltd.

Tramways Committee. Accepted:—
Steel tramway axles.—J. Baker & Co. (Rotherham), Ltd.
Copper trolley wire.—R. Johnson & Nephew, Ltd.
Cadmium copper trolley wire.—Elliott's Metal Co., Ltd.
Block tin.—French & Smith.
Destination indicator.—English Electric Co., Ltd.
Special track work.—Edgar Allen & Co., Ltd.

Electricity Committee. Accepted:—
Supply and laying 33,000-volt cable.—Callender's Cable and Construction Co., Ltd., and Pirelli-General Cable Works, Ltd.
Modification of existing switchgear.—British Thomson-Houston Co., Ltd.

Salford.—Health Committee. Accepted:—
Electric wiring at 143 and 147, Regent Road (£122).—W. Anderton & Co., Ltd.

Sheffield.—Electricity Committee. Accepted:—
Transformers (£5,771).—British Electric Transformer Co., Ltd.
Air pump at Blackburn Meadows generating station (£646).—Mirrlees, Watson Co., Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Accepted:—
Polyphase testing meter (£274).—South African General Electric Co., Ltd.
Steam piping for turbo set (£496).—Babcock & Wilcox, Ltd.
Cables (£1,035).—British Insulated Cables, Ltd.
Switchgear (£6,119).—A. Reyrolle & Co., Ltd.

Streets Committee. Accepted:—
Motors for electrification of plant at quarry (£1,528).—F. W. Searle.

Drainage Committee. Accepted:—
Electrical plant at sewage works (£690).—British General Electric Co., Ltd.

Germany-Sweden.—The Reich Ministry of Posts and the Swedish Postal Administration have in conjunction placed an order with the Felten & Guilleaume Company for a new cable for German-Swedish communication. It is to be laid next August between Zarrenzin, Pomeranis, and Kampinge, Sweden, and will have a length of 78 miles, plus 24 miles of land cable for connection with Stralsund and Malmo.

Uxbridge.—Works Committee. Recommended:—
Electrical water-indicating instrument (£84).—Glenfield and Kennedy, Ltd.
Electrical sirens at market house and waterworks (£208).—Walters Electrical Mfg. Co., Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, February 4th. 39, Victoria Street, S.W. "The Theory of the Gyroscopic Compass," by Mr. P. R. Jackson.

Friday, February 11th. At 7.30 p.m. "The Physiology of Work under High Air Temperature Conditions," by Prof. K. N. Moss.

Diesel Engine Users' Association.—Friday, February 4th. Discussion on the "Report on Heavy Oil Engine Working Costs for 1925-26."

Electrical Power Engineers' Association (Southern Division).—Friday, February 4th. Institution of Electrical Engineers, London, W.C. "Pulverised Fuel and its Application to Boilers." Mr. R. B. Potter.

(Glasgow Section).—Friday, February 11th. Reids Restaurant, Glasgow. 7.30 p.m. "The Policy of the Association." Mr. G. E. Smith.

Society of Engineers.—Monday, February 7th. 5.30 p.m. Presidential address by Mr. D. C. Fidler.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, February 7th. London. 7 p.m. "Some Interesting Features in Modern Installation Work." Mr. R. Grierson.

Thursday, February 10th. Hotel Cecil. 7.15 for 7.45 p.m. Annual dinner.

(North-Eastern Centre).—Tuesday, February 8th. Central Station Hotel, Newcastle-upon-Tyne. 7 p.m. Annual dinner.

(North-Midland Centre).—Tuesday, February 8th. Hotel Metropole, Leeds. 7 p.m. Informal discussion on "Electric Heating and Cooking."

(North-Western Centre).—Tuesday, February 8th. Engineers' Club, Manchester. 7 p.m. "Electrical Equipment of Track on the Underground Railways of London." Mr. A. R. Cooper.

(Scottish Centre). — Tuesday, February 8th. McLellan Galleries, Sauchiehall Street, Glasgow. 7.30 p.m. Faraday lecture, "What is Electricity?" Prof. W. M. Thornton.

(South-Midland Centre).—Wednesday, February 9th. Midland Institute, Birmingham. Faraday lecture, "What is Electricity?" Prof. W. M. Thornton.

British Electrical Development Association.—Wednesday, February 9th. Sopwith's Lounge, Newcastle-upon-Tyne. 7.15 p.m. "Industrial Heating." Mr. S. E. Monkhouse.

Institution of Heating and Ventilating Engineers.—Wednesday, February 9th. Holborn Restaurant, London. 2.30 p.m. "The Effects of Weather Conditions upon the Heat Requirements of a House." Dr. Margaret Fishenden; and Presidential address by Mr. J. L. Musgrave.

Institution of Engineers-in-Charge.—Wednesday, February 9th. St. Bride Institute, E.C. 7.30 p.m. "The Use of Oil Engines for Private Installations." Mr. B. P. Dean.

Institution of Welding Engineers.—Wednesday, February 9th. Milton Hall, Manchester. 7 p.m. "The Welding of Cast Iron." Mr. P. L. Roberts.

Royal Institution.—Thursday, February 10th. 5.15 p.m. "Acoustic Problems—Echoes." Sir William Bragg.

Electromobile Association.—Friday, February 11th. Royal Society of Arts, London, W.C. 7 p.m. "The Use of Storage Battery-type Electromobiles." Mr. J. C. Elvy.

Electrical Trades Commercial Travellers' Association.—Friday, February 11th. Holborn Restaurant, W.C.1. 7 p.m. Annual dinner.

British Electrical and Allied Industries Research Association.—Friday, February 11th. At the Savoy Hotel, London, W.C. 12.45 for 1 o'clock. Luncheon—Annual general meeting.

Association of Mining Electrical Engineers (North of England Branch).—Saturday, February 12th. Neville Hall, Newcastle. 3 p.m. "Failures in 3-phase Windings." Mr. R. G. Morgan.

(South Wales Branch).—Saturday, February 5th. Cox's Café, Cardiff. 6.30 p.m. Annual dinner.

(London Branch).—Tuesday, February 8th. Junior Institution of Engineers, London, S.W. 6.30 p.m. "Auto Synchronous Motors for Colliery Use." Messrs. H. O. Burge and C. S. Buyers.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

LUSTRAL glassware.

HOUGH watertight fittings.

Notes.

Registration of Engineers.

At a meeting of the Institution of Production Engineers, on January 26th, Mr. Richard Hazleton, Secretary of the Society of Technical Engineers, explained the aims of the Bill for the Registration of Engineers which is expected to be introduced again in this session of Parliament, and also the objects which the Society had in view. On the general question of the desirability of registration for engineers as a means of improving their status and protecting the public, Mr. Hazleton did not believe there was any difference of opinion among engineers; it was on the details for securing that end that the scheme was likely to meet with serious opposition. He reminded his audience that the Bill of the Institution of Civil Engineers, which was introduced about five years ago and was eventually withdrawn, practically provided that the Council of the Institution of Civil Engineers should be the Registration Authority, and it was because the other leading engineering institutions objected to this that the scheme failed. Discussing the reasons why the practically unknown and new Society should have introduced the Bill now, Mr. Hazleton said they were solely with the object of ensuring that some serious action should be taken in the matter. It was the hope of his Council that the Joint Engineering Council would take the matter up in an authoritative manner, and in that event the Society of Technical Engineers would be only too pleased to hand it over. The general scheme of the Bill was that there should be a General Registration Authority, but that the Councils of various engineering institutions, which would be scheduled to the Bill, should act as the registration authority for their particular members. A registration fee of £4 per annum was suggested, of which £1 would go to the Central Registration Authority and the remaining £3 to the particular institution under which the member became registered. It was proposed that the Central or General Engineering Council should consist of representatives of the Government, scientific institutions, universities and technical colleges, and engineering employers' and employés' organisations. The Bill had been framed, generally, on the constitution governing the General Medical Council. The object of making the Councils of the Engineering Institutions the actual registering authorities was to prevent a person registering with the General Engineering Council without being a member of any of the engineering institutions. Practising members of the institutions would be entitled to registration within two years of the passing of the Act. Persons who were not members of the institutions would be able to apply for registration on bringing satisfactory evidence that they had been engaged in responsible positions in the engineering industry for a period of not less than five years.

Mr. Hazleton pointed out that registration of engineers had been the law of the land for several years in many of the States of America. A similar measure had been in force in Italy for two years, and in New Zealand the registration of engineers had been in force since the middle of last year. He believed that if the Society of Technical Engineers was compelled to go ahead without the support of the leading engineering institutions, and was successful in getting a place in the Private Members Ballot, there were sufficient members of Parliament in favour of the general scheme of registration of engineers to ensure a second reading of the Bill and its committal to a Standing Committee, and then the leading engineering institutions would have to justify their position in not supporting the proposals.

Appointments Vacant.—Assistant mains engineer ($400 per month+dollar=2s. 4d.), for the Penang Municipal Commission Electricity Supply and Tramway Department. General, filing correspondence and shorthand clerks, for the West Midlands Joint Authority. Showroom salesman and two canvassers, for the Beckenham Urban District Council. Engineer and manager, for the Borough of Loughborough Electricity Department. (See our advertisement pages to-day.)

New Accumulator Separators.

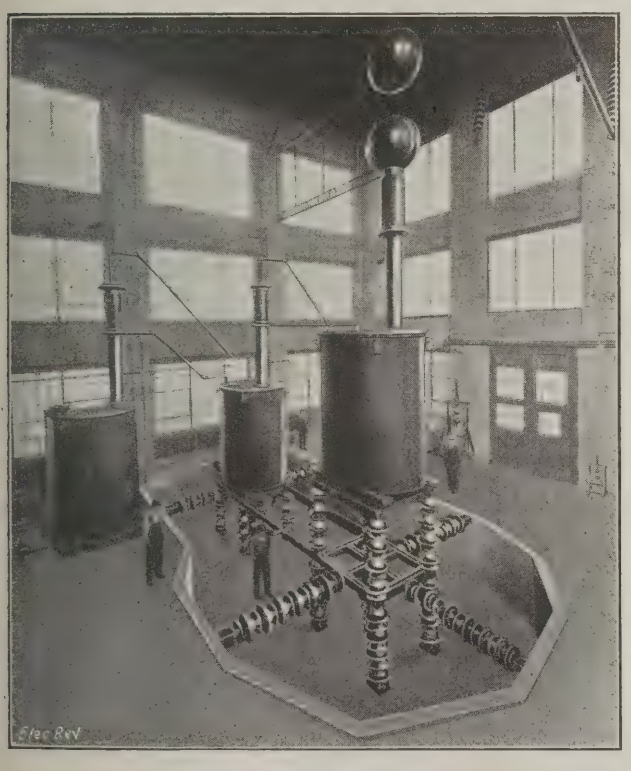
The subject of a recent demonstration at the Northampton works of the Electrical and Chemical Ebonite Co., Ltd., was the process of manufacture of a new accumulator separator which has been devised by Dr. Meyer Wilderman, and which is to be produced commercially by the above company. The invention is based on the necessity for increasing the concentration of the acid at the surface of the electrodes, and for this purpose introduces an automatic mixing and circulation of the electrolyte. This is brought about by means of a diaphragm of special construction and porosity for creating between the electrodes a hydrostatic and an increased electro-osmotic pressure. The separator, which is constructed in such a way that the electrolyte is unequally distributed between it and the electrodes, is made entirely of ebonite and is highly porous. This latter and essential feature of the device is brought about by treating a specially-prepared ebonite powder with pressure and heat. In each separator two porous diaphragms are held in ebonite non-compressible separating frames. These are stamped from sheets of the soft ebonite preparation before vulcanising, and by means of a horizontal press are made to adhere to lead-tin sheets, twelve being applied at one time. The frames are accommodated in grooves in the sheeting, which is stamped out

beforehand so as to give the required design and thickness to the diaphragms. The special powder referred to is then "spread" on the sheets so that it just fills up the spacings within the frames. This operation is performed by a somewhat complicated and ingenious piece of machinery of the firm's own design. The "spreading" of the powder is a delicate performance which, we understand, owing to the peculiar nature of the preparation, cannot be done by hand. A second sheet, suitably pressed to cover the frames and diaphragms, is placed in position, and the whole is clamped tightly together between suitable templet facings on the same machine which incorporates the spreading equipment. Held thus firmly and accurately in position between the sheets, the complete separators are vulcanised, after which the lead-tin foil is easily detached from the ebonite. After vulcanising, a surface tension exists between the diaphragm surface and the fluid, and this is removed by a special chemical treatment which leaves the diaphragm with an absorbing capacity somewhat approaching that of blotting paper. After a final grinding and polishing process, the separators are ready for immediate use.

Equipped with Wilderman separators, it is claimed, the efficiency of an accumulator will be considerably increased, its life substantially lengthened, and the volt-drop during discharge appreciably decreased. It is further claimed that the non-compressible frames counteract the bending and buckling of the electrodes in both the vertical and horizontal directions, thus constantly maintaining the correct conditions for the required distribution and circulation of the electrolyte. An important advantage of the separators is that they can be stored dry, either in or out of the accumulators. They can be made in any size, shape, or form.

A High-Pressure Testing Laboratory.

To ensure that the electrical equipment offered for sale will meet the severe conditions imposed on it by the super-power transmission systems in the United States, it is necessary to subject it to severe factory tests. A testing laboratory constructed by the Delta-Star Electric Company, Chicago, Illinois,



High-Voltage Transformers.

U.S.A., for the use of its designing engineers is shown in the accompanying illustration. The three transformers are each of 250 kVA capacity, and weigh approximately 18 tons. They are wound for a primary pressure of 2,000 V and a secondary pressure of 250,000 V, and are arranged for cascade or chain connection. Excitation and control of the transformer bank is secured by a synchronous motor-generator set, the 2,000-V winding of the first transformer being connected directly to the alternator. With the three transformers in series there is a pressure of 750,000 V between the high-pressure terminal of the third transformer and earth.

International Conference on High-Pressure Networks.

Preliminary arrangements have now been made for the 1927 session of the Paris E.H.P. Conference. It will be opened on Thursday, June 23rd, and will close on Saturday, July 2nd. During the interval the proceedings of the three Sections will be allotted two days each, from 9.30 a.m. to 4.30 p.m., and time will be found for visits to the power station of Eguzon (50,000 kW), the Paris-Orleans electric railways, and the transmission lines of that system, operating at 150,000 and 90,000 volts; there will also be excursions to Fontainebleau or Chantilly, and tours will be organised to the principal works and lines of the Alps and (alternatively) to the 150,000- and 90,000-V installations of the Midi railways in the Pyrenees.

Already 23 countries have arranged to participate in the proceedings; the list of subscribers will close on May 1st, but it is urgently desired that applications for membership shall be sent to the secretary as soon as possible, as the addition of large numbers during the last weeks upsets the organisation of the meetings. The cost is 250 francs, which covers copies of all the reports and participation in the sessions and fêtes.

An addition to the programme, at the request of an important member company, is the study of the measurement of energy at very high pressure; communications on this subject can be received (exceptionally) up to March 1st in one language. As decided in 1925, not more than 60 papers will be discussed this year. Papers submitted in both French and English can be received up to March 1st.

Amongst those already received are the following from British authors:—

Messrs. A. R. Everest, A. C. Michie, and E. B. Wedmore: Review of researches on insulating oils.

A nominee of the Cable Makers' Association: High-pressure cables.

E. T. Painton: High-pressure lines of aluminium-steel cable.

F. H. Riddle: The raw materials of porcelain.

R. Borlase Matthews: Distribution lines on farms.

V. Ferranti: Suppression of pressure waves in h.p. networks.

W. W. Lackie: The Electricity (Supply) Act in Great Britain.

The following papers have been received from the United States:—

C. Mailloux: The rational use of combustibles.

H. W. Young: Open-air installations.

J. T. Barron: A distribution network in New York.

Apart from the Sectional activities, Mr. C. Le Maistre has contributed a paper on national standardisation in various countries and the co-ordination of effort towards international unification.

The "Phonoscope."

The Westinghouse Electric and Manufacturing Co.'s "Osiso" is a single-element oscilloscope which may be used as an oscillograph. The instrument is remarkably light and portable, and will operate off dry cells. For electrical engineering work, it can be used to show alternating-current waveforms and phase relations and, by adding a synchronously-driven film holder, it may be used to photograph six different a.c. wave-forms and phase relations. Also, it may be used as a "phonoscope" to enable totally deaf persons to understand speech by viewing the audio-frequency waves of the output of any good radio receiving set or telephone. A spot of light, reflected from the mirror of the galvanometer, moves back and forth on the ground glass of the "Osiso," following the instantaneous changes in the current; a rotating polygon of mirrors gives a time component to the moving spot of light so that an observer may see waves of light. Each sound has a different wave shape: a pure note appears as an endless repetition of a "sine" wave. The height of the wave is a function of the loudness of the sound; the length of the wave, from crest to crest, is inversely proportional to the frequency; thus, with each sweep of each mirror, the number of oscillations that appear stretched out in a record of light are proportional to the frequency of the note. When a high note is being viewed many oscillations are apparent with each sweep of each mirror; when a low note is being viewed, only a few oscillations appear for each sweep of each mirror. The waves change with pitch and with different voices, but certain similar characteristics remain for each vowel sound. Any ordinary telephone microphone may be connected in series with dry cells and the vibrator ribbon of the "Osiso"; one may speak into the microphone and see the voice waves dance in the rotating mirrors. A single step-down audio-frequency transformer is used between any radio receiving set and the vibrator ribbon, any signal that will operate a loud speaker giving sufficient deflection; if the primary of the transformer is connected in series with the loud-speaker coil, one may hear and see the audio-frequency at the same time. No photographic action is required to receive the audio-frequency waves. A deaf person may be taught to understand speech by sight in a class and though such instruction would take much time, it seems probable that it would be more successful than the method of reception by feeling.

Electrification and the Electricity Act.

In the *Quarterly Review* for January, Sir Charles Bright, F.R.S.E., discusses the subject indicated in the title, from the standpoint of the onlooker who accepts without question the statements of the supporters of the Government scheme, and is ready to attribute our industrial difficulties mainly to our backwardness in the use of electricity. In the space of 16 pages it is, of course, impossible to take account of all relevant considerations, but without doing so it is equally impossible to draw fair comparisons between the progress made in this country and that made abroad. For instance, Switzerland has no coal and perforce must use her water

power, which means that she *must* use electricity lavishly—there is no alternative. We, on the other hand, have developed gas lighting to a remarkable degree, and electricity is heavily handicapped in the race, but nevertheless is making extraordinarily rapid progress. As for the statistics freely quoted by the author, we have repeatedly shown how unreliable they are. Belgium, for instance, is said to put "England far behind her in the matter of electricity." In point of fact, as we recently showed, there is very little difference. However, the author takes a hopeful view of the future.

A Colour-Lighting Demonstration.

On January 11th, the members of the General Council of the Cinematograph Exhibitors' Association attended a lecture on "Colour Lighting and its Future Application to the Kinema" in the miniature theatre attached to the showrooms of Messrs. Holophane, Ltd., when the effects of colour on the stage and film were demonstrated in conjunction with the use of a new range of stage-lighting equipment, "Duo-Phantom," which has been introduced by the company, and which we hope to describe in a later issue. The lecturer outlined the theory of colour, explaining and demonstrating the formation of the many colours from combinations of the basic ones. Some very striking and curious effects were shown. A man on the stage was made to appear as a negro, and the costume of a girl was represented as something entirely different to that which she was wearing It was also shown how, by a pre-selection of the material, the stage curtain could be made to appear in many entirely different colours and designs. A film was projected and made to float in a surround of colour which changed as the film went on to suit the emotional change of the various scenes a little in advance, suggesting to the audience what was shortly coming in the story. The title of the film was shown on a coloured, instead of a black, background, with the effect that it was much easier to read. The value of colour-lighting the kinema entrances, lobbies, vestibules, and waiting rooms was emphasised, and it was pointed out that if it definitely paid to increase the intensity of light in shop windows, then the practice could with benefit be applied to the kinema entrances.

The Shannon Scheme.

It is reported that the three turbines for the partial development of the Shannon scheme are being built by the firms of Voith and Escher, Wyss, sub-contractors to Messrs. Siemens-Schuckert, the German contractors for the scheme. Survey parties are engaged in surveying the route of the 110,000-V line between Limerick, Dublin, and Cork. The line will be carried by steel poles of an average height of 50 ft. The final survey of the cable routes *via* Dublin-Wexford-Waterford-Kilkenny-Carlow-Maryborough will soon be completed. Both main and auxiliary lines will be completed next summer. The latter line will have a voltage of 38,000. Distant towns from the main line will be linked up by 10,000-V lines radiating from transformer stations.

The Electromobile Association.

An informal meeting of the above Association will be held on February 11th at 7 p.m. at the Royal Society of Arts, John Street, Adelphi, Strand, when a general discussion will be opened by Mr. J. C. Elvy on "The Use of Storage Battery-type Electromobiles." The chair will be taken by Mr. J. H. C. Brooking, M.I.E.E. Tickets may be obtained on application to the Association, 3-7, Southampton Street, Strand, W.C.2.

Service Notes.

Vacancies for Navy Electricians.—The quarterly schedule of recruiting for the Royal Navy and Royal Marines shows increases in certain of the technical grades, and *The Times* points out that the outstanding feature of the list is the decision to enter 56 electrical artificers, more than double the usual quota. This is an attractive branch of the Service. Candidates must be efficient fitters and turners, or instrument makers, with at least five years' practical experience. No electrical knowledge is necessary on joining, a long training course being given. Pay begins at £2 16s. a week, with rations, accommodation, free kit, &c., and rises to £4 0s. 6d. a week according to rating. On promotion to warrant rank the pay is from 14s. 2d. to 17s. a day; to commissioned warrant rank, 18s. 10d. to 24s. 6d. a day; and to electrical lieutenant, 26s. 6d. to 34s. a day if promoted to electrical lieutenant-commander with the necessary qualifying service.

Those who do not reach warrant or commissioned rank may earn a pension after 22 years' qualifying service of approximately £100 a year. Warrant officers can earn up to £170 per annum retired pay, commissioned warrant officers up to £236, electrical lieutenants up to £284, and electrical lieutenant-commanders up to £331. The present openings are due to an unusually large number of time-expired men leaving the Service.

Vacancies for Aircraft Apprentices.—Five hundred aircraft apprentices, between the ages of 15 and 17, are required by the Royal Air Force for entry into the Schools of Technical Training at Halton, Bucks., and at Flowerdown, near Winchester. They will be enlisted as the result of an open competition and of a limited competition held by the Civil Service Commissioners and the Air Ministry respectively. Full information regarding the aircraft apprentice scheme can be obtained on application to the Royal Air Force, Gwydyr House, Whitehall, London, S.W.1. One of the trades open to boys is that of wireless operator-mechanic.

Swiss Electricity Exporters' Union.

Under the title of the Union des Exportateurs d'Energie Electriques, a body has lately been formed in Switzerland with headquarters at 29, Avenue de la Gare, Lausanne, to protect the interests of the Swiss undertakings "exporting" electrical energy.

Amplifiers for Community Singing.

The *Daily Express* community singing movement has met with an enthusiastic reception, and we learn that arrangements are being made for it to be extended to open air meetings all over the country. The problem of how to address the large audiences has been solved by the use of Marconiphone "Public Address" amplifiers, which were employed for the purpose in the Albert Hall, at Birmingham on January 1st, and at Swansea and Reading on January 8th, and will be a feature in future arrangements.

Chiswick Power Station.

It is reported that the Bill promoted by the London and Home Counties Joint Electricity Authority, seeking powers compulsorily to acquire land at Chiswick (Duke's Meadows), on which to erect a super-power station, will probably not be proceeded with in the coming Parliamentary session. The examiner of private Bills, after hearing allegations on behalf of the Barnes Urban District Council, that the Standing Orders of Parliament had not been complied with, gave his decision on January 26th, to the effect that the allegations had been sustained in several important respects. The promoters will therefore have to consider whether it is worth while to apply to the Standing Orders Committee for dispensation.

The Engineers' Club (London).

The fifth annual general meeting of the Engineers' Club (London) was held at the Club premises, Coventry Street, on January 26th, when the president, Sir Joseph W. Isherwood, Bt., occupied the chair. Reviewing progress during 1926, he pointed out how, in spite of the extreme difficulty of the period, the results exhibited very substantial support, and proved that the Club itself was a well-needed rendezvous of both the professional and the commercial engineer. The report and accounts were received and approved. Sir J. Fortescue Flannery, Bt., M.Inst.C.E., past president Institute of Marine Engineers, was unanimously elected president of the Club for the year 1927. Messrs. Vizard, Oldham, Crowder and Cash were re-elected honorary solicitors, and Messrs. Chantrey, Button & Co. were re-appointed auditors.

During February thirteen meetings are to be held at the Engineers' Club by 11 associations, mainly of engineers, including the Batti-Wallahs' Society, the I.E.E. Wireless Section, the Associated Municipal Electrical Engineers, and the Institute of Wireless Technology.

Lecture.

Mr. S. Gordon Monk, B.Sc., Department of Engineering, Plymouth Technical College, lectured to the members of the Plymouth Institution on January 27th, on electric furnaces, particularly with regard to iron smelting and refining, and steel production. The advantages of electrical treatment were the avoidance of contamination, minimum loss of heat, more compact and cleaner plant, precise control of temperature, and the fact that the exact composition of the final steel was known and specific samples could always be reproduced. Mr. Monk illustrated his lecture with lantern slides and demonstrations. A model of an induction furnace was shown, and Mr. Monk mentioned that the idea was in use at the Compton depôt of the Plymouth Corporation tramways for expanding steel tires for shrinkage on to wheels.

Fatality.

Whilst working at Blackburn Infirmary, on January 25th, Thomas Austin, apprentice electrician, was killed. At an inquest on January 27th a witness said that to secure a light he plugged one adaptor to another, and placed a bulb into the lampholder. He then received a shock which threw him against the hoardings. Recovering, he told another man something was wrong with the lamp. Another workman said he switched off the current at the main before the deceased fixed the bulb in the holder. Witness heard him shout, and saw him holding the wires with both hands. The workman thereupon tore the wires from the switchboard, and Austin fell to the floor. John Holliday, electrical foreman, said temporary cables had been run to enable the plasterers to work overtime. The holder and the lamp were in perfect order. He thought that the interior of the lampholder had been turned round when the lamp was put in, causing one of the screws to touch the case of the holder. He could not account for the wire being alive; the current could not have been switched off. The Coroner returned a verdict of "Accidental death."

National Association of Supervising Electricians.

The twelfth annual dinner and musical evening is to be held at the Holborn Restaurant, London, on February 26th, 1927. The President of the Association, Mr. A. M. Sillar, M.Inst.C.E., will preside, and will be supported by many other distinguished engineers.

Educational.

FARADAY HOUSE SCHOLARSHIPS.—The annual examinations for a Faraday and a Maxwell scholarships, each of fifty guineas per annum and tenable for two years in college and one year in manufacturing works, will be held on April 5th, 6th and 7th, 1927. Exhibitions may also be awarded to candidates who acquit themselves creditably but do not qualify for a scholarship. Particulars are obtainable from Faraday House, 62, Southampton Row, London, W.C.1.

Bauxite.

According to a German metallurgical journal, the world production of bauxite in 1926 amounted to 1,475,000 tons, as compared with 928,000 tons in the previous year, the French mines again occupying the first position with 440,000 tons last year.

Electrical Association for Women.

The first meeting in the new year of the Manchester District Branch was held on January 12th in the Lecture Hall of the Y.M.C.A. The Singer Sewing Machine Company gave a very interesting demonstration of its electric sewing machine, and entertained the members at tea. On January 19th members visited the all-electric house at Denton, which is open in connection with the "Wiring the Homes of Britain" campaign.

The lecture given earlier in the winter by Mr. R. C. Hawkins, of the Lighting Service Bureau, on "Lighting in the Home," proved so useful that it was decided to repeat it for members who were unable to attend the last meeting. This lecture was given on Monday evening, January 24th, and was very much appreciated.

Institution Notes.

Institution of Electrical Engineers.

ANNUAL DINNER.—Applications from members to attend the annual dinner on February 10th have been received in such large numbers that all the tickets have been disposed of, and it will not be possible to issue any tickets for non-members other than the official guests. Arrangements have, however, been made for additional accommodation in the Oak Room (immediately adjoining the Grand Hall). At the conclusion of the dinner the boxes and gallery in the Grand Hall will be thrown open to those who will have dined in the Oak Room, to enable them to hear the after-dinner speeches. Those wishing to avail themselves of the accommodation in the Oak Room are requested to communicate with the secretary of the Institution immediately.

Institution of Public Lighting Engineers.

CHANGE OF ADDRESS.—We have been notified by the hon. secretary of the above-named Institution, Capt. W. J. Liberty, that its address has been changed to: General Buildings, Aldwych, London, W.C.2.

Junior Institution of Engineers.

On Friday last, a paper on the "Design of High-Pressure Sub-stations" was delivered by Mr. C. E. Atkinson, A.M.I.E.E. The lecturer held that self-cooled 3-phase transformers should be used wherever the size and transport facilities permitted, and metal-clad switchgear for voltages up to 35,000 V. He considered that outdoor switchgear should be used for higher voltages.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

MR. R. WILSON JONES, A.M.I.E.E., A.M.Inst.M. & Cy.E., electrical engineer, Locomotive Superintendent's Department, Federated Malay States Government Railways, is at present in England on eight months' furlough. His temporary address is, c/o The Engineers' Club, Coventry Street, London, W.1.

A presentation has been made to Mr. R. P. JONES, district representative of the Kidderminster Lighting and Traction Co., Ltd., who is leaving Kidderminster to take up a post at Halesowen.

MR. R. B. LEACH has resigned the post of borough electrical engineer to Loughborough Corporation owing to ill-health, after 11 years' service.

The Manchester Corporation Electricity Committee has recommended the appointment of Mr. W. H. DUNCAN, of Newcastle-on-Tyne, as chief mains engineer.

A correspondent states that Mr. R. GREGORY, formerly a member of the Mold Council and chairman of the Electricity Committee, has been appointed electrical engineer to the Mold Council, at a salary of £300 per year.

It is reported in the Press that Captain W. J. LIBERTY, the Lighting Inspector to the City of London Corporation, has retired after 30 years in charge of the street lighting of the City.

Mr. T. H. WILLIAMS, electrical engineer to the Hoyland Silkstone Coal and Coke Co., who has become mining representative in the Yorkshire and Lancashire coalfields for the Marconiphone and Sterling Telephone and Electrical Companies, has been presented by the electrical staff with a fountain pen.

The Kingston-on-Thames Town Council has granted the borough electrical engineer, Mr. T. A. KINGHAM, six weeks' leave of absence, as he is suffering from the effects of overwork and strain to which he has been subjected during the past year. He has left for the Canary Islands, and during his absence Mr. P. C. SIMPSON is acting borough electrical engineer.

CAPT. I. MACKINTOSH, consulting engineer, Midland Bank Chambers, Wigan, closed his office on January 31st on taking over the general managership of the Corlett Electrical Engineering Co., Wilcock Street, Wigan. He asks that all correspondence for him should now be sent to the latter address.

The Leeds City Council has been recommended to grant salary increases to eleven principal municipal officials, including Mr. C. N. HEFFORD, city electrical engineer (from £1,600 to £1,650), and Mr. W. CHAMBERLAIN, tramway manager (from £1,500 to £1,600).

Cape Town Electricity Committee recently recommended that the salary of the city electrical engineer should be increased from £1,500 to £1,750 per annum.

Mr. G. A. HARRISON, district engineer to the West Gloucestershire Power Co., Ltd., has been presented by the employés with a suitcase on his resignation to take up a post abroad.

The Long Eaton Urban District Council has adopted the minimum salary scale of the Associated Municipal Electrical Engineers (Great Britain and Ireland) for the purpose of fixing the salary of its electrical engineer and manager, Mr. F. NEWEY.

A reference to the presentation made to Mr. CHARLES VERNIER on his leaving to take up his new appointment appears below.

Mr. G. L. PORTER, A.M.I.E.E., late of Messrs. Merz and McLellan, has joined the staff of Ferranti, Ltd., as advisory engineer.

Obituary.—MR. J. T. RAMSAY.—We regret to record that on January 25th Mr. John Thomas Ramsay, assistant superintendent of traffic in the Telephone Department of Glasgow Post Office, was knocked down and killed within 100 yards of his home by a motor-'bus.

MR. W. H. GUY.—We regret to learn that Mr. W. H. Guy, who was at one time connected with electrical and other technical publications, passed away on January 22nd, after a very brief illness.

MR. C. E. ELDER.—We deeply regret to record the death, which occurred with tragic suddenness last Saturday evening, of Mr. Charles E. Elder. He was one of a happy company assembled at the Savoy Restaurant, Newcastle, to make the farewell presentation of testimonials to Mr. Charles Vernier, for many years chief mains engineer, Newcastle-upon-Tyne Electric Supply Co., Ltd., who is joining the Macintosh Cable Co., Ltd., of Liverpool, as chief engineer. Mr. Elder was one of the soloists, and he expired suddenly after singing a song. Mr. Vernier received a silver coffee service from his colleagues in the company and a silver cigarette-case and a crystal cut-glass flower vase from the contractors who undertake work for the company from time to time. The presentation ceremony was necessarily of a formal character on account of the sad occurrence, and the proceedings came to an abrupt termination. Sincere sympathy with Mr. Elder's widow and relatives was expressed. Mr. Elder, who was about 57 years of age, was Mr. Vernier's chief assistant in the mains engineering section, and had been in the company's service for nearly 38 years. He was popular with all the staff. He had been in indifferent health for some time.

MR. A. J. WILKINS.—We regret to announce that Mr. A. J. Wilkins died suddenly on January 27th. He was associated with Messrs. G. E. Taylor & Co., as engineer and manager, from the commencement of the firm in 1899. Previously he was connected with Messrs. Laing, Wharton & Down, Ltd., for about 10 years. He was well known throughout the contracting industry, and will be greatly missed.

MR. C. G. VALLANCEY.—*The Times* records the death, in his 62nd year, of Mr. Charles George Vallancey, late of the Western Telegraph Co., Ltd.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Lisburn Electric Supply Co., Ltd.—Registered in Belfast January 18th. Capital, £100 in £1 shares. Objects: To carry on business as indicated by the title. The directors are:—E. S. Dashwood, Laurel Bank, Windsor Avenue, Belfast, electrical engineer; A. E. Salmon, Browne End, Bucks; Sir Robert J. Lynn, Kt., Belfast; Edward S. Clarke, Lisburn. Qualification, 20 shares. Secretary: J. G. Megaw. Registered office: Coates Buildings, Belfast.

Archibald Bryce & Co., Ltd.—Private company. Registered January 25th, in Edinburgh. Capital, £3,000 in £1 shares. Objects: To carry on the business of general manufacturers, merchants or traders, agents for and dealers in electrical and mechanical supplies, engineering and colliery supplies and furnishings, &c. The first directors are:—A. Bryce, 16, Whitehill Street, Dennistown, Glasgow, electrical engineer; J. Kinloch, 5, James Street, Whiteinch, Glasgow, electrical engineer. Qualification, one share. Secretary: G. Gibb. Registered office: 257, West Campbell Street, Glasgow.

Alldays & Onions, Ltd.—Registered as a private company on January 24th.. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in fans, blowers, furnaces, power or other hammers, forges, cranes, and lifting tackle, &c. The subscribers (each signing for one share) are:—A. T. Cocking, J.P., Hartopp Court, Four Oaks, Warwickshire; H. C. Chambers, Kerri, Blakesley Road, Yardley, Birmingham, solicitor's managing clerk. No share qualification necessary. Solicitors: Pinsent & Co., 6, Bennett's Hill, Birmingham.

Chromium Plating and Development Co., Ltd.—Private company. Registered January 28th. Capital £15,000 in £1 shares. Objects: To acquire from E. V. Hayes-Gratze, M. Fink, and A. Hurter the benefit of certain existing inventions of processes relating to the electro-deposition of chromium, and to carry on the business of chromium miners, electro-platers, metallurgists, &c. The first directors are:—E. V. Hayes-Gratze, 1, Gledhow Gardens, South Kensington, S.W.5, engineer; A. Hurter, 27, Soho Square, W.1, engineer; S. D. Kittel, address not stated. Qualification, 400 shares. Solicitors: Kenneth Brown, Baker, Baker, Lennox House, Norfolk Street, W.C.2.

Electric Fans, Ltd.—Private company. Registered January 29th. Capital, £500 in £1 shares. Objects: To adopt an agreement with S. J. Flatau and B. Freedman, to acquire the registered trade mark "Manda." No. 452,496, Class 7, and to carry on the business of manufacturers of, and dealers in electric fans, electric motors, mechanical signs, &c. The first directors are:—S. J. Flatau (chairman), 4, Kidderpore Gardens, Hampstead, N.W.; B. Freedman, 549, Finchley Road, N.W.; and V. Delebecque, 26a, St. Peter's Square, Hammersmith, W. The first two named are permanent. Solicitors: M. A. Jacobs, 73 and 74, Jermyn Street, S.W.1. Registered office: 53 and 54, Royal Mint Street, E.1.

Ruud Manufacturing Co., Ltd.—Private company. Registered January 29th. Capital, £20,000 in £1 shares. Objects: To carry on the business of manufacturers and suppliers of automatic and other types of water heaters, mechanical and electrical engineers, machinists, smiths, founders and fitters of brass, iron, and other metals, &c. The first directors are:—E. Ruud, 240, South Graham Street, Pittsburgh, gas engineer; A. P. Brill, 712, St. James Street, Pittsburgh, secretary; E. J. Horton, 330, Gross Street, Pittsburgh, U.S.A., mechanical engineer; E. C. A. Bliault, 5, Carlton Gardens, Ealing, W.5, merchant; A. J. Greenop, 6, Riverview Mansions, East Twickenham, solicitor. Qualification: 5 shares. Remuneration (except managing director, if any), as fixed by the company. Solicitors: A. J. Greenop & Co., Bush Lane House, Cannon Street, E.C.

E. A. Dale, Ltd.—Private company. Registered January 31st. Capital, £1,000 in £1 shares. Objects: To carry on the business of factors of, agents for and dealers in electrical goods and appliances, and materials, and plant for manufacturing wireless goods, wires and cables, lamps and shades, &c. The first directors are:—E. A. Dale, "Caledol," Tennis Court Drive, Leicester, electrical agent; A. Dale, 47, Devonshire Road, Sherwood, Nottingham, surveyor. Qualification, 100 shares. Solicitors: Whetstone & Frost, Leicester.

Official Returns of Electrical Companies.

British Electric and General Insulators, Ltd. (197,340).—Capital, £1,000 in £1 shares. Return dated May 16th (filed October 18th), 1926. Two shares taken up. £2 paid. Mortgages and charges, nil.

Refty Electrical Appliances, Ltd.—W. E. Fisher, of 12, Old Square, Lincoln's Inn, W.C.2, ceased to act as receiver or manager on January 8th, 1927.

Neutron, Ltd.—H. Hackett, C.A., of 448, Strand, W.C.2, was appointed receiver on January 18th, 1927, under powers contained in instrument dated September 29th, 1924.

H. L. Wood & Son, Ltd.—Mrs. L. O. L. Wood, of 7, Tasswell Road, Southsea, was appointed receiver and manager on January 13th, 1927, under powers contained in debentures dated November 17th, 1925.

Stensigns, Ltd.—A. B. Burbridge, of 32, St. James Street, S.W.1, was appointed receiver and manager on January 17th, 1927, under powers contained in debenture dated January 30th, 1926.

Deansgate Electro-Radio (Manchester), Ltd.—Debenture dated January 10th, 1927, to secure £775, charged on the company's property, present and future, including uncalled capital. Holder: C. Leeming, 10, Merton Road, Cheadle Heath, Stockport.

Wireless Experts, Ltd.—D. V. L. Craddock, of 2, Forbury, Reading, ceased to act as receiver on December 29th, 1926.

A. E. Acton-Burnell, Ltd.—G. Sunley, of 9-11, Copthall Avenue, E.C., was appointed receiver and manager on January 11th, 1927, under powers contained in debenture dated July 31st, 1923. R. Paiba, of 73, Basinghall Street, E.C., ceased to act in the above capacities on January 11th.

Atlas Light and Power Co., Ltd.—Particulars filed of £2,089,757 debenture stock (inclusive of £1,200,000 secured by trust deeds dated March 12th, 1909, February 10th, 1922, and July 16th, 1923), plus premiums relating thereto, authorised by resolution of December 31st, 1926, and covered by supplemental trust deed of same date, the amount of the present issue being £889,757 5 per cent. debenture stock. Trustees:—Col. C. W. Trotter, C.B., W. K. Whigham, Earl of Dunmore, V.C., M.V.O., and N. G. Touche. The present issue of stock is redeemable at 105 per cent. ranking *pari passu* (except as regards interest and redemption) with the debenture stock already authorised. The company has power to issue further stock ranking *pari passu* with the above 6 per cent. and 5 per cent. stocks at varying rates of interest, but so that such further stock with the £889,757 debenture stock shall not exceed half the nominal capital of the company beyond 1,925,211 £1 shares now issued).

Hall Telephone Accessories, Ltd. — Debenture dated January 6th, 1927, to secure £25,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: British Stamp and Ticket Automatic Delivery Co., Ltd., 70, Dudden Hill Lane, N.W.

New Phonopore Telephone Co., Ltd.—Debenture dated January 19th, 1927, to secure £100, charged on freehold factory at Southall, and company's undertaking. Holder: A. F. Liddell, 26, Austin Friars, E.C.2.

Buenos Aires Town and Docks Tramways, Ltd.—Trust deed dated December 31st, 1926, to secure £100,000 7 per cent. debenture stock, charged on the company's undertaking and property, present and future, including uncalled capital, with power to create any mortgage or charge ranking *pari passu* with or in priority to the stock, except as provided in the trust deed. Trustees: Law Debenture Corporation, Ltd., 2, Old Broad Street, E.C.

Shenton & Co., Ltd.—W. B. Pearson, of 5, John Street, Bedford Row, W.C.1, was appointed receiver and manager on February 25th, 1926, under powers contained in first mortgage debentures dated July 16th, 1925. (Notice filed January 21st, 1927.)

Pickvance, Ltd.—Issue on January 21st, 1927, of £25 debentures, first part of a series already registered.

City Notes.

Singapore Traction Co., Ltd.

The report which is to be presented at the annual meeting on Wednesday next covers a period of 14½ months (ended September 30th last) from the date of the company's incorporation. The undertaking was acquired from the receiver and manager of the Singapore Electric Tramways, Ltd. (in liquidation). After transferring £5,000 to depreciation and renewals account and carrying forward £7,028, there remains a sum of £20,000, one-half of which is payable to the managers, the remaining half being available for dividend. The directors recommend the payment of a dividend of 5 per cent. on the 7 per cent. cumulative preference shares. The profits for the first year of operation include £10,180 from the power station, derived mainly from the supply to the Municipal Commissioners, which was discontinued in October last. At the date of the accounts, 35 trolley-'buses had been put into service on a route of 6¼ miles, and a further 20 were in hand. The company has made an agreement with the Municipal Commissioners to take a supply from the municipal power station, thus avoiding expenditure upon the power plant.

Fife Tramway, Light and Power Co., Ltd.

The subsidiaries of this company earned a trading profit of £75,605 during the past year, as compared with £114,098 in 1925. The company receives a sum of £65,436 and, after meeting expenses, has a balance of £54,348. To this is added £9,694 brought forward, making £64,042. It is proposed to pay a dividend of 3 per cent. on the ordinary shares (against 6 per cent.) and to carry forward £6,145. In 1925 £10,500 was transferred to reserve. The meeting is to be held at Edinburgh to-day (Friday).

A Franco-Swiss Investment Bank.

The Banque Général pour l'Industrie Electrique is the title of an investment undertaking which has been formed in Geneva, with a share capital of 20,000,000 Swiss francs, for the purpose of carrying out financial operations in connection with the examination, establishment, and working of electrical undertakings. The bank has been constituted under the leading of the Union Financière of Geneva in Switzerland, and in France under that of the Credit Commercial de France and the Compagnie Générale d'Electricité.

Melbourne Electric Supply Co., Ltd.

The recently-issued accounts cover a period of 9 3/5 months. Against the receipts is charged a sum of £345,000 under the agreement made with the State Electricity Commission. The balance on trading account is thus reduced to £216,142, as compared with £567,610 in the previous period (14⅖ months). After meeting debenture interest, &c., and crediting interest received, there remains a balance of £102,989. The reserve for income tax receives £18,000, and to the balance is added £14,254 from general reserve. A final dividend of 5 per cent. actual is recommended on the consolidated ordinary stock, making 10 per cent., free of British income tax, for the year, and the balance of £3,195 will be paid over to the State Electricity Commission. The directors state that it is intended to continue to pay 10 per cent. on the ordinary stock. The rate is fixed at 7 per cent., but the balance is made up from income from investments.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Smith (S.) & Sons (Motor Accessories), Ltd.—400,000 7½ per cent. cumulative preference shares of £1 each partly paid and fully paid, Nos. 1 to 400,000.

The undermentioned securities have been ordered to be officially quoted:—

Perak River Hydro-Electric Power Co., Ltd.—£1,250,000 5 per cent. guaranteed debenture stock, 1951.

Tottenham District Light, Heat and Power Co.

The directors recommend the following dividends in respect of the half-year ended December 31st last:—At the rate of 5½ and 5 per cent. on the preference stocks; at the rate of 7⅝ per cent. on the "A" stock; and at the rate of 6¼ per cent. on the "B" stock. Similar dividends were paid for the previous six months.

Westinghouse Brake and Saxby Signal Co., Ltd.

The net profit for the year was £157,922, and the amount available, after meeting debenture interest, &c., and adding £7,866 brought forward, is £138,177. Of this £10,000 is put to reserve, £30,800 is written off expenses, and it is proposed to pay a dividend of 8 per cent. (against 6 per cent.), leaving £10,254 to be carried forward.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the register, and they are thereby dissolved:—

Borra Magneto Repairing Co., Ltd.
Multi-Electrode Radio Valve Co., Ltd.
Savoy Electric Construction Co., Ltd.
Woodhouse & Baillie Riviera Electricity Co., Ltd.

Companies to be Struck Off the Register.

The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

B. Barnett (Electrical Engineering), Ltd.
British Generator Co. (1922), Ltd.
British Homo Wireless Co., Ltd.
Broadcasting Installations, Ltd.
Eclat Electrical Accessories (Paddington) Co., Ltd.
Electronic Devices, Ltd.
Hull Wireless Co., Ltd.
Prior's Television (Parent Company), Ltd.
Radio Products, Ltd.
Reynard Electrical Co., Ltd.
Wilmore's Wireless, Ltd.

Metropolitan Railway Co.

A final dividend of 1½ per cent. has been declared on the ordinary stock, making 3 per cent. for the year, as against 5 per cent. for 1925. £100,000 has been taken from the reserve. The final dividend on the Surplus Land stock is 2⅛ per cent., making 3⅝ per cent., as against 3½ per cent for the previous year.

United Alkali Co., Ltd.

At a recent board meeting, Mr. Holbrook Gaskell (one of the existing directors) was appointed a managing director, and the following gentlemen were appointed additional directors of the company:—Sir Alfred Mond, Sir Harry McGowan, Mr. J. G. Nicholson, and Lieut.-Colonel G. P. Pollitt.

City of Buenos Ayres Tramways Co. (1904), Ltd.

A final dividend of 1¼ per cent., making 5 per cent. for the year (as in 1926), has been declared. It is proposed to transfer £5,500 to amortisation and general fund and to carry forward £15,114.

New Issue.

Ascot Gas and Electricity Co., Ltd.—Last week the company's agents invited tenders for 3,000 6-per-cent. preference shares of £10 each, to rank with the existing preference shares.

The A.E.G.

It is reported that the net profit of the Allgemeine Elektricitäts Gesellschaft for the past year was 10,761,000 marks, and a dividend of 7 per cent. has been declared.

Western Union Telegraph Co. (Inc.).

The gross revenue for 1926 was $136,445,900, and the net surplus, after providing for debt interest, &c., was $15,223,143.

Cable, Telephone and General Trust, Ltd.

The dividend has been declared for 1926 on the 6 per cent. cumulative preference shares.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets suffered from disappointment at the retention of the Bank Rate at 5 per cent., consequent upon the Chinese riots and the dispatch of troops from this country to the scene of action. There was a temporary check to the pleasant cheerfulness that had previously prevailed, and a drop in the new Consols spread general dullness amongst investment stocks. But neither investor nor speculator permitted the foreign disturbances to ruffle for long his confidence in the financial prospect, and therefore the Stock Exchange price lists show long strings of rises—substantial in many cases—in to-day's quotations as compared with those of the beginning of the year. The Home Railway sections are amongst the few that reveal losses, but these are mostly confined to the ordinary stocks, for the pre-ordinary issues are firm as a rule, improvements being registered in some instances.

Had not a nominal fall occurred in Edmundson's ordinary, caused by the marking of the price ex dividend, the particular section in which the shares are quoted would be void of alteration this week. Debenture stocks are better, the chief changes being gains of 4 points in County of London Electric first and second debenture stocks. The company has formulated an interesting plan, details of which appeared last week (ELECTRICAL REVIEW, page 147), under which the proprietors of the 4½ per cent. first debenture stock are offered £115, and of the

second debenture stock £112 10s., in the new 4 per cent. Consols. The first debenture is redeemable at 115 and the second at 105, at the option of the company. Meetings of proprietors are called for February 17th to consider the necessary resolutions. The latter must be passed by a 75 per cent. majority for them to become effective. The Board has given proprietors ample time to think over a matter that requires serious attention. Most proprietors will elect, we imagine, to accept terms which are undoubtedly attractive.

Brazilian Tractions remain amongst the most volatile shares in Stock Exchange markets. The price went ex 1½ dollars dividend last week, and had been up to 119. The present quotation of 117 is not far short of the recent best, allowing for the dividend. Rumour declares that the struggle for control has been renewed, and mentions the name of Mr. Alfred Loewenstein in this connection. It was this gentleman's offer that drew from the president of the Brazilian Traction Board such an extremely definite snub some few months back.

Marconis have been undergoing a series of abrupt transitions between firmness and weakness. After their jump to 17s. the price reacted to 15s. The movements are supposed to be actuated by bull and bear anticipations of the forthcoming issue of the report that has reached the sub-committee's hands. However great has been the vigilance exercised to stop any possibility of leakage, it is difficult to suppose that no information at all has been permitted, perhaps almost unconsciously, to filter through. Marconi Marines are 1/16 lower at 22s. 6d., notwithstanding the attention drawn to the shares in some directions, as a good speculative investment.

Cable stocks and shares are steady, but exhibit little vitality. Anglo-American preferred and deferred have gained small amounts. Indo-Europeans are down 1 to 46½. The telephone group is somewhat easier; United River Plates fell ⅛ to 8¼. In the Home list, International Automatic B have drooped to 42s. 6d., but Automatics hold their price at 55s. General Electrics, while nominally unchanged at 31s. 6d., have attracted support at that level. Metropolitan Vickers ordinary went ahead with an eighteenpenny rise to 28s. 3d. on account of the contracts which the company is known to be securing. Callenders improved to 48s. 9d. Siemens at 30s. 6d. are 9d. lower on the week. Business in the cable construction and equipment shares remains moderately active, but has become more of the investment type, the speculators being now busy with interests in other markets. Ever Ready shares touched 4½, and then reacted to 4⅜.

Home Railway ordinary stocks are weak. This is due to the declaration by the Metropolitan Railway of a final dividend of 1½ per cent., making 3 per cent. for the year 1926, as against 5 per cent. in the previous twelve months. Anticipation had looked for a probable 4 per cent., and the announcement led to a fall throughout Home Rails. Metropolitans are 3½ points lower on the week, and Districts shed 10s., Underground Electrics also being dull.

The Mexican Utilities group has strengthened noticeably. News from Mexico—direct—suggests that the country is about to make a payment of interest upon certain of the Mexican Railway national bonds, and this brought about rises ranging from 1 to 3 points in Mexican Light and Power descriptions. Mexican Electric Light 5 per cent. bonds advanced to 58½. British Columbia Electric stocks further increased their values. Kalgoorlie Electric Power and Light shares gained a few pence at 5s. 3d. In the dollar stocks, Shawinigan common shares are 6 points better at 283½.

Fife Tramway Light and Power shares, which were standing at 16s., fell back to 12s. 6d. on the cutting in half of the previous dividend of 6 per cent. The report says that the power and lighting properties were seriously affected by the complete dislocation caused by the coal dispute in Fife, and that the transport department suffered severely from the unfavourable industrial situation during the last eight months of the year. The working costs and output of the two former sections are now, says the report, "almost back to normal conditions." It is significant to read that the Power Company's generating station is being interconnected with the Scottish Central Electric Power Company by a trunk transmission line. Holders of shares in provincial electric supply companies will note this with especial interest.

Rubber shares lack lustre and activity. The exportable allowance is reduced to 70 per cent. for the three months that start with the Tuesday in this week, but this failed to energise the market. Iron and steel shares lean to the lower side, Vickers easing off to 8s. 7½d., Armstrongs being 3s. 4½d. The prices of the best-class shares are well maintained, however, and Babcocks continue to be steadily absorbed by the investor who looks well ahead.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1924.	1925.	Price Jan. 31 1927.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	14	14	£0 9	—	4 12
Brompton Ordinary	1	10	10	25/-	—	5 12 0
Charing Cross Ordinary	1	15	15	25/-	—	5 12 0
do. do. 4½ Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	25/-	—	5 12 0
City of London	1	15	15	2⅜	—	... ...
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/6	—	5 12 4
County of London	1	15	15	27/6	—	... ...
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/3xd	—	6 2 0
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	30/6	—	6 11 2
Kensington Ordinary	1	15	15	24/-	—	5 16 8
Lancs. Light and Power	1	7½	7½	24/-	—	6 2 5
London Electric	1	10	10	24/-	—	5 17 8
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	26/-	—	5 7 8
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 8
Newcastle-on-Tyne Ordinary ...	1	7	7	20/-	—	7 0 0
do. 5% Pref. ...	1	5	5	17/6	—	5 14 8
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	24/-	—	5 16 8
South London	1	15	15	24/6	—	6 8 0
South Metropolitan Pref.	1	7	7	1⅛	—	6 3 6
Urban Ordinary	1	4	7	1 1/16	—	5 17 11
do. 6% Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	24/6	—	5 14 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	1	8	8	27/6	—	5 16 5

Home Rails.

Central London Ord. Assented ...	Stock	4	4	70	—	5 14 4
Metropolitan	,,	5	5	60½	—3½	4 19 2
do. District	,,	8½	8½	56½	—½	6 4 0
Underground Electric	£1	Nil	Nil	13/-	—	Nil
do. do. Income ...	Bonds	6	6	104	—	*5 15 8

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	100½xd	+½	5 19 8
do. Def.	,,	1½	1½	24¼	+¼	6 3 9
Automatic Telephone	1	8	10	2⅝	—	8 12 9
Chili Telephone	5	5	6	6½	—	4 12 4
Cuba Sub. Ord.	10	5	5	7	—	7 5 6
Eastern Extension	10	10	10	17⅝	—	*5 13 4
Eastern Tel. Ord.	Stock	10	10	174½	—	*5 14 7
Globe Tel. and T. Ord.	10	10	10	18⅝	—	*5 6 8
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	22	20	27	—	7 8 2
Indo-European	25	8½	10	46½	—1	*5 7 6
Marconi	1	10	Nil	15/-	—9d.	... ...
Marconi-Marine	1	10	7½	1⅛	—1/16	6 13 4
Oriental Telephone Ord.	1	12	12	2 7/16	—	*4 18 4
United R. Plate Tel.	5	8	8	8¼	—⅛	*4 17 0
Western Telegraph	10	10	10	17	—	*5 17 8

Home and Foreign Trams, &c

Anglo-Arg. Trams First Pref. ...	5	5½	5½	2 13/16	—	9 15 6
do. do. 2nd Pref. ...	5	6	6	2⅞	—	10 8 8
do. do. 5% Deb. ...	Stock	5	5	70⅛	—	7 1 10
British Electric Traction Ord. ...	,,	7	8	144½	—	5 10 9
do. do. 6% Pref. ...	,,	6	6	109	—	5 10 1
Brazil Traction	100	4	5	117xd	—	5 2 6
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	89⅜	—	5 11 9
do. do. Preferred ...	,,	96/-	136/9	123	+1½	*5 1 11
do. do. Deferred ...	,,	129/5	8	153½	+1	*5 4 7
do. do. Deb. ...	,,	4½	4½	80½	—	5 5 7
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	7/-	—	Nil
London United Tram. Deb. ...	Stock	4	4	42½	—	9 8 4
Mexico Trams, 5% Bonds	—	5	5	64	—	7 12 0
Mexican Light Common	100	Nil	Nil	33½	+1	Nil
do. Pref.	100	Nil	Nil	80½	+3	Nil
do. 1st Bonds	—	5	5	64½	+1	7 16 1
Yorkshire (West Riding)	1	5	—	12/6	—	... ...

Manufacturing Companies.

Babcock & Wilcox	1	12	18	53/9	—	4 16 8
British Aluminium Ord.	1	5	10	48 3	—6d.	4 2 8
British Elec. Transformer Pref. ...	1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	1	15	15	70/-	—	4 5 9
Brush Ord.	1	10	10	21/6	+9d.	7 5 4
Callenders	1	15	15	8½	—	4 5 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	84	—	5 19 1
Electric Construction	1	10	10	31/3	—	6 8 0
Enfield Cable Pref.	1	7½	7½	1⅛	—	6 6 4
English Electric	1	5	Nil	15/-	—	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	5	7½	31/6	—	4 15 8
Henley	1	16	20	4 7/16	+1/16	4 10 4
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1	—	*5 0 0
Johnson & Phillips	1	10	17½	2 1/16	—	5 19 1
Met.-Vickers Ord.	1	8	8	28 3	+1/6	5 13 3
do. Pref.	2	8	8	2 3/16	—	6 18 4
Siemens Ord.	1	7½	7½	30/6	- 9d.	4 18 4
Telegraph Construction	12	20	10	29¾	—	*4 0 8

*Dividends paid free of Income Tax.

High-Voltage "S.L."-Type Cables.

33,000-Volt Cables with Metal-sheathed Cores, each of which is Separately Lead-covered.

By P. DUNSHEATH, O.B.E., M.A., B.Sc., M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

(Concluded from page 154.)

In the next series of tests two lengths of steel-tape-armoured cable, one of the plain 3-core type and the other of the S.L. type, were buried in the ground at a depth of 2 ft. and subjected to steady loads in turn, each run being continued for several days to ensure ultimate conditions. The point at issue is illustrated in the comparative figures

TABLE I.

Cable.	Current, amps.	Temperature. Conductor, deg. C.	Outside surface, deg. C.	Rise, deg. C.
S.L. type ...	256	58.1	44.7	13.4
Plain 3-core ...	256	61.8	44.7	17.1

in Table I, from which it is evident that in spite of eddy-current losses in the sheaths the temperature-rise in the S.L. cable is less than in the plain 3-core cable. As the heating is proportional to the square of the current, under conditions in which the external thermal path has negligible resistance (with the cables lying in flowing water) the S.L. cable would have a current-carrying capacity of over 12 per cent. in excess of that of the plain 3-core cable. In order to simulate practical conditions, the cables were subjected to a variable load, and fig. 4 shows the variation of temperature in the two cables for the last three days. Throughout the run the S.L. cable remained considerably cooler than the plain 3-core cable.

In a more complete set of tests an experimental 75-yard length of 0.2 sq. in., 3-core, 33,000-volt, S.L.-type cable with a dielectric thickness of 0.34 in. and having the section shown in fig. 2, was tested. The main armouring is a double layer of steel tape, and over the individual cores is applied a coat of impregnated cotton tape for protection against corrosion and to form bedding. Laid out on the ground and covered with a few inches of earth to avoid the effects of air currents, varied d.c. up to 300 amperes was passed through the conductors, each run being maintained for 24 hours in order to reach steady conditions. The d.c. tests were followed by a.c. tests at 50 and then at 25 cycles.

Fig. 5 shows that no danger need be anticipated from the magnitude of these voltages; even if the effect on the pilots is considered, transposing at each joint would easily eliminate all interference. Fig. 6 shows that the magnitudes of the longitudinal sheath currents amount to about 7 per cent. of the main cable current. Fig. 7 demonstrates how insignificant are the sheath losses; even allowing for the less important sheath eddies not measured in this test, the total loss expressed as a percentage of the copper loss at the full working current of the cable is only of the order of 3 or 4 per cent. Comparison of the values in figs. 8 and 9 is illuminating as it shows the negligible heating effect of the sheath losses (the outside surface being maintained at 20 deg. C.); the temperature rises under a.c. conditions are only very slightly higher than those under d.c. conditions. In order to obtain a straightforward assessment of the S.L. type, it must be credited with the advantage of the cooling due to the sheaths, as well as being debited with the additional heating caused by them. In fig. 10 are given the sheath and conductor temperatures for various 50-cycle currents noted in a load test on a 200-yard length of 0.2 sq. in., plain 3-core, single-wire-armoured, 33,000-volt cable. The important comparison to show up the merits of the S.L. cable is between figs. 9 and 10; if both cables were laid in water, the S.L. cable for the same temperature rise would carry 14 per cent. more current than the plain 3-core cable.

In order to obtain a still more practical comparison, heating tests have been carried out on three 50-yard lengths of 0.2 sq. in., 33-kV cable, a plain 3-core cable, an "H"-type cable and the S.L. type; the same paper and compound were used on all three, and the same manufacturing process adopted in all. The results are briefly summarised in fig. 11, which show the ultimate temperatures attained by the conductors.

Full appreciation of the merits of the S.L. construction for 33-kV transmission raises the question of using single-core

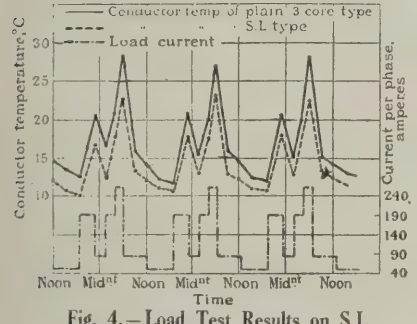


Fig. 4.—Load Test Results on S.L. and Plain 3-Core Cables.

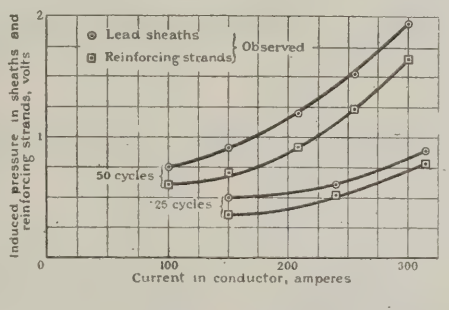


Fig. 5.—Induced Voltages on Open Circuit, S.L. Cable.

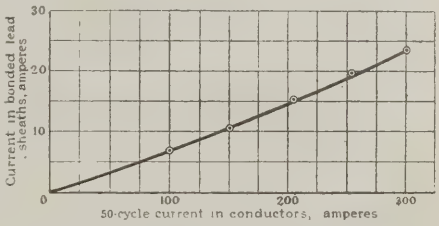


Fig. 6.—Longitudinal Sheath Currents, both ends Bonded.

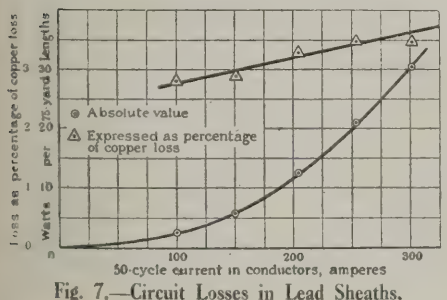


Fig. 7.—Circuit Losses in Lead Sheaths, Bonded, S.L. Cable.

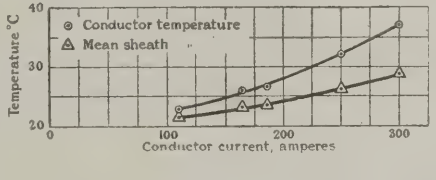


Fig. 8.—D.C. Heating Tests, S.L. Cable.

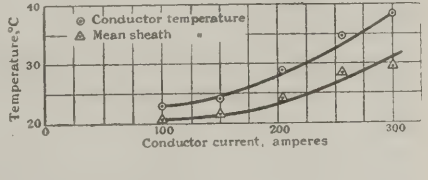


Fig. 9.—A.C. Heating Tests, S.L. Cable.

cables for the same purpose. If they can be laid in triangle formation close together, there is no reason why the losses with single-core, lead-covered, unarmoured cables should be any greater than those with the S.L. cable. From the point of view of mechanical protection, the S.L. cable can be laid direct in the ground as manufactured; the use of single-core, armoured cables for a.c. transmission is impracticable both from the point of view of losses and that of current-carrying capacity, and their use in place of S.L. cables for 33-kV systems must allow for at least equal mechanical protection. As regards convenience, small single cores are admittedly easier to handle, but this ease is a danger; the less a super-voltage cable is bent during laying the better are its chances of a long life. Whenever single-core cables are used, interference with external telegraph and telephone circuits must be watched. The cores in the S.L. type are twisted together with a lay of only a few feet, while the equivalent single cores are laid together side by side without any twist; therefore, with the former interference would be absent, while with the latter it might be very pronounced.

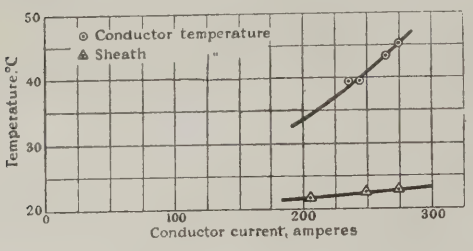


Fig. 10.—A.C. Heating Tests, Plain 3-Core 33-kV Cable.

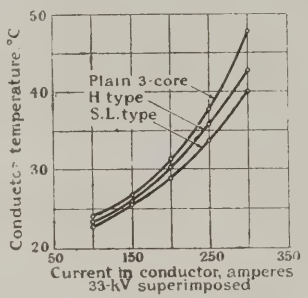


Fig. 11.—Heating Tests, Various Loadings and Types of Cable.

Comparison of a number of cases of different sizes shows that, taking into account the cost of cable, excavation, laying, jointing and reinstatement, the advantage is with the S.L. cable. A single-core installation for the same thickness of dielectric costs slightly more than an S.L. installation. If pilots be included in the comparison, the advantage in favour of the S.L. type may amount to as much as 6 or 8 per cent. on the cost.

The general conclusions are that metal-sheathed-core cables have many important advantages over plain 3-core cables, and practically no disadvantages. Of the two types, the S.L. has important advantages, but has been considered to have disadvantages because of the voltage generated and losses incurred in the sheaths surrounding the separate cores. A wide range of tests shows conclusively that these fears are groundless. The voltages are very small, even when not suppressed by bonding, and when the cables are bonded together the losses due to eddy currents are negligible. Also, contrary to the previous supposition that the losses reduce the rating of the cable by the heat generated in the sheaths, the cooling effect of the sheaths carries the balance far in the opposite direction, resulting in the S.L. type of cable running very much cooler than the plain 3-core cable. Considering also that the S.L. cable is lighter in weight than the plain 3-core cable and carries with its use a very simple joint construction, in addition to the known electrical advantages, it seems that an unanswerable case is made for its use as a solution of the 33,000-volt cable problem.

A Large Cable Armouring Machine.

50-h.p. Plant Made and Recently Installed by Messrs. Johnson & Phillips, Ltd.

THE accompanying illustration shows a large cable armouring machine which has recently been installed in the paper cable shops of Messrs. Johnson & Phillips, Ltd. It is some 220 feet long, over all, and is intended to armour cables with outside diameters up to 5½ in. Two armouring cages containing 96 floating bobbins and 24 fixed bobbins, each measuring 18 in. by 9 in., provide for serving the cable with 120 wires in all. The capacity of each bobbin is about 3½ cwt. of wire. The jute is served by means of six disks, each carrying 64 spools of the material. There are ten compound tanks, which are provided with special exhausting gear for the removal of the fumes. The machine is also arranged for steel-tape as an alternative to steel-wire armouring. The diameter of the draw-gear wheel is 9 ft., and the take-up stand will receive drums up to 12 ft. in diameter and from 15 to 20 tons in maximum weight.

The drive is by a 50-h.p. centrally placed motor directly coupled, through friction-clutch gear, to the main shaft, an arrangement which enables the heaviest load to be picked up gradually and easily. The wire cages run on ball bearings, and are provided with a loading gantry. The two wire sections can be coupled together by means of a coupling tube and the centre serving plant removed, the cages being synchronised so that the 120 wires can be put on in one layer if required: It is of interest to learn that the machine was manufactured entirely in the Johnson & Phillips' engineering shops.

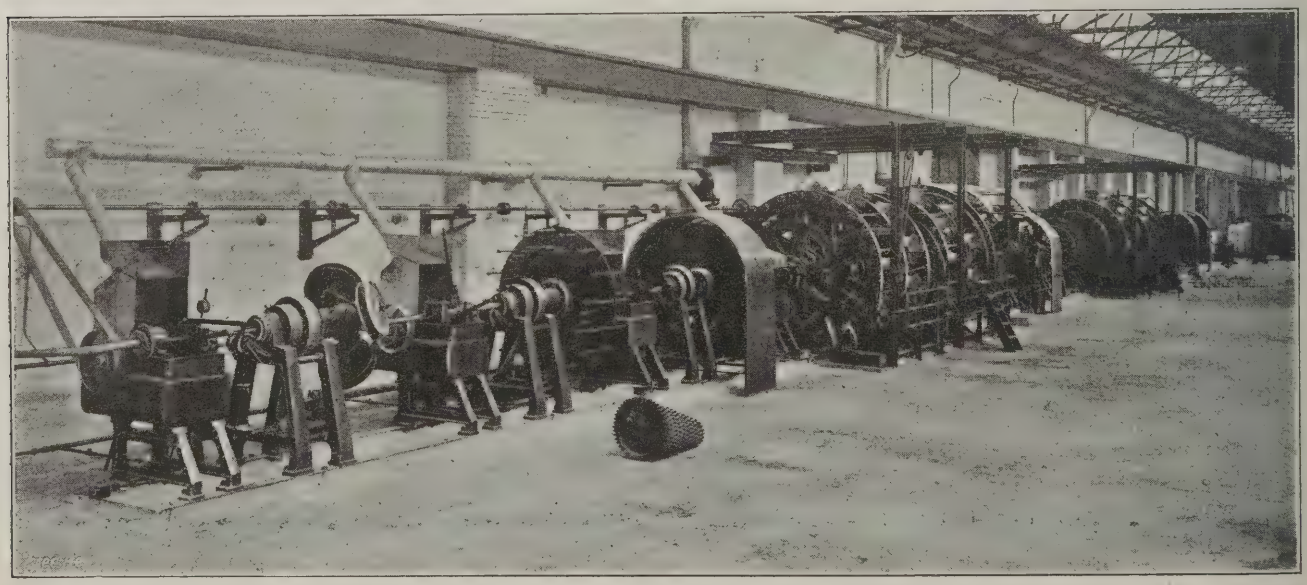


Fig. 1.—"J. & P." Electric Cable Armouring Plant, 220 feet in length.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

(*Concluded from page* 153.)

Klaxon, Ltd.

The Company's chief exhibit was the "Audiwave" used for applying the new Eldred method of relieving deafness. The machine's action is the same in principle as that of the radio loud-speaker; in front of it is a rigid vibrating cone which is operated by mechanism similar to that of an electric bell, but designed to produce vibration of the required characteristics. The instrument is driven off a 6-volt battery, and a rheostat controls the amplitude of the vibration, this quantity being indicated simply by a mark on the cone. Patients may apply the treatment themselves at home.

New Oscilloscope Co., Ltd.

Improved models of the Elverson oscilloscope, or flashing-lamp stroboscope, are more robust and compact than the earlier ones; in addition to the usual method of operation by direct connection to mechanisms to be examined, the new types can be used for cursory examinations in exactly the same manner as hand tachometers, the oscilloscope gear-box being held in one hand and the lamp for the examination of the mechanism in the other hand.

The vibrating-wire stroboscope, by Prof. A. Guillet, is a new form of stroboscope, which has a field of utility supplementary to the oscilloscope, and can be used for quantitative tests on various electrical applications besides its utility in instances of tests on mechanical plant where it may not be convenient or possible to obtain a direct connection (and thus absolute synchronism) between the stroboscope and the mechanism to be examined. The instrument is suitable for tests at all frequencies or speeds from 1,000 to 12,000 r.p.m., and is compact and easy to operate. In principle, it consists of a metal strip of wire, the vibration of which is sustained electrically by means of a small electromagnet suspended over its centre and actuated by the current from a small battery; the current is cut off by the wire itself at the moment of its passing through the position of equilibrium. The frequency of vibration of the wire can be regulated by imperceptible degrees, through varying its tension by means of a screw on which is engraved an accurately divided scale. This vibrating wire opens and closes the primary circuit of an induction coil, across the secondary of which is connected a special form of neon lamp, the flashing frequency of which coincides exactly with that of the cord, and thus it is possible at any moment to follow the movements of a mechanism.

Radio Communication Co., Ltd.

This exhibit consisted of an automatic signal call device; a continuous-wave radio transmitter with an input rating of 1.5 kW, of the standard type for wave-lengths of from 500 to 3,000 m.; and a "Polar Four" broadcast receiving set, consisting of a detector and three resistance-capacity coupled l.f. stages, the outfit having been designed for operation by a simple method of remote control.

Other Exhibitors.

Other exhibitors in the trade section of the show included the Zenith Electric Co., Ltd. (resistances and rheostats). R. M. Catterson-Smith and K. S. Mills (electric resistance laboratory and other furnaces). Damard Lacquer Co., Ltd. ("Formite" and "Bakelite" synthetic resin products). Darimont Electric Batteries, Ltd. (two-fluid primary cells). W. Edwards & Co. (vacuum pumps, cathode-ray oscillograph, photo-electric cells, quartz mercury-vapour lamps, and other laboratory apparatus). A. Gallenkamp & Co., Ltd. (electric furnaces, electro-titration apparatus, &c.). Gambrell Bros., Ltd. (cable and other testing apparatus, fire-alarm call box, and wireless gear). John J. Griffin & Sons and Baird and Tatlock, Ltd. (calorimeters, CO_2 indicators, laboratory ovens, oil-testing and other measuring instruments, pyrometers). The India Rubber, Gutta Percha & Telegraph Works Co., Ltd. (telegraph apparatus and wireless accessories). Isenthal and Co., Ltd. (resistances and motor mercury starters, automatic voltage regulator, regulating transformer, &c.). Kelvin, Bottomley & Baird, Ltd. (quartz mercury-vapour lamps, and artificial daylight lamps). P. J. Kipp & Zonen (optical and electrical instruments). Laboratory Equipment Co. (electric lamps). Baird & Tatlock (London), Ltd. (electrometric titration apparatus). W. H. Pettifor (electrical aids for the deaf). W. G. Pye & Co. (electrical laboratory apparatus). Schall & Son, Ltd. (high-voltage transformer for X-ray research on crystals, which is also useful for cable testing). Venner Time Switches, Ltd. (street-lighting automatic switches).

Research and Experimental Section.

Group A of this section was representative of typical results of recent physical research of general interest, and examples of new or improved laboratory methods.

Amongst the 19 exhibitors, the British Photographic Research Association showed a phonometer for the measurement of the opacity of photographic negatives. The selenium cell used in the original instrument has been replaced by a special gasfilled photo-electric cell, constructed by Mr. T. C. Keeley, of the Clarendon Laboratory, Oxford. The current is magnified by means of a valve and recorded by a comparatively insensitive galvanometer which is extremely dead-beat and very quick in action. In order to obtain sensitivity, the whole of the light which passes through the negative is collected by the photo-electric cell, the negative being placed in contact with the cell window; this creates a practical difficulty, in that usually the comparison beam (which passes through the calibrated optical wedge) enters the cell through the same window. The difficulty is overcome by providing a second window, so that the two beams enter the cell at right angles to one another.

Amongst the Admiralty Research Laboratory's exhibits was a sub-standard for the determination of frequencies above the range of tuning forks. A metal rod, set into longitudinal vibration by a blow on one end, emits sound waves which influence a microphone placed near the other end; the alternating current whose frequency is to be measured flows through the microphone, and a note is heard in a telephone receiver connected in parallel with the microphone, having a frequency which is equal to the difference between the rod and current frequencies, which can be measured by means of a sonometer.

For the determination of the strength of wireless signals on wavelength greater than 6,000 metres, a meter was shown which is operated thus: a small e.m.f. is introduced periodically into the aerial circuit, and its magnitude and frequency are altered till the signal is matched.

The Air Defence Experimental Establishment (Major W. S. Tucker) had an instrument on view for training sound locator operators indoors, *i.e.*, where actual aeroplane flights are impracticable. It consists of an addition to the ordinary sound locator whereby a.c. is produced in telephones worn by the operators. When the trumpets are manipulated, the phase displacements between these currents are altered, and the operators experience binaural sensations, whereby they are enabled to point the locator at a dummy target running on a track.

Mr. J. L. Baird's model of the transmitting portion of his original "television" apparatus was lent by Messrs. Television, Ltd.

Prof. W. Cramp's magnetic balance for measuring field intensities is capable of reading below 50 lines per sq. cm., and is based on the principle of balancing by a weight the force which deflects a short conductor carrying a current and placed in a magnetic field.

The research laboratories of the General Electric Co., Ltd., demonstrated a circuit devised by Boucherot, which gives a constant-current supply from a fixed a.c. voltage supply: an inductance and capacity were connected in series across the mains and tuned to the supply frequency, the load being connected across either the inductance or the capacity. The network has the remarkable property that the current through the load is entirely independent of the load impedance; in contrast with a constant-voltage supply, the load terminals may be safely short-circuited, but may not be left open-circuited.

Other items included a sensitive electroscope, the moving system of which consists of an inverted loop of tungsten wire of such length in proportion to its other dimensions that it is nearly unstable, so that the restoring force is made very small: the use of tungsten wire allows the moving part to be made very light, so that air damping is effective, and sensitivity may be controlled by rotating the instrument. A machine which enables the voltage rating of electric lamps (gasfilled or vacuum) to be determined automatically and rapidly to a high degree of accuracy employs colour matching by means of two photo-electric cells, one being more sensitive to red light and the other to blue; vacuum lamps can be rated with a mean error of 0.13 per cent. in voltage at a rate of about 200 per hour. In a sector photometer designed for the rapid measurement of polar distribution of large lighting units or light sources, a Lummer-Brodhun contrast head is used, and the brightness of the comparison field is controlled by a stationary variable aperture sector and rotating prisms

as in the Weber photometer. The photometer and mirror gear can be so arranged that a single observer can make all necessary adjustments, and take all readings.

The structure of opal glass was illustrated, and apparatus for determining the absolute expansion coefficient of glass. Three specimens showing stages in the making of the flat annular hard-glass type of photo-electric cell were on view; also electric ovens of a type developed for use particularly in the pumping of large valves of light weight and very low heat capacity for their size.

Mr. A. F. Hallimond's contribution was a magnetic separator for research on powdered minerals, rocks, &c.

In the Henley Research Laboratories (Capt. P. Dunsheath) a covering power tester has been devised for the purpose of discriminating between one yarn and another from the point of view of the manner in which a given quantity of the yarn will cover a wire; the principle of the machine consists in winding the yarn to be tested on to a rotating mandril with a continuously varying pitch, the gear ratios of the machine fixing the pitch at the moment that the yarn just covers the mandril. A machine has been designed to compare the softness of any particular sample with the softness of perfectly annealed wire: by the release of a fixed spring load, a centre anvil deflects the wire through an amount given by the dial indicator, which is a direct measure of the softness.

One of the most important tests of an insulating oil is its electrical breakdown, and the apparatus used in the Henley Research Laboratories for this purpose was shown. One of the samples illustrating the breakdown of impregnated paper under electric stress indicated the combination of the tangential discharge on two opposite sides of a sheet connected by a puncture through the paper. The cheeselike formation found in certain insulating oils used for impregnating paper cables, when subjected to prolonged high electrical stress, appears to be a highly polymerised product of certain constituents of the oil, and is quite inert. Apparatus has been in use for some time for testing this property of impregnating oil, a sample of the substance being subjected to a high dielectric stress between two electrodes.

Dr. E. W. Marchant's apparatus for comparing the conductivities of metal plates and for determining flaws in metal surfaces was exhibited.

The Metropolitan-Vickers Electrical Co., Ltd. (Research Dept.) exhibits were illustrative of the "shortpath" principle of thermionic valve construction, which gives reduced ionisation and low impedance. A molybdenum-wound resistance furnace which can be operated up to 1,800 deg. C. was shown, in which a hydrogen atmosphere is used.

The National Physical Laboratory's many exhibits included a demonstration of the production of standard telephonic frequencies directly from the seconds given by the pendulum of a clock (Mr. D. W. Dye):—(*a*) A tuning-fork, adjusted to a frequency as nearly as possible 50 cycles per second, was provided with an electromagnet; impulses of current through the magnet, caused each second by a contact on the pendulum, maintained the fork in vigorous vibration at its frequency of exactly 50 cycles per second. (*b*) A two-valve "multivibrator" provided sudden impulses of current at intervals of 1/50th of a second, which were kept rigorously uniform in rate by the tuning-fork. (*c*) The impulses provided by the multivibrator maintained oscillations in a tuned resonant circuit, which could be adjusted to any frequency within limits: whenever the frequency had a value which was an integral number of times that of the impulses, large forced resonant oscillations of this exact frequency were built up and maintained.

The British Thomson-Houston Co., Ltd. (Engineering Laboratory) had a model which represented mechanically the electrical action in an oscillating valve circuit. The Company also showed how, by the use of a gasfilled photo-electric cell working at its ionisation point, rapid determinations of the percentage flicker of light emitted from lamps on a.c. circuits can be made. The lamp under test is fed at normal voltage, and the light intensity reaching the cell is adjusted (by diminishing the distance) until the cell suddenly ionises, and a large increase of current occurs; this point is very sharp and well defined. The lamp voltage is carefully observed at this point; d.c. is then substituted for a.c., and the voltage slowly raised until the ionisation point is again reached: from the relative voltage readings the variation in light may be calculated.

The effect caused by the liberation of a dose of tungsten vapour into an argon discharge tube was shown, using a type of discharge described by Dr. Langmuir. The tungsten vapour thus produced caused the discharge to pass through a characteristic series of changes.

Models.

Group B of the experimental section, which consisted of some eleven exhibits, was intended to illustrate some little-known and effective lecture experiments of interest to teachers of physics. Amongst the items on view were the following:—

Mr. G. G. Blake, a model designed to illustrate the action of a three-electrode valve, employed for instructional purposes by the Royal Air Force.

Mr. A. E. Bowyer-Lowe, a model for demonstrating beat notes in connection with super-heterodyne wireless receivers: it consisted of six organ pipes.

Prof. G. B. Bryan showed a valve-characteristic model designed by Prof. C. L. Fortescue for the purpose of showing the relationship between three independent variables of a thermionic valves, *viz.*, grid voltage, anode voltage, and anode current.

Prof. W. Cramp, apparatus for the measurement of capacity by analogy.

Mr. J. F. Gill's model illustrated the principle of synchronous and induction motors.

Dr. Edward Hughes, a model for demonstrating three-phase currents, the whole arrangement being mounted so that it can be placed in a projector instead of the usual slide carrier.

Mr. J. Paley Yorke's models for use of teachers assist in demonstrating some of the fundamental principles of magnetism and electro-magnetism, designed for projection by means of a demonstration lantern; also some working models demonstrating the principles of some instruments.

Mr. L. G. Vedy and Mr. G. Gowland demonstrated the rotation of bodies with dielectric surfaces in electrostatic fields: the bodies are usually charged during rotation, and the phenomenon appears to be due to the effect of the discharge on the non-conducting surface layer.

In Group C, famous historical experimental apparatus was shown.

Electrical Notes from Canada.

The Development of Power on the River St. Lawrence.

[By Our Special Toronto Correspondent.]

THE outstanding event of recent weeks has been the presentation of the report of the Joint Engineering Board appointed in 1925 by the Governments of Canada and the United States to report on the feasibility of developing the St. Lawrence River for both navigation and power. This report reveals that the engineers representing the two countries are fully agreed as to the desirability of making use of this great waterway for both purposes, but on the question of how the power development should be carried out they differ. Their attitude with regard to the latter is unfortunate for it will no doubt cause considerable delay.

The situation is a little peculiar in that the works necessary to provide a deep waterway for navigation will, unless they are to be ineffective for some years, have to be carried out on the whole stretch of the river from Lake Ontario to Montreal, a distance of 183 miles, which includes the international section of the river and a portion which lies entirely within Canada. The United States is, of course, vitally interested in the entire scheme, since it would provide both countries with an outlet to the sea for ocean-going ships. On the other hand, so far as power development is concerned, while the two countries must work together on the international section, the all-Canadian portion has nothing to do with the United States.

It is interesting to note from the report of the Joint Engineering Board that navigational works carried out in conjunction with power development will be less costly than if carried out alone, so that not only will the power development be a source of revenue, but it will actually be the means of reducing the capital cost of the navigational works. The report states that there will not be more than 25 miles of canal navigation and not more than nine locks and eight bridges, and that the waterway can be kept open for traffic during eight months each year—ice, of course, will close it for the other four months.

The Canadian engineers believe that it would be better to build two dams and develop power at two different sites, while the Americans favour a single dam and the utilisation of the entire available head at one site. The advantages of the Canadian plan appear to be that considerably less land would be flooded, that power could be made available in about three years' time, instead of six, after the date of actually commencing work, and that although the capital cost would be higher this would be offset, at least to some extent, by the fact that the interest charges during the construction period would be less. The disadvantages are that not only would the total capital cost be somewhat higher than for the American scheme, but the actual power made available would be slightly less.

Another difference in the views held on the two sides of the river, though this is not a matter dealt with in the above-mentioned report, is that, so far as the development of power on the international section is concerned, public ownership is favoured in Ontario and private ownership in the United States. This fact may possibly introduce some difficulties in the two countries arriving at satisfactory agreements for the carrying out of the work which would not exist if both sides favoured the same plan of ownership.

Further progress towards the realisation of this great project has just been made by the issuing of a report by the St. Lawrence Commission, some details of which have appeared in the daily Press. This body, with Mr. H. Hoover as chairman, was appointed by the Federal Government of the United States to consider the several proposals which have been made to provide outlets to the sea, and to report which it considered to be the best. The Commission's report favours the St. Lawrence route.

The other proposals referred to had many supporters in New York State. One of these, known as the "All-American" route, involved the construction of a great system of canals linking the lower end of Lake Erie with the Hudson River. The other scheme would have run from the eastern end of Lake Ontario to the Hudson River. It is said that each of these would have been much more costly in construction, and also in maintenance, than the St. Lawrence scheme.

Before leaving this subject, some figures given out by a prominent American engineer and quoted in the Canadian *Electrical News* may be of interest. In the distance (120 miles) between Lake Ontario and Montreal, the St. Lawrence River falls 220 ft., carrying all the discharge water from the Great Lakes system, which comprises 200,000 sq. miles of catchment basin, of which 90,000 sq. miles is lake area. The present shipping, representing about 6,000,000 tons of freight, can be increased to about 100,000,000 tons per annum—this will greatly lessen the cost of shipping grain from the immense wheat-growing areas of the west. The St. Lawrence will produce about 5,400,000 h.p., 1,200,000 h.p. of which will belong to the United States and the rest to Canada.

From the foregoing, it is easy to realise why Canadians, and particularly those in Eastern Canada, take such an interest in the question of the St. Lawrence River development.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A 'Bus Lighting Lamp.

A recent development of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, is the production of the internally frosted "Pearl Osram" lamp for the interior lighting of 'buses. The outer surface of the lamp is quite smooth so that it can readily be cleaned with a duster. Compared with the clear lamp the new model has many advantages claimed for it, one of the chief being that its enclosure in globes or well-glasses is unnecessary. In this respect it is interesting to learn that the G.E.C. recently carried out certain tests to ascertain the amount of light lost by and through the use of various forms of well-glasses. It was established that a thin, clear well-glass absorbed as much as 8 per cent.

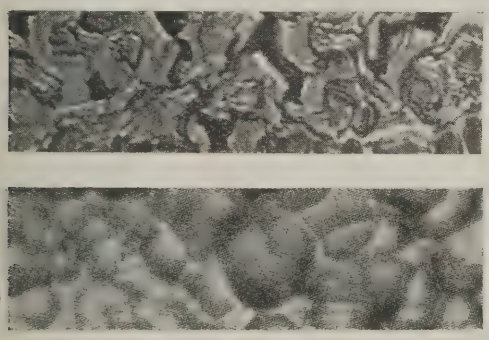


Fig. 1.—Bulb Surface, before and after Final Treatment.

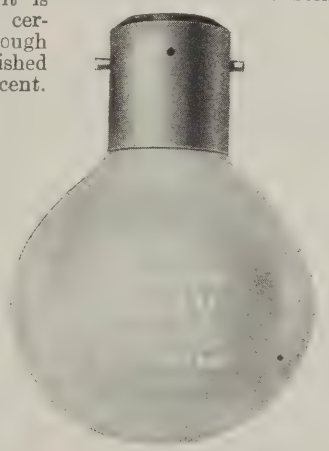


Fig. 2.—"Pearl" Osram 'Bus Lamp.

of the light emitted from the lamp, and that an elaborate pattern of opal well-glass was responsible for a loss of light of approximately 40 per cent. These tests resulted in a decision by a 'bus company to use the internally frosted lamp, which, it is claimed, absorbs scarcely 2 per cent. of the light emitted from the filament, with efficient diffusion. The first process employed for internally frosting lamps made the bulb so fragile that it was unfit for practical lighting purposes. The method weakened the wall in the same way as a metal bar is weakened by notching it with a file. The acid used for internal frosting, by its chemical action, actually cuts innumerable notches in the glass. It is a well-known fact that a notched metal bar increases in mechanical strength when the notches are filed down until they disappear. A somewhat similar principle is employed for the lamp frosting, the sharp grooves cut by the acid being rounded off by a further acid treatment. Fig. 1 shows photo-micrographs of the internal surface of a bulb before and after the second acid treatment, the latter or lower illustration being highly magnified. Fig. 2 shows the "Pearl" 'bus lamp.

An Electric Iron Safety Stand.

With a view to the prevention of fires or other accidents due to the overheating of an electric iron, Messrs. BRUCE, DAWSON & Co., 70, Finsbury Pavement, London, E.C.2, have recently placed on the market their "Itur" safety stand, fig. 3. This is in the form of a convenient iron rest of a similar shape to that of the iron itself, and carries an internally arranged switch which is operated automatically to the "off" position by the depression of the top plate, under the influence of the weight of the iron. The supply to the iron is taken through the stand switch, suitable inlet and outlet connections being provided. If it is desired that the current should remain on, the iron is placed crosswise on the stand so as not to depress the top plate. The standard article is suitable for all makes of electric iron and for any of the voltages in use. Practice has shown, it is claimed, that the use of the device has resulted in a considerable saving in energy.

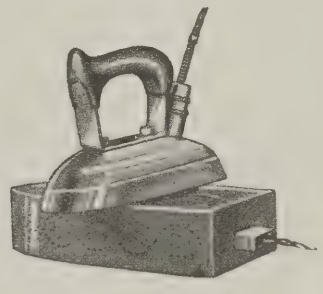


Fig. 3.—Electric-Iron Safety Stand.

An Electric Bedwarmer.

The "Thermal" electric bedwarmer, fig. 4, is a recent production of the LONDON AND RUGBY ENGINEERING CO., LTD., 36-7, Queen Street, London, E.C.4. It is made for voltages of 100/110 and 200/250, and consumes 300 W. It is not intended for connection to the supply during use, being capable, it is

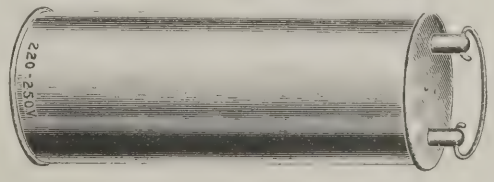


Fig. 4. An Electric Bedwarmer.

claimed, of retaining its heat for from 6 to 8 hours after being "on circuit" for only 10 minutes. It is suitable for use in other connections where local warmth is required. It is 9 in. long by 3½ in. wide, and has a nickel-plated finish.

A New Electric Geyser.

The accompanying illustration, fig. 5, shows a recent addition to the "Gee-Gee" products of Messrs. George Green and Co., 40, Aybrook Street, London, W.1, the instantaneous geyser. It is constructed of cast aluminium, and is complete with a swivel spout and lugs for wall fixing. The heating equipment is enclosed in tinned-copper sheaths and is entirely electrically insulated from the water. To comply with the I.E.E. regulations, the switch is arranged as a separate unit, and has been so combined with the cold water inlet valve that it can only be "on" when the water is running. The construction and finish of the apparatus gives it an attractive appearance.

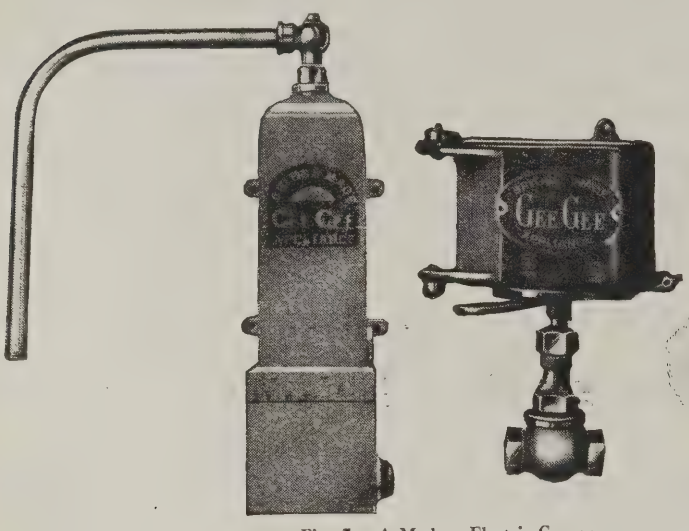


Fig. 5.—A Modern Electric Geyser.

"Morganite" Heaters.

Since the general description of the "Morganite" resistor and its applications in our issue of June 13th, 1924, p. 958, the Morgan Crucible Co., Ltd., Battersea Works, Church Road, London, S.W.11, has developed several models of wall and floor radiators. Fig. 6 shows a "Morganite" imitation luminous heater which has been designed to produce the psychological effect of a glowing fire, while preserving the essential feature of low-temperature radiation. The result is achieved by concealing lamps within a sheet-metal scroll which reflects the light on to the glazed or coloured surface of the heating element. The wall-fixture radiator shown in fig. 7 is particularly suitable for public halls, dining rooms, and so on, the mounting being ornamental and self-contained, while a guard in front of the element can be supplied in various designs to suit different styles of decoration.



Fig. 6.—Imitation Luminous Heater.



Fig. 7.—A Wall Radiator.

Industrial Electric Heating.

The Fourth E.D.A. Salesmanship Conference.

Mr. R. W. L. PHILLIPS (electrical engineer to the Bedford Corporation and president of the I.M.E.A.) was in the chair at the conference of the Electrical Development Association, on Friday, January 21st, when Mr. S. E. Monkhouse, of the Newcastle-upon-Tyne Electric Supply Co., Ltd., read a paper on the above subject.

Mr. Monkhouse said that as a first step in the direction of developing this class of load, the Newcastle Company had detailed an engineer some months ago to deal exclusively with industrial electric heating, and, as a result of his efforts, Mr. Monkhouse was convinced that considerable propaganda was necessary if the business were to be stimulated with the minimum of delay. He disagreed with the view that industrial heating business would be developed only if electricity were sold at a price which was competitive on a heat basis with that for other classes of fuel. To develop the business with profit supply engineers would require to discriminate between a competitive price on a heat basis and an economic price, between which there was a great difference; there was always a market for the superior commodity. Many cases had come to his notice during the last few months where processes could be dealt with more efficiently and completed more economically by employing electricity than by employing other media, after paying a price remunerative to the supply authority. The author said that one important feature of a furnace heated electrically was its high efficiency when working at high temperatures. At temperatures round about 2,400 deg. F., gas, coal and oil had efficiencies of from 10 to 20 per cent.; in the case of electricity it was 75 per cent. Other advantages of electric heating were close temperature control; the ability to apply heat just where it was wanted, avoid cold spots, and arrange the rate of heating to suit the process; the absence of fumes and soot; automatic stopping and starting; elimination of coal- and ash-handling and banking losses; uniform rate of heating; and reduced maintenance costs, owing to the absence of corroding fumes and the scouring action of gases. There were numerous installations of electrical heating processes in operation in this country, and it was a matter for regret that the existence of those installations was not made more generally known to the manufacturers. To illustrate the variety of purposes for which electricity had been applied in this country, the author mentioned steel annealing, linseed-oil burning, bitumen heating, paint drying, vacuum drying ovens, and many other uses. He also gave a list of typical installations in operation in the United States, giving a comparison of the cost when using electricity as compared with the fuel used previously, as well as the reasons why electric heating was adopted. This produced many points in favour of electricity.

One direction in which he considered a development might be expected was in the application of electricity for the heat treatment of colliery drills and coal-cutting picks used in mechanical coal cutters; it seemed probable that in the future it would become common practice for each colliery where coal cutters were employed to have a furnace in which to treat the cutting tools periodically. Many mines in South Africa were already so equipped. Another application of electrical industrial heating might be cultivated in works where a small quantity of steam was required intermittently in different parts of the factory. In such cases, if independent electrically heated steam-raising boilers were installed, a saving in cost would result, first because the cost of providing and maintaining long lengths of steam pipes could be avoided, and, secondly, for the reason that steam could be raised quickly as and when required, and need not be maintained constantly. There were a few installations in operation in this country in which the circulating water for heating large buildings was heated electrically during off-peak hours, a system of thermal storage being provided for maintaining the water at the required temperature during the day. The Newcastle Electric Supply Co. has this system in operation in one of its buildings, and it was being installed in another now in the course of erec-

tion. In both cases an electrode system of heating was employed, and the high pressure supply was used without resort to transformers. The demand made by these installations was 800 kW and 1,800 kW, respectively.

A recent important development was an apparatus which made use of high-frequency currents for the production of intense local heat. Many furnaces of this type were already in operation in this country, and very high temperatures were being obtained with considerable accuracy. The frequency usually adopted was 25,000 cycles per second, but in one case a frequency of 50,000 cycles per second was being used for heating a material having a comparatively high resistance.

With regard to the conversion of existing heating appliances, he said that so far as technical considerations were concerned he was in sympathy with the view held by competent engineers that this was not a practice to be recommended. From a commercial point of view, however, he felt that there was a good deal to be said against it. It was a question for serious consideration within the industry as to whether every effort should not be made to meet the users' dictates in this connection. Conversions might be troublesome to effect, and might lead to indifferent efficiency, but if they provided a means for encouraging the adoption of electricity for heating purposes, surely they were justifiable. He had heard of cases where considerable ingenuity had been shown by the engineering staff of various works in converting steam and other heating apparatus to electricity; it was doubtful whether all or any of these would have been working electrically to-day if it had been necessary to discard the whole of the existing equipment. As an example he mentioned a case in which, in order to overcome the cost involved in maintaining steam at night for the purpose of heating a large vacuum drying oven, the steam pipes were insulated from the oven and a current passed through them from the secondary of a special low-voltage transformer, so that the oven was heated during the day by steam and at night electrically, and considerable saving had been effected.

In conclusion, Mr. Monkhouse said that the industry would benefit greatly by an active publicity campaign on behalf of industrial heating.

Discussion.

Opening the discussion, Mr. T. SETTLE (General Electric Co., Ltd.) said that while, so far as he knew, the Newcastle Electric Supply Co. was the first and only supply authority in this country to appoint a qualified engineer to deal with electric heating problems, in the United States a very active policy had been adopted. Lectures were given, to which everybody interested in industrial heating was invited. As electric heating, when using apparatus of the resistance furnace type, had an inherent high power factor, and often a high load factor, it might appeal to the Electricity Commissioners to appoint a committee to deal with industrial heating. His own company had decided to go in wholeheartedly for developing industrial heating, and proposed to install electric ovens in some of its own works in order to convince intending users that satisfactory results could be obtained under practical conditions. In the United States he had seen works in which electric furnaces were used for enamelling watch dials in large quantities, for the coating of pipes with asphalt, for softening bakelite for moulding purposes, electric sherardising ovens, ovens for coating wires with enamel, and plant for electrically sterilising milk cans, &c. The water heating problem was entirely in the hands of the supply authorities; everything depended upon the rate charged for energy. If the future lay entirely with "off-peak" load, that would lead us automatically towards thermal storage. The conversion of existing apparatus would not, in the majority of cases, justify the trouble and expense involved.

Mr. F. W. LEEVERS (British Thomson-Houston Co., Ltd.) drew attention to a few of the difficulties in the way of industrial heating. There was first the question of capital cost, and if there was difficulty in getting firms to go in for complete new plant, then the conversion of existing apparatus should be advocated. Then there was the cost of operation, which called for the collaboration of the supply authorities, and in this connection the better quality of product in industrial processes when electricity was used should be stressed to the manufacturer. Finally, there was the psychology of the user, which meant that some sort of guarantee as to results must be given by the manufacturers.

Mr. H. MARRYAT (Messrs. Marryat & Place) said that the better quality of the product with electric heating in some industrial processes was so great that competition hardly entered into the question. There were other applications, however, in which other fuels could do the work practically as well, and there was a large field in this direction. There the cost of energy was important. A case in point came before his notice recently when a proposal was made to a supply authority for a 20-hour load with four hours off for what was conceived to be the peak. Unfortunately the rate quoted was such that the transaction fell through. No mention had been made of spot welding, but there was a large amount of work to be done in displacing the riveting and seaming in shipbuilding.

Mr. H. T. SULLY (Marylebone) referred particularly to water heating, and said that in Switzerland there were installations using up to 10 million kWh per annum for this purpose, the rate being extremely low. As another special application of electric heating he mentioned the new reptile house at the Zoo, where the consumption would ultimately be two million kWh.

Mr. H. J. ADAMS (Metro-Vick Supplies, Ltd.) spoke of the large extent to which electricity was used for steam raising in Canada, Newfoundland, and the United States, especially in paper mills.

Mr. R. D. GIVEN said he had gone into the question of steam raising by electricity, but had found that unless the rate was exceedingly small it would not pay. The policy in Canada was for the hydro-electric plants to sell their excess energy at exceedingly low rates on the understanding that the amount would be reduced at short notice if an ordinary customer came along.

Mr. LESSERS (City of London Electric Lighting Co., Ltd.) said that architects designed buildings so that 80 per cent. of the heating was by central heating from fires, leaving only 20 per cent. for electric heating. That did not give a good load factor. His company had special rates for water heating.

Mr. J. W. BEAUCHAMP (E.D.A.) said there were many installations of industrial heating of which no information was published, and he asked manufacturers and others not to keep this to themselves, but to let the technical Press or E.D.A. have it for propaganda purposes. A recent inquiry had been for the use of electricity for drying hops.

Mr. A. R. BROWNE (Woolwich Electricity Department) mentioned one or two hot water electrical installations which had shown considerable economies over other methods.

The CHAIRMAN, referring to Mr. Marryat's remarks, said the supply undertaking had several difficulties in fixing a suitable tariff, and one of them was to avoid preferential treatment. Another was that in dealing with so-called "off-peak" loads care must be taken that another peak was not being created. It might be found that the natural peak and the artificial peak would overlap.

Mr. MONKHOUSE, winding up the meeting, again pleaded for greater publicity and propaganda in connection with industrial electric heating.

Domestic Refrigeration.

An E.D.A. Conference at Newcastle.

AT a conference held under the auspices of the British Electrical Development Association at Newcastle, on January 12th, Mr. N. E. Barber read a paper on "Domestic and Small Capacity Refrigeration." Mr. H. J. Miles (president of the Electrical Contractors' Association) was in the chair.

Mr. Barber said that the main use of refrigeration was the preservation of food; it was the best preservative method because it permitted the retention of the food's natural flavour and its nutritive qualities. An effective refrigerator must possess adequate heat-insulating material; must be arranged so that the air was continually moving; and should be constructed with a view to easy cleaning. Compressed granulated cork had been found to be an efficient and convenient insulating medium. A very difficult problem was the proper fitting of the door; that had been largely overcome by the use of substantial teak frames and labyrinth seals. To facilitate the movement of air the shelves should be of an open mesh type and not solid; they should also be removable. Another feature which a refrigerator should possess was lightness and a size which would allow it to be taken through doorways easily. The author proceeded to deal with the three means of refrigeration, *viz.*, ice-thawing, mechanical and chemical. Generally speaking, the first method was not satisfactory. Mechanical refrigerators utilised condensable gases possessing a high latent heat combined with a high ratio of latent heat to specific heat, a low boiling point, a low-pressure condensing temperature, and a low ratio of

compression, while being non-corrosive, non-inflammable, and non-injurious to health. The three agents most favoured for small-capacity machines were sulphur dioxide, ethyl chloride, and methyl chloride. Refrigerating machines all operated on a common cycle, *viz.*, compression and condensation of the refrigerant and the expansion of the liquid into gas. Generally, the compressors were run at low speeds. There were several machines of the intermeshed gear type running at electric motor speeds and at least one of turbine form. It added to the efficiency to have the machines hermetically enclosed; such machines were of stationary and revolving types. The stationary forms were usually operated by a squirrel-cage motor, the rotor being within the hermetically-sealed enclosure, but in other forms the complete motor was within the sealed envelope, the necessary leads being conducted through the enclosure by a type of sparking plug. The most prominent machines on the market were of American manufacture, but European makers had produced small machines showing marked advance in design. British refrigerators were usually on orthodox lines, but two makes were hermetically enclosed. The principal difficulty in compressor design appeared to be the gland through which the operating shaft projected; some form of disk packing backed by a spring system to compensate for wear appeared to have met with success. Those glands had to be gastight under considerable pressures, and remarkable efficiency had been attained in many small machines. The electric motor had been found to be the most suitable and convenient driver, but i.c. engines had proved satisfactory. Mr. Barber proceeded to explain the working of a mechanical refrigerator and the cycle of compression, condensation and expansion. He then dealt with the control of the machine, making special reference to direct and indirect thermostatic and non-automatic control. "Service" in connection with refrigerators was an important matter. The author quoted from a report of the National Electric Light Association, which showed that for 262 machines studied 411 service calls were made in a year; of those 119 were in respect of control, 44 related to expansion valves, and 15 to compressors; 60 were "false alarms" and the rest related to routine matters. The study indicated room for improvement in design, but "service" still had to be regarded as a factor in the sale of the appliances. Non-automatic control eliminated the cause of trouble and operation could become a matter of routine. The author said that greater economy of energy was obtained with non-automatic control. He then proceeded to explain the chemical method of heat extraction, and said that recent inventions had greatly improved the system. With regard to the application of refrigeration, he said that some thousands of ice-cooled refrigerators had been supplied to retail shopkeepers in this country, but very few had been converted to mechanical operation. The new Pure Food Regulations should do much to stimulate the sale of refrigerators. In conclusion, he said that there were British-made refrigerators which would fulfil all the requirements.

A discussion followed, and Mr. Barber, in reply to questions raised, said that to protect meat against bacterial action the temperature should be below 50 deg. There were advantages in the employment of a brine tank which acted as an "accumulator of cold." He did not think that glass insulation was satisfactory, even from a display point of view. There was a lack of standardisation, and there were many ways of converting ice-cooled refrigerators to mechanical operation. Any attempt to reduce prices by using inferior and inadequate materials would be unsafe. He thought that manufacturers should get together and share the credit to enable people to purchase refrigerators. The absorption type of machine was certainly preferable to the motor-operated pattern, but at present the scale of operation was restricted. It was generally accepted that we were only at the beginning of things in refrigeration. Mr. Barber thought, however, that a demand had been created, and that anyone who spent time and money in research stood a reasonable chance of being compensated for it.

The Telephone Service.

Statistics which Reveal Progress and Development in the London Area during 1926.

A STATEMENT of the progress made in the London telephone area during 1926, prepared primarily for the London Telephone Advisory Committee, and signed by Mr. W. A. Valentine, Controller of the London Telephone Service, and Mr. R. McIlroy, superintending engineer, London Telephone District, indicates that the boundaries of the area remained unaltered during the year; it covered 750 square miles and extended from Reigate to Waltham Cross and from Tilbury to Hayes (Middlesex).

With the opening of seven new exchanges and the closing of Bank and Latchmere, the number of exchanges reached 112 (including the trunk and toll exchanges), as compared with 107 in the previous year. The number of exchange lines connected at the end of 1926 was 298,766, the net increase for the year being 28,965, or about 10.7 per cent. The demand for private wires connecting subscribers' offices (not connected to the public exchange system) continued, the total number being 15,400. The total number of telephones (exchange and private) was 519,969, the net increase being 43,156, or about 9.0 per cent.; the 500,000th London telephone was installed on July 16th, 1926, in the Press Gallery of the House of Commons.

During the year there was an increase in the number of private branch exchanges, which totalled 22,970, as compared with 21,000, of which number 97 are automatic; orders were placed for 18 new automatic installations and schemes formulated in 10 other cases. Approximately 30,000 removals were effected during 1926. The number of call offices working was 4,686, the increase being 283. There were 418 kiosks in public thoroughfares and on private sites in the London area at the end of the year, and local, toll and trunk calls may now be made and telegrams dictated from them. The new prepayment coin boxes being fitted in call offices accept different classes of coins; 2,000 of the new instruments will be in service within the next 12 months.

Development in the business areas of London has not been so great as was anticipated, but there was a marked increase in the rate of development in the suburban areas; the extraordinary building development in the outer London areas made it specially difficult to determine the anticipated growth in those areas and to provide spare plant economically in advance of the requirements. Seven new exchanges were opened, providing an increased capacity of 11,000 lines; three new ones were also provided to replace exchanges already existing, and, together with extensions to 47 existing exchanges, provided additional accommodation to the extent of 33,000 lines. Plans were approved for five new manual exchanges to replace existing equipment, and consideration was being given to schemes for a further increase in capacity of 91,000 lines. Eleven new exchange buildings were in process of construction, and sites for 29 additional ones had been obtained.

The preliminary work incidental to the conversion of the London area to automatic working was well advanced, and specifications for exchanges to accommodate more than 100,000 automatic lines had been issued; the installation of automatic equipment was in progress at the Holborn, Western, Sloane, and Bishopsgate exchanges, and some of them should be available for service during 1927. The equipment at the "Tandem" exchange (the new junction exchange) was rapidly approaching completion, and a further essential preliminary was the changing of the numbers of subscribers connected to exchanges in the automatic area to four figures The anticipated rate of growth during the next five years would necessitate the construction of 60 automatic exchanges within 10 miles from Oxford Circus and 25 manual exchanges outside that radius, but within the London telephone area, to replace worn-out plant as well as provide for growth.

Much progress was made during the year with schemes for improving the standard of speech, which involved the provision of a large number of cables with conductors of larger gauge than that previously employed; "loading" was also extensively utilised to improve speech transmission. The total mileage of single wire provided for subscribers' lines and local junctions was 2,030,000, an increase of 225,000 miles, the greater proportion in underground cables which contain from 20 to 2,000 copper wires, are lead sheathed, and are drawn into 7,402 miles of earthenware ducts or iron pipes, an increase of 1,000 miles. The total length of pole lines in London was 5,533 miles and the length of single wire carried on them 59,250 miles; while the total length of wire increased by 225,000 miles during the year there was an actual decrease in the length of overhead wire. In addition to existing repeater stations at Fenny Stratford and Derby, others were completed at Leeds, Catterick, Newcastle, Jedburgh, Edinburgh, Gloucester, Newport, and Birmingham, and work was in progress on stations at Taunton and Tavistock. During the year communication with Germany was provided by means of repeater circuits, nearly all underground, with the exception of the submarine cable between England and Holland. Repeater stations were under construction at Marks Tey and

Halesworth in connection with the London-North Walsham route, and the Aldeburgh underground and submarine route to Holland and Germany, as well as at Canterbury in connection with the London-Canterbury cable, which will connect with submarine cables to Belgium and France. In certain cases additional trunk circuits were provided by means of the high-frequency carrier-current system, sometimes referred to as "wired wireless," thus avoiding the cost of the erection of additional wires.

The number of calls originated during 1926 was 499,473,766, an increase of about 4.9 per cent., which was not quite commensurate with the growth of subscribers, and it appeared that the average number of calls made per subscriber was decreasing. The acquisition of the telephone habit requires time for its development and the new subscriber does not, at the outset, make use of the telephone facilities at his disposal with that freedom which characterises the more experienced user. In a rapidly developing system the accession of blocks of new subscribers with low calling rates tends appreciably to depress the average calling rate over the whole system; trade depression also had an adverse effect on the calling rate. The number of calls outgoing daily from London at the Trunk exchange was 14,700, and at the Toll exchange 15,200, representing increases of 10 and 16 per cent., respectively. Traffic over the Anglo-Continental routes continued its upward tendency, and the outgoing effected calls for 1926 showed an increase of 20.2 per cent. At the end of 1926 there were 53 international circuits, of which 21 terminated in France, 8 in Belgium, 12 in Holland, and 12 in Germany. During the early part of 1926 a preliminary night service to Germany was opened with three circuits—Berlin, Hamburg, and Cologne; later, continuous service was available to Berlin and Hamburg, and to other towns reached through them. Four circuits were available to Berlin, four to Hamburg, and one each to Cologne, Frankfurt, Dusseldorf, and Bremen; Anglo-German traffic was increasing rapidly, and additional circuits to France and Belgium were nearing completion. A new French cable containing 42 pairs of wires, with the appropriate land lines, will improve the existing Anglo-French service and provide direct Swiss and Italian services. A new submarine cable laid between England and Belgium provided 21 additional circuits, and there is a possibility of obtaining circuits later to Vienna and Prague *via* this cable. Proposals are also in hand for the provision of a circuit to Stockholm. A transatlantic (London-New York) radio-telephone service was inaugurated on January 7th, 1927.

To the Phonogram exchange at the Central Telegraph Office, equipped for the reception and transmission of telegraph messages direct from and to telephone subscribers, 100 lines from local telephone exchanges were added, making a total of 480 lines; sixty-eight telephone exchanges have direct circuits to the Phonogram exchange, at which 234 operating positions are staffed during busy periods. The number of phonograms dealt with during 1926 was 1,616,784, the increase being about 13.5 per cent.

The operating staff in the exchanges within the London telephone area numbered about 9,400 telephonists and supervisors; over 1,200 new entrants passed through the Telephone Operating School during the year, and 61 telephonists employed by subscribers for the operation of their private branch exchanges were trained. Over 7,000 engineering workmen were employed in the London area.

The average time of answer to the subscribers' calling signals for the year was 5.7 seconds, and the average time from the commencement of a call until the called subscriber answered was 38.6 seconds. The difficult conditions during the period of the general strike affected the figures to some extent; also the strike resulted in increased traffic at some of the exchanges by nearly 50 per cent., the Trunk and Toll exchanges being very heavily pressed. The percentage of calls completed on first application was 82.4, which figure has remained almost unaltered for five years. The proportion of telephones to population was 1 to 14.96.

Sulphur Mines Electrification.

Sulphur is one of the few minerals that Italy possesses and exports in large quantities. Her mines in Sicily afford employment for some 18,000 persons; they are therefore of great economic importance to the island, but hitherto they have laboured under the disadvantage of antiquated equipment and working organisation. It has long been felt that the electrification of the mines is essential for their economic recovery, and now at last comes the news that a decisive step has been taken in this direction. The Corporation for the Technical and Economic Development of the Sulphur Industry has signed a contract with the General Electric Company, of Sicily, for the electrification of all the services connected with the Sicilian sulphur mines. The power will be produced by a steam-operated station at Catania, which will transmit it to all the sulphur mining districts over a main line at 40,000 volts running between Catania, Caltanisetta, and Campo-Franco, with a subsidiary line at 10,000 volts for the Caltanisetta-Sommatino district. The cost of the installation is estimated at from 34 to 35 million lire, of which the Corporation is to contribute eight millions. The total length of the lines to be installed is over 300 miles.

Electric Floodlighting.

Review of Illuminating Society Paper and Discussion.

A PAPER on the above subject was read recently by Messrs. W. J. Jones, H. Lingard and T. Catten, at the meeting of the Illuminating Engineering Society, held at the Lighting Service Bureau. Mr. C. W. Sully presided.

The paper was illustrated with numerous lantern slides and examples of apparatus, and contained an excellent review of the subject. In the introduction, reference was made to the many applications of floodlighting, for illuminating posters, lighting up monuments, and revealing the outsides of buildings. Attention was drawn to the great importance of the surfaces of buildings illuminated. White glazed brick, when clean, reflected 85 per cent. of light, very dirty stone and concrete only 5 per cent., and in this extreme case the absorption of light was practically prohibitive. The smoke-begrimed surfaces of buildings in many industrial cities presented one of the greatest obstacles to flood-lighting. With white glazed brick from 2 to 5 foot-candles illumination, according to the surroundings, might suffice; with fairly clean granite, reflecting 10-15 per cent. of light, from 13 to 33 foot-candles was specified. For ordinary posters in poorly lighted districts 5 foot-candles might be allowed, but in very brightly lighted areas 15 or even 25 foot-candles might be necessary to cause the surface to "show up" satisfactorily.

The next section of the paper dealt with the optical principles underlying floodlighting equipment. The formation of the beam by a parabolic mirror was explained and it was pointed out that at moderate distances the inverse square law applied. An interesting feature of the paper was the description of sectional mirror floodlights, the author pointing out that in this case the maximum beam candlepower depended primarily on the candlepower of the source, whereas with a polished parabolic mirror the intrinsic brightness of the filament was the determining factor. Some very interesting curves showing the distribution of candlepower in the beam were presented; they showed that with a bare lamp there were usually marked "kinks," a fact that was evident from inspection of the various floodlights on view. The curves might, however, be smoothed out by using frosted lamps, or light-diffusing cover-glasses, though they naturally diminished the maximum beam candlepower and tended to greater dispersion angles. Asymetric light-distribution, which was occasionally desirable, might also be obtained by applying specially designed "spreading glasses." Effects were also illustrated by "isolux" diagrams.

A very useful table contained particulars of the utilisation efficiencies of various types of floodlighting units. The maximum utilisation efficiency recorded was 55 per cent. with a deep parabolic plain mirror, the same value being reached with a ribbed-mirror square-pattern flood lantern; at the other extreme the efficiency of the diffusing glass front and plain mirror was only 35 per cent. Mr. Jones described the use of anti-glare shields and methods of confining the beam to the object to be lighted, and referred to the influence of "spill" light (which passed by the edge of the building, or area to be lighted, and was thus wasted). This loss was not taken into account in the coefficient of utilisation, and naturally depended on the local conditions.

In the concluding part of the paper a number of floodlighting installations were described and illustrated, and the special problems met with in each case discussed.

The paper led to an animated discussion, which was opened by Lt.-Commander Haydn T. Harrison. Mr. J. W. T. Walsh, who followed, pointed out that in several respects floodlighting units differed from searchlights and suggested 40 ft. as the minimum distance at which the inverse square law could be utilised. The suggestion was made that the use of a special front-mirror, directing back part of the light received, might have advantages in eliminating undesirable effects of direct rays from the source. Various technical points were discussed by Mr. Milner, Mr. Ritchie, and others.

Mr. L. G. Applebee demonstrated a number of projectors which had been used for stage lighting, &c., illustrating his remarks with views of the scenes in the searchlight tattoo at Wembley, &c. Others who took part in the discussion included Mr. Morton, Mr. Long, Mr. Cunnington, Capt. W. Liberty, and Mr. J. S. Dow. The chairman (Mr. Sully) joined with others in complimenting the authors on their paper, and Mr. Jones briefly replied to a number of the points raised.

Electricity on the Poultry Farm.

Poultry farmers in the Preesall district, near Blackpool, have adopted the system of utilising electric light for increasing the production of eggs. A large poultry farmer states that the fertility of the eggs used for hatching has increased 20 per cent. In October he installed electric light, and was rewarded by an increase of 60 eggs per day at a time when eggs were 3s. 2d. per dozen; he thus made an extra 15s. daily, and in a short time paid off his initial outlay of £15, and £2 cost of electricity. The light gives the hens a 16-hour day in the depths of winter, and so long as there is light they will take exercise, feed, and lay.

Reviews.

Principles of Electric Power Transmission and Distribution.
By L. F. Woodruff. Pp. 340; 112 illustrations. London: Chapman & Hall, Ltd. Price 20s. net.

According to the preface this volume is intended primarily as a text book for senior and graduate students in electrical engineering in the American Universities and Institutes of Technology. As is so often the case with volumes of this kind, the text has been elaborated from notes used in technological courses on the subject, and quite naturally the requirements of the particular Institute with which the author is connected are reflected in the treatment of the work.

Chapter I gives a very brief survey of the general problem of electric power transmission and distribution, with special reference to the progress made in the United States. On page 8 the author is not very consistent, for he says: "the efficiency of a transmission system is not of much importance in itself," &c., while a little lower down on the same page he says: "the power losses in lines and machinery are but one item, albeit an important one, of the total annual cost." The power losses and, therefore, the efficiency of a system are distinctly important, but what the author does not make clear is that reliability should not be sacrificed in efforts to obtain what often are unduly high efficiencies.

Chapter II is merely a three-page note purporting to give an idea of the electron theory and of the general electromagnetic circuit; it is, however, so scanty as hardly to have been worth including.

The really serious part of the volume commences with Chapter III, which studies the characteristics of the electromagnetic circuit and of its natural property, inductance. This chapter presupposes an elementary knowledge of the calculus and of the symbolic method of vector notation.

Chapter IV is companion to the preceding one and deals with the dielectric circuit and its natural property, capacitance. The treatment also is similar to that of the preceding chapter.

In Chapter V the author considers the efficiency and voltage regulation of short and medium-length transmission lines, dealing first with very short single- and three-phase lines, neglecting the effect of capacitance. He then studies what would be the general effect of allowing for capacitance, and shows the two well-known methods of treatment, namely, the nominal T and the nominal π circuits.

Chapter VI is another very short chapter which could with advantage have been eliminated; it deals with the mechanical principles of overhead transmission lines. The only part in this chapter of any real interest is a short analysis of the sag and stress in an overhead line. When we consider the tremendous amount of matter that has been published dealing with the mechanics of overhead lines, it will be realised how futile it is to include just a few pages on the subject in a book of this description; moreover, it is disappointing to the student and does not tend to enhance an author's reputation.

Chapter VII deals with the all-important subject of skin effect in conductors carrying alternating currents; the author mentions first the cause of skin effect and then passes on to an elaborate study of alternating-current distribution in an isolated round wire. He then gives expressions for the skin-effect resistance ratio for round wires and also a table of skin-effect resistance and inductance ratios for solid round wires.

Chapter VIII, which is concerned with the subject of corona, opens with a general description of what the term is intended to convey and an explanation of it in terms of the electron theory.

Having in mind the increasing tendency to raise already high transmission-line pressures and the importance that insulation must of necessity play in the transmission of electrical energy, it is particularly disappointing to find this subject dismissed in Chapter IX with a mere 12 pages. In these the author indicates very briefly the latest theories of insulation breakdown, the variation of breakdown voltage with insulation thickness, the potential gradient in single-core cables, with homogeneous and multiple dielectrics, and finally the distribution of voltage stress on suspension line insulators. The whole treatment in this chapter in inadequate.

Chapter X is a study of hyperbolic solutions of long-line, steady-state problems concerning which the general considerations are first enumerated.

Chapter XI is mostly a reprint of a paper contributed by the author to the *Electrical World*, and is a very cursory survey of the subject of power-factor correction and voltage control of long lines. The comments put forward are very brief, and we cannot imagine them adding appreciably to any student's technical equipment.

Chapter XII is an anlysis of the steady-state performance of long transmission circuits and accessory apparatus. It opens with a short analysis of equivalent star (called by the author "wye") and delta connections, in which the very reprehensible practice has been adopted of writing "same numerator" and "same denominator" in an expression where the numerator or denominator is the same as in an immediately preceding expression; we think there is no excuse for such slovenly composition.

The interesting subject of inductive interference with telephone and telegraph circuits is covered by Chapter XIII.

Chapter XIV deals with the solution of the current and voltage values in a.c. networks under normal operating conditions and under fault conditions of short circuit.

In Chapter XV commences the most interesting part of the book. This deals with transients in circuits with lumped constants, and simple d.c. excited circuits are first investigated. The author then passes on to considerations of the transients in simple a.c. circuits, and after having shown the utility of Heaviside's and Carson's expansion formulæ for d.c. and a.c. transients respectively, passes on to consider the transients in circuits containing iron. For this purpose the switching-in phenomena of a static transformer are investigated in a manner similar to that already covered by Steinmetz.

Chapter XVI studies current and voltage transients on transmission lines, a preliminary solution being given by differential equations. The treatment is extended to cover mathematically and diagrammatically the transient conditions when an overhead line is short-circuited at one end, and when it is open. The reflections that occur at transition points, and the attenuation due to resistance and leakage, are investigated, and some interesting oscillograms are given of representative tests made in the laboratory on artificial lines.

The volume is concluded by three appendices, an index, and examples to be worked out, at the end of each chapter, bearing upon what has immediately preceded them.

While the work evidently meets the requirements of those for whom primarily it has been written, we think the author would be well advised to recast it in a more generous mould for a future edition, in which case we feel confident it would appeal considerably to a much wider section of the electrical engineering profession.—S. Austen Stigant.

Overhead Electrical Transmission Lines: Wade's Tables.
Revised and Enlarged Edition, 1926. Hull: Richard Wade, Sons & Co., Ltd. Price 15s. net.

The production, in 1906, by Messrs. Richard Wade, Sons and Co., Ltd., of that little handbook of tables of wooden-pole strengths which has been the standard of reference on the subject ever since, was, at the time, regarded as an achievement, and the engineer in this country who is not familiar with "Wade's Tables" has certainly not been in touch with overhead-line construction. New requirements, new ideas, and new legal regulations have come into being since then, and, although the basic facts still remain unchanged, they are now differently applied. The new "Wade's Tables" give not only the old information in a form suited to the altered requirements, but also include a great deal of supplementary information, and the authors are to be complimented on their compilation.

One of the first things to be determined in designing an overhead line is the size of pole. This is so bound up with the span and the sag of the conductor that one cannot be decided without a knowledge of the others. The new edition of the tables provides all three: it gives them in a useful and concise form; it gives full details of the methods by which the figures have been calculated, and states clearly the physical constants and values on which they are based—a most important point and one that is frequently overlooked.

The choice of sizes of solid and stranded conductors displays a tendency to cling to the old standards rather than the new ones of the B.E.S.A., but the range covered is in line with present practice, and has wisely been extended at both ends to beyond the normal requirements. It is rather a pity that the B.E.S.A. standards of tensile strength were not adopted in drawing up the sag-tension tables instead of the minimum allowed by the Electricity Commissioners, as considerably smaller sags are thereby obtainable. The sags given for 22 deg. F. with ice and wind loading, it should be noted, are not vertical sags. The vertical sag with ice and without wind, which is what is required for determining ground clearance at 22 deg. F., is appreciably less than the figures given for the longer and more usual spans of medium-sized conductors.

The values given for both sags and tensions are well within the attainable limits, and are consequently useful and safe figures for the mains engineer, but not for the competitive contractor. The table on page 64, showing the deflection of poles under load, is both interesting and useful. Too often is the capability of a pole to withstand a given load with safety taken as a final indication of its suitability without any consideration of what the pole will look like when loaded! A table of pole weights and cubic capacities would enhance the value of the book in the eyes of the erecting engineer and would form a desirable addition to future editions. The notes and illustrations on foundations of Rutter and A-type poles are quite in order, but would have been more complete had the comparison been extended to Anchora and other types of poles with improved foundations.

Perhaps it is not too much to hope that Messrs. Wade will be able in the next revision to amplify their excellent tables by coupling the correct sinking depth and area of kicking baulk (or other details of substructure) with each size of pole, so that the most economical use of the materials may be obvious at a glance. In the meantime every line engineer will find the present edition well worthy of a place on his bookshelf.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

18,468. "Variable electric condensers." Dubilier Condenser Co. (1925), Ltd. July 19th, 1924. (237,286.)

20,702. "Magnetic materials." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). August 18th, 1925. (263,207.)

20,974. "Two-pin electrical plugs." H. Rottenburg and H. B. Bartholomew. August 21st, 1925. (263,208.)

21,080. "Fusible electric cut-outs." W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nichols. August 22nd, 1925. (263,209.)

21,327. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). August 25th, 1925. (263,210.)

21,483. "Telephone instrument circuits." Siemens Bros. & Co., Ltd., and G. F. Dutton. August 27th, 1925. (263,211.)

23,012. "Apparatus for compensating or regulating the power factor of asynchronous dynamo-electric machines." J. L. Matabon and C. M. Foucault. September 20th, 1924. (240,158.)

23,386. "Testing thermionic valves, lamp bulbs, and the like." C. J. Sutton. September 19th, 1925. (263,218.)

23,791. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). September 23rd, 1925. (263,226.)

23,892. "Electric fuses." Brighton Lighting and Electrical Engineering Co., Ltd., and E. Heaps. September 24th, 1925. (263,233.)

23,955. "Electric condensers." British Thomson-Houston Co., Ltd., C. J. Morton, and L. Griffiths. September 25th, 1925. (263,236.)

25,090. "Means for cutting out a faulty line section in an electrical distribution system." F. J. Nankivell. October 8th, 1925. (263,247.)

25,513. "Water- and gas-tight electric switches." J. P. Annacker. October 13th, 1925. (263,251.)

25,924. "Electric cooking stoves and the like." Jackson Electric Stove Co., Ltd., and F. Smith. October 16th, 1925. (263,254.)

26,204. "Apparatus for receiving wireless signals." A. Barringer and Ormsby & Co., Ltd. October 20th, 1925. (263,258.)

26,368. "Electric inductance and transformer coils." E. L. Wildy and London Electric Wire Co. & Smiths, Ltd. October 21st, 1925. (263,259.)

30,432. "Automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and C. C. Puckette. December 2nd, 1925. (263,283.)

30,979. "Ignition magnetos for internal-combustion engines." British Lighting & Ignition Co., Ltd., and J. C. Hutton. December 8th, 1925. (263,286.)

31,323. "Terminal connecting devices for high-tension cables." British Lighting & Ignition Co., Ltd., and J. C. Hutton. December 11th, 1925. (263,291.)

31,729. "Hand-tool for adjusting and cleaning the sparking terminals of ignition plugs for internal combustion engines." W. D. L. Busby. December 16th, 1925. (263,294.)

32,191. "Condenser telephones." P. G. A. H. Voigt. December 21st, 1925. (263,300.)

16,094. "Electromagnetic apparatus for recording sound and record produced thereby." A. F. Sykes. June 22nd, 1925. (Cognate application 21,011/25 and 10,645/26.) (Addition to 210,956.) (263,302.)

21,399. "Electrical resistance units." American Resistor Corporation. August 29th, 1924. (239,216.)

21,430. "Process for the cooling of internal-combustion engines and electric transformers." T. Popescu, A. Pais, and C. Pais. August 26th, 1925. (263,511.)

22,129. "Automatic and semi-automatic telephone systems." Siemens Bros. & Co., Ltd., and W. G. Patterson. September 4th, 1925. (263,514.)

23,857. "Acoustic horns." Standard Telephones and Cables, Ltd. December 31st, 1924. (245,415.)

24,154. "Fine-adjusting devices for radio and like instruments having a rotary part." Igranic Electric Co., Ltd., and A. H. Curtis. September 28th, 1925. (263,531.)

24,258. "Alternating-current commutator machines." Siemens-Schuckertwerke Ges. October 4th, 1924. (240,831.)

24,402. "Protective arrangement for electrical machinery." T. W. Ross and Metropolitan-Vickers Electrical Co., Ltd. September 30th, 1925. (263,544.)

24,411. "Means and method for controlling or preventing oscillations in vacuum tube circuits." R. E. Thompson Manufacturing Co. October 13th, 1924. (241,185.)

24,542. "Recording of sound." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). October 1st, 1925. (263,550.)

24,629. "Submarine cable core and insulation therefor." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). October 2nd, 1925. (263,553.)

24,630. "Inductance coils." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). October 2nd, 1925. (263,554.)

24,842. "Wireless circuits." M. A. Robinson. October 6th, 1925. (263,560.)

24,905. "Apparatus for compensating or regulating the power factor of dynamo-electric machines." J. L. Matabon and C. M. Foucault. December 24th, 1924. (Addition to 240,158.) (245,067.)

25,360. "Circuit-breakers, current-limiters, and the like for electric wiring installations and supply distribution systems." M. S. Hoban. October 12th, 1925. (263,565.)

25,532. "Operating mechanism for wireless apparatus." C. Holt. October 13th, 1925. (263,567.)

25,580. "Apparatus for compensating or regulating the power factor for asynchronous dynamo-electric machines." J. L. Matabon and C. M. Foucault. February 17th, 1925. (Addition to 240,158.) (247,913.)

25,624. "Electrical wiring systems." W. Shaw and G. Hoptonstall. October 14th, 1925. (263,568.)

26,467. "Dynamo-electric machines with series excitation." Maschinenfabrik Esslingen. October 23rd, 1924. (241,924.)

26,669. "Filtering arrangement for direct current." Dubilier Condenser Co. (1925), Ltd. October 24th, 1924. (241,944.)

27,504. "Electro-magnetic apparatus for collecting electric currents from space." J. E. Christofleau. December 19th, 1924. (244,723.)

27,961. "Process for making electric batteries." Dr. F. Melms. November 6th, 1925. (263,587.)

29,713. "Electrically-driven lawn-mowers." H. Watson & Sons, Ltd., and E. Watson. November 24th, 1925. (263,597.)

29,895. "Electric circuit-protecting devices." English Electric Co., Ltd., and R. A. R. Bolton. November 26th, 1925. (263,598.)

29,945. "Electric vacuum cleaners." H. Ascher. December 3rd, 1924. (244,084.)

30,987. "Interrupting devices for electric circuits." British Lighting and Ignition Co., Ltd., and J. C. Hutton. December 8th, 1925. (263,609.)

31,735. "Single-phase induction regulators." Switchgear & Cowans, Ltd., G. H. Neep, and D. Firth. December 16th, 1925. (263,615.)

31,769. "Protection of rotary convertors." English Electric Co., Ltd., and R. A. R. Bolton. December 16th, 1925. (Addition to 237,730.) (263,616.)

1926.

1,293. "Electric solenoids." S. L. Glenn and E. E. Pierce. January 16th, 1926. (263,315.)

2,996. "Motor driven electric current rectifiers." H. Gottschlich. February 2nd, 1926. (263,326.)

6,978. "Apparatus for the electrification of gases." C. H. Shearman. March 13th, 1926. (263,356.)

9,107. "Cooking stoves with thermo-electric storage." S. Sacerdote. April 6th, 1926. (263,365.)

10,401. "Electric batteries." M. Turnauer. April 20th, 1926. (263,374.)

11,386. "Electromagnetic sound-reproducing apparatus." Brandes Laboratories, Inc. February 16th, 1926. (263,382.)

14,023. "Electricity meters." P. R. Kuehnrich. June 3rd, 1926. (263,399.)

15,513. "Tungsten arc lamp." General Electric Co., Ltd. February 3rd, 1926. (263,405.)

15,900. "Electric motor controllers." R. H. Barbour and J. R. Walton. June 24th, 1926. (263,408.)

17,458. "Diaphragms." Standard Telephones & Cables, Ltd. (Bell Telephone Laboratories, Inc.). September 22nd, 1925. (Divided application on 23,664/25.) (263,411.)

17,712. "Electric batteries of the flash-lamp and similar type." T. Winston. July 15th, 1926. (263,413.)

18,000. "Electrical socket connectors." J. W. Barber and Brownie Wireless Co. July 19th, 1926. (263,415.)

20,865. "Combined altimeter and telemeter." Soc. d'Optique et de Mécanique de Haute Précision. January 26th, 1926. (263,437.)

21,937. "Combined electric table lamp and alarm clock." F. Halstrup. April 26th, 1926. (263,447.)

26,679. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). August 25th, 1925. (Divided application on 263,210.) (263,467.)

30,775. "Magnetic materials." Standard Telephones & Cables, Ltd. (Bell Telephone Laboratories, Inc.). August 18th, 1925. (Divided application on 263,207.) (263,476.)

1,166. "Electrical resistance devices." Igranic Electric Co., Ltd., and J. H. Abbink-Spaink. January 15th, 1926. (263,634.)

4,095. "Electric switches." Metropolitan-Vickers Electrical Co., Ltd. February 12th, 1925. (247,593.)

4,756. "Adjustment of vehicle searchlights." R. Bosch Akt. Ges. March 16th, 1925. (249,090.)

5,725. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. February 28th, 1925. (248,308.)

6,798. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. March 11th, 1925. (249,132.)

6,805. "Electric motors." British Thomson-Houston Co., Ltd. March 11th, 1925. (249,134.)

6,917. "Contact body for crystal detectors." S. Berglund. March 12th, 1926. (Convention date not granted.) (249,145.)

7,178. "Thermionic valve amplifier circuits." W-K Electric Co. May 13th, 1925. (252,128.)

7,204. "Junction box or pull-box for electric wiring." D. Houtman, jun. March 14th, 1925. (249,165.)

7,320. "Electric transformers." A. B. Cooper. March 21st, 1925. 249,524.)

7,649. "Electric elevator systems." Waygood-Otis, Ltd. May 21st, 1925. 252,329.)

7,852. "Loud speakers or earphones for wireless reception and other applications." Soc. Anon. des Brevets Kornfeld. March 23rd, 1925. (Patent of addition not granted.) (249,558.)

8,863. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. April 25th, 1925. (251,252.)

9,703. "Electrical water-heaters." H. W. Woodgate and F. W. Slade. April 13th, 1926. (263,664.)

10,222. "Earthing bush attachment for electric conduits." J. C. Davidson. May 1st, 1925. (251,610.)

10,619. "Rotary sparking devices for converting three-phase supply currents into high-frequency energy for induction furnaces." G. M. Ribaud. May 13th, 1925. (252,138.)

10,869. "Radio receiving system." Hazeltine Corporation. May 26th, 1925. (252,691.)

11,801. "Differential frequency relays." British Thomson-Houston Co., Ltd. May 6th, 1925. (251,994.)

11,809. "Automatic regulator systems for dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd. May 11th, 1925. (251,995.)

11,870. "Electric current-converting systems." British Thomson-Houston Co., Ltd. May 9th, 1925. (252,003.)

11,920. "Electrically-illuminated signs and display apparatus for advertising and other purposes." F. Biggin and G. H. Biggin. May 7th, 1926. (263,667.)

12,172. "Method of transmitting electric charges through a gaseous medium." L. Levy. May 14th, 1925. (252,167.)

13,265. "Machine for electric welding, soldering, or the like." J. E. J. Languepin. May 23rd, 1925. (252,411.)

13,842. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. June 1st, 1925. (252,746.)

13,848. "Electric switches and systems of motor control employing the same." British Thomson Houston Co., Ltd. June 1st, 1925. (252,748.)

15,595. "Thermo-electric generators." British Thomson-Houston Co., Ltd. June 22nd, 1925. (Addition to 250,188.) (253,942.)

16,582. "Tautening devices for stretched filaments in electric lamps and discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 2nd, 1925. (254,733.)

17,002. "High-tension electric cables." Pirelli & Co. September 1st, 1925. (257,894.)

19,819. "Method of and means for insulating high-tension members in electrical gas-purifying apparatus." Lodge-Cottrell, Ltd. (Metallbank und Metallurgische Ges. Akt.-Ges.). August 11th, 1926. (263,698.)

20,750. "Electrical signalling and controlling systems." Metropolitan-Vickers Electrical Co., Ltd. August 28th, 1925. (257,606.)

21,581. "Securing device for the terminal box of electricity meters." Landis & Gyr Soc. Anon. November 21st, 1925. (261,710.)

21,582. "Application of a permanent brake to electricity meters." Landis and Gyr Soc. Anon. November 17th, 1925. (261,711.)

21,737. "Lightning arresters." British Thomson-Houston Co., Ltd.. September 14th, 1925. (258,253.)

22,541. "Transformers." British Thomson Houston Co., Ltd. September 11th, 1925. (258,287.)

22,622. "Sockets for Pupin coils in marine cables." Siemens-Schuckertwerke Ges. September 15th, 1925. (258,584.)

22,623. "Sockets for Pupin coils in marine cables." Siemens-Schuckertwerke Ges. September 15th, 1925. (258,585.)

22,757. "Electric power amplifiers." British Thomson-Houston Co., Ltd. October 1st, 1925 (259,197.)

25,191. "Electric heating devices." Metropolitan-Vickers Electrical Co., Ltd. October 10th, 1925. (259,610.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 26th :—

Tubolume. No. 474,851. Class 6. Illuminated electric signs.—Gesellschaft fur Elektrische Industrie, Berlin. (British representatives: Cruikshank and Fairweather, 65-66, Chancery Lane, W.C.2.)

Octron (lettering and design). No 475,561. All goods in Class 6. No. 475,562. All goods in Class 8. No. 475,564. Class 13. Electric alarms (as systems in buildings) and complete electric lighting sets for vehicles.—H. S. Electric, Ltd., 32, Charlotte Street, Birmingham.

Monosonic. No. 473,065. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—Anglo-American Chemical Co., Ltd., 114-115, Saffron Hill, E.C.1.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

AYR.—Housing scheme (4th section, 68), Woodfield; burgh surveyor.

AYRSHIRE.—Hall at St. Ninian's Episcopal Church (£3,200); the rector.

BARDNEY (Lincs.).—Sugar beet factory, for Lincs. Beet Sugar Co.; Sir Robt. McAlpine & Sons, builders.

BATH.—Additional 140 houses, Southdown, for the T.C.; borough surveyor.

BERKHAMSTEAD (Herts.).—Additional housing scheme (56), for the T.C.; borough surveyor. Bank, High Street, for the Westminster Bank, Ltd.

BIRMINGHAM.—Branch municipal bank at Stratford Road; H. H. Humphries, Hall Green, city engineer.

BRIGHTON.—Reconstruction, 5 & 6, Manchester Street, and 5, Steine Street; Southdown Motor Services, Ltd. Alteration, Theatre Royal, New Road; Theatre Royal Co., Ltd. Development of Patcham Place, including Pavilion; borough engineer. Extensions, New Sussex Hospital (£10,000); the secretary.

BRISTOL.—Housing scheme (174), for the T.C.; L. S. McKenzie, city engineer.

CARLISLE.—Houses (50), for the T.C.; J. & R. Bell, builders.

CATERHAM.—Machinery and plant (£40,000), mental hospital, for the Metropolitan Asylums Board.

CHICHESTER.—Secondary school for boys (£15,000), for West Sussex E.C.; director of education, Chichester. Enlargement, Royal West Sussex Hospital; governors.

COLYTON.—Grammar school; Devon County architect.

CROYDON.—110 houses, Chipstead Avenue, &c.; F. H. Willcocks, Beechwood Avenue.

DOVER.—Harbour buildings; Harbour Board. Harbour improvement scheme; Southern Railway and Dover Corporation.

EDINBURGH.—Department of Zoology at University (£80,000); Sir Robert Lorimer, architect.

ELTON.—Schools (£9,000), for Cheshire E.C.; J. G. Davies and Sons, builders, Frodsham.

EXETER.—Library; J. Bennett, city architect.

FALKIRK.—276 houses for Corporation (£100,000); burgh surveyor.

FINEDON (Northants).—Factory, Irthlingborough Road, for the Highfield Boot Co., Ltd.

FIRBECK (Doncaster).—Housing scheme (1,000), for the Firbeck Colliery Co.

GLASGOW.—Additions to Royal Infirmary (£25,000); medical superintendent. Nursing home at Merryflatts (£25,000); clerk, Govan Combination Parish Council. Works and alterations at Mauldslie Street, Partick, for Scottish Farmers' Dairy Co. (Glasgow), Ltd., 2, Anderson Street, Kinning Park; the manager. Alterations and additions to College Buildings at 83, Buccleuch Street, for Glasgow Veterinary College; the principal. Warehouse and offices at Elliot Street, for Broughton Copper Co., Ltd.; the manager.

GLOUCESTER.—Police station at Almondsbury, for the Gloucestershire County Council; E. S. Sinnott, county surveyor.

GUILDFORD.—Electrical installation, new premises, Worplesdon Road; Mason & Toogood.

GRANGEMOUTH.—Additions for Scottish Dyes, Ltd. £18,500), also water condensation machinery (£4,000); the manager.

GREAT CROSBY.—50 houses; U.D.C. surveyor.

HAMILTON.—222 houses for Corporation; burgh surveyor.

HARROGATE.—Administrative block and sick wards at Primitive Methodist Orphanage, Pannal Ash Road; J. Houfe, architect, Albert Chambers.

HASTINGS.—Pavilion; S. Little, borough engineer.

HAWARDEN.—Housing scheme (68), for the R.D.C.; F. Barrett, surveyor, Wold House.

HOLMFIRTH (Yorks).—Housing scheme (61), for the U.D.C.; surveyor.

HUDDERSFIELD.—Distributing centre, with electrical work, for the Co-operative Society; J. Berry & Sons, architects, 5, Market Place.

HULL.—Extension of Cottingham Infectious Diseases Hospital (£11,370); city architect, Guildhall.

IRISH FREE STATE (Dublin).—Child welfare centre, Lord Edward Street (£25,000); J. Beckett, Ltd., builders.

(Thurles).—Improvements at the County Home (£11,479); Fogarty & Dwyer.

LEEDS.—University buildings (£500,000); Lanchester, Lucas and Lodge, architects, London.

LONDON (Hackney, E.).—3-storey factory, Theydon Road; Merrington Bros., Ltd.

(Aldwych, W.C.).—Proposed four new theatres, restaurant, offices, &c., Aldwych improvement scheme (£1,500,000); C. Gulliver, London Theatres of Varieties, Ltd.

(West Ham, E.).—Remodelling school (£11,333), and extensions to other schools, with central heating (£9,000), for the Borough E.C.; the clerk.

(Edmonton, N.).—Enlargement Lattymer School (£67,000); H. Knight & Sons, for Middlesex Education Committee.

(Islington, N.).—Bank, City Road, for Westminster Bank, Ltd.; H. Cheston & Son, architects.

(Kensal Rise, N.W.).—Alteration and additions, Pavilion Cinema, Chamberlayne Road; Acme Picture Palace Co., Ltd.

(S.E.1).—Partial reconstruction of the "Old Vic" Theatre, Waterloo Bridge Road (£15,000); the manager.

(Balham, S.W.).—Premises for Royal Arsenal Co-operative Society, Hebdon Road and Upper Tooting Road; S. W. Ackroyd.

(Brixton, S.W.).—Kinema and dance hall, Brixton Road; E. A. Stone, architect.

LOWESTOFT.—Pavilion and bathing châlets; borough engineer.

MARCH.—Railway developments, including goods marshalling yard, electrically operated, for the London and North-Eastern Railway Co. (£300,000).

MERTHYR.—Extension, General Hospital; governors.

NEWMARKET.—Hospital extensions; Joint Hospital Board.

READING.—Bank for Lloyd's Bank, Ltd.; J. P. Briggs, F.R.I.B.A.

RETFORD.—Cinema, for Retford Cinema & Motors, Ltd.; Sydney Neve, secretary, Gwydyr Chambers, 140, Holborn, London.

ST. HELENS (Lancs.).—Additional housing scheme (48), Clock Face site, for the T.C.; A. W. Bradley, borough engineer.

ST. NEOTS.—Secondary schools, for Hunts. E.C.; director of education, Shire Hall, Huntingdon.

SHIPLEY.—Electricity supply, Canal Ironworks; J. Parkinson & Sons, Ltd.

SLOUGH.—Bazaar premises, High Street, for F. W. Woolworth & Co., Ltd., Kingsway, London. Shops, Alpha Street, for S. R. Bloxsome. Factory extensions, Wexham Road, for Naylor Bros.

SOUTH AFRICA (Cape Town).—Grain silos, Canterbury Street; Daniel Mills & Sons. Factory, Rhodes Drive; Lamson Paragon (South Africa), Ltd. Soap and chemical factory, Chapel Street; A. H. Gatz.

SOUTHAMPTON.—150 houses on various sites; borough engineer.

STALYBRIDGE.—Houses (64), for the T.C.; Thomas Warrington, builder.

STOCKTON-ON-TEES. — Secondary schools, for Durham E.C.; director of education, Shire Hall, Durham.

STRATFORD-ON-AVON.—Proposed Shakespeare memorial theatre.

SUNDERLAND.—Alterations and additions to the Technical College, for the Education Committee; G. T. Brown and Sons, architects, 51, Fawcett Street.

SUTTON.—County school for boys; Surrey Education Committee.

SWANSEA.—46 houses, Cocket Road and Corse Road; S. Davies.

SWINTON.—Housing scheme (182), Folly Lane; H. Entwistle, engineer and surveyor, Council Offices.

THORNABY-ON-TEES.—Central schools (£15,700), for North Riding E.C.; director of education, Northallerton.

TWICKENHAM.—Secondary schools (£40,677), for Middlesex E.C.; J. Lovell & Son, builders, Gerrards Cross, Bucks.

TYNEMOUTH.—Quay shed (£7,000); borough engineer.

WARSOP.—Houses (107), Church Warsop Estate, for the Housing and Town Planning Trust.

WEMBLEY.—50 houses, Christchurch Estate; U.D.C. surveyor.

WETHERBY.—School (£10,000), for West Riding E.C.; director of education, County Hall, Wakefield.

WIGTON.—School (£6,100), for Cumberland E.C.; director of education, Carlisle.

The

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Contents:

	PAGE
Edison's 80th Birthday	201
High-Pressure Cable Tests	202
Local Exhibitions and the Public	202
The Electricity Board	202
Electrical Developments at Gt. Yarmouth—I. (*illus.*)	203
The Earthing of Portable Domestic Appliances, by R. H. Rawll	206
The Trials and Humours of an Estimating Department	207
Quality versus Price, by Robert Marsden	208
Rural Electrification and Agriculture, by Major Andrew McDowall	209
New Electrical Devices, Fittings and Plant (*illus.*)	210
Business and Industrial Notes	212
Lighting and Power Notes	217
Tramway and Railway Notes	218
Telegraph and Telephone Notes	219
Radio Notes	219
Contract Information	220
Forthcoming Events	221
Notes	222
Institution Notes	225
Our Personal Column	225
Financial Section—	
New Companies Registered	226
Official Returns of Electrical Companies	226
City Notes	226
Stocks and Shares	227
The Import Trade of China	229
The Import Trade of Siam	229
A Cathedral Lighting Scheme (*illus.*)	230
Kiosk-Type Sub-Stations (*illus.*)	231
A.C. Measuring Instruments, by Lieut-Col. K. Edgcumbe and F. E. J. Ockenden (*illus.*)	232
Electrical Installations in Mines, by J. A. B. Horsley	235
Institution of Electrical Engineers	236
Correspondence—	
Electric Flood-lighting	237
Power Supply for Wireless Sets	237
Extra-High-Pressure Transmission	237
Purchase of Coal to Specification	238
Employment for Unemployed Power Station Engineers	238
Legal	238
Published Specifications	239
Trade-Mark Applications	239
New Work for Contractors	240

Edison's 80th Birthday.

EIGHTY years ago to-day, there was born Thomas Alva Edison—one of the most remarkable characters that have played their part on the stage of the world. Like so many other electrical pioneers, he entered the industry by way of the telegraph, at the age of 15, and has thus been associated with it for no less than 65 years. His latest biography (by no means the first), written by George S. Bryan,* opportunely reached our hands a month ago, and records in most readable fashion the fascinating story of his career—from newsboy to doyen of an industry whose capital value, largely due to his inventiveness, has been estimated at £3,000,000,000 in the United States alone.

Probably Edison is the most prolific inventor that the world has ever known; but unlike many an inventive genius, he made his profession pay. The number of his patents runs into thousands (already in 1910 they numbered 1,328), and some of them were extremely lucrative—yet he cared little for wealth. Hundreds of law-suits were fought in defence of his electric lamp patents, at enormous expense, but he said he "never enjoyed any benefits" from those patents. Few men have followed so many vocations, and with so much success: newsboy, printer and publisher, telegraph operator, telephone inventor, electric light and power engineer, moving-picture and phonograph inventor, manufacturer of lamps, dynamos, cement, storage batteries, and concrete houses—the versatility of his genius is astonishing. A devotee of research, which he prosecuted with an unprecedented intensity and comprehensiveness (10,000 experiments were made in the search for a substitute for the lead-acid accumulator, and 50,000 before final success was achieved), he invariably had a definite commercial aim in view and never embarked on scientific research for its own sake. His well-known saying that "genius is 1 per cent. inspiration and 99 per cent. perspiration" crystallises his views on this subject, though in its excessive modesty it is blatantly unjust to his own inexhaustible fertility of invention, his extraordinary insight into the possibilities of an idea. But he is far from scorning the labours of scientific men; he is an omnivorous

* "Edison: the Man and his Work." London: Alfred A. Knopf. Price 18s.

reader, and possesses the invaluable capacity of quickly absorbing information from books and storing it in a most retentive memory.

His greatest success, probably, was the development of the carbon-filament lamp, an efficient type of dynamo to supply it with current, and the feeder-and-main system of distribution, perfected by his invention of the three-wire system—the whole forming a complete equipment for the electric lighting of a town. The fact that other inventors, such as Swan and Hopkinson in this country, were working on parallel lines, in no way detracts from the credit due to Edison for establishing a system which in one city alone—Chicago—now employs generating plant of more than 1,000,000 kilowatts capacity and supplies electric light, heat, and power to a population of some four million souls. When he was in his prime, his industry was a consuming fire—but his physical constitution, happily, was equal to the strain. He possessed the faculty of inspiring his staff and employés with a large measure of his own impetuous eagerness to obtain results, and was no less distinguished by his qualities as a leader of men, than by his intuitive genius as an inventor—a rare, almost unique, combination.

Returning to Mr. Bryan's book, we heartily commend it to our readers as a most interesting and satisfying work, which will hold their attention from cover to cover; and we tender our congratulations to Mr. Edison not only on having so competent a biographer, but also—what is vastly more important to him— on his having the happiness to bring to fruition so many inventions for the use and benefit of man, and to know that his name is held in honour by every nation.

From his Laboratory at Orange, New Jersey, on the occasion of our Jubilee in 1922, Mr. Edison sent us a felicitously-worded message of congratulation; it is with the greatest pleasure that we now convey to him, on behalf of our readers as well as ourselves, the most cordial greetings on the eightieth anniversary of his birth.

High-pressure Cable Tests.

According to a paper read before the American I.E.E. last year by Messrs. D. W. Roper and H. Halperin (of the Commonwealth Edison Co.), in the past the principal safeguard of the purchaser of electric cable has been the manufacturer's guarantee, since factory tests, in the case of cables operating at a normal voltage above 7.5 kV, were quite perfunctory; they served merely to eliminate sections of very defective workmanship, but failed to indicate the quality of the insulation, unless it happened to be very bad indeed.

Since 1920 nearly all American cable manufacturers have modified the impregnating compounds they used in an effort to minimise dielectric loss; during the same period some users demanded a reduction of the insulation thickness, which resulted in the dielectric stresses being increased. In a number of cases unwisely chosen compounds, and perhaps the insulating papers employed also, developed faults that were more serious than high dielectric loss; the dielectric strength of some cables proved to be deficient, while in others ionisation occurred. Consequently, when manufacturers in the United States about two years ago reduced their five-year guarantee period to two years, it became necessary to attempt to devise tests to be applied in the factory which would permit the purchaser to determine, before delivery of the cable, whether it would be likely to operate satisfactorily in service.

Notwithstanding test modifications, however, trouble continued, and an investigation was accordingly undertaken (correlating with the specifications and test results the operating experience of some 4,000,000 ft. of high-voltage, three-conductor, cable purchased from 10 manufacturers during the past six years) with the object of determining what changes should be made in cable specifications in order to reduce the number of service failures.

The results obtained indicate that the best cable is, in general, made by those manufacturers who exercise the best control over their processes, as shown by the uniformity of test results and inspection data. Laboratory work in this country has proved itself to be of the greatest value in the examination of materials and the checking of process operations in the factories, thus confirming in England the conclusions drawn above.

It may be remarked that Col. E. Mercier, in his recent I.E.E. paper, referring to the 60,000-V cable network in Paris, said that no dielectric acceptance tests were specified, because in his opinion they were useless as a guide to cable users. A good deal of light was thrown on the subject by Mr. Luigi Emanueli in the paper of which a translation appeared in the Electrical Review for December 24th, 1926. The author's ingenious experiments were exceedingly interesting, and appear to afford a working hypothesis on which to base further improvements in the methods of manufacturing cable.

Local Exhibitions and the Public.

We have always maintained that one of the best means of spreading the electrical idea is the local exhibition. While displays of a national character implant general impressions which may or may not be lasting, the local exhibition brings the present or prospective consumer into touch with local contractors and retailers; there is far more hope of doing business when the customer realises that the seller is within easy reach to give advice and service. The value of such exhibitions is, however, largely negatived if the exhibitors' representatives adopt a very superior, technical attitude, and if they are not very precise in their statements regarding the capabilities and costs of their appliances.

A lay correspondent has written at length upon this subject, after visiting a recent local exhibition, in the form of an electric home. He admits that the dwelling was admirably furnished and electrically equipped in a thorough manner, but he complains that the replies to his questions were of a very vague character. Apparently he would have been satisfied with a definite statement regarding the wattage of each appliance, but evidently he could not get this. He quotes an instance, concerning a water heater, in which the reply was actually misleading.

This is quite wrong; but from our own experience we know that it is not altogether unusual. We would go further than our correspondent and say that not only should the consumption be definitely stated, but also the actual cost of running should be given. At a local exhibition this is not difficult; in fact, it is very often done. But we should like to see the practice adopted generally. The public isn't interested in "watts" and other vague quantities. Its standard is £ s. d., and all exhibitors at local displays should conform to this standard.

The Electricity Board.

In fulfilment of general expectations there was issued on Monday, on the eve of the re-assembly of Parliament, the official list of the seven gentlemen who have been appointed to be members of the Central Electricity Board, under the chairmanship of Sir Andrew Duncan. Their names and qualifications are published in our "Personal" column to-day. All we have time to say as we go to press, is that some anticipations have not been realised, that secrets have been well kept, and that the selections reflect on the whole a determination to secure men possessed of those special and varied kinds of experience essential to the elaboration and execution of a broad-minded and sound national policy and the bringing into harmony of diverse interests. Finance, industry, coal, electric power and electricity supply, all have their fully qualified representatives on the Board.

Electrical Developments at Gt. Yarmouth.—I.

The remodelling of the generating station, involving an entirely new boiler house and reconstruction of the turbine room for the installation of up-to-date plant for modern steaming and generating conditions.

THE official inauguration of the extensions at the South Denes generating station of the Great Yarmouth Corporation, which was to take place on Thursday of this week, marks an important stage in the development of the scheme for the reconstruction of the whole of the system of generation and distribution which was commenced a few years ago, and which is believed to be the largest change-over scheme yet sanctioned by the Electricity Commissioners.

The public supply of electricity at Yarmouth was begun in 1895. A scheme had been drawn up by the late Sir W. H. Preece, C.B., for the lighting of the borough, and the entire contract for the required generating plant was placed with Messrs. Crompton & Co., Ltd.

The original station plant had a total capacity of 150 kW, and consisted of two steam reciprocating sets, two 4,500-lb. Babcock & Wilcox boilers, and the necessary auxiliaries and switchgear. The supply was generated at 2,000 V, single-phase, and delivered to the consumers at 100 V. The original capital expenditure for the undertaking was £16,500.

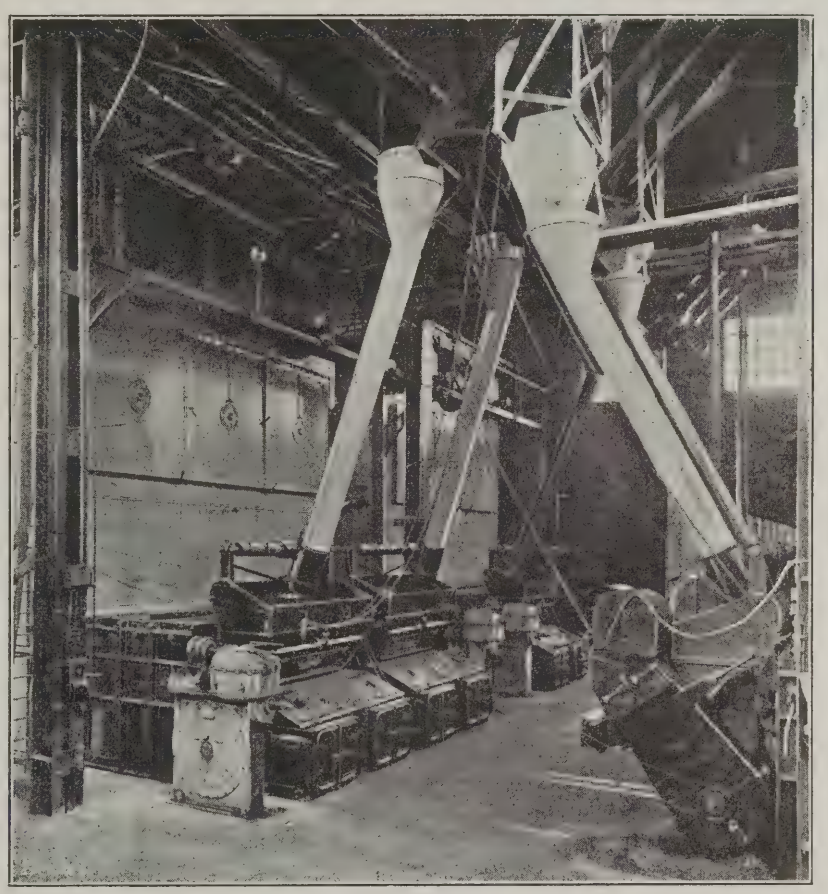


Fig. 1.—New Boiler Plant at Yarmouth.

The capacity of the station was increased from time to time, and in 1920 the Corporation instructed Mr. A. H. Preece, of the firm of Messrs. Preece & Cardew, consulting engineers, to report on the condition of the undertaking, in view of the passing of the Electricity (Supply) Act of 1919, and the urgent need to bring the concern up to date. The total capacity of the works at that time was 2,300 kW, made up of eight sets, the largest being a 600-kW turbo-alternator, whilst the steaming capacity of the boilers was 56,000 lb. of steam per hour, delivered by ten units. The system of generation and supply was still single-phase at 83.5 cycles.

Mr. Preece advised the installation of plant for generating at 50 cycles, and a new 1,500-kW Brush-Ljungström turbo-alternator, 3-phase, 50 cycles, 3,850 V, was put into commission in 1921, together with a 500-kW rotary convertor and one 500-kW frequency changer.

In 1923 a second and similar 1,500-kW set was installed, and also a 1,000-kW frequency changer.

In 1924, as the result of a communication from the Electricity Commissioners, Mr. J. H. Rider, of Messrs. Preece, Cardew & Rider, was requested to report on the undertaking, with special reference to the advisability of changing the system of generation and distribution.

On the appointment in that year of Mr. P. G. Campling, A.M.I.E.E., as engineer and general manager of the Electricity Department, consequent on the death of the late borough electrical engineer, Mr. Gordon Bryant, the Corporation instructed him to prepare a scheme in accordance with Mr. Rider's report for the installation of a new boiler to meet the immediate requirements for the winter of 1925, and for the remodelling of the existing power station and distribution system to the standard system of general supply in accordance with the recommendations of the Electricity Commissioners.

After careful consideration of the existing site of the power station, with regard to the facilities offered for the supply of sea- or rail-borne coal and circulating water, a scheme was drawn up which involved the reconstruction of the generating plant so as to provide for an ultimate output of 40,000 kW. A lay-out was also prepared for a new e.h.p. and l.p. transmission system, in accordance with the desired change-over of the supply from single-phase, 83.5 cycles, to 3-phase, 50 cycles, 4 wire, including the provision of 11 new overground sub-stations. The proposals were adopted by the Corporation and involved an approximate expenditure of £243,000.

The reconstruction of the generating station is of unusual interest, involving some structural alterations of a somewhat delicate nature. The design of the old

station was on the parallel boiler and engine house lines, running east and west, with provision for extensions in the easterly direction. The remodelling reverses the order, and the new plant has been installed at the east end of the station so that additional plant can be put down towards the starting end on the sites of the old

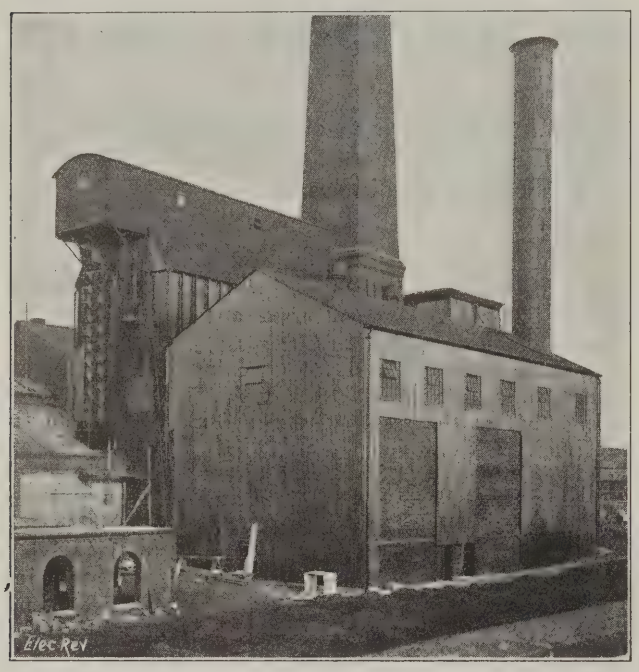


Fig. 2.—Boiler House and Coal Conveyor.

machines which have been or are being scrapped, thus avoiding that mixture of old and new equipment which is often the result of reconstruction schemes. The only portions of the old plant which are to remain are the two 1,500-kW turbine sets already referred to. These are shown in fig. 4, which gives a general view of the old turbine room looking west. The capacity of each of these machines is to be increased to 2,000 kW by the makers, who will take the turbine portions of the sets to their works and either recondition the existing blading or supply new to suit the new steaming conditions of the station. The alternators will be suitable for the increased output.

The development scheme has involved the provision of an entirely new boiler house, a steel-frame structure covered with Robertson sheeting, and increasing the width and height of the east end of the turbine room. These increased dimensions necessitated a new roof, some 7 ft. higher than the old one, with a different centre, the widening being effected on one side of the building only by including what was originally a wing for the station workshops. To effect this, some intricate underpinning of the foundations was essential, credit for which should be given to the Fawcett Construction Co., Ltd.

The new boiler house, fig. 1, at present accommodates two recently installed 30,000-lb. boilers, in addition to the 25,000-lb. boiler installed in 1925, and provision is made for the installation of a fourth unit. As already indicated, future extensions to the boiler house can easily be effected in a westerly direction. The boilers are all of the Babcock & Wilcox water-tube type, the two most recently installed being arranged with Green economisers in single units, and the other with separate economiser plant. The boilers each have a heating surface of between 6,000 and 7,000 sq. ft.; they are equipped with Diamond soot blowers and chain-grate stokers served by traversing coal shoots fed from overhead bunkers. The lower end of each shoot is carried to and fro from end to end of the coal hopper by means of a revolving coarsely-threaded shaft with which the shoot is engaged, thus ensuring a uniform mixture of the fuel used, nuts and fine coal, on the grate. A feature of interest is the grate drives for the 30,000-lb. boilers, a driving unit being employed which has only recently been introduced into this country by the makers of the plant. Each consist of a 4-speed motor-car type gearing driven by a 1-h.p. motor mounted on the apparatus, fig. 1. The drive to the stoker shaft is through a worm equipment, the whole running in an oil bath. The grate speeds range from 16 to 40 ft. per min.

The steaming conditions for the whole of the new equipment are 250 lb. per sq. in. g. and 700 deg. F. superheat. Forced and induced draught are provided for the two new boilers, the former by means of a motor-driven fan under each boiler, and the latter by a similar fan installed at the base of a new steel chimney, common to both boilers, the system being designed to give a maximum flexibility for dealing with low- or high-grade fuels on light or heavy loads The feed water is delivered by means of two Weir turbine pumps, each of 7,500 gals. per hr. capacity, from a hot tank into which the condensate from the turbine plant is fed.

The overhead coal bunkers have a total capacity of 450 tons, and are fed by a gravity bucket conveyor capable of handling 40 tons of fuel per hour, fig. 2. This is driven by an 8-h.p. motor, and travels at 48 ft. per min. The coal is raised from a receiving hopper on the ground level, an automatic filler allowing just sufficient coal to pass into each bucket without spillage.

The firing floor of the new boiler house has been arranged 12 ft. above the old floor, so as to enable a modern ash-handling system to be installed in the basement on the old level. The ash passes from the grates

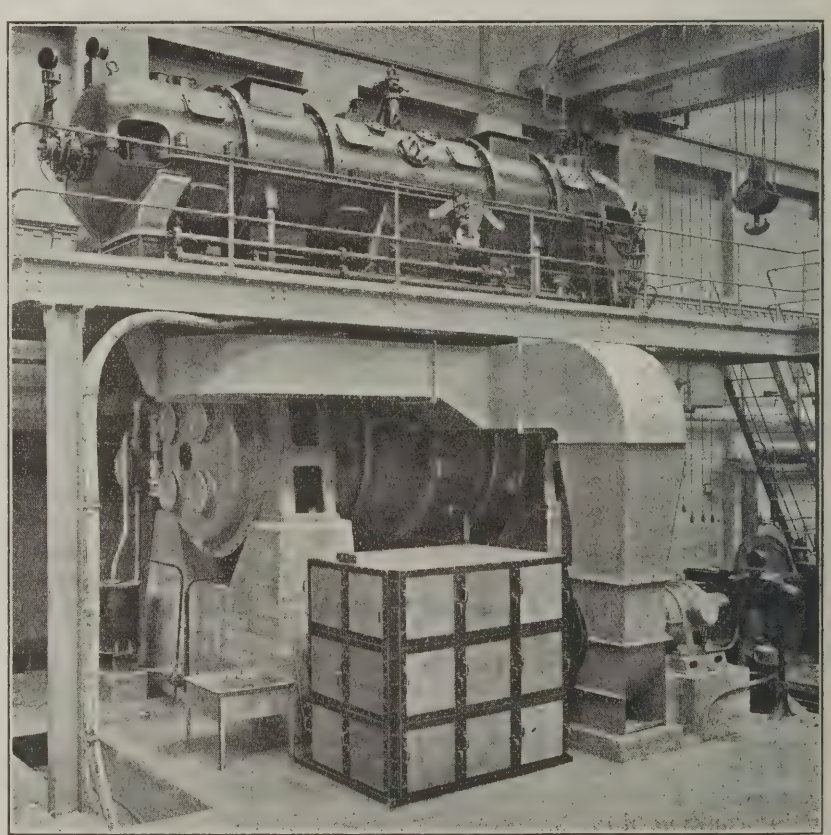


Fig. 3.—3,000-kW Turbo-alternator Plant.

into suitable hoppers, which are emptied as desired into tip wagons which run on rails to the dumping ground.

Arrangements are being made for the installation of a modern overhead coal-handling plant for transport-

ing fuel from vessels at the quay side to the works yard and to the receiving hopper. In this connection it is interesting to note that an old conveniently placed disused pond in the works yard is to be used as a pit for reclaiming the coal by means of the telpher grab.

The boiler equipment is completed by the provision of suitable overhead water tanks and hot wells. The lay-out generally has been designed to ensure the maximum efficiency and economy under all working conditions, and at the same time to afford complete accessibility to all working parts and so reduce the maintenance costs to the lowest possible limits. The whole of the plant, including the buildings above the firing floor, the boilers, coal bunkers, conveyors, mechanical stokers, and all the accessories was manufactured and installed by Messrs. Babcock & Wilcox, Ltd. All the foundation work for the buildings, bunkers and boilers, and the construction of the main flue, were executed by direct labour under the supervision of the engineer and manager.

In the reconstructed section of the turbine room, which is served by a 20-ton three-motor electrically driven overhead Morris crane, 50-ft. span, 120 ft. per min., is installed a 3,000-kW Brush-Ljungström turbo-alternator, fig. 3, of the double-rotation radial-flow type, 3-phase, 3,850 V, 50 cycles, 3,000 r.p.m., capable of a continuous overload of 25 per cent. The machine is mounted directly on its two-flow type surface condenser, which has a cooling surface of 3,000 sq. ft., and is capable of dealing with 32,250 lb. of exhaust steam per hour, maintaining a 28.5-in. vacuum. The air is extracted by a two-stage Brush-Delas ejector, with a dry-air capacity of 19.34 lb. per hr. The condensate is withdrawn by an electrically driven "Pulsometer" centrifugal pump capable of delivering 51,600 lb. of water per hour against a head of 57 ft.

The alternators are air cooled, a fan by Messrs. Standard & Oswald Stott, Ltd., being employed in conjunction with an oil-type air filter by the Premier Engineering Co. A novel feature of the turbo-alternator plant is a small steam turbine employed on the oil-circulation system. This is brought into operation automatically when the circulating pressure drops below a predetermined figure. The control is by means of a flexible diaphragm, which is normally balanced between equal steam and oil pressures on either side.

The cooling water for the condensers is delivered from the river through a 4-ft. gravity-flow pipe line to a sump where it is cleaned by two self-cleaning rotary strainers, made and installed by Messrs. F. W. Brackett & Co., Ltd., each capable of dealing with 800,000 gal. of water per hour. For the circulating water a new pump house accommodates two Mather & Platt vertical-spindle pumps, each having a delivering capacity of 5,280 gal. per min. The condenser discharges are connected to a common main leading into the river at a point below the low-water level, so as to obtain the benefit of siphonic action. Owing to the industrial difficulties of 1926, it has not been possible yet to complete the circulating-water system, and the cooling water for the new turbo-alternator is at present being obtained from the old cooling-tower equipment, a temporary sump having been installed. In this connection it is interesting to note that one of the 55-h.p. vertical-drive motors to be installed in the new pump house is running horizontally and driving a turbine pump in the temporary system.

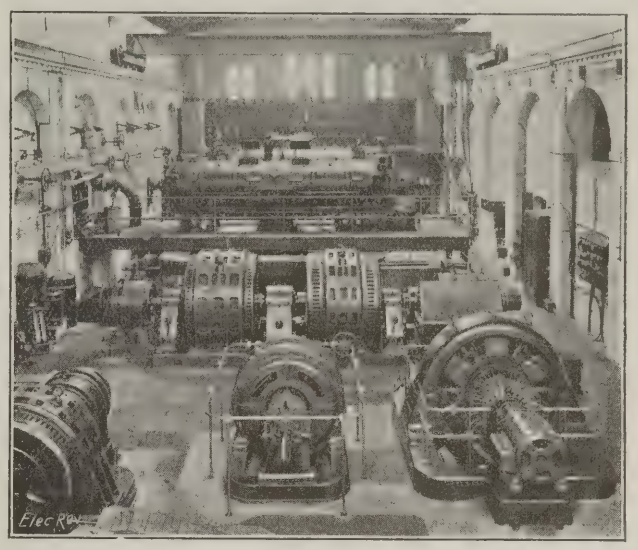


Fig. 4.—Old Turbine Room.

The extensions also include a 500-kW English Electric rotary convertor, with the necessary transformer equipment for receiving from the e.h.p. system, for supplying the tramway undertaking at 525/560 V. This machine is of the six-phase type, 1,500 r.p.m., and is fitted with special commutating poles and a centrifugal speed-limiting device. It is equipped with voltage-adjustment tappings, and provision is made for direct starting. The traction supply is dealt with by a 5-panel B.T.-H. switchboard

New e.h.p. switchgear, fig. 5, has been erected immediately over the switchboard, which was installed originally as the necessary medium between the 3-phase generators and the frequency changers. The latter board is to be used for the station auxiliaries. The new equipment is housed in ten stone cubicles, and is remotely operated, mechanically, from a 10-panel enamelled-slate board equipped with the necessary instruments, and Merz-Price protective gear for the alternators. A Brown Boveri voltage regulator and modern synchronising apparatus are also provided. The switchgear is of the English Electric oil-immersed type, the breakers having a rupturing capacity of 150,000-kVA. Duplicate busbars are provided, and in each case the phases are carried in separate chambers. Arrangements are made for the speed of the turbo-alternator to be controlled from the switchboard, motor-driven governor equipment being installed on the turbine.

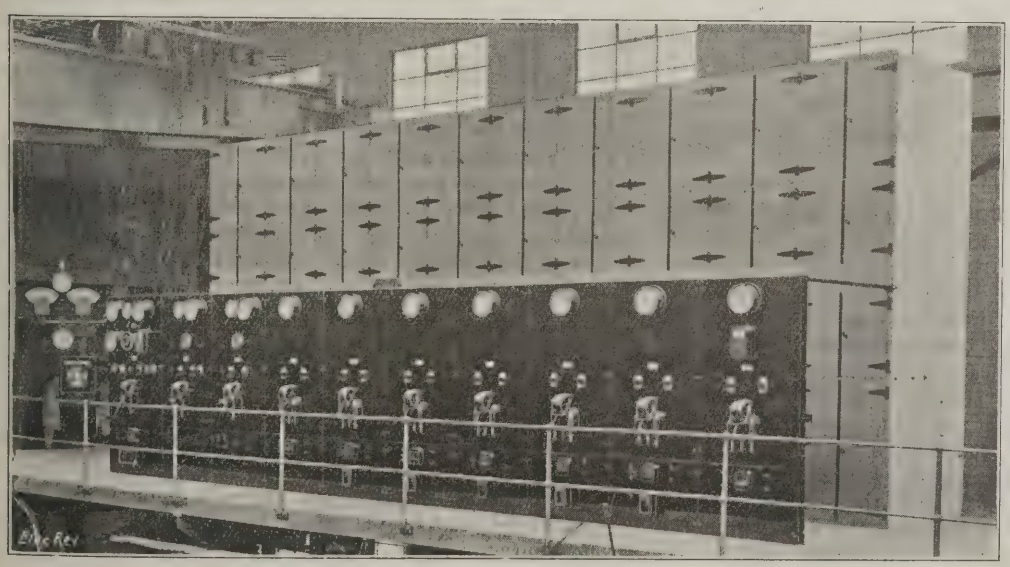


Fig. 5.—New e.h.p. Switchgear.

To meet the 1928 load, a 7,500-kW turbo-alternator and an additional boiler are to be installed.

The Earthing of Portable Domestic Appliances.

Many installation engineers regard the risk of shock as insufficient to justify the earthing of portable apparatus in the home; the danger is, however, in the author's opinion, a real one, and the cost of providing against it by using three-pin plugs and earthing wires is inconsiderable.

By R. H. RAWLL.

IT is not proposed to discuss here the earthing of the framework of more or less permanently fixed electrical apparatus, such as large radiators, wash boilers, geysers, cookers, &c. Fortunately, in those situations where earthing is essential (for example, bathrooms and kitchens), such appliances usually can be easily and efficiently earthed by means of a connection to a convenient water pipe. The earthing of portable apparatus obtaining its supply by means of a flexible cable and plug from a socket, however, does not present such a simple problem, and it is this aspect of the subject which is to be considered.

First of all, it will be perhaps helpful in approaching this subject to consider the reasons and necessity for earthing. It is, of course, well known that the chief reason is to ensure immunity from shock should metal other than conductors become charged. (Incidentally, on those systems of supply whereof one pole is permanently earthed, it fulfils, in addition, another useful function in calling attention to such leakage by the blowing of the fuse connected to the other pole, thus disconnecting the faulty apparatus.) Many persons, however, although they are fully aware of these reasons, do not consider the risk of shock sufficiently great to justify the earthing of portable apparatus in the home. Their argument is usually based on the facts that—

(1) The majority of portable apparatus, *e.g.*, radiators, vacuum cleaners, etc., are used in rooms with wood floors covered with carpets, where the risk of shock to earth, should contact with live metal take place, is practically nil, and

(2) On those rare occasions when a shock is actually experienced, although it is unpleasant, it is not a matter of great importance.

Portable apparatus to-day, however, is not confined to living rooms, and besides appearing in such diverse forms as shaving mugs, toasters, immersion heaters, etc., the numbers in use are much more extensive than a few years ago, and are likely to be more so in the near future. There is, therefore, a greater risk of shock in the home nowadays than hitherto. In the same way, shocks experienced in the past from portable apparatus have usually occurred in situations and under conditions tending to minimise their intensity; while to-day portable apparatus is on the market for use in bathrooms and similar places where a shock can easily be highly dangerous. Even in the old days the risk in the bathroom was realised, hence the provision of a shock-proof type of tumbler switch, when fixed within reach of an occupant of the bath. That this danger of obtaining a severe shock in such conditions is not an exaggeration is shown by the following incident, which occurred quite recently to a consumer of the supply undertaking of which the writer is a member of the staff. This particular individual placed a small immersion heater in a jug of water in the bathroom and then proceeded to have a bath. During his ablutions he observed the water in the jug boiling furiously, and being unable to reach the switch controlling the plug and socket to which the immersion heater was connected, he placed a sponge on top of the jug to prevent the water boiling over. A little while after he stepped out of the bath, and on picking up the sponge received the shock of his life (in more senses than one). The water in the sponge had penetrated the flexible lead at the connection to the immersion heater and rendered the whole thing alive. Considering that the shock was sufficient to throw him to the other side of the bathroom, it requires very little imagination to realise what would have happened had his body been in the bath when he made contact with the live metal. Some engineers are of the opinion that earthing such appliances is by no means a necessity, and in support of their argument point to America, where, although the use of electricity is considerably more extensive than in this country, it is not usual to earth portable domestic appliances; but it is often overlooked that the supply pressure in America for residential purposes is in most cases considerably lower than that prevailing in Great Britain, being in the region of 100 volts. It must also be borne in mind that the Government proposes standardising the pressure for domestic purposes at 230 volts, which, in respect of a.c. systems, in most cases will mean 312 volts to earth as regards intensity of shock. That the Home Office is fully aware of the risk of dangerous shock from portable electrical apparatus in factories is demonstrated by the very definite regulations for earthing all such apparatus or else completely enclosing them in insulating material. It also seems very inconsistent to make a practice of earthing the metallic sheathing of wiring, which is rarely handled, and then to leave unearthed the exposed framework of portable apparatus, which is frequently touched. Even in those cases where the shock is of a slight nature, it often causes nervousness to the user and is the cause of much prejudice against the further use of electricity in the home, on the score of its being "dangerous." In other words, the possibility of electric shocks in the home is a bad advertisement for electricity, particularly at a time like the present, when its use and advantages in the domestic sphere are being boomed. Thus from all points of view, besides that of safety, the earthing of portable apparatus is decidedly necessary.

If it is decided to earth portable apparatus, this is usually effected by means of a 3-pin plug and socket, one contact of which is efficiently connected to earth. The earth connection is made to the apparatus by means of an additional conductor incorporated in the flexible cable. It may be observed that when it is proposed to adopt the above procedure, it is often found that the manufacturer of the particular apparatus has not provided an earthing terminal. All electrical apparatus, whether portable or fixed, should be provided with an earthing terminal in case it should be required.

The cost of this additional item should be practically negligible. It is, of course, possible that with some makes of domestic apparatus the increased potential strain on the insulation, set up by deliberately connecting the framework to earth, would cause a breakdown, but this shows bad design and should not be tolerated as an excuse for not providing the necessary earthing terminal.

It has been already stated that the most likely place in the ordinary house where dangerous shocks may occur from portable appliances is the bathroom. But if a 3-pin plug and socket is fitted only in this position and the remaining plug points in the house are of the 2-pin type, several important disadvantages immediately present themselves. With such an arrangement, apparatus used in the bathroom cannot be utilised in the other rooms, and *vice versa*, on account of the non-interchangeability of the plugs and sockets. One method of getting over this trouble is to provide special apparatus for use in the bathroom only, but since this is obviously a most uneconomical proposition, it is usually ruled out of court at once. (This difficulty can, of course, be overcome by providing special 2-pin/3-pin plug and socket adaptors, but all will agree that such a solution is not an engineering job.) The writer has seen several contractors, when faced with this dilemma, install an ordinary 2-pin plug socket *outside* the bathroom door, and, on inquiring as to the purpose to which it will be put, has been informed that it is for use with portable apparatus in the corridor or on the landing only. In such cases the inevitable occurs. The consumer takes the unearthed appliance into the bathroom with the flexible cable trailing under the door to the socket fixed outside.

The writer's solution of this problem, which he knows is felt keenly by many engineers engaged in installation work, is to provide 3-pin plug sockets at all power points. The objections usually raised to this suggestion are: (1) the extra expense involved, and (2) the necessity of running a special earth wire or using only earthed metallically sheathed wiring or tubing throughout the installation, in order to provide the necessary earth connection at each plug socket. With regard to the first point, in a large number of cases the extra cost of providing 3-pin plugs and sockets is greatly exaggerated. The writer has carefully ascertained the prices of different makes of 3-pin plugs and sockets, compared with the 2-pin variety, and for the 15-ampere size the average extra cost is in the region of 4s., the figure for smaller current-carrying capacities being proportionately less. Added to this, of course, is a small amount to cover the provision of the earthing connection. The labour involved in fixing a 3-pin plug-socket is practically the same as that required for the 2-pin type. The cost of installing four or five power plug points (which are the requirements of the average house) would, therefore, not be increased by much more than £1. Thus, it can hardly be said that undue expense rules out the provision of 3-pin plug sockets. With regard to the other objection, provided lead-covered wiring, or other wiring enclosed in steel conduit, is used throughout the installation, the necessary earth connection, of course, does not present any difficulty. But, even if C.T.S. or v.i.r. in capping and casing is utilised for the wiring, and although 3-pin plug sockets are fitted at all points, it will only be necessary to make earth connections in such places where danger of shock to earth exists; and since these positions are usually in the bathroom, kitchen, or scullery, a neighbouring cold-water pipe generally provides the necessary earth connection It may be objected that to provide 3-pin plug sockets in rooms where the third pin is not earthed is to create a sense of false protection. But in a living room with wood floors covered with carpets, even if the frame of a portable appliance becomes alive, the risk of shock is negligible. But directly the same faulty piece of apparatus is plugged-in at a point where a dangerous contact to earth prevails, the third pin, in this case being earthed, causes the circuit-fuse to blow, and calls attention to the fact that some fault must be present.

It is hoped that these few notes may arouse interest in a subject which hitherto has received very little serious attention, and has been shelved by the majority of installation engineers.

The Trials and Humours of an Estimating Department.

By "ONE OF THEM."

THE engineer in charge of the estimating department of any firm manufacturing all classes of high- and low-voltage switchboards and motor-starting gear does not fill a post which, by any stretch of the imagination, can be called a sinecure. Neither, in general, is it lucrative when one considers the years of study necessary before one can satisfactorily fill such a position. Gone are the posts which, in return for votes, and without work or responsibility attached to them, were filled by Robert Walpole and others regardless of the remuneration. Your engineer cannot be included in the category covered by Walpole's dictum that "Every man has his price." He has a price in the opposite sense, in return for which he ploughs his way through good and bad, clear and vague, and (in the case of foreign correspondence) wretchedly translated inquiries. He is assailed on all sides and at all inconvenient times—directors want him (three at once occasionally), and simultaneously he is called up on the telephone to be given an inquiry now by a good customer and again by a firm which in 20 years has sent multitudinous inquiries, but has never screwed up enough courage to send an order, although in every case it has had "hopes." Bearing in mind all this and other innumerable worries which occur during office hours, it is no wonder that the engineer in question, sitting by the fireside in the evening, and turning to Dickens for a tonic, feels rather envious of, and impatient with, Micawber, who, lucky man, was always waiting for something to turn up.

The good people who send the inquiries seem to conspire to upset your engineer's equanimity at the beginning of each new day, although, taken as a whole, a little dry humour shows itself from time to time. The following examples, taken at random from a large number, will illustrate the funny side of the business:—

(1) "Can you let me have a price for a liquid starter for 185 kVA?"

(2) Extract from lengthy and verbose specification

sent out by an eminent consulting engineer: "The star-delta starters must be so arranged that, with the handle in the 'starting' position, the motor windings are connected in 'star,' and in the 'running' position in delta'"!

(3) Further extract from the same specification:—"The starters are to be packed for shipment with a view to preventing breakage in transit."

(4) "The whole of the switchgear, when erected, must be given three coats of *navel* paint."

(5) Conversation following the submission of a quotation for an alternating-current switchboard, embodying moving iron instruments, in response to inquiry specifying moving-coil shunted instruments:—

A: "I specified moving-coil instruments."
B: "Just so."
A: "But you have allowed for moving iron."
B: "Quite so, but the instruments you mention will not indicate on an a.c. circuit."
A (getting excited): "That's all right, but you have the same heating effect."

(6) An inquiry is received for a switch-panel for use with a 3-wire generator, 400 kW, 500 V d.c., and 800-ampere gear is specified in quotation. The inquirers receive quotation and 'phone to say that we have allowed gear twice as big as we should have done. Upon asking the reason for their criticism, we are told that, as the scheme is three-wire, the current will divide equally between the two outers, therefore 400-ampere gear should be specified!

And so on.

It is no exaggeration to state that if, in the inquiry stage, a full and lucid statement were given as to actual requirements and the conditions under which the gear in question would have to work, the pressure on the staffs of estimating departments would be reduced by 25 per cent. Take one instance of this kind. What is the good of sending an inquiry for a switchboard for controlling 3-wire d.c. generators running in parallel if no indication is given whether the machines are shunt or compound wound and, if the latter, whether there are split- or single-series windings?

Quality *versus* Price.

By ROBERT MARSDEN, M.M.A.E.

WHAT does the average buyer of electrical plant term a fair price? First of all it is essential to place your buyer under one of three headings:—(1) The purchaser with limited means—nowadays the most common; (2) the engineer of a concern who must not exceed a certain sum for his plant; (3) the "specification" man. Generally speaking, the last two types are easily dispensed with as knowing exactly what they want, they also know within a small margin what they are going to pay, and therefore do not present any real difficulty when you are called upon to meet their requirements. Therefore, we are left with the limited means man—invariably a difficult proposition.

As is often the case, it is assumed that he knows very little regarding electrical equipment. In 50 per cent. of these cases you receive a letter containing the sentence: "The equipment is required to drive a 'so-and-so' machine. Please quote your lowest price and best delivery." No particulars of speeds, horse power, pulleys, type of control, &c., are included. Unless it is a well-known machine, the details have to be obtained either by further correspondence (the worst method by far) or by a personal visit. The latter, if at all possible, is by far the better way, for it is impossible to gauge the personality and type of buyer from the letter heading of to-day. If you visit a man, you can show your interest in the problem in a practical way, and often decide everything on site. If you do not get in direct touch, it not uncommonly happens that you lose the order. This particular type of buyer has spent £500 on a machine and invariably wants it to be driven for about £25. In the design of present-day machinery particular features are incorporated, and probably to ensure real service the type of equipment required costs £50. These are days of severe competition, insomuch that it is possible with such a buyer for someone to come along with no reputation to lose and give him his £25 equipment.

What happens?

The thing is unsatisfactory. It repeatedly breaks down, and the buyer loses output; often the very features for which the machine was bought are lost, and last, but by no means least, the *machine operator loses faith in the electrical equipment, and his fears prevent both good work and output.* Therefore, you and the buyer are faced with the argument:—Quality *versus* Price. You know, but the buyer does not, the quality of the goods offered for the job, and if the buyer's price is £40 and your estimate £60, tell him the complete reason for the necessary extra £20? Here is a practical instance: To drive a certain flat-bed printing press, a buyer purchased a drum-controller equipment for £40 and it gave him excellent service. The same buyer was again in the market with a similar press to drive, but this time with an automatic feeder (for the paper); he wanted to run the press at top speed and output. He was quoted, correctly, a push-button control (start, stop, and inch) equipment, which is essential for giving the additional service required, for £60. The estimate was duly received, and it was read and scrapped immediately. *The estimate was not fully explanatory, and the buyer assumed it an unnecessary extravagance.* Without further consultation, he ordered a hand-operated controller elsewhere and suffered in consequence. You cannot blame the buyer for passing over your estimate under the circumstances, and, further, you are not respecting the confidence placed in you if you neglect to state fully why you put forward special features; once again, whilst B.E.S. Specification, 1923, stands electrically for a great deal, it conveys insufficient to the "man-in-the-street" buyer. Therefore tell him the MECHANICAL DETAILS of your design! Any machinery man will appreciate these point. You should see that he gets to know them.

Tell him how they are put together, and stop talking too electrically if your man is "at sea." If you must, and it is necessary at times, then make mechanical analogies. It pays, and you make a friend as well.

Electricity in French Mines.

The French mining regulations require that authorisation must be secured from the French Bureau of Mines for the use of electrical equipment underground in collieries. This has proved easy in the case of mines producing little gas, but quite impossible where they produce a great deal of gas. It is understood, however, that new regulations are now being formulated by the Bureau of Mines, and that they will be more liberal regarding the use of electrical equipment underground.

Rural Electrification and Agriculture.

Electric ploughing is the largest and most remunerative application of electric power in agricultural operations; the development of a suitable electrically-driven tractor for the purpose is the pressing need of the day.

By Major ANDREW McDOWALL, of Mungoswells.

THERE are to-day, broadly speaking, two new developments in the agricultural world—first, the application of electric power to land tillage, the driving of farm machinery, and the encouragement of plant growth; and secondly, the development of sugar-beet as a farm crop. The latter, owing to the subsidy, has for the present become the best, and, in fact, the only paying crop grown in our arable districts, and for this reason sugar-beet may be said to overshadow mean-time rural electrification; but let us remember that the beet industry is drawing in subsidy over £23 per ton of sugar produced, and that the State payments will steadily decrease, when it will be self-evident that the present boom is entirely artificial and that in reality the healthiest movement in present-day farming is the possibility which the Electricity (Supply) Act gives us of supplying our countryside broadcast with cheap power. It is only common sense to suggest that the development of machinery which will allow the ploughman to use this power should be pushed on, and thus with less physical labour to himself the ploughman may increase his daily output by 300 or 400 per cent. At present experiments have made it clear that electrically-driven ploughs can be profitably used. There is, however, a mild controversy as to the method of application, and by a coincidence the writer stumbled the other day on an article in the *Illustrated London News* of 1858, when the same problem was being discussed in connection with the application of steam to land cultivation. Each side then, as now, had its champions, and as all the world knows, the wire-winding sets, in spite of all the cumbrous and expensive gear involved, won the day.

What interests us now is the reason why the wire-winders established their undoubted superiority. It was found that the equipment employing the farm pressure steam of those days, and carrying with it boiler, water, and the heavy wheels necessary for firm grip, was (owing to the weight) almost impossible to manœuvre on land, except when the soil was in a dry condition; also that the coming and going of the engine across the field compressed and churned up the land to such an extent that the mechanical texture of the soil was affected, and the whole scheme of direct haulage was a failure. The wire-winder then carried the day, and as a mechanical method of power tillage reigned without question till the paraffin tractor showed that light, direct-haulage machines could with ease and profit be used on the land without damage to the soil.

This, then, is the position when we are promised a cheap supply of electric power in our rural areas, and the engineers are now making inquiry as to what can be done with their power when we get it in the farmyard. Their inquiries so far have not been too encouraging—a threshing mill running perhaps two days per week, a corn-crusher perhaps one half day, and a few small odds and ends are all they can see, and therefore they tell the farmer his load is unattractive, his line will cost him perhaps £400 per mile to connect up, and his power units will cost perhaps 3d. when delivered, and if the farmer's land is not right astride the power line he decides to let well or ill alone.

What the power engineer forgets to look at on his farm visits is the four or five pairs of horses filing away from the water trough and the tractor men placidly filling endless oil cans with which to stimulate their iron horses in their daily toil.

Why the engineer takes so little interest in this side of farm work it is difficult to say. Clearly in his student days he has been educated to look on anything outside a factory and off a tramway rail as quite outside the scope of his work. I know myself that, had I taken the advice of some well-meaning and senior professors, I would never have moved in electrical-tractor design, far less the actual construction of a tractor for land work.

Engineers unacquainted with the land make the mistake of looking at the farmer's engine shed as his power house, whereas it is only a convenience. The real power house is the stable, and it is only by bagging the tillage load from the horse that they can hope to give the much-talked-of cheap power; further, it is by tackling tillage work that the farmer will most substantially benefit from electric power.

Engineers should firmly grasp the fact that it is the ploughman with his single-furrow, horse-drawn plough that puts up costs to the arable farmer, and that the difference between the actual driving of a mill or milking machine by oil engine or electric motor is a very trifling affair, which will hardly be noticeable on the farm balance-sheet.

By this statement it is not intended to question the superiority of the electrical drive—there is no question about that—but no farmer will spend much on a connecting line if the total result is to be the scrapping of his present oil engine and the small saving he can hope for by the change-over.

When the farmer is convinced that by using electric power he can save substantially in his tillage department, then the whole position is changed. The power company will be as anxious to build the line and secure the increased load as the farmer will be to have it, and once the reliable, ever-ready electric drive is experienced, it will be only a question of a little time before the oil engines are weeded out and electrically replaced. The question of the day, therefore, resolves itself into the development of a suitable tractor. Early in 1923 the writer tried to impress this fact on the authorities in Whitehall and elsewhere; the suggestion, however, was before its time, and as there was then no sign of a State-aided rural-electrification scheme, no encouragement was given. I had, therefore, to carry on as best I could with the construction of a tractor which it was believed would link up our oldest and youngest industries and be of substantial benefit to both.

In considering tractor design, the question of the direct haulage of ploughs or indirect (by means of wire winding) first presented itself, and as a tractor carrying an electric motor can be built light, strong, and at

moderate expense, the temptation to use it in place of the wire winder, with its accompanying expensive and cumbrous gear, became irresistible. On the other hand, the difficulty of feeding a direct-haulage tractor, which must move freely about any irregular field and must not by any chance get entangled with its cable, seemed almost insurmountable.

It became clear that to solve this problem of feeding a radically new type of tractor would require to be designed, and this, after much delay, was finally achieved.

Continental experiments conclusively proved that to attempt to feed a tractor, moving round a rectangular block, by means of a trailing cable could only lead to trouble with the cable and danger to the attendant: this old-established method of rectangular working was therefore scrapped as impracticable, and it was decided that, as ploughing should be done in straight parallel lines, and as a trailing feeder cable can also only be safely handled in straight-line work parallel to the ploughing, these two circumstances should be combined, when a really foolproof and simple method of feeding at once emerges. This tillage scheme has already been ably described in detail by Mr. R. Borlase Matthews in the Electrical Review, July 2nd, 1926, p. 4, and nothing further is necessary here, but the advantages of this system of tractor feeding over the wire winder are not yet fully appreciated.

First, in the matter of expense, the wire-winding equipment will probably cost four times as much as a direct-haulage tractor. Wire-winders, again, will require a minimum of three, and probably four, men to operate, when the direct tractor requires but one. Depreciation will be heavy with wire-winding and light with direct haulage. The feeding of the direct-haulage plant from one point half-way down the furrow is infinitely easier than the two-point feeder scheme required by the best wire winders, and, in addition, feeding should never be done from the furrow ends, as there are other duties to be carried out there, such as picking up the new alignment, bringing the new plough into work, &c., which fully engage the attendant's time and attention. By the half-way, single-point, direct-feeding system, automatic movement of the feeder point is obtained, requiring only general supervision by the attendant and at a time when he is not engaged with other duties.

There is another advantage which electric tractors will have over all rivals. It will be possible (so reliable is the motor and its power supply) to pay the ploughman by results.

If a farmer attempted this with horse teams they would at once wear thin under the pressure, and the men would plough light to ease their sorrows. Paraffin tractors are too unreliable for piece work, and if it is attempted, the tendency is to race the tractor, plough a light furrow, generally scamp the job, and ruin the machine. With a well designed electrical machine, on the other hand, the motor has practically one speed and will run at that speed whether light or heavy loads are taken. In consequence, the ploughman gains nothing by light ploughing, and it is impossible for him to damage the equipment by over-speeding. Also, as the driver has heat and light, as well as power at his command, it becomes possible in good weather to work double shifts, and thus escape from that most fatal predicament of the horse farmer—being behind with his work and unable, when a favourable spell of weather presents itself, to jump on the job which, if timorously done, will mean success, and if delayed may mean failure of the crop.

In addition to the tillage and barn-machinery loads, the farmer with cheap power at his elbow will seek other methods of using it, and it is anticipated that a grinding load will soon develop. Well-built grinders and meal mills can now be obtained at reasonable cost, and farmers will soon learn the advantages of purchasing (through their unions) phosphate rock, lime, and other such materials in bulk, and grinding at home when time permits. It is, in fact, difficult to see the end of electrical developments in rural areas, but our distribution engineers must develop their system and supply cheap farm lines and cheap power.

The Commissioners and supervising officials have arrived early on the scene, and have duly justified their necessity by passing regulations and restrictions which have a crippling effect on distribution schemes and generally block progress. We well know what is going on in other countries where successful electrification is carried out. We have to stand the competition of those countries in our home markets, and clearly it is the duty of the Commissioners to bring us into step with our more progressive neighbours.

The payment of our national debts and the expense of providing, free of charge, a market for the competing goods of our foreign competitors are surely a sufficient handicap without the maintenance of a set of regulations, which practice in other countries has proved to be not only unnecessary, but unreasonable. Let the Commissioners and supply companies remember that the agricultural demand for electric power and equipment may in the not distant future be their best market, and that agriculturists will much prefer a roughish power line to a ragged balance-sheet.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

An Electric Carpet Washer.

An interesting electrical introduction to this country by Messrs. S. G. Leach & Co., Ltd., 26-30, Artillery Lane, London, E.C.1, is the Hamilton Beach carpet washer. As the machine is moved forward over the carpet an action similar to that of the human hand is produced, and two sponge-rubber brushes, rotating at 500 times a minute, scrub the sud of a special compound, H-B, into the fibres of the rug, and the dirt and grease in the carpet are instantly, it is claimed, dissolved. An ingenious semi-squeegee device prevents the solution from spreading, and the whole of the moisture is suctioned back into the receiver pan. Finally, a brush lifts and straightens the nap.

Electric Wax Baths.

The Ingleby electric paraffin wax bath, made by Ingleby Motors, Sweet Street, Leeds, has been installed in various hospitals and institutions throughout the United Kingdom for the treatment of neuritis, rheumatism and other complaints. Results of observations and tests have proved, it is claimed, that the apparatus has considerable healing value in itself, and is also useful as a preliminary for massage and other treatment. It is manufactured in three different types, large horizontal and vertical, and a small horizontal model for local treatment. Some designs are of white glazed fireclay, while others are of white enamelled iron, and all are fitted with self-contained heating apparatus and switches to control the temperature. The baths are wired up in the usual way from a plug or terminal box to a switch panel equipped with an ammeter, d.p. switch and fuses, and are designed for working at pressures of 200/220 V, a.c. or d.c.

A Three-Light Automobile Lamp.

Of particular interest to those interested in motor-car lighting is a 3-light electric lamp, fig. 1, which has recently been put on the market by the Runbaken Magneto Co., Tipping Street, Ardwick, Manchester. A main spotlight lamp, which, it is claimed, throws a quarter-mile beam, is supplied from

the car lighting system, and in addition are an auxiliary lamp and a red rear lamp. The auxiliary is intended to serve in the case of breakdown or during ordinary garage repair work, when the apparatus is used as a portable lamp and the additional bulb is supplied from a small 2-V battery contained in the case. The auxiliary can also be used as a "see-you-home" in the event of failure of the main lamp or the lighting system, and can be fed either from the main supply or from the battery. The rear light is intended for use during

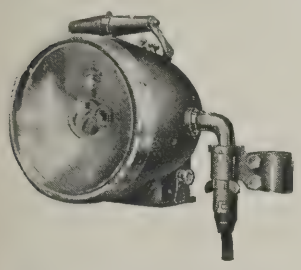


Fig. 1.—3-Light Automobile Lamp.

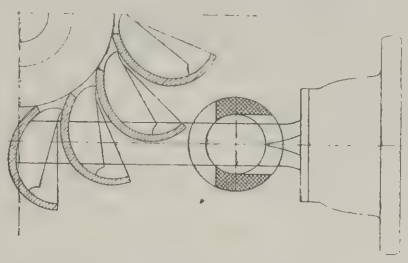


Fig. 2.—Deflector Diagram; Full-load Position.

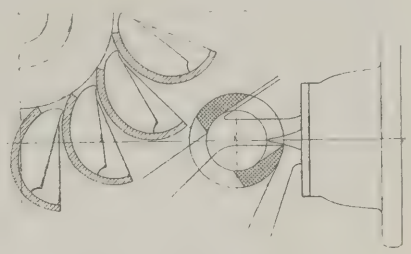


Fig. 3.—Position of Deflector at No Load.

parking, and is also supplied from the auxiliary battery. This lamp is exposed when a driving mirror at the back of the lamp is removed. When the mirror is replaced the locking device automatically switches off the light. A combined spot-light switch and charging indicator can be supplied for fitting to the dashboard. The lamp and its accessories are of nickel-plate finish.

An Electric Washer Combination.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, is shortly placing on the market a new electrical domestic machine, the "Magnet" Wizard, fig. 4, which appears to be a distinct variation from the electrical domestic appliance being sold at present. Essentially it is a machine for washing and wringing clothes, but it will also perform several other important functions. Arrangements are



Fig. 4.—The "Magnet" Wizard.

made for the easy interchange of parts, and by the simple turning of a switch the machine can be used to make sausages and ice-cream, to mince meat and vegetables, and to clean and sharpen knives. The necessary apparatus for performing each separate function is attached to the general driving shaft, one motor being employed for all the operations. A plug-and-socket device is provided for taking the supply from the mains. The machine is compact in design, occupying little space, and entailing very little supervision. The manufacturers claim that it costs very little to run, and can be handled with safety even by a child.

The Pitman Water Turbine Regulator.

The cheap, reliable and automatic governing of water turbines is a matter of some importance, particularly in the case of small installations. An ingeniously simple deflector regulator has been designed by Mr. Percy Pitman, 25, Victoria Street, Westminster, London, S.W.1, to maintain constant speed on the impulse turbine at all loads, so that the turbine may be allowed to run continually without attention; the device is strongly constructed, becomes fully operative a few seconds after the main water supply has been turned on, and is said to enable a battery of storage cells to be dispensed with entirely in the case of a hydro-electric installation. The essence of the Pitman regulator, which is adaptable to existing water turbines, is a deflector; its various ports are so proportioned as to make the reactions of the two streams on the deflector equal and opposite, the deflector being in equilibrium at all positions. The power required to actuate it is thus very small, and any type of standard centrifugal or oil-pressure governor can be used to operate it; moreover, the deflector can be designed for practically any size of plant, even down to a 1/20-h.p. set. The accompanying diagrams, figs. 2 and 3, are self-explanatory: the deflector is arranged directly in front of the nozzle and embraces the jet, instead of being located above or below it; the water passage through the deflector being slightly constricted towards the outlet end, allows for instant action to take place on all load changes, however small. Fig. 3 indicates diagrammatically the position of the regulator when the whole load is suddenly thrown off the turbine, the deflector having been rotated by the automatic governor gear, diverting the whole of the jet of water momentarily from the wheel buckets. When economy of water is of great importance, the needle valve for reducing the flow of water can be interconnected with the deflector in order to permit of the whole or any portion of the load being instantly cut off without increasing the pressure in the pipe line. A master patent protects the deflector arrangement in this country and abroad. It has been tested at all jet diameters, we understand, with the following results: the normal speed of the turbine was 9 r.p.m.; when the whole load was suddenly thrown off, the speed of the machine did not rise above 926 r.p.m., or approximately 3 per cent. speed rise; no hunting was noticeable during the trials. Messrs. G. E. Milner & Co., Ltd., are the sole licensees for the granting of licences.

The "Emvee" Cord-grip.

The latest addition to the "Emvee" range of wiring requisites made by Metro-Vick Supplies, Ltd., Trafford Park, Manchester, is a special ceiling plate and cord-grip. The plate, while of handsome appearance, possesses no new features, but the cord-grip is a novel device. It is made of non-inflammable moulded insulating material, and is in two parts, as seen in fig. 5. The wiring of the device is very simple. The flexible is threaded through the cord-grip and connected to the porce-

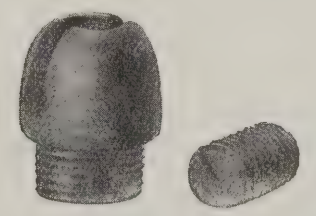


Fig. 5.—The "Emvee" Cord-grip.



Fig. 6.—Ceiling-plate and Cord-grip.



Fig. 7.—The Cord-grip in use.

lain in the usual way. The two leads are then opened out and the screw plug is inserted and tightened up with a screw-driver. There is no risk of short-circuiting, as the leads are kept well apart at the point of entry. It is claimed that the grip will sustain a weight of 56 lb. Fig. 7 shows the appearance of the finished job, while fig. 6 shows the application of the device to one of the company's ceiling plates.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

The official report of the Campaign for the week ended February 5th states that electric demonstration houses were opened at Exeter and Hendon. Demonstration houses were to be opened during the current week at Glasgow (2), Birmingham, and Carlisle, and on February 22nd and March 2nd similar houses will be opened at Durham and Chesterfield respectively. Further houses will be opened shortly at Bath and Newcastle-on-Tyne. At Cardiff Messrs. Warden and Co. intend to run an all-electric house in conjunction with the Better Housing and Housekeeping Exhibition, which will be opened on February 22nd. The first Glasgow demonstration house attracted 6,476 visitors during the fortnight, and good attendances are reported from Walsall, Bishop Auckland, and the Denton House, near Manchester. The chairman of Bramhill Urban District Council has offered one of his own houses for demonstration purposes, and at Blackpool a five-roomed bungalow, electrically equipped, has been organised in connection with the *Blackpool Times* Health, Home and Fashion Exhibition. Glasgow Corporation Electricity Department showroom has taken 9,000 competition books. The travelling model house organised by the Birmingham Circle is doing excellent work, and was used at Wolverhampton during the exhibition period. The North-East Coast area reports increasing interest in the Campaign. This is being stimulated in some places by the children's competition. At Greenock a Campaign whist drive is being held on February 25th. A district officer for the Nottingham district states that, from experience to date, he is informed that on an average 75 per cent. of the visitors may be looked upon as potential consumers. The chairman of the North-West area has circularised a large number of supply engineers with a view to setting up more circles. The number of visitors attending the Wembley house has reached 600 per day, and not per week, as has been previously and incorrectly reported. The exhibition held at Wolverhampton attracted over 6,000 people in three days, and 3,000 people visited the exhibition held at Hampstead. An electrical exhibition was opened on February 7th at Falkirk, and the South Wales Electric Supply Power Co. will open an exhibition in Halesowen on February 14th.

In our last issue we reported that an exhibition in connection with the Campaign had been held at Wolverhampton. We are now able to reproduce a view of the display,



The Wolverhampton Electrical Exhibition.

which was held at the Public Baths. It will be seen that a wide variety of appliances was open to public inspection, including several types of fires, cookers, vacuum cleaners, wash boilers, and smaller devices. One section of the exhibition was arranged as a model bathroom, complete with electric geyser, towel rail, fire, shaving pot, and other articles. Members of the Electrical Association for Women paid an official visit to the show.

The "all-electric" house at Muirend, Glasgow, was visited by 6,500 people during the fortnight it was open. Two further "all-electric" houses at Shawlands, which have been arranged by the various local electrical interests in connection with the Campaign, were opened on February 7th and will close on February 19th.

The Exeter District Electrical Circle has opened a demonstration electric house, and it will be kept open until February 18th. The General Electric Co., Ltd., has supplied the complete equipment of the house, comprising "G.E.C." fittings and "Magnet" domestic appliances, and has provided a demonstrator. Mr. A. H. Brooking, of Messrs. Brooking Bros., electrical contractors, Exeter, is acting as secretary to the circle.

The front page of "Home Lighting News," No. 7, bears a map of Great Britain, upon which are marked the localities in which circles have been formed (109). Another feature of the issue is an illustration, plan, and details of the February campaign window display. The back page contains illustrations of six typical demonstration houses, giving particulars of attendance and expenses.

An Electricity Committee and Dutch Cables.

We reported in our last issue that the Salford Electricity Committee had proposed that all its members should proceed to Holland to investigate wages and conditions in the Dutch cable-making industry. At last week's meeting of the Council, however, the chairman of the Committee (Alderman Billington) withdrew the recommendation, explaining that, although he was in favour of a direct investigation, it would be sufficient for the chairman, deputy-chairman, and the engineer to pay a visit to Holland. A councillor suggested that all the required information could be obtained from the appropriate Government department.

Floodlighting for Night Work.

It will be recalled that the grand stand on Epsom Downs was destroyed by fire last year, and it was decided to proceed immediately with the erection of a new and larger structure to take its place. The coal dispute interfered with the progress of the work, and it became apparent that in order to have the new stand ready by Derby Day in June next it would be necessary to carry on at night. Accordingly the electrical contractors, Messrs. Bell Bros., Cannon Street, E.C., arranged with the British Thomson-Houston Co., Ltd., to resort to floodlighting at night. For this purpose 16 16 "B.T.-H." Type 786 floodlight projectors with diffusing mirror reflectors and 1,000-W "Mazda" lamps were mounted on eight masts ranging in height from 10 to 40 ft., erected at suitable points around the site. It is claimed that almost daylight conditions are thus obtained and that the work proceeds as well by night as by day.

Something similar has recently been done at Weston-super-Mare, where the town authorities are engaged on a scheme to lock the tidewater at Glentworth Bay, and so enable visitors to have the benefit of tidal water at all times of the day. It was necessary to proceed with the work between tides at all times of the day and night. Messrs. Nott, Brodie & Co., the contractors, consulted the General Electric Co., Ltd., upon the matter, and the result has been the installation of a number of "G.E.C." floodlight projectors equipped with 1,000-W "Osram" lamps, which now provide adequate illumination for the carrying out of the work through the night.

The Wholesalers' Dinner.

The annual dinner of the Electrical Wholesalers' Federation is to be held on February 24th. A number of prominent men have promised to attend, including Sir Andrew Duncan, the Chairman of the Central Electricity Board, Viscount Peel, and Col. Moore-Brabazon.

Paint Industry Amalgamation.

Messrs. Pinchin, Johnson & Co., Ltd., have entered into an agreement with Messrs. Docker Bros. whereby the two businesses will be associated.

Modern Restaurant Lighting.

The Café Verrey, Regent Street, W., has recently been rebuilt, and the opportunity was taken to equip the building with a thoroughly up-to-date lighting installation. The effectiveness of this can be gauged from our illustration of the main restaurant. The decoration in this hall is carried out on "Empire" lines, and the principal illumination is provided by three centrally-suspended ceiling fittings equipped with 36-in. cut glass bowls surrounded by hand-painted silk valances. A number of wall brackets supplement these and give high-intensity but, at the same time, softly-diffused illumination. Another large apartment, the ball room, is equipped with seven massive mahogany fittings, 36 in. in diameter, supporting hand-painted silk shades. Mahogany wall brackets in consonance with the main fittings are also installed. The banqueting hall has for its main lighting



The Café Verrey, Regent Street, W.

seven 20-in. diameter cut-glass bowls, each fitting having four arms which carry smaller lamps. In the entrance lounge are 12 flambeau-type wall brackets and a massive central ceiling fixture. All the fittings were designed specially by the Fittings and Fixtures Department of the General Electric Co., Ltd., and "Osram" gasfilled lamps are employed. The installation work was carried out by Messrs. Foote & Milne, 15, Stockwell Road, S.W.9.

Lamp Business in Switzerland.

The Philips Lampen Gesellschaft is the name of a new company which has just been formed in Zurich (3, Rue Thalberg), to handle the business in Philips lamps, &c., in Switzerland.

German Exports to New South Wales.

The *Board of Trade Journal* states that during October last New South Wales imported German electrical appliances valued at £1,104 and vacuum cleaners valued at £4,187.

A French View of the British Market.

The French Commercial Attaché in Great Britain has made some interesting observations on the subject of our new Electricity (Supply) Act. After referring to the object of this measure, he reports that the principal British electrical manufacturers have already revised their production programme in anticipation of an increase in the demand, and that several among them during the past few months have even doubled their staff. Importers on their side, he adds, have been equally active. The Commercial Attaché notes also growing activity among the manufacturers of wire, meters, and accessories. Building contractors, he says, are now adopting the system of electrically equipping most of the new houses, as it is foreseen that there will be a general adoption of electricity for domestic purposes. With regard to the houses already constructed, it is estimated that only one-fifth of the 7 to 10 million houses which are within one or other of the distribution systems are already supplied with adequate equipment. The Commercial Attaché therefore emphasises that for electric household appliances, as well as accessory material, new openings are arising in England, and he draws the attention of French export manufacturers to this market.

Big South American Scheme.

A message from Brussels published in Berlin, states that the Compania Hispano-Americana de Electricidad, of Madrid (the successor to the German Transmarine Electricity Co.), proposes to establish in the new harbour at Buenos Ayres a generating station of 900,000 h.p., which will be "the largest works hitherto constructed," and will be equipped with 12 turbines, each of 75,000 h.p.

A Peruvian Hydro-Electric Contract.

It is stated that the Bergmann Electricity Company, of Berlin, has received an order from the Government of Peru in connection with the impending establishment of a hydro-electric works at Tamboraque, near Callao. The negotiations concerning the execution of the general scheme, which contemplates the erection of a station of 12,000 kW and the construction of a high-pressure line of a length of about 25 miles, have not yet been concluded.

German Trade in India.

A new concern is reported to have been formed in Berlin under the title of the A.E.G. India Electric Co., Ltd., with a share capital of 20,000 marks. The company is to regulate the representation of the A.E.G. and allied concerns in India.

A Bradford Exhibition.

Under the auspices of the Bradford Corporation Electricity Department, an exhibition of mercury vapour ultra-violet ray equipment was opened at the electricity showrooms in Sunbridge Road, on February 2nd, by the British Hanovia Quartz Lamp Co., Ltd., and continues until February 12th. Mr. A. K. James is in attendance to explain to inquirers the healing powers of this apparatus.

Irish Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during December last, amounted to a value of only £37,004, as compared with £47,404 in the corresponding month of 1925. The aggregate imports during the whole of the past year are returned at £450,249, as compared with £403,585 in the preceding year.

Chinese Notes.

The wireless station at Pehchiko, Nanking, was opened on November 28th last, and it is now in direct communication with most of the other Chinese stations. The cost for commercial messages is the same as that for telegrams.

The Telephone Administration of Tientsin is planning the installation of modern automatic telephones in the foreign concessions. The work of installing the equipment will commence almost immediately.

In order to facilitate the transmission of military dispatches, the provincial authorities of Shantung have decided to install a long-distance telephone system throughout the province, commencing with the ten districts in the Tsinan circuit. Preparations for the installation are now being made.

The long-distance telephone service between Mukden and Chengkiatun has now been opened to the public.

Trade Announcements.

During the recent terrific storm which raged throughout Scotland, the Scottish branch offices of the RAWLPLUG CO., LTD., at 19, Wilson Street, Glasgow, were completely demolished, and stock to the value of many hundreds of pounds was destroyed. The disaster occurred in the day-time, but, fortunately, the entire staff escaped injury. Until further arrangements are made, all the Scottish business will be transacted through the head office in London.

REDMANOL, LTD., has removed to 82, Victoria Street, S.W.1.

New Catalogues and Lists.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Booklet B.C. 4,335 (32 pp.), describing "Gecophone" radio products, including headphones, loud-speakers, crystal detectors, condensers, l.f. transformers and chokes, filament rheostats, super-heterodyne components, &c. Illustrated and priced.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—February calendar-blotter advertising the "Samson" coal-cutting machine. Also Pamphlet No. 261/5, illustrating and describing the company's ironclad control pillars for mining and industrial service.

ELECTRIC FIRES, LTD., Norwich.—Supplementary Folder No. 5, containing illustrations, particulars and prices of the company's "Heatrae" imitation coal fires.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—A series of illustrated descriptive pamphlets dealing with outdoor h.p. switchgear; oil-immersed circuit breakers; earthing resistances; air-break series-parallel starters; and d.c. and a.c. drum controllers and resistances.

MESSRS. J. BLAKEBOROUGH & SONS, LTD., Brighouse, Yorks.—A comprehensive catalogue (No. 100, 228 pp.) of valves and auxiliaries for steam power plant. Each item is illustrated and full dimensions and descriptions are given. A code is included for the use of buyers.

MESSRS. W. E. BURNAND & CO., 66-106, Shoreham Street, Sheffield.—A pamphlet illustrating a machine converted from a generator to a rotary convertor by the firm.

Messrs. Prideaux & Co., Ltd., Midland Lamp Works, Macdonald Street, Birmingham.—A priced and illustrated catalogue of electric light brackets, lanterns, pendants and standards, and electric signs.

Mr. O. N. Beck, 11, Queen Victoria Street, E.C.4.—An illustrated pamphlet dealing with the "Hurricane" electric hand blower for cleaning machinery, &c.

The Hart Accumulator Co., Ltd., Stratford, E.15.—February calendar-blotter advertising "Hart" batteries.

Messrs. Hans Renold, Ltd., Burnage Works, Didsbury, Manchester.—"The Power of the Press," an illustrated folder dealing with chain driving in the printing industry.

Messrs. W. Crockatt & Sons, Ltd., Darnley Street, Glasgow.—Illustrated pamphlet describing the "Simplex" patent electric salinometer for indicating impurity in condensate and boiler-feed water.

Hopkinson Induction Motors, Willesden Lane, North Acton, London, W.3.—Monthly stock list of induction motors.

Mr. E. J. Baty, 157, Dunstable Road, Luton.—Leaflet describing the "Baty" condenser, and quoting terms for giving a "wireless doctor" service.

Radio Instruments, Ltd., 12, Hyde Street, New Oxford Street, London, W.C.1.—Folder describing the company's new rectifier for battery charging.

British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.—Miniature edition (exact replica), measuring 6¼ in. by 4¾ in., for pocket use, of the company's 120-page catalogue of electric wiring supplies and domestic appliances. Pamphlet L.385a, dealing with "Pearl Mazda" vacuum and gasfilled lamps. Priced.

Messrs. F. & A. Parkinson, Ltd., Guiseley.—Abridged list U/6, giving tabulated details and prices for two- and three-phase induction motors from 1 to 1,000 b.h.p.

Messrs. John Moores & Co., Ravald Street Works, Salford.—February price list of various insulating materials for electrical and mechanical purposes.

Neron Lamps, Ltd., 1-3, Brixton Road, London, S.W.9.—Folder price list of "Bilux" lamps.

The Electric Heating Co., George Street, Croydon.—List No. 267, describing and fully illustrating the "Elect" electrical ovens and cookers; also a 36-page pamphlet containing priced and illustrated information regarding "Elect" fires, cookers, irons, and other domestic appliances.

Messrs. I. Calvete, Ltd., 11, Little St. Andrew Street, W.C.2.—An illustrated and priced brochure dealing with "Icall" and "Everay" electro-medical appliances.

Messrs. Watson & Sons (Electro-Medical), Ltd., 43, Parker Street, Kingsway, W.C.2.—A new edition of "Artificial Sunlight," a publication illustrating and describing the company's mercury-vapour, tungsten, and carbon arc lamps. Priced.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—February stock list of dynamos and motors.

Marconiphone Co., Ltd., 210, Tottenham Court Road, W.1.—Coloured trade poster; also illustrated and priced folder descriptive of the new indirectly-heated cathode KL.1 valve for operation off the domestic mains.

Bankruptcy Proceedings.

Ernest Frederick Woodgate, 7, St. John's Terrace, Weymouth, Dorset, and Brunswick Cottage, Weymouth, electrical engineer.—This public examination was held recently at Dorchester. The statement of affairs showed liabilities of £155, against assets of £224. In October, 1922, debtor commenced business with a capital of £30. He had not kept a complete set of books, and no accounts had been prepared showing the profits or losses. Several creditors obtained judgments against him, and an execution was levied on his effects early in January, which was paid out. During the strike of last year and when he was being pressed, his solicitor advised him to file his petition. The examination was closed.

F. H. Thomas, electrical engineer, carrying on business with W. E. Evans as Thomas & Evans, at Salubrious Chambers, Salubrious Passage, Swansea.—Bankrupt discharged as from January 1st, 1927.

C. G. Hofman (L. J. Chambers & Co.), wireless components manufacturer and electrical engineer, Andrews Works, Cowthorpe Road, Wandsworth Road, S.W., and 7a, Victoria House, South Lambeth Road, S.W.—Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.1, released January 1st, 1927.

J. N. Davenport and L. A. Hackett (Davenport, Hackett and Co.), electrical engineers and contractors, 36, Spring Gardens, Manchester.—Last day for proofs for dividend, February 15th. Trustee, Mr. A. Grierson, 21, Spring Gardens, Manchester.

J. H. Dollittle (Zenith Radio Manufacturing Co.), wireless engineer, Virginia House, Portsmouth Road, and 17, Park Street, Guildford.—First and final dividend of 2s. 3½d. in the £, payable February 16th by the Official Receiver, 29, Russell Square, W.C.1.

W. R. Squire, electrical engineer, 11, Steward Street, Spring Hill, Birmingham.—Trustee, Mr. C. Hoult, Official Receiver, 191, Corporation Street, Birmingham, released January 26th.

G. R. Sims, motor and electrical engineer, Hartlepool Street, Thornley, Durham.—Receiving order made February 1st on debtor's own petition.

Private Arrangements.

Southern Sales Co., Rye, Sussex, electrical and radio dealers.—A meeting of creditors was held on January 31st at Winchester House, E.C., when the chair was occupied by Mr. E. H. Hawkins, representing the largest creditors. A statement of affairs was presented which disclosed a surplus of assets over liabilities of £343. The liabilities totalled £4,681, and there were also unsecured loan creditors for £2,448. The net assets were £7,472. The solicitor for the debtors said that he had called the meeting in conjunction with Mr. Fox, the accountant who had prepared the statement of affairs. The business was started by Mr. G. W. Page and his son in 1923. Shortly afterwards a Mr. Garrard became a partner, and in 1924 the business was transferred to Rye. The turnover then increased very rapidly, and in his (the solicitor's) opinion the present position had been brought about by over trading. Various loans totalling £2,448 had been obtained from time to time from friends of the partners. With the exception of £500 of that money, the loan creditors were prepared to stand aside provided some scheme was adopted. It was thought that if the business could be carried on, there was every prospect of the creditors being paid in full. Another suggestion was that the business should be converted into a limited company, the creditors taking first debentures and the loan creditors second debentures. Mr. Page, junr., had retired from the business. For the two years ended February 28th, 1925, the accounts showed that there was a trading profit of £624 on a turnover of £12,219. In the following year there was a further profit of £730, the turnover being £13,651. It was decided that a committee of five should be appointed to investigate the position and report to the creditors as to the best method of securing the continuance of the business, subject to no proceedings being taken against the assets of the business, and to further purchases being for cash only. The committee appointed consisted of Mr. C. Latham, Mr. E. H. Hawkins, and representatives of the North British Rubber Co., the Vacuum Oil Co., and Moseley & Sons.

Company Liquidations.

Watson, Jones, Ltd., wireless and electrical factors, 235a, Blackfriars Road, London, S.E.—A meeting of the creditors was held on February 2nd at Caxton Hall, Westminster. Mr. George Dickinson, certified accountant, of Messrs Leonard Dickinson & Co., 82, Victoria Street, S.W., who presided, stated that he had been appointed to act as the liquidator in the voluntary liquidation. The statement of affairs presented disclosed unsecured liabilities of £8,330 and the assets totalled £4,725, from which had to be deducted £194 for preferential claims, leaving net assets of £4,530, or a deficiency of £3,800. The asssets included cash at bank and in hand, 11s. 3d.; stock-in-trade, £2,232, estimated to realise £1,500; shares in the B.B.C., £10 11s. 3d.; and sundry debtors, £3,174, estimated to produce £2,750. The issued share capital of the company was £4,579, so that there was a deficiency, as regarded contributories, of £8,379. The liquidator said that stock had been taken at cost or market value, and he was informed by Mr. Watson, the managing director, that it had been taken on the lowest possible basis. The book debts were practically all good. Mr. Dickinson said that the company was formed in December, 1925, with a nominal capital of £10,000, of which £4,579 had been issued. £1,579 had been subscribed in cash, and £3,000 worth of shares were allotted to the three partners of the old business which was taken over. Since the inception of the company the turnover had been about £45,000, but the expenses had been so heavy that they had more than wiped out the profit.

In reply to Mr. P. Houston, of Messrs. Corfield & Cripwell, the liquidator said that there were certain suing creditors, and that was one of the reasons why the company had decided to wind up. The company had never made a profit. The four directors were Messrs. Watson, Jones, Eckford, and Bowditch.

Mr. Houston said that the creditors ought to have some figures as to the trading, because it seemed curious that a concern which was formed as late as the middle of December, 1925, and at that time had a surplus of assets over liabilities of £3,000, should within 12 months be in the present position.

The liquidator said that the turnover was £44,726 for the 13 months of the company's trading, and there was a gross profit of £4,456. The gross profit was absorbed by the following expenses:—Wages, £3,300 (that figure included directors' salaries); motor-van expenses, £1,090; travellers' commission, £525; rent, rates and taxes, £636; bad debts, £617; and other small items, bringing up the gross total to £7,721 Three of the directors had drawn £6 per week, and one £7 weekly.

Mr. Watson, a director, said that before the company was formed, they got out a balance-sheet, and it was evident that it would be difficult to carry on without additional capital. Mr. Eckford then came along and offered to put up capital and found certain friends also willing to put up money. The company was formed because Mr. Eckford insisted on it being done. The partnership had been going about 3½ years. The stock was principally wireless apparatus.

After some further discussion, Mr. Hunter, of the Wireless and Radio Trades Guardian Association, said that the case was one where a creditors' nominee ought to liquidate the

company. He proposed that another liquidator should be appointed in the place of Mr. Dickinson. The resolution was duly seconded and, on a show of hands, was carried. A poll was demanded, however, and the liquidator declared that the resolution was lost. An amendment for the appointment of a joint liquidator was also lost. A resolution was then passed confirming the voluntary liquidation, with Mr. Dickinson as liquidator.

The following are creditors:—

	£		£
Auto Sundries, Ltd.	100	Hunt, A. H., Ltd.	346
Burndept Wireless, Ltd.	99	Hart Bros.	31
Beard & Fitch	25	Igranic Electric Co., Ltd.	232
Bolwell, W.	34	London Electric Wire Co.	67
Bulls Rubber Co.	31	Siemens Bros. & Co., Ltd.	28
Bowyer, Lowe Co., Ltd.	72	Shaen, Roscoe, Massey and Co.	38
Brown Bros., Ltd.	46	Siemens & English Electric Co., Ltd.	1,200
British Thomson-Houston Co., Ltd.	249	Telegraph Condenser Co.	97
Benjamin Electric, Ltd.	59	Trojan, Ltd.	44
Brownie Wireless Co.	36	Vandervell, C. A., & Co.	59
Cole, E. K.	29	Leyland Motors, Ltd.	69
Clayton Rubber Co.	30	Metro - Vick Supplies, Ltd.	464
Climax Radio Electric, Ltd.	32	Marconiphone Co., Ltd.	732
Cleartron Radio, Ltd.	25	Mullard Radio Valve Co., Ltd.	274
Cahill & Co.	67	McMichael, L., Ltd.	38
Cossor, A. C., Ltd.	191	New London Electron Works	57
Dubilier Condenser Co., Ltd.	124	Odhams Press, Ltd.	38
Dwyer, P. L., & Co.	80	Oliver Pell Control, Ltd.	26
Edison Swan Electric Co., Ltd.	104	Peto, Scott & Co.	53
Ever-Ready Co. (G.B.), Ltd.	167	Phillips Lamps, Ltd.	35
Ede, C., & Co., Ltd.	45	Proctor, E., & Sons, Ltd.	53
Formo Co., Ltd.	29	Radio Communication Co., Ltd.	100
Ferranti, Ltd.	107	Ruhl, O.	87
Graham, A., & Co.	142	Radio Instruments, Ltd.	141
General Electric Co., Ltd.	94	Reed, R. N.	102
Garnett, Whiteley & Co., Ltd.	40	Yesley Electric Supplies	41
Hart Accumulator Co., Ltd.	41		
Hough, J. E., Ltd.	200		

NATIONAL WIRELESS CORPORATION, LTD., 112, Westminster Bridge Road, S.E.—The first meeting of the creditors and shareholders of this company was held last week at Carey Street, W.C. Mr. E. T. A. Phillips, Official Receiver, reported that the winding-up order was made last December on the petition of a creditor for £60 in respect of £50 lent to the company and law costs. The company was formed in February, 1925, with a nominal capital of £1,000 to carry on business as radio and general engineers. Subsequently it was decided to increase the capital to £20,000, and at the date of the winding-up order the issued capital was £3,363. The intention was to open retail shops and a wholesale depôt to deal in wireless apparatus. In August, 1925, the capital was increased to £3,500, and a shop was opened at Raynes Park and a warehouse in Little Pulteney Street. The property at Raynes Park had been disposed of to a company, part of the consideration being a debenture for £250 charged on the property. In 1926 an arrangement was made by the directors with a Mr. G. E. Hill and the British Fiduciary Co., Ltd., for the latter to secure subscriptions for the shares on a commission basis. In the transactions which followed, shareholders of the Burndept Wireless Co. were invited to hand over their shares in exchange for the shares of this corporation, and as a result 3,552 Burndept shares had been obtained. Some of the number had taken action against the corporation to obtain an injunction restraining it from acting on their application for shares and from parting with the proceeds of sale of their shares in the Burndept Company, the allegation being that the shares were obtained from them by misrepresentation; it was understood that some of those actions had been settled by Mr. Hill. Various sums had been paid to Mr. Hill as commission. The liabilities of the corporation amounted only to £396, and as the assets were valued at £322, the creditors would doubtless receive a substantial dividend, but the shareholders, whose loss was estimated at between £2,000 and £3,000, could not hope for any return for their money. In the absence of any resolution, the liquidation was left in the hands of the Official Receiver.

ELECTRIC LIGHT AND POWER CONTRACTS FINANCE CORPORATION, LTD.—A petition for the winding up of this company has been presented to the High Court by Messrs. H. Saunders, Ltd., of 40-41, Great Charles Street, Birmingham, and will be heard in London on February 15th.

BRITISH ELECTROLYTIC ZINC CO. (ISHERWOOD PROCESS), LTD.—Winding up voluntarily. Liquidator, Mr. E. Fairweather, Pinners' Hall, Austin Friars, E.C. Meeting of creditors, February 16th, at Pinners' Hall. Particulars of claims to the liquidator by February 21st.

UNIVERSAL RADIO SYNDICATE, LTD.—A meeting of members is called for March 9th at Marconi House, Strand, W.C., to hear an account of the winding up from the liquidator, Mr. F. A. Walrond.

RADIO PHONOPORE AND ELECTRICALS, LTD.—First and final dividend of 2s. 8d. in the £ payable February 28th at 3, Frederick's Place, Old Jewry, E.C.

BRITISH BROADCASTING CO., LTD.—Winding up voluntarily. Liquidator, Sir J. C. W. Reith. A meeting of creditors was held at the Hotel Cecil on February 7th, when the voluntary liquidation was confirmed. (This notice is purely formal, all creditors have been or will be paid in full.)

NEUTRON, LTD.—A petition for the winding up of this company has been presented to the High Court by Messrs. M. & J. Macrae (Macrae Bros.), wireless manufacturers, St. James' Avenue, West Ealing, creditors, and will be heard in London on February 15th.

RADIO CABINETS, LTD.—Winding up voluntarily. Liquidator, Mr. O. A. Hibbert, Capel House, 54, New Broad Street, E.C.2. Meeting of creditors at Capel House on February 15th. Particulars of claims to the liquidator by March 15th.

UNIQUE WIRELESS CO., LTD.—A meeting of creditors was held on February 4th at 132b, Regent Street, W. Liquidator, Mr. A. S. Hobbiss, 9, Beachcroft Mansions, Streatham, S.W.16.

Dissolution of Partnership.

W. D. FLETCHER and H. CALDWELL, electrical supplies merchants, 86, Bath Street, Glasgow.—Messrs. Fletcher & Caldwell have dissolved partnership on the retirement of Mr. Fletcher. Mr. Caldwell will continue the business on his own account and in his own name.

Indian Cable Sports.

We have received interesting particulars of the first annual sports of the Indian Cable Co., Ltd., which took place at Tatanagar, B.N. Railway, on Saturday, January 15th. The factory of the Indian Cable Co. is under the control of British Insulated Cables, Ltd. It is now in its fourth year, and combines wire-drawing and cable-making. It is the only works of its class in India. At the sports referred to the events, which were keenly contested, comprised the usual flat races, high and long jump, putting the weight, and the more spectacular items, such as sack fight, obstacle race, and wrestling. The arrangements were carried through by the Employés' Welfare Committee, which includes amongst its activities, football, cricket, badminton, volley ball, a dramatic club, and a lending library. When one considers the nationalities, tongues, tribes and castes covered by the word "Indian," one commences to realise the difficulties to be overcome in arranging competitions. Hindi, may be likened to Esperanto, a universal language of the North, but it fades away in Central India, and on the sports ground could be heard Punjabi, Nepali, Urdu, Bengali, Hindustani, Santali, Ho, Tamil, Telugu, Malayalam, Kanarese, and Gujarati. North, South, East and West had met to try their skill, individually, and they intermingled in team events. Caste and creed were forgotten and the spirit of sport reigned supreme. Coolies and Rejas who had never before seen an organised sports meeting, competed in the events for novices, the prizes of clothing being supplied by Mr. R. B. Paul (Calcutta), the managing director. The championship cup, given by Mr. F. W. Leake, director, was won by M. Joseph (Madras), of the cotton covering department, with 9 points, P. C. Chatterji (Bengal), of the wire mill, finishing a good second, with 7 points. Brawn met brains in the final of the tug-of-war, the general office being unable to hold the more robust wire mill team. In all it was a most successful meeting, and marks a step in linking up the Empire, not only with cables, but with the bonds of good fellowship.

New Domestic Appliance Venture.

At last week's meeting of John Shaw & Sons, Ltd., Wolverhampton, Mr. G. Terrell (chairman) said that the company had launched out into a new field of activity at Wolverhampton by the opening of an electrical department. They had found that the thousands of ironmongers with whom they did business throughout the country were to some extent extending their operations to the sale of domestic electrical appliances. The department had barely had a month's trial. It would be developed on the lines of the old business. It would not involve them in any new establishment expenses, and would keep them in the forefront as a distributing house. It would, of course, take some little time to build up, but he was hopeful that it would result in substantial profits.

Callender's Hospital Fund.

We have received a copy of the 24th annual report of Callender's Hospital and Distress Fund. This shows that a total of over £880 was distributed between a number of hospitals and kindred institutions; Guy's Hospital received £250, the Erith and District Hospital £105, and the Metropolitan Convalescent Institution £110. In addition to this, 609 hospital letters were issued; 239 surgical appliances were provided at a cost of £102; 120 pairs of spectacles were provided, costing £34; and in a number of other directions the Committee, of which Mr. H. Bragg is chairman and Mr. J. W. Giles hon. secretary and treasurer, did excellent work.

The Shipping, Engineering, and Machinery Exhibition.

This biennial exhibition is to be held at Olympia from September 8th to 24th next. The organisers, Messrs. F. W. Bridges & Sons, Ltd., Avenue Chambers, Southampton Row, W.C.1, inform us that 90 per cent. of the available space has already been booked, mainly by previous exhibitors. Arrangements are being made to invite overseas buyers, and a number of engineering institutions are being requested to pay official visits to the exhibition.

Company Law Amendment.

Parliament reassembled on Tuesday last. One of the first matters which will receive consideration this session is the amendment of the existing company law. *The Times* says that a Bill for this purpose will be introduced into the House of Lords, based upon the recommendations of the Departmental Committee which reported last year. The necessity for two meetings for the passing of a special resolution will be dispensed with, and the Bill will prevent directors from contracting out of all liability for loss except when it is due to their "wilful neglect or default." An undischarged bankrupt will not be permitted to be a director or to take part in the management of any company without the leave of the Bankruptcy Court. The investigation and prosecution of offences will be facilitated, and it is hoped to make it less common for offenders to escape prosecution when a company is wound up voluntarily. Additional facilities will be given to shareholders for obtaining copies of the balance-sheet, and the accounts of holding companies must state how the aggregate profits and losses of their subsidiary companies have been dealt with in the accounts. House-to-house hawking of shares will be prohibited, and steps will be taken to hamper the dishonest touter of shares by making it compulsory to disclose a certain minimum of information which he may find it inconvenient to give.

Book Notices.

"Official South African Municipal Year Book, 1926-27." Edited by W. P. M. Henderson and F. G. Pay. (Pp. 505 and tables.) London: E. G. Allen & Son, Ltd., 12 and 14, Grape Street, W.C.2. Price 25s. net.—This latest edition of the standard municipal compendium for South Africa and Rhodesia has again been brought up to date. All phases of municipal activity are dealt with, the business of electricity supply receiving ample treatment. It is noted that 19 new undertakings were laid down during the past year. Even greater developments may be expected when the Electricity Supply Commission is in a position to supply electricity in bulk from its super-power stations. One of the tables gives full particulars of the plant installed, &c., in municipal power stations.

"The Electrical Trades Directory and Handbook, 1927" ("The Blue Book"). (1,432 pp.) London: Ernest Benn, Ltd. Price 25s. net.—This is the 45th consecutive issue of this directory. The principal features are retained, having been brought up to date. In particular, the section dealing with the law relating to electricity supply has been revised in the light of the new Electricity (Supply) Act. An innovation is the provision of a celluloid thumb index to the various sections of the work.

"A Handbook of Physics Measurements." By E. S. Ferry. Vol. I. Fundamental Measurements, Properties of Matter and Optics. Second edition, revised. Pp. xii+288; figs. 162. Price 12s. 6d. net. "Laboratory Manual for Automotive Electricity." By W. R. Varner and F. C. Smith. Pp. ix+199; figs. 157. Price 10s. net. "Electro-Organic Chemistry." By C. J. Brockman. Pp. xi+381; figs. 15. Price 25s. net. London: Chapman & Hall, Ltd.

"Science Abstracts" (A and B). Vol. XXX. Part I. No. 349 and Indexes to Vol. XXIX. London: E. & F. N. Spon, Ltd. Price 3s. each.

"Machine Tool Driving and Feed Gear Poxes." By H. C. Town, F.R.S.A. "Some Considerations in the Design of Spur and Helical Gearing." By H. Walker, B.Sc. The Association of Engineering and Shipbuilding Draughtsmen. Price 2s. each.

"Technologic Papers of the U.S.A. Bureau of Standards," No. 330, "Resistance of Conductors of Various Types and Sizes as Windings of Single-Layer Coils at 150 to 6,000 kilocycles" (5 cents).

"Gramophone Tips." 1927 edition, has been received from Mr. H. T. Parnett, M.I.E.E., 123, High Street, Old Portsmouth (price 1s. post free). It contains, in addition to the author's excellent "tips," very eulogistic references to the electrical system of recording which has been adopted.

"The Practical Electrician's Pocket Book, 1927." Edited by H. T. Crewe, M.I.Mech.E. Pp. 602+xci; fully illustrated. London: S. Rentell & Co., Ltd. Price 2s. 6d.—In this 29th edition of the above pocket book many of the chapters and sections have been revised, and new ones have been added. The revision work includes the sections on illumination and lamps, and also that on gas, oil, and petrol engines. The new sections deal with fault localisation, a.c. motors, installation testing, and other subjects of interest to the electrical engineer. The section on central stations has again been enlarged.

Scientific Papers of the U.S.A. Bureau of Standards, No. 537: "Formula for the Inductance of a Helix Wire made with Wire of any Section" (25 cents). No. 538: "Spectral Energy Distribution of the Light Emitted by Plants and Animals" (10 cents).

"History of Radio-Telegraphy and Telephony," by G. G. Blake. Pp. xix+425; illustrated. London: Radio Press, Ltd. Price 25s.

"The New Electricity Act," by W. S. Kennedy. Pp. 142. London: Ernest Benn, Ltd. Price 6s. net.

E.D.A. Conference Alteration.

We are informed that as Mr. Morshead finds himself unable to fulfil his engagement to read a paper on "Refrigeration" at the E.D.A. Conference on March 18th, his place will be taken by Mr. N. E. Barber, who will deal with the same subject.

Fulham Civic Week.

The first Civic Week ever to be held by a London borough commenced at Fulham last Saturday. One of the principal features of the week is an exhibition, at the Fulham Baths, of the various industries connected with the Borough, and it is pleasing to note that electricity is well to the fore. The Borough Council Electricity Department has an exhibit occupying six stands showing the domestic application of electricity; various types of domestic apparatus are displayed, and the exhibit is arousing considerable attention. Another interesting exhibit is that of Mr. E. R. Armfield, builder and electrician.

For Sale.

Reigate Corporation invites offers for surplus generating plant installed at the Electricity Works, Wray Common Road. By order of the joint receivers and liquidators of Eastwood, Swingler & Co., engineers, &c., of Osmaston Road, Derby, Messrs. Richardson & Linnell will sell by auction at St. James' Sale Rooms, Derby, on March 8th, the freehold property, plant, buildings, and machinery, &c. (See our advertisement pages to-day.)

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Feb. 8th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton.	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£9 10s.	...
a	,, Roll ... ... ,,	£9 10s.	...
a	Soda, Chlorate ... ... per lb.	3¾d. to 3½d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	4d.	...
	METALS, &c.		
b	Aluminium, Ingots... ... ... per ton.	£107 to £112	...
b	,, Wire ... ... per lb.	1/6 to 2/-	...
b	,, Sheet ... ... ,,	1/3 to 2/9	...
p	Babbitt's Metal and Anti-friction Metal—		
	Grade I ... ... per ton net.	£267	£12 inc
	Grade II ... ... ,, ,,	£185	£5 inc.
	Grade III... ... ... ,, ,,	£96	...
c	Brass (rolled metal 2" to 12" basis) per lb.	9⅜ d.	...
c	,, Tubes (solid drawn) ... ,,	11¼ d. to 1/-	...
c	,, Wire, basis ... ... ,,	9¾d.	...
c	Copper Tubes (solid drawn) ... ,,	1/0¾	...
c	,, Bars (best selected) ... per ton.	£83	£2 dec.
c	,, Sheet ... ... ,,	£88	£2 dec.
c	,, Rod ... ... ,,	£84	£2 dec.
d	,, (Electrolytic) Bars ... ,,	£60 10s.	5us. dec.
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£74 15s.	...
d	,, ,, H.C. Wire per lb.	9d.	1/32d. inc.
f	Ebonite Rod ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	8/-	...
h	India-rubber, Para fine ... ... ,,	1/1	½d. dec.
l	Iron Pig (Cleveland No. 3.) ... per ton.	122/6	...
l	,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g	Lead, English pig ... ... ,,	£28	...
g	Mercury ... ... per bot.	£17 10s.	...
e	Mica (in original cases) small ... per lb.	3d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/ to 20/- & up.	...
p	Phosphor Bronze, plain castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/3	...
p	,, ,, rolled strip & sheet ,,	1/2⅝	...
p	,, ,, wire... ... ... ,,	1/3¾	...
o	Platinum ... ... per oz.	£23	...
d	Silicium Bronze Wire ... ... per lb.	10½d.	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
n	Tin, Block (English) ... ... per ton.	£303 10s to £304	£2 10s. inc.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co,. Ltd
g James & Shakespeare.
h Edward Hill & Co.
j Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Messrs. James Forster & Co., reporting on February 5th, state that so long as the lead market here is glutted with extra supplies from the Continent there can be no hope of any alteration in present conditions. On the other hand, an improved demand from consumers both here and on the Continent, especially if coinciding with a decrease in arrivals, would result in a sharp recovery from the present low level of values.

Czech-German Co-operation.

A scheme is being promoted for the transfer of the Podenbach Machine Works, belonging to the Bohemian-Moravian Electrotechnical Works (Krizik) to a new company, in which the shares will be held in equal halves by the present owning company and the Berlin A.E.G., and in this way the new concern will have the advantage of the patents of the American General Electric Company. The other works of the Krizik Company—the cable and insulator works in Bodenbach, the Chaudoir Metal Works, and the Karolinenthal Works—are to be combined into a single company. The Karolinenthal Works will be extended so as to produce high- and low-pressure apparatus and complete switchboard installations.

British Manufacturers' Representatives in Leningrad.

A correspondent states that the arrival in Leningrad is reported of Messrs. Richard and Simons, of the Metropolitan-Vickers Company. In the course of a conversation with a representative of a Moscow newspaper, they are stated to have said that the company was at present executing orders for electrical plant for Russia of the value of 10,000,000 roubles. Two turbo-generators of 20,000 kW were in hand for Baku, while the installation had been completed in Leningrad of a turbine of 30,000 kW for the Krasni Oktyabr station. The company had received orders for the construction of a turbine of 45,000 kW, and for two turbines for the Moscow combination (Moges) of 17,600 kW. It was added that the object of the visit was to enter into negotiations respecting the company's further participation in the electrification of Russia.

Patents in Esthonia.

The *Board of Trade Journal* states that the Esthonian Legislature has passed a law providing for the registration of patents and trade marks belonging to British subjects which were registered in Russia prior to February 24th, 1918. Applications must be sent in by May 23rd next.

Lamps by the Million.

The General Electric Co., Ltd., claims to have made over 200 million "Osram" lamps of all kinds, from the giant lighthouse lamp, which is 2 ft. long, to the smallest pocket torch lamp. The company continues to receive very large orders, among the latest being one from the Admiralty for 215,000, and another from the General Post Office for 150,000.

Lighting and Power Notes.

Aldershot.—Electricity Scheme.—As the result of a conference of representatives of the Town Council, the Farnborough, Farnham, Fleet and Frimley Urban District Councils, and the Hartley, Wintney and Farnham Rural District Councils, it has been decided to approach the Electricity Commissioners with regard to a scheme for supplying electricity in the area concerned which does not appear to have been dealt with by the Commissioners in connection with the supply of electricity in bulk from any station erected or to be erected in the future. Supply companies in the area and the Alton Urban and Rural District Councils are being invited to associate themselves with the Conference.

Audenshaw. — Street Lighting. — The Urban District Council has asked a sub-committee to report upon the question of lighting all the main roads by electricity. Meanwhile it is proposed to arrange for all night electric lighting in Delta Road, electricity being supplied by the Manchester Corporation at 1d. per kWh, with a view to obtaining data in connection with the general question of adopting electricity for street lighting.

Australia.—Tasmania.—We have received from Mr. H. A. Curtis, chief engineer and general manager of the Tasmanian Government Hydro-Electric Department, a copy of his report for the year ended June 30th last, together with branch reports. The income from the operation branch amounted to £172,612, the major part of which was derived from the sale of electricity in bulk. The working expenses amounted to £19,898, and there was a gross profit of £152,714. The Hobart branch earned a revenue of £110,551, against which was charged working expenses of £13,592, and the purchase of bulk supplies amounting to £46,325, leaving a gross profit of £50,635. The Derwent Valley service recorded a revenue of £5,110, and working expenditure of £3,243, leaving a gross profit of £1,867, which was transferred to a main joint account, together with the gross profits from the operation and Hobart branches, and interest, making a total of £205,373 available. Interest and other charges absorbed £211,326, and the net debit balance for the year amounted to £5,953. The result of the preceding year's working was a net loss of £20,170. The output of the Waddamana power station fell from 284,125,900 to 276,314,500 kWh, the decrease being due to the stoppage of the Carbide and Electro-Products works during alterations to the plant. Good progress has been made with the Shannon scheme. The construction of the channel for the diversion of the Shannon River was completed and work on the dam commenced. In the Hobart district new feeder lines have been constructed, existing lines have been changed over from 6,600 to 11,000 V, and a new 500-kVA sub-station, capable of being duplicated, has been constructed.

Launceston (Tasmania).—The report on the working of the city electricity undertaking (engineer: Mr. R. J. Strike) for the year ended June 30th last shows a total income of £61,475, as compared with £63,930 in the preceding year. Working expenses amounted to £42,930, as against £45,196, leaving a gross profit of £18,545 (£18,734). After deducting interest and sinking fund charges there was a net surplus of £2,001, as compared with £3,285, which was transferred to reserve. The sales of electrical energy increased from 5,964,709 to 6,372,370 kWh.

Ayrshire.—Electricity Supply.—At a recent meeting of the Ayrshire Electricity Board it was reported that terms had been arranged for a supply of electricity to Turnberry Hotel and Ayr Harbour for the L.M. & S. Railway Co. It was felt that the present boilers were inadequate, and to remedy this an expenditure of £47,500 would be involved. The Board has the matter in hand.

Bath.—Electrical Development.—The *Financial News* reports that on February 3rd, Madame Sarah Grand, Mayoress of Bath, inaugurated the reconstructed Corporation electricity works, starting a 7,000-kW turbo-alternator. Alderman Sir Harry Hatt, chairman of the Electricity Committee, stated that since 1901 the demand for electricity had increased from 500 to 5,000 kW, the works capacity from 600 to 13,500 kW, the invested capital from £81,000 to about £500,000, and revenue from £11,000 to over £65,000 a year.

Beckenham.—Electricity Supply.—The London and Home Counties Joint Electricity Authority will not sanction the proposal of the Urban District Council to install a further 3,000-kW turbo-generator, and the Electricity Committee has recommended putting forward a case for plant extensions rather than taking a bulk supply as suggested by the Authority.

Bexhill.—Cable Extensions.—The Electricity Committee has prepared a scheme for additional feeder and distributor cables, &c., at a cost of £5,300.

Burnley.—Electrical Progress.—During December the Corporation Electricity Department connected 55 new consumers, and there were 97 applicants waiting for service. There were 36 houses wired, and 100 cookers were connected up. The value of the appliances sold and installed on hire-purchase during 1926 was £5,519.

Canada.—Saskatchewan.—The Saskatchewan Government has appointed a Commission to inquire into the economic practicability of generating electricity at central power plants and water power sites for distribution throughout the province. The Commission was created by Order-in-Council under the Public Enquiries Act. A similar but abortive inquiry was made in 1912.—*Reuter's Trade Service* (Regina).

Cheltenham.—Loan.—The Corporation Electricity Committee is to apply for sanction to a loan of £10,000 for mains and services.

Colchester.—New Power Station.—At a meeting of the Town Council on February 2nd it was reported that good progress was being made with the construction of the new power station, and it was hoped that it would be in operation by July or August next.

Continental.—Switzerland.—The municipal authorities of Zurich have applied to the Aargau Cantonal authorities for a concession to utilise the water power of the Limmat river near Weltingen. The scheme provides for the construction of a dam sufficient for minimum and maximum outputs of 14,000 and 25,000 kW, respectively. The local authorities of Scanfs, in the Engadine, have also applied for a concession to establish a hydro-electric plant near Taralp at a point where it is estimated a minimum of 300,000 h.p. is available. A scheme is also reported to be under consideration for the establishment of a hydro-electric power station on the Lower Aare river, near Klingnau, the electricity from which would be "exported" to Wurtemberg.

Crediton.—Electricity Scheme.—Following a visit paid by a deputation to the Electricity Commissioners with a view to expediting the proposed electricity scheme, it was reported at a recent meeting of the Urban District Council that consent had been obtained for it to proceed with the work of linking up with Exeter for the purpose of an electricity supply. The Council has instructed the engineer to invite tenders for the work.

Hamilton.—New Sub-Station.—Permission was recently granted at the Dean of Guild Court for the erection of a sub-station for the Town Council.

Hawarden.—Electricity Extensions.—The engineer to the Rural District Council (Mr. A. J. Richardson) writes to emphasise, in connection with the note in our issue of January

28th under the above heading, that his Council has merely postponed, not abandoned, the idea of supplying electricity to Cymmau, Ffrith, and Tryddyn.

Hemsworth.—WIRING OF SMALL HOUSES.—The Rural District Council has accepted the tender of the Electrical Distribution of Yorkshire, Ltd., for wiring houses at South Kirkby and supplying electricity on the current limiter system at 1s. 5d. per week during the winter months, and 1s. 2d. per week during the summer months.

Hull.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to a loan of £187,000 for mains and services.

Liverpool.—ACQUISITION OF UNDERTAKING.—At the last meeting of the Electricity Committee the Town Clerk reported the completion of the agreement for the acquisition of the undertaking of the Hightown Electricity Co. The town clerk, city treasurer, and city electrical engineer were authorised to take the necessary steps for carrying on the undertaking pending the actual transfer thereof to the Corporation. The Electrical Engineer has been authorised to execute such works as may be necessary to enable the Corporation to supply the company's district pending the transfer, at a cost of not exceeding £2,000.

SUB-STATION EQUIPMENT.—Authority has been given for the installation of equipment at the following sub-stations: Hampton Street, Stoneycroft, Walton Hall Avenue, and Norris Green housing estate. An underground sub-station is to be constructed at Princes Park Gates, and h.p. and l.p. mains laid to supply the surrounding district.

London.—SOUTHWARK.—An inquiry was opened at the Town Hall on February 2nd, and continued on the 3rd and 4th, by Col. T. C. Ekin into the application of the Borough Council for sanction to extend its power station. The application was opposed by the London Power Co. and the County of London Electric Supply Co., Ltd., as ratepayers. For the Borough Council it was stated that the electricity undertaking had always been a profitable one since its inception, with the exception of one year. There were three electricity undertakings in the borough, and one had offered a bulk supply at an annual charge of £15,000. The cost of the proposed extension would be approximately £37,500, whereas the capital expenditure which would be incurred by the Council if a bulk supply was substituted would be £40,000. The present capacity of the plant was 4,800 kW, and the maximum demand during 1926 was 3,200 kW. The inquiry is to be resumed to-day (Friday).

Maldens and Coombe.—ELECTRICITY SUPPLY.—The Urban District Council has entered into an agreement with the Wimbledon Borough Council for lighting the whole of the district by electricity.

Manchester.—PROGRESS DURING DECEMBER.—During the month of December the Corporation electricity undertaking showed an increase in connections of 3,160 kW, bringing the total to 300,049 kW; and the number of applications received for supply, including consumers for additional supplies, was 1,010, representing a total of 2,413 kW. The number of hired cookers connected increased by 192, bringing the total actually on circuit to 2,691. Applications for the hire of cookers totalled 93. The maximum supply demanded reached 140,960 kW; this constitutes a record for the undertaking. Two new sub-stations were put into commission during the month.

Montgomery.—ELECTRICITY SUPPLY.—The Town Council recently further considered the question of an electricity supply for the district. The North Wales Power Co. had intimated that some delay would occur before a supply for the district could be given from its system. A letter was also received from Mr. L. S. Davey, Corlan, Montgomery, who stated that he was in a position to put a scheme before the Council and, if that was accepted, there should be no difficulty in providing a supply before the summer. He asked whether the Council would consider the following:—The scrapping of the present gas plant, and giving the free use of the site for the power plant; guaranteeing a definite sum per annum for street lighting; authorising the adoption of overhead wiring. The Council decided to rescind the previous resolutions expressing agreement with the North Wales Power Company's scheme, and to apply to the Electricity Commissioners to be removed from the scheme. Pending a reply, consideration of Mr. Davey's letter was deferred.

Persia.—HYDRO-ELECTRIC SCHEME.—It is reported that the Persian Ministry of Public Works is preparing a Bill relating to a concession for the construction of a dam in connection with the utilisation for electrical purposes of the Abschar Falls, near Parkale (Schimvan).

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

LEAMINGTON.—*The Leamington and Warwick Electrical Co., Ltd.*—Lighting: From 7½d. to 7d. per kWh.

LUDDENDEN FOOT.—*The Electrical Distribution of Yorkshire, Ltd.*—A reduction of ½d. per kWh.

NORTHAMPTON.—*The Northampton Electric Light and Power Co., Ltd.*—The 10 per cent. surcharge made owing to the coal dispute has been removed.

HAWORTH.—Lighting: From 7d. to 6d. per kWh. Power: From 4d. to 3d. per kWh.

HASLINGDEN.—A reduction of ½d. per kWh to domestic consumers.

Retford.—PROGRESS OF ELECTRICITY SCHEME.—The Town Council's consulting engineers, Messrs. A. Hugh Seabrook and Partners, report that the electricity undertaking should be ready to commence supply by about the end of this month.

Rochdale.—STREET LIGHTING.—The Fire Brigade and Lighting Committee has approved in principle a scheme for lighting the main streets of the town by electricity.

Scarborough.—ELECTRICITY EXTENSIONS.—The Corporation electricity works are to be extended at an estimated cost of £47,500. It is proposed to erect a new generating station at Irton within the next five years.

Sheffield-Rotherham.—INTERLINKING SCHEME.—A scheme has been prepared for interlinking the Corporations' power stations at an estimated cost of £41,500. The scheme is subject to the approval of the Electricity Commissioners.

Stoke-on-Trent.—SUPPLY TO PUMPING STATION.—The Corporation Electricity Committee has had further correspondence with the L.M.S. Railway Co. regarding a supply of electricity to the pumping station at Whitmore. The electrical engineer reports that the cost of an e.h.p. line would be £16,640, and he has been instructed to interview the electrical engineer of the company on the matter.

EXTENSION OF SUPPLY.—The electrical engineer is to prepare a report on proposals to provide an electricity supply to Milton and Norton-in-the-Moors.

LOAN SANCTIONED.—Sanction has been received to a loan of £20,000 for mains in connection with the supply of electricity to the new works of the Michelin Tyre Co.

Tain.—ELECTRICITY SUPPLY.—The Town Council has instructed its consulting engineers, Messrs. A. Hugh Seabrook, to take the necessary steps in conjunction with the Parliamentary Agents to obtain a Special Order authorising the Council to supply electricity within the borough.

Torquay.—ELECTRICITY EXTENSIONS.—The Corporation has received sanction to extensions to its generating station at Newton Abbot and the provision of further plant. New boiler plant is to be installed, and the engineer has been instructed to submit a comprehensive scheme for bringing up-to-date the whole system of distribution in the Torquay district. The supply of electricity in bulk to Teignmouth is now in operation. The electricity generated during December showed an increase over the corresponding month of the previous year of 538,006 kWh.

Walthamstow.—LOAN.—The Urban District Council has applied for sanction to a loan of £9,950 for the installation of electric cookers on the housing estates.

Wetherby (Yorks.).—INAUGURATION OF SUPPLY.—An electricity supply for the district was inaugurated on February 1st. Electricity is supplied by the Yorkshire Electric Power Co.

Wigton (Cumberland).—ELECTRICITY SCHEME.—At a meeting of the Rural District Council on February 1st a communication was received from the Allerdale Coal Co. stating that it proposed to apply for powers to provide a supply of electricity for West Cumberland. The area to be covered would extend from Workington in the south-west to Maryport and Allonby in the north-west, and from Cockermouth in the south-east to Aspatria and West Newton in the north-east, the power station to be erected at Great Clifton. The Council is to await further details before giving its support to the scheme.

Wimbledon.—NEW PLANT.—The Electricity Committee is to apply for consent to the extension of plant by the addition of a 6,000-kW turbo-alternator, a new boiler, auxiliary plant and switchgear, at an estimated cost of £75,000.

Worthing.—LOAN.—The Electricity and Waterworks Committee has recommended to the Town Council that application be made for sanction to a loan of £51,640 for electricity extensions, including the installation of a 1,500-kW set at an estimated cost of £27,000.

Tramway and Railway Notes.

Argentina.—TRAMWAY AGREEMENT.—A new agreement has been entered into between the Société des Tramways de Rosario and the municipal authorities of that city, under which the period of the concession has been extended until the end of 1970. The Tramways Co. has undertaken to construct about 34 miles of new lines within the next two years.

Australia.—LAUNCESTON (TASMANIA).—The accounts of the city tramway undertaking (superintendent: Mr. R. J. Strike) for the year ended June 30th, 1926, record a total revenue of £47,974, as compared with £50,531 in the preceding year. Operating expenses amounted to £38,810, as against £35,460, leaving a gross profit of £9,164 (£15,071). Interest and sink-

ing-fund charges absorbed £9,213, and there was a net loss of £49, as compared with a surplus of £5,650 in 1924-25. The number of car-miles run increased from 463,718 to 492,395, but the number of passengers carried decreased from 4,573,275 to 4,486,587.

Bradford.—RAILLESS CARS.—The *Yorkshire Post* states that a proposal for the substitution of railless cars for tramcars has been made by the Tramways Committee and will be submitted to the Corporation in due course. Two years ago the Committee approved a proposal for the relaying of the tramway track from Four Lane Ends to Allerton at an estimated cost of £31,350, but on January 31st it approved a reduced estimate of £29,560 for the substitution of a railless-car system on the Allerton route.

Continental.—AUSTRIA.—Work is proceeding with the electrification of the Saalfelden-Worgl, Kufstein-Worgl, and Innsbruck-Brenner sections of the Austrian State Railways, and it is expected that electrical operation will commence by the end of the present year.

SWITZERLAND.—From Berne it is reported that work is shortly to be commenced on the electrification of the Berne-Neuenberg section of the Swiss Federal Railways.

Halifax.—TRACK RENEWAL.—The Finance Committee has approved a recommendation of the Tramways Committee to reconstruct the tramway track between King Cross and Cote Hill, at an estimated cost of £3,600.

London.—NEW "DISTRICT" LINE.—The *Financial News* states that at a meeting of the Seven Kings Ratepayers' Association on January 31st, the Mayor of Ilford stated that there was a possibility of the District Railway being extended from Barking to the Becontree estate. He said the L.C.C. had offered the necessary land free, and the District Railway Co. was in agreement with the scheme, but the sanction of the London Midland and Scottish Railway Co. had to be obtained before the extension could be made. The L.M.S. had been communicated with, but had not replied. The L.C.C. and the Ilford Council were of opinion that if the company did not give its consent the Government should take action.

FASTER TRAMCARS.—*The Times* reports that the Metropolitan Electric Tramways, Ltd., is introducing new tramcars fitted with higher-powered motors capable of a speed of 30 miles per hour. It is also proposed to eliminate a number of the existing stopping places. The new tramcars are being tried on the route from Paddington to Finchley, and it is intended to place similarly-equipped tramcars on the other routes of the system within the next few months.

Oldham.—ABANDONMENT OF ROUTE.—The Town Council has decided not to reconstruct the tramway track from the centre of the town to Lees, a distance of two miles. The tramway service on this route will be replaced by motor-omnibuses.

Walsall.—ABANDONMENT OF ROUTE.—The Town Council has decided to abandon the Walsall Wood tramway and to substitute an extended motor-'bus service. Application is to be made for sanction to the borrowing of £16,000 for the purchase of new motor-omnibuses.

Telegraph and Telephone Notes.

Bolivia.—NEW RADIO STATION.—A wireless station is to be erected at Lake Gaiba, in Eastern Bolivia, and the purchase completed of apparatus temporarily installed on the s.s. *Saavedra*. The Marconi Company, which holds a 25-year monopolistic contract for telegraph services in Bolivia, has undertaken to provide special apparatus for short-wave transmission.—*Reuter's Trade Service* (La Paz).

Poland.—NEW RADIO SERVICES.—Direct wireless communication has been opened between Poland and Syria, the Lebanon, Transjordania, Palestine, Egypt, Eritrea, and Abyssinia, and *vice versa*. Regular exchanges have been arranged between the central wireless station at Warsaw and the Orient Radio Co.'s station at Beyrouth.—*Reuter* (Warsaw).

India.—LONG-DISTANCE TELEPHONY.—The new telephone trunk line between Calcutta and Delhi is now ready for the use of the public. This, in conjunction with the trunk lines between Delhi and Bombay and between Delhi and Lahore, will enable Calcutta to be in direct telephone communication with Bombay and Lahore. The distance between Calcutta and Bombay *via* Delhi is well over 1,800 miles.

Irish Free State.—TELEPHONE CAPITAL BILL.—In Dail Eireann on January 26th Mr. Ernest Blythe, Minister for Finance, was given permission to introduce the Telephone Capital Bill, which is to grant further money for the development of the telephone system in the Free State. The Bill, in addition to moneys authorised by the Telephone Capital Act of 1924; will enable the Minister for Finance to issue out of the Central Fund such sums, not exceeding £500,000, as may be required by the Minister for Posts and Telegraphs for the development of the telephone system. He may borrow by means of terminable annuities extending over a period not exceeding 20 years.

Jersey.—TELEPHONE SERVICE.—The rent of a telephone in Jersey is only twopence a day, or roughly £3 a year, and calls cost a penny each. There are now 2,847 telephones on the island, or one to every 14 inhabitants, as compared with one to 29 in Great Britain. The Jersey telephone system has almost doubled since 1923, when the States purchased it from the Post Office; there were then only 1,600 telephones on the island.

The Telegraph Service.—PRESS TRAFFIC LOSS.—In the first and second reports of the Select Committee of Public Accounts, just issued by the Stationery Office, it is stated that the telegraph service has rarely if ever paid, and on the basis of the Post Office commercial accounts the losses in the last three years have been:—

1923	...	...	...	£1,697,000
1924	...	...	...	£1,271,000
1925	...	...	...	£1,645,000

The loss is attributed in part to the growing competition of the telephone service, especially for short-distance traffic, but an appreciable portion is undoubtedly due to the annual loss on Press telegraphy, which was estimated in June, 1907, apart from interest on capital, at about £250,000. On the same basis the loss for 1922-23 was estimated at about £360,000. Since then it has fallen, partly because the Press has adopted the policy of leasing telegraph lines, and is now put at about £230,000 a year. The Committee is "of the opinion that this position should not be allowed to continue."

Radio Notes.

Bulgaria.—PROPOSED NEW STATION.—A 5-kW transmitter to replace the present one at Sofia is contemplated; it will cost £30,000 and not be ready before the end of the year. Public subscriptions are to be invited at once by the Government.

China.—NEW STATIONS.—The contract for a 2-kW station, with a wave-length of 250 to 550 metres, for installation at Mukden, was awarded to a French firm. An American firm received the contract for the installation of a 1-kW station with a similar wave-length in Harbin. These two broadcasting stations should be in operation early in 1927, and a new market for receiving sets will be opened, says *Commerce Reports*, as the installation of receiving sets was previously prohibited, except for military purposes, in Manchuria outside of the South Manchuria railway zone. Receiving sets will be taxed and licensed according to type and size; the licence fee for crystal sets to be approximately $3 a year, valve sets $6 a year, and a tax of 10 per cent. *ad valorem*, in addition to the regular Customs duties, will be imposed on imported sets. Dealers in radio receiving sets will be licensed; a deposit of approximately $5 will be required of all dealers prior to the issue of the licence.

High-power Stations.—EUROPEAN CONFERENCE.—A conference of European wireless engineers will shortly be held under the auspices of the International Radio Union to examine the position of high-power European stations working on long wave-lengths. Russian delegates are expected to attend.—*Reuter* (Brussels).

New Zealand.—NEW STATIONS.—The installation of powerful broadcasting stations at Auckland and Christchurch has been completed by the Radio Broadcasting Co. of New Zéaland, Ltd., a subsidised company organised to operate a chain of broadcasting stations throughout New Zealand on a uniform basis, says *Commerce Reports*. The Auckland station is already in service, and the stations at Christchurch, Wellington, and Dunedin soon will be installed. It is estimated that about 8,000 licences were issued in 1926. Practically all of the equipment used in this area is American.

United States.—BROADCASTING REVENUE.—Figures considered to be average in relation to the operation of broadcasting stations in the United States indicate that those who believe that to own a commercial radio station is to possess a "gold mine" may be disillusioned. "Time on the air" is sold for from $25 to $400 an hour, says *World Radio*, and the average is considered to be about $200 per hour. Few stations broadcast more than eight hours a day, and most of them no more than six. If six hours could be sold every day of the year at, say, the average rate of $200 per hour, which is unlikely, the revenue would be $438,000 annually. Most advertisers desire the time between the hours of 8 and 10 at night, and a station that averages one hour per day for 365 days considers it is doing well, which means an average income of $73,000 per year.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Sydney.—April 6th. New South Wales State Railways. One 7,500-kW turbo-alternator. (B.X. 3179.)*

February 16th. One 100-kVA, 3-phase oil-insulated indoor-type transformer. (B.X. 3200.)*

February 21st. Municipal Council. 660-V cable. (B.X. 3200.)*

Melbourne.—February 21st. State Electricity Commission of Victoria. V.i.r. insulated control cable. (B.X. 3214.)*

April 5th. Postmaster-General's Department. Condensers. (B.X. 3215.)*

March 30th. Victorian Railways. Lightning arrestors. (B.X. 3213.)*

Brisbane.—April 13th. Brisbane City Electric Light Co., Ltd. Transformers. (B.X. 3218.)*

Bedford. — February 28th. Electricity Department. Twelve months' supplies of e.h.p. and l.p. cables and incandescent electric lamps. (See this issue.)

Belfast.—February 18th. Electricity Department. Twelve months' supply of materials, including electrical accessories, lamps, carbon brushes, cables, &c. (January 28th.)

Belgium.—February 27th. Permanent Deputation of the Province of Limburg, Hasselt. Ten static transformers, &c. Service Provinciale d'Electricité, 27, Avenue Bamps, Hasselt (6 fr.).

Bexley.—Electricity and Tramways Department. One 1,400-kVA bank of Scott-connected transformers. Two 140-kVA single-phase induction regulators, e.h.p. and h.p. switchgear and cable connections. (February 4th.)

Bristol.—February 18th. Electricity Committee. Coal- and ash-handling plant, and railway sidings; circulating-water screening plant. (January 28th.)

Canterbury.—February 21st. Electricity Department. L.p. lead-covered and armoured feeder cables. (February 4th.)

Cardiff. — February 23rd. Electricity Department. Twelve months' supply paper-insulated cables. (February 4th.)

Croydon.—March 3rd. Electricity Department. 12,000 tons of coal suitable for use on chain-grate mechanical stokers. (February 4th.)

Dundee.—February 21st. Electricity Department. Two water-tube boilers with superheaters, economisers, mechanical stokers, and coal-handling plant. (January 28th.)

February 28th. Education Committee. Electrical installation for the new secondary school, Perth Road. Messrs. Thoms and Wilkie, architects, 21, South Tay Street, Dundee.

Eastbourne.—February 21st. Electricity Department. E.h.p. cable, static transformers, and e.h.p. switchgear. (January 28th.)

The Electricity Committee is inviting quotations for coal-handling plant, which is estimated to cost £1,150.

Eccles.—February 12th. Electricity Department. Two 500-kVA, 3-phase oil-cooled transformers. Borough Electrical Engineer, Cawdor Street, Patricroft.

Egypt.—Cairo.—March 3rd. Ministry of Public Works. Two internal-combustion engines and accessories for the Egyptian Army Flour Mills, Tura, near Cairo. (A.X. 4187.)*

Hamilton.—February 14th. District Committee of the Middle Ward of Lanark. Electric lighting installation for Longriggend Sanatorium. Mr. P. C. Smith, architect, District Offices, Hamilton.

Harrogate.—February 28th. Electric lighting installation for St. Mark's Church, Leeds Road. Particulars from the Verger.

Huddersfield.—February 19th. Town Council. Electrician's work at maternity home, Greenhead Road. Borough Architect, 26, Ramsden Street.

Hull.—February 14th. Tramways Committee. Stores for 12 months, including car-lighting fittings, lamps, cable and switches, &c. General manager.

India.—February 18th. India Store Department. 100 miles insulated copper wire. March 1st. 300,000 insulators. (See this issue.)

Leeds.—February 18th. Electricity Department. Twelve months' supply of stores, including cables, boxes and fittings, jointing and insulating materials, &c. (January 28th.)

London.—Shoreditch.—February 23rd. Electricity Department. One 1,500-kW automatic sub-station converting equipment and one 20-ton electrically-operated overhead travelling crane. (January 28th.)

London County Council.—February 14th. Electrical installations at the undermentioned schools:—Barrett Street Trade School Extension, Oxford Street, W., lighting, power, telephones, bells, &c.; County Secondary School, Eltham, S.E., lighting, power, telephones and bells; Crondall Street Elementary School, Shoreditch, lighting; Drayton Park Elementary School, Islington, lighting. (February 4th.)

H.M. Office of Works.—February 17th. Electrical accessories. (February 4th.)

Metropolitan Asylums Board.—February 23rd. Carrying out the installation of electric lighting at Millfield, Rustington, near Littlehampton, Sussex. (February 4th.)

Long Eaton.—February 24th. Electricity Department. One 500-kW convertor set and one switchboard platform. (February 4th.)

Morley (Yorks.).—Electrical wiring and services for 48 Corporation houses on the Bradford and Wakefield Road site. Mr. F. Turner, borough engineer and surveyor.

New Zealand.—Wellington.—March 4th. Poverty Bay Electric Power Board. Switchgear and transformers. (B.X. 3160.)*

April 26th. Public Works Department. Secondary battery for the Lake Coleridge scheme. (B.X. 3202.)*

February 12th. Department of External Affairs. Apia hydro-electric power scheme, Samoa. Transformers, lightning arresters, cable, &c. (B.X. 3200.)*

Newark-upon-Trent.—February 22nd. Electricity Department. Gasfilled electric lamps for street lighting for 12 months. (See this issue.)

Oldham.—February 14th. Town Council. Electrical installation for 302 houses, Greenacres and Boarshaw. Borough Engineer and Surveyor, Town Hall.

Peterborough.—February 28th. Electricity Department. One 12,000-kW turbo-generator, with foundations, condensers, air and extraction pumps, air cooler, oil cooler and pipework, e.h.p. switchgear, coal-handling plant, &c. (January 28)

Portsmouth.—Electricity Department. Coal-handling plant. (January 28th.)

South Africa.—Johannesburg.—March 19th. Municipal Council. Transformers. (B.X. 3219.)*

March 3rd. South African Railways and Harbours. Overhead line material. (B.X. 3224.)*

Spalding.—February 26th. Urban District Council. 28 sets of centrifugal pumps (for sewage pumping), including electric motors, automatic starters, floats, valves, pipes, &c. Mr. C. F. Murphy, Lloyd's Bank Chambers, Morpeth.

Tilbury.—February 12th. Urban District Council. H.p. underground cables, l.p. distribution mains, house services, transformers, h.p. and l.p. switchgear and conversion of public street lamps. (January 28th.)

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*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Barking Town.—Special Urban District Council Committee. Recommended:—
Electrical apparatus for heating water and raising steam at baths (£2,647).—Bastian Meter Co., Ltd.
Filtration plant (£1,545).—Paterson Engineering Co., Ltd.

Electricity Committee.
Switchgear for River Road sub-station:—

Metropolitan-Vickers Electrical Co., Ltd. (Recommended.)	**£369**
New Switchgear Construction Co., Ltd. ...	376
English Electric Co., Ltd.	383
Ferguson, Pailin, Ltd.	418
Johnson & Phillips, Ltd.	429
Edison Swan Electric Co., Ltd.	441
General Electric Co., Ltd.	456
Crompton & Co., Ltd.	496
Bertram Thomas	507
British Thomson-Houston Co., Ltd.	616

Birkenhead.—Electricity Committee. Accepted:—
Transformer kiosk at Upton (£187).—Yorkshire Switchgear & Engineering Co., Ltd.

Doncaster.—Electricity Committee.
L.p. cables (£1,597).—Enfield Cable Works, Ltd.
Overhead travelling crane (£889).—Herbert Morris, Ltd.

Dumfries.—Electricity Committee. Recommended:—
Switchgear for Maxwelltown sub-station (£697).—Metropolitan-Vickers Electrical Co., Ltd.

Dundee.—Town Council. Accepted:—
Electric lighting installation at the new library at Broughty Ferry (£126).—Marshall, Hutton & Co.

Eastbourne.—Electricity Committee. Accepted:—
Turbo-generator (£13,954).—W. H. Allen, Sons & Co., Ltd.
Foundations (£665).—Peter Lind & Co.
Boiler (£15,726).—Vickers Boiler Co., Ltd.
Cooling tower (£1,897).—Premier Cooling & Engineering Co.
Cable (year's contract).—Craigpark Electric Cable Co., Ltd.

Glasgow.—Health Committee. Accepted:—
Electric cooking plant at Bellefield Sanatorium (£275).—Corporation Electricity Department.

Tramways Committee. Recommended:—
Supply of a coil winder.—Midland Dynamo and Motor Repairs Co., Ltd.

Heckmondwike.—Urban Council. Accepted:—
Installing electric lighting at houses on the Heaton House estate.—Butler & Horn.

Liverpool.—Electricity Committee. Recommended:—
One h.p. switch cubicle for the control of the new 25,000-kW alternator, with l.p. panels, main cables and small control wiring (£7,531).—Metropolitan-Vickers Electrical Co., Ltd.

London.—LONDON COUNTY COUNCIL.—Education Committee. Wiring and fittings for electric lighting at Frankham Street school, Deptford:—

Alpha Manufacturing & Electrical Co., Ltd. (Recommended.)	**£400**
Anderson, Angell & Co.	419
A. Higginbotham & Sons	449
A. Meckhonik	466
A. Hawkins & Sons	469
Burdette & Co., Ltd.	540
Marylebone Electrical Stores	622
Douglas Electric Lighting & Power Co. ...	670

(The chief engineer's comparable estimate is £420.)

Wiring and fittings for electric lighting at Lomond Grove school, Camberwell:—

Anderson, Angell & Co., Ltd. (Accepted.)	**£327**
A. Dean & Co., Ltd.	324
Commercial Telephone Co., Ltd.	343
Commercial Lighting, Heating & Power Co.	359
Alpha Manufacturing & Electrical Co., Ltd. ...	373
G. E. Taylor & Co.	398
Smethurst & Co. (London), Ltd.	398
Bailey & Incledon, Ltd.	417
A. Higginbotham & Sons	430
Burdette & Co., Ltd.	440
A. Hawkins & Sons	449
F. W. Whymant	460
Marylebone Electrical Stores	533

(The chief engineer's comparable estimate is £350.)

ABERDEEN LINE (G. Thompson & Co., Ltd.).
Electric lamps.—Edison Swan Electric Co., Ltd.; British Thomson-Houston Co., Ltd.; Siemens and English Electric Lamp Co., Ltd.

ADMIRALTY.
Torch batteries.—Edison Swan Electric Co., Ltd.

New Zealand.—The Auckland Electric Power Board has placed a contract with the British General Electric Co., Ltd., for the supply of over half a million yards of triple-braided cable.

Plymouth.—Tramways Committee. Accepted:—
Turbine vacuum cleaner (£175).—Sturtevant Engineering Co., Ltd.
16 sets brake equipment (£2,212); magnet brake equipment for 15 cars (£1,185).—Westinghouse Brake and Saxby Signal Co., Ltd.

Electricity Committee. Accepted:—
Conduit.—Doulton & Co., Ltd.
Two l.p. transformer switches.—Switchgear & Cowans, Ltd.

Stoke-on-Trent.—Hospitals Committee. Recommended: Installation of fire-alarm system at infectious diseases hospital (£209).—Associated Fire Alarms, Ltd.

Torquay.—Electricity Committee. Accepted:—
16,500 yd. cable for the Newton Abbot and Paignton ring main (£13,530).—Hackbridge Cable Co., Ltd.

Windermere.—Urban Council. Accepted:—
Wiring houses for electric lighting (£216).—Thornborough & Co.
Supplying and laying cables (£300).—Windermere and District Electricity Supply Co., Ltd.

Forthcoming Events.

Electrical Engineers' Ball.—Friday, February 11th. At the Hotel Cecil.

Electrical Trades Commercial Travellers' Association.—Friday, February 11th. Holborn Restaurant. 7.30 p.m. Annual dinner.

Electromobile Association.—Friday, February 11th. Royal Society of Arts. 7 p.m. "The Use of Storage Battery Type Electromobiles." Mr. J. C. Elvy.

Junior Institution of Engineers.—Friday, February 11th. London. 7.30 p.m. "The Physiology of Work Under High Air Temperature Conditions." Prof. K. N. Moss.
Friday, February 18th. 39, Victoria Street, S.W. 7.30 p.m. "Modern Concrete Construction." Mr. L. Turner.

Physical Society.—Friday, February 11th. Imperial College of Science, London. 5 p.m. Annual general meeting, and ordinary meeting to follow.

Royal Society of Arts.—Monday, February 14th. London. 8 p.m. Cantor lecture, "Photo Elastic Measurements of Stress Distribution." Prof. E. G. Coker, F.R.S.
Wednesday, February 16th. 8 p.m. "Some Studies in Connection with the Manufacture of Electric Lamps and Thermionic Valves." Mr. C. C. Paterson.

Electrical Association for Women.—Tuesday, February 15th. King's College for Women, Campden Hill, W. 5.15 p.m. "How the American Housewife Solves Her Household Difficulties." Mrs. C. Frederick.

National Association of Supervising Electricians.—Tuesday, February 15th. Chalmers House. 7.15 p.m. Annual general meeting.

South Wales Institute of Engineers.—Tuesday, February 15th. Royal Metal Exchange, Swansea. 6 p.m. "The Romance of Copper." Mr. Ll. B. Atkinson.

Batti-Wallahs' Society. — Wednesday, February 16th. Hotel Cecil. Luncheon. Sir Duncan Watson on "The Prospects of the Electrical Industry."

Institution of Electrical Engineers.—Thursday, February 17th. London. 6 p.m. "Stability of Large Power Systems." Mr. F. H. Clough.

(Western Centre). — Wednesday, February 16th. Museum and Arts Gallery, Bristol. 7 p.m. Faraday Lecture, "What is Electricity?" Prof. W. M. Thornton.
Monday, February 14th. South Wales Institute of Engineers, Cardiff. 7 p.m. "Power Stations and Their Equipment." Mr. W. M. Selvey.

(North-Eastern Centre).—Monday, February 14th. Sopwith's Café, Newcastle-on-Tyne. 7 p.m. Discussion. "The Problem of Rural Supplies."

(North-Western Students' Section).—Tuesday, February 15th. 7.30 p.m. At Queen's Hotel, Manchester. Smoking concert.

(Mersey and North Wales (Liverpool) Centre).—Wednesday, February 16th. At The Temple, Dale Street, Liverpool. Joint meeting with the Liverpool Engineering Society.

(South-Midland Centre). — Wednesday, February 16th. University, Birmingham. 7 p.m. "33,000-V Cables with Metal-sheathed Cores, with Special Reference to the S.L. Types." Mr. P. Dunsheath.

(Sheffield Sub-Centre).—Wednesday, February 16th. Mappin Hall, Sheffield. "Application of X-rays to the Examination of Metals." Dr. E. V. Pullin.

(Irish Centre, Dublin).—Thursday, February 17th. Trinity College, Dublin. 7.45 p.m. "History of Telephone Transmission." Mr. J. D. Ferguson.

Meter Engineers' Technical Association.—Thursday, February 17th. Lighting Service Bureau. 7 p.m. "Meter Testing Methods and their Relationship to Output and Accuracy." Mr. C. W. Pike.

Royal Institution.—Thursday, February 17th. 5.15 p.m. "Acoustical Problems—Bells." Sir Wm. Bragg.

Edinburgh Electrical Society.—Thursday, February 17th. Royal Scottish Society of Art. 8 p.m. "Electric Light as Applied to the Home." Mr. H. E. Hughes.

British Electrical Development Association.—Friday, February 18th. Royal Society of Arts. 7.30 p.m. "Assisted Wiring Schemes." Mr. W. F. T. Pinkney.

Notes.

Fire Alarms at Lytham.

A new fire alarm system is contemplated at Lytham St. Annes, and the Ministry of Health is being asked to sanction a loan of £1,200 for the purpose. Messrs. Carter & Co. (Nelson) are the inventors of the system, which consists of a series of boxes containing loud-speaking telephones. When the alarm is given and the glass is broken, a door automatically flies open, and reveals the telephone whereby direct information can be given.

Lectures.

On Wednesday last Mr. R. P. Howgrave-Graham, M.I.E.E., was to give a lecture demonstration of high-frequency oscillating currents, at pressures up to half-a-million volts, in aid of the Penge and Anerley Philanthropic Society, at the Town Hall, Anerley.

The Principal of East London College (University of London) informs us that owing to illness Mr. J. H. Morrell will be unable to deliver the proposed course of six lectures on "Short Electric Waves" during the present term. It is hoped that he will be able to do so next term.

A Large Electrically-Controlled Bridge.

What is described as the largest bascule lift bridge of its type provided with an elaborate electrical protective system to ensure safe operation, the Roosevelt Avenue Bridge, will soon be completed across the Flushing River to Flushing, Long Island, New York. This new structure will have a double deck and will carry the Manhattan subway trains across the river. Two movable leaves turn upon huge trunnions and open like the blades of a knife to permit the passage of ships, each leaf being 152 ft. long. So delicately is this great weight counterbalanced, however, that four 80-h.p. electric motors can open or close the bridge in 45 seconds against a pressure equal to a 25-m.p.h. wind. The motive power is provided by Westinghouse motors of 328 total h.p. Special attention has been given to ensuring complete safety in the operation of the bridge. When a ship wishes to pass beneath, it signals the bridge operator, who signals to the towerman controlling the operation of the trains that he wishes to open the bridge. The towerman then sets the signals against the trains, and this operation automatically energises the bridge's motive power circuits, permitting the bridge operator to start up the motors, which perform a series of functions necessary for the opening of the bridge. The system is so arranged that each step in the process of opening or closing the bridge must be taken in exactly the right order, and no step can be taken until the previous one has been properly completed. A signal light on the operator's desk at the controllers indicates the proper performance of each step. Should anything jam or should power fail, everything becomes locked in position, so that no part of the mechanism can "run wild." The total cost of the bridge and its approaches is $2,700,000.

Educational.

East London College, Electrical Engineering Department.—A course of five lectures on "High-Voltage Insulation, Particularly the Application of Micanite and Varnish-paper Materials," by Mr. A. Collins, will be delivered on Mondays commencing February 21st, at 6 p.m. (See our advertisement pages to-day.)

Electrically-driven Artificial Silk-Spinning Machines.

Constant effort is being made to improve the method of application of the electric drive to artificial silk-spinning machines, and in view of the increasing use of this class of plant in all parts of the world, the following notes with regard to a machine introduced by Messrs. Ramesohl & Schmidt, of Westphalia, are of interest. The Westphalia electrically-driven centrifugal spinning machine, as it is called, has flexible bearings to compensate for uneven loading of the coiler can when running at high speeds. The rotor of the motor is carried on a tubular shaft running in ball bearings. The spindle carrying the coiler can is supported within this shaft, and also by an additional spring-loaded ball race. This flexible bearing serves to damp out any vibration set up by the coiler can; thus the rotor and practically all the rotating mass runs smoothly. The spindle of the rotor being vertical, the least possible load is put on the bearings, thus reducing the friction to a minimum.

The lubrication is carried out in a novel manner. The bottom part of the casing forms an oil container, and an extension of the hollow spindle of the rotor projects into the oil. On account of the high speed of rotation, the oil rises up this spindle till it reaches the flexible bearing, which is thus well lubricated, as are also the springs which carry it, and the rotor bearing immediately below. The surplus oil is collected by means of a disk placed immediately under the upper bearing of the rotor, and is conducted past an inspection window back to the sump *via* the bottom conical bearing of the rotor. The proper functioning of the lubrication system can therefore be observed from the outside at any time. The solidly-constructed bearings of the machine enable the clearance between the stator and the rotor to be reduced to a minimum; therefore the efficiency is extremely high, while the speed remains constant and the slip is very small.

Starting the machine is effected either by means of an ordinary switch or by a special form of starting switch, which also enables a quick stop to be obtained by reversing two phases of the circuit. The machine is driven by a.c., and the speed depends upon the frequency; as this is usually insufficient in the ordinary way, a secondary circuit with higher frequency is provided in order to obtain the speed desired. This higher frequency is obtained by means of a frequency changer. A slip-ring rotor is driven by a motor, and has the available a.c. supply current fed into the stator, so that the rotor is driven against the field thus set up, and from the slip-rings of the rotor the secondary current of higher frequency is taken to drive the spinning machine; or the primary current may be fed into the rotor through the slip-rings, the secondary current being taken from the stator.

A High-pressure Steam Turbine in Operation.

The Milwaukee Electric Railway and Light Company has started operation of a 7,000-kW steam turbo-generator which uses steam at a pressure of 1,200 lb. The 3,000-kilowatt turbo-generator in the Edgar station of the Edison Electric Illuminating Company, of Boston, Mass., U.S.A., also operates at 1,200 lb. pressure. Both are of General Electric design and manufacture. The Milwaukee turbine receives steam at a pressure of 1,200 lb., superheated to 720 deg. F. It exhausts at 320 lb., the steam being conducted at this pressure to the station mains serving several 30,000-kW machines where more of its energy is extracted. The final exhaust is at one inch absolute.

A pressure of 400 lb. is now common in central stations, with some operating well above this figure; 600 lb. is, however, the maximum, except in the cases of these two 1,200-lb. machines. As recently noted, Mr. Thos. Roles is installing a 1,200-lb. set at Bradford.

Two-fluid Boiler Systems.

Diphenyl oxide, a white chemical with a powerful odour like strong geranium scent, is being used in one boiler to run an engine, and the exhaust vapour from that engine, still very hot, to raise steam from ordinary water in a second boiler, according to Dr. H. H. Dow, a manufacturing chemist of Midland, Mich., U.S.A. Dr. Dow has been experimenting with the system for some months, and states that it has proved itself quite successful and very economical of fuel.

The idea was tried first with mercury as the liquid in the first, or high-temperature boiler, but its great weight and considerable initial expense, together with constant losses, interposed engineering and economic difficulties. Further, leakage of mercury vapour is almost certain to be injurious to the workmen, because mercury is exceedingly poisonous. For these reasons, therefore, Dr. Dow sought for a liquid that is light, cheap, and non-poisonous, and still has a large capacity for carrying heat over into the second boiler to generate steam for the second engine.

A number of organic chemical compounds were found to possess these qualities, but at the temperatures used in boilers they tended to break up into other compounds useless for power purposes and to clog the boilers with carbonaceous materials of no use for carrying heat. Diphenyl oxide, however, has been used and condensed and used over again many times at a pressure of 200 lb. per sq. in. and a temperature of 800 deg. F., with but little deterioration. It weighs little more than water, as contrasted with mercury, which is heavier than lead. Its price is only 30 cents a lb. in quantity lots, which, according to Dr. Dow, makes its cost, volume for volume, less than two per cent. of that of mercury. The compound has been produced hitherto in comparatively limited quantities, because its only use has been in the perfume industry, but Dr. Dow states that there is no limit to the bulk that can be manufactured if it is desired for power plant uses.—*Science.*

High-Power Street Lighting.

The seven blocks of State Street, which lies within Chicago's "Loop" district, often alluded to as the most concentrated shopping district in the world, may now be described as the world's greatest "White Way" as the result of the installation of what is claimed to be the most powerful street-lighting system ever built. This intensive lighting system was financed by the State Street merchants, who estimate their aggregate sales at approximately $1,500,000 a day. It is said that the street is now fully three times brighter than any other in the world, and compares favourably with the lighting in many stores and factories. The light is furnished by 70 "Union" metal standards, placed ten to a block, five on each side of the street, each equipped with G.E.C. fittings containing 2,000-W "Mazda" lamps, said to be the largest ever used for street-lighting purposes.

Fatality.

Herbert Cunliffe, employed in the moulding shop at Messrs. S. S. Stott's Laneside Foundry, Haslingden, on February 3rd received a fatal electric shock whilst assisting a fitter to drill a plate by means of a portable electric drill.

Train Collision Report.

The official report on the inquiry into the circumstances of a derailment and collision which occurred on November 30th at Crofton South Junction, Wakefield, on the L.M. and S. railway, has been issued. It appears that the derailment was caused by the breaking of a brake pull rod of the running engine, and the broken end of the rod striking a sleeper. There were two fractures, and one had at some time been electrically welded, but left in an unsatisfactory manner, and it is held that this was partially responsible for the final collapse of the rod. It is pointed out that the men engaged on the electric welding have attained a considerably higher degree of skill than was at first shown, recent testing by cutting through the joint showing in all cases a satisfactory repair, and that so long as this can be ensured, the practice of electrically welding fractures of the kind is not open to objection.

Storage Batteries in Gassy Mines.

A new use for storage batteries is foreshadowed in the United States. Writing in the American *Mining Congress Journal*, Mr. Graham Bright, a consulting engineer, of Pittsburgh, states that it is only recently that storage-battery power has been used in coal-mining operations in any part except in "gathering" the coal. The element of safety obtained by the use of storage-battery equipment has however, opened up the possibility of extending the use of the battery in gassy mines to practically all underground power requirements, including haulage, cutting, drilling, auxiliary pumping, and ventilation. This would eliminate wires from the mine except at the charging stations. It is stated that battery power has been successfully applied to haulage and cutting operations in the Phelps Dodge Company's mines in New Mexico, and the Consolidation Coal Company's mines in West Virginia.

Electricity on Japanese Farms.

The Japanese Minister of Communications has decided to grant credits to agricultural societies for the purchase of electrical machinery which will assist them in their farming operations. Only 5½ per cent. interest will be charged on the sums advanced. Several agricultural groups in the prefectures of Aichi, Osaka, and Hyogo have already received advances amounting to £26,000 from an *ad hoc* committee. The first purchase by the Aichi prefecture consisted of 53 motors intended for the drying and treatment of rice and seeds. The electrical distribution systems are accordingly being extended. The Commercial Attaché expresses the view that this installation of modern equipment on comparatively small farms constitutes an important step in the development of Japanese agriculture. It is thought that the movement will considerably extend.

Research at Birmingham.

The Joint Standing Committee for Research of the University of Birmingham reports that in the Department of Electrical Engineering work on the following subjects is now being done:—The characteristics of the electric arc, investigated in the research into the transmission of power at high frequencies which is proceeding; the conduction of currents by electrolytes; and the testing of a.c. machines by means of direct current.

Water Power versus Diesel Engines in Bulgaria.

A few years ago the idea of "the electrification of the whole of the country" by means of hydro-electric stations was very popular in Bulgaria, and the State advanced considerable sums to water syndicates and corporations founded in many parts of the country. It has been necessary, however, to moderate many dreams, for most of the rivers in Bulgaria are almost dry in summer, and on an average not more than 1,000,000 hydraulic h.p. is available. It is evident that encouragement must be given to towns which confine themselves to obtaining the power for their electric lighting and local industries from the rivers in the valleys where they are situated. During the last few years many power stations have replaced their steam engines by Diesel (or other) oil engines and use liquid fuel in place of coal. Prof. Danailov has protested in the Slovo against this practice; he points out that Bulgaria is rich in coal still to be exploited, while she has no native liquid fuel. She is therefore obliged to purchase it abroad, to the great detriment of her balance of trade and the quotation of the lev; the professor concludes, therefore, that it is necessary to place heavy import duties on Diesel engines and foreign liquid fuels entering Bulgaria.

In reply, Engineer B. Radev says that it is true that many Bulgarian towns use modern Diesel engines, these being the most practical and economical; indeed, in many towns they are the only possible means of producing electric light. These towns number fourteen at present and possess about 300,000 inhabitants, or 75,000 families. Statistics show that each provincial family in Bulgaria consumes for lighting purposes an average of about 60 kilowatt-hours a year, so that the 75,000 families consume annually about 4,500,000 kilowatt-hours; in order to produce this total, it is necessary to use about 1,600,000 kilograms of liquid fuel at a price of two or three leva a kilogram, making a total of about 3,700,000 leva; the cost of about 35,000 kilograms of lubricating mineral oil used (about 500,000 leva) must be added to this figure. Apart from these fourteen large central electricity stations belonging to the municipalities, there exist in Bulgaria many other privately-owned electricity stations which use Diesel engines. Furthermore, eighteen other Bulgarian towns or co-operative companies have decided to introduce electric lighting into their districts in 1927, and they will also use Diesel engines; 250,000 inhabitants, forming 62,000 families, will profit when electricity replaces paraffin in these districts. If high import duties were placed on imports of Diesel engines, mineral oils and their products, many families would probably be obliged to return to the use of the paraffin lamp, which would add considerably to the money spent abroad by Bulgaria on paraffin. M. Radev concludes that in Bulgaria the *rôle* of the State should not consist in favouring any one category of electric power stations, but in leaving each organisation to choose for itself the system it finds most profitable in view of the special conditions in the locality. The only thing the State ought to do, he says, is to demand of each new municipal electrical enterprise to make its choice in such a way that from the first, or second, year of its working it is able to meet expenses, to pay interest on the capital invested, and provide an annual redemption sum, or be deprived of all credit or other form of encouragement from the State.—*Reuter's Trade Service* (Sofia).

Coal Mines: Certificates of Competency.

The Board for Mining Examinations, with the approval of the Board of Trade, has made rules for the qualifications of applicants for certificates of competency under the Coal Mines Act, 1911. An applicant must be at least 23 years of age, and must submit to the Examining Board testimonials and certificates of his preliminary qualifications, as specified. He must satisfy the Examining Board that he has had practical experience in mining for not less than five years (or not less than three years if he holds an approved degree or diploma), and must pass written and oral examinations. The rules made by the Board for Mining Examinations in August, 1919, are revoked, and the new rules will come into operation on March 1st, 1927. Copies can be obtained from H.M. Stationery Office, price 1d. net.

Advertising Electricity by Films.

With the object of attracting more customers for electricity supply in rural areas, the Bernische Kraftwerke Gesellschaft, Berne, is showing in the principal villages in the canton a film depicting the uses of electricity in agriculture.

Photo-telegraphy.

A service for the exchange of pictures between Austria and Germany by wireless telegraphy will, it is hoped, be inaugurated before long. The Königswusterhausen station in Germany is to serve Rosenhügel as the return station during the preliminary experiment. The public service will be in the hands of the Austrian Marconi Co. (Radio Austria), and the Austrian Broadcasting Co., says *The Times*, will include within its range Great Britain and all other countries willing to co-operate. The system adopted by Austria deals with photographs and graphic reproductions of every kind, 4 in. square.

The tests which are being undertaken by the Austrian Marconi Co. jointly with the Telefunken Gesellschaft, of Germany, which it is hoped will lead to the establishment of a public service for the exchange of news and pictures, will extend over a considerable period. The experiment will be in connection with the Karolus-Telefunken-Siemens system. Tests made last year yielded good results, but only one-way, and were therefore inconclusive.

The results of the first Transatlantic experiments in the transmission of pictures and writing in facsimile by the system have now become available in Europe. Messages of acknowledgment from Rio de Janeiro and Buenos Aires showed that, in spite of atmospheric difficulties, the images were received there with encouraging clearness. Two certified facsimiles were reproduced in *The Times* (of London) on January 28th, which explains that though most of them were rather plainly marked with the vertical lines characteristic of facsimiles received under experimental conditions and some showed slight distortion, the pictures were, on the whole, remarkably clear, and print and script passed the essential test of legibility. The Telefunken Gesellschaft is fully satisfied with the results of this 6,000-mile transmission from the Nauen wireless station to Rio; in view of the atmospheric disturbances there was some doubt whether the images would get through at all. Transmission to Rio was begun on a wave-length of 40 metres, but owing to atmospheric disturbances a change was made to 25 metres. The time taken was from five to ten minutes, compared, it is stated, with 1½ hours required by other systems which have been tried over long distances. A transmitter is being built for the Rio station, and is nearly completed. Short-distance transmission in Europe is regarded as almost past the experimental stage. The average rate of transmission between Berlin and Vienna on the 1,300-metre wave-length is 30 seconds.

Electrical Association for Women.

The first of a series of evening lectures arranged by the above Association for women working in the industry and domestic-science mistresses was given by Mr. J. W. Beauchamp, director, Electrical Development Association, at the Lighting Service Bureau, London, on January 26th. In a very clear and lucid manner Mr. Beauchamp dealt with the history and economics of electricity supply in this country. He also gave an interesting description of the geography of the electrical world, and referred to the principal developments which would take place under the new Electricity Supply Act.

On February 8th Mr. W. E. Bush delivered the second lecture, on "Electric Light in the Home and in the School."

The following lectures have been arranged for: February 18th, "Household Engineering and Efficiency Tests," by Mrs. Christine Frederick (U.S.A.); March 9th, "Simple Household Repairs"; March 23rd, "Electric Power Appliances in the Home"; and April 6th, "Women's Place in the American Electrical Industry," by Mr. T. Settle. All the lectures will take place at 7 p.m.

Miss Reynard, M.A., Warden of King's College for Women, has kindly placed the Lecture Hall of this College at the disposal of the E.A.W. for February 15th, at 5.15 p.m., when Mrs. C. Frederick will lecture on: How the American housewife solves her household difficulties. A limited number of tickets for this lecture are obtainable from the director, E.A.W., 26, George Street, Hanover Square, W.1.

Electricity in Gasworks.

After a brief mention of the uses of pneumatic, hydraulic, and gas power, the applications of steam in a gasworks with an output of more than 15 million therms per annum were detailed in a paper which Mr. H. C. Smith recently brought forward for discussion at the Institution of Civil Engineers. The steam generated on an average day is at the rate of 44,110 lb. per hour from and at 212 deg. F., or 16,718 h.p. The efficiency of transmission of energy from heat in steam to b.h.p.-hr. is 3.5 per cent., which low figure is due to the fact that steam is used in a large variety of scattered units, the majority of which have been in use for several years under non-condensing conditions. The generation and use of electric power in gasworks is dealt with: the efficiency of generation from heat in steam supplied to engines to heat in electricity generated is 10.1 per cent., and the efficiency of generation and transmission from heat in steam supplied to engines to brake-horse-power developed by works motors is 6.1 per cent., which is comparable with the efficiency of 3.5 per cent. given for the use of steam power. Of the 16,718 h.p. of steam generated, 2,647 h.p. is used for gas-making and purposes other than power, and 14,071 h.p. for power purposes; of the latter, 1,524 h.p. is converted into electrical energy, giving 147.8 h.p. of electricity. The author suggests that in designing new gasworks of a similar size to the one under review power would be most economically produced and applied as electricity, generated by steam at a central station, the bulk of the steam being produced by waste-heat boilers; it would then all be used at one point, the exhausts of engines discharging into suitable condensing plant. Assuming that the mean total power required in new works would be the same as in the existing works, 494.0 b.h.p. would be required per average day; if applied as electricity with an efficiency from steam to motor of 6.1 per cent., it would be necessary to generate only 8,098 h.p. of steam instead of 14,071 h.p. as at present; plant capable of generating 818 h.p. or 610 kW would be required, with which a higher efficiency should be obtained than with the 150-kW plant now in use and, assuming this to be 14 per cent., the steam required would be only 5,843 h.p. The saving in steam would amount to 233 tons per diem, which, at 25.3d. per ton, gives a saving of £8,963 per annum, and it is shown that it would be possible to make 83 per cent. of the steam required in the works for gas-making and power purposes (apart from that necessary for the working up of by-products) in waste-heat boilers under average day conditions. Under existing conditions it would only be possible to make 42.1 per cent. of the steam required from the waste heat of the various carbonising processes.

Further Swiss Railway Electrification.

The electrification of the Federal Railways in Switzerland is now bringing before the directors of the secondary lines the desirability of electrifying their railways. The first of these to change its form of traction will probably be the "Directe," a line that unites Berne and Neuchâtel, the traffic of which is seriously threatened by the electrification of the section of the C. F. F. Berne-Bienne and Bienne-Neuchâtel. It is estimated that a sum of 6,800,000 fr. will be required for the project. The Confederation is authorised to advance one-half of this sum, the other half to be provided by the three cantons interested in the scheme, *viz.*, Berne, Neuchâtel, and Fribourg. The Confederation demands that the present situation of the "Directe" must be rendered satisfactory before the loan can be advanced, and the directors have accordingly made certain proposals. It is hoped, therefore, that the work will be put in hand soon, and that the line will be running electrically at the beginning of 1928. The energy needed for the railway will be furnished by the Muhleberg power house of the Forces Motrices Bernoises, and the line will be electrified in the same manner as the Federal Railways. The preparatory labour necessary for giving the supply is already in hand, which will prove a distinct gain of time when once the real work is undertaken. Four electric locomotives and five motor coaches will be used on the line, and a considerable speeding-up of the time-table will be the welcome result, while the saving on the cost at present paid annually for coal will be no less than 375,000 francs.

Fires and Electric Shocks.

The *Birmingham Post* quotes some suggestions for minimising the risks of electric shocks made by the Chief Officer of the Birmingham Fire Brigade (Mr. A. R. Tozer) in a circular issued recently.

It is pointed out that the risks from the 220- and 440-volt systems in houses and shops are accentuated by the adoption in large factories and works of the high-pressure system. Mr. Tozer is anxious to make arrangements which will be satisfactory to users, and at the same time safeguard, to some extent, members of the brigade who may receive a fire call. With the permission of firms, he is willing to place indication plates beside the main doors to premises, and suggests a 6-in. enamelled plate bearing the letters "H.T." Where there is only one entrance red letters on a white ground would, he considers, be suitable, and where there is more than one entrance black letters on a white ground, with the red-lettered plate by the nearest entrance to the electrical control room. On the arrival of the brigade, these plates would give warning of the high-pressure installation, and, if necessary, the Electric Supply Department could be summoned at once to cut off the supply to the works.

Where premises are locked up at night without any person in attendance, it would greatly help the brigade if the electrician were to cut off the current at the distributing board. It is stated that at a number of fires recently Birmingham firemen have received shocks.

A New Mica Insulation.

Phthalic anhydride, a few years ago a chemical curiosity produced from naphthaline or moth balls, has been combined with glycerine to produce a synthetic resin to replace shellac as a binding material in the manufacture of pasted mica insulation or micanite. The resin, which has been developed by the General Electric Company of America, is known as "Glyptal," and has been standardised for use with all rigid mica insulation used in the apparatus made by the company. Experiments have shown that mica plates pasted with the new resin are not only more firmly bonded, but have several other advantages over shellac-pasted plates. It is claimed that the Glyptal-pasted material has from 10 to 60 per cent. more dielectric strength, twice the resistivity, four times the surface resistivity, and only two-thirds the dielectric loss. It is slightly denser, has about twice the transverse strength, and has about the same resistance to abrasion. It shows very little tendency to carbonise, and the products of decomposition do not attack copper, and are non-conducting. An advantage in the use of the new mica insulation is that it does not require new or additional equipment to that used heretofore for micanite insulation. Glyptal can also be used in the manufacture of flexible mica sheets, mica tape, and so on.

Appointments Vacant.

Five transmission line engineers (£400) for the Shannon Hydro-Electric Scheme; high-pressure cable jointer for the Tunbridge Wells Corporation Electricity Department; junior mains assistant for the Borough of Dover Electricity Department; chief clerk (£230), mains foreman (95s.) for the Corporation of Middleton Electricity Department; clerk of works (£250) for the Millom Urban District Council; assistant engineer (£200 +) for the Park Prewett Mental Hospital, Basingstoke; meter tester and repairer for the Borough of Haslingden Electricity Department; showroom manager, wireless correspondent and estimator, order clerk and correspondent, trade counter salesman and storekeeper, for Metro-Vick Supplies, Ltd.; engineer, Consumers' Department (£1,200) for the Perak River Hydro-Electric Power Co., Ltd.; three shift engineers for the Salt Union, Ltd., Runcorn. (See our advertisement pages to-day.)

E.P.E.A. Dinner.

The annual dinner of the Scottish Division of the Electrical Power Engineers' Association was held at Edinburgh on February 5th. Mr. H. J. Taylor, chairman of the division, presided over a company of 80. Councillor Couston, sole convener of Edinburgh Corporation Electricity Committee, proposed the toast of the "Electricity Supply Industry," and in reply Mr. R. B. Mitchell, chief electrical engineer, Glasgow Corporation, referred to the trade revival, which had been quite marked in Glasgow since the beginning of the year, and said that the output figures were very encouraging. He did not think that large undertakings like those of Edinburgh and Glasgow would benefit very materially from the Electricity Act, but the smaller undertakings would. They had bright prospects. The manufacturers of electrical plant had been very busy during the past year, in spite of all that had happened, and they now had their order books very full, more so than since the war.

Mr. Edwin Seddon, chief engineer of the Edinburgh Corporation Electricity Department, gave the toast of "The Association," and Mr. A. W. Crompton, Newcastle, the president, responded.

Institution Notes.

Institution of Electrical Engineers.

NORTH-WESTERN STUDENTS' SECTION.—A dance will be held at the Manchester Municipal College of Technology on Saturday, March 5th. Tickets (4s. 6d. each) can be obtained from members of the Committee or from the hon. secretary.

The Physical Society.

During the year 1926 fourteen ordinary meetings were held, at which 32 papers were presented and 12 demonstrations were given. The average attendance was 54. At the sixteenth annual exhibition trade exhibits were arranged by seventy-two firms, and the Research and Experimental Section contained sixty-one exhibits. On the third day the general public were admitted, and the total attendance at the exhibition was estimated at 3,500. The Council has awarded the Fourth Duddell Medal to Mr. F. Twyman, F.R.S. The new agreement between the Society and the Institution of Electrical Engineers in respect of "Science Abstracts" has been sealed, and is regarded by the Council as satisfactory. The Council has decided to take no formal action in the matter of changing the name of the Society; the words "of London" are to be omitted from all publications except where legally necessary. The number of Honorary Fellows on the roll on December 31st, 1926, was 12, the maximum permissible number. At the same date Ordinary Fellows numbered 666 and Students 12, the net increase being 23.

The annual general meeting is to be held to-day. It will be followed by an ordinary meeting, at which the presidential address will be given by Prof. O. W. Richardson, M.A., D.Sc., F.R.S., on "The Present State of Atomic Physics."

The twelfth Guthrie Lecture will be delivered on Friday, February 25th, by Prof. Sir Ernest Rutherford, O.M., D.Sc., P.R.S., on the subject of "Atomic Nuclei and their Transformations."

INSTITUTE OF PHYSICS.—On the resignation of Prof. A. W. Porter from the honorary secretaryship, Prof. A. O. Rankine, of the Imperial College of Science, has been appointed his successor. Mr. Thomas Martin, M.Sc., D.I.C., has been appointed secretary of the Institute. The office of the Institute of Physics has been transferred from 90, Great Russell Street, to 1, Lowther Gardens, Exhibition Road, London, S.W.7.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The Electricity Board.—On Monday last the Minister of Transport announced that he had appointed the undermentioned to fill the seven places on the Central Electricity Board under the chairmanship of Sir Andrew Duncan:—

Sir James Devonshire, K.B.E., M.I.E.E., chairman and general manager, the North Metropolitan Electric Power Supply Co. and allied companies. Vice-president Incorporated Association of Electric Power Companies.

Mr. Frank Hodges, J.P., secretary, International Miners' Federation.

Sir James Lithgow, Bart., M.C., T.D., D.L., J.P., ex-president of National Confederation of Employers' Organisations.

Alderman W. Walker, M.I.E.E., M.I.M.E., vice-chairman, Manchester Corporation Electricity Department. Chairman of National Joint Industrial Council for the Electricity Supply Industry and chairman of National Joint Board of the Electricity Supply Industry.

Sir Duncan Watson, J.P., M.I.E.E., chairman of the London and Home Counties' Joint Electricity Authority. Chairman of the Conference of Joint Electricity Authorities, Joint Advisory Boards and Joint Committees.

Mr. W. K. Whigham, director, Bank of England, and member of the Trade Facilities Act Advisory Committee.

Brevet-Colonel the Hon. Vernon Willey, C.M.G., M.V.O., C.B.E., director Lloyd's Bank, late Controller of Wool Supplies, Ministry of Munitions, and ex-president of the Federation of British Industries.

Eastbourne Electricity Committee recommends increasing the salary of the electrical engineer (Mr. J. K. Brydges) from £900 per annum to £1,000.

Mr. W. THYNE, late of Glasgow, has been appointed district manager of the Canterbury telephone district in succession to Mr. A. M. Kidd, who recently retired.

Mr. K. D. CAMPBELL, late sales manager of the Campbell Gas and Oil Engine Co., Ltd., Halifax, has been appointed to a similar position with Petters (Ipswich), Ltd.

The Southport Town Council has adopted a recommendation by the Finance Committee disapproving of a proposal by the Electricity Committee that Mr. W. T. GANN should be appointed deputy electrical engineer at the salary fixed by the E.P.E.A. schedule. An amendment that the appointment be made was negatived by a small majority. Mr. Gann has been first assistant at the electricity works for three years.

The *Yorkshire Post* says that at a meeting of the Hull City Council last Friday a motion to increase the salary of the city electrical engineer was defeated by 27 votes to 15.

Mr. MOXON, electrical engineer, has been awarded £100 by the Southport Council for his services as fuel overseer during the coal strike.

The *Australian Electrical Times* states that Mr. J. G. KILPATRICK, supervising engineer in the Central Administration, P.M.G.'s Department, Melbourne, has been provisionally appointed State engineer for Western Australia in place of Mr. PETER KENNEDY, who has been promoted to South Australia. Mr. Kilpatrick has been attached to the Department's engineering staff since 1915, and has previously had 14 years' experience with the engineering branch of the British Post Office.

On Monday the Newark Town Council appointed Mr. A. J. WARING, A.M.I.E.E., distribution electrical engineer to Torquay Corporation, as borough electrical engineer.

The accompanying portrait is that of Mr. J. SCRIVENER, who is, as we recently reported, managing director of Volta, Ltd., which is handling a new suction cleaner of Swedish manufacture. During the past seven years Mr. Scrivener has been associated with a well-known company specialising in vacuum cleaners, as managing director. He has therefore had a good



Hugh Cecil **Mr. J. Scrivener,** *[London.*

Managing Director of Volta, Ltd.

deal of experience in this particular direction. Mr. Scrivener informs us that although his company has only been functioning for three or four weeks, he is very gratified by the response made by the trade. As soon as the machine is reasonably well distributed throughout the country, the company is undertaking a national advertising campaign.

Mr. HAROLD PARKER has resigned his position as sales manager to Messrs. S. G. Leach & Co., Ltd., London, and has been appointed assistant manager to Walter's Electrical Manufacturing Co., Ltd., of Kensaltown Telegraph Works, Kensal Road, London, W.10. The latter company was established in 1880 as contractor for telegraph instruments, railway signalling apparatus, &c. Mr. Parker was for eight years in India and the Far East, connected with the Metropolitan Vickers Electrical Co., Ltd.

The British Thomson-Houston Co., Ltd. (Lamp Sales Department) announces that in future Mr. F. E. BING will be representing the company for "Mazda" lamps in the place of Mr. A. H. Cooling, who has left the service.

Major G. FETHERSTONE resigned his appointment as British Trade Commissioner in South Africa in order to take charge, as from February 1st, of the South African interests of the group of engineering firms controlled by Agricultural and General Engineers, Ltd.

Mr. L. J. N. KIRKBY has been appointed assistant mains engineer to the City of Chester electricity department.

The Spalding Urban Council has appointed Mr. R. J. CALDERWOOD, gas and waterworks engineer, as manager of the new electricity department, at a salary of £100 per annum.

By the casting vote of the Mayor, Middleton Town Council has increased the salary of the electrical engineer from £500 to £600 per annum.

At a meeting of the Society of Technical Engineers on February 7th, Capt. W. J. Liberty was awarded the Society's "Nersey" premium for a paper on the "History of Artificial Lighting."

Obituary.—Mr. W. S. Bemrose.—The death occurred suddenly, on February 3rd, of Mr. William Scofield Bemrose, who for about 48 years had been in business as an electrical engineer at Rochester. He was in his 75th year, and since his retirement about two years ago the business has been managed by his son, Mr. J. Bemrose, A.M.I.E.E., and other relatives.

Mr. G. H. Fawcus.—We learn with regret of the death of Mr. George Henry Fawcus, A.M.I.E.E., chief engineer and manager of the Altrincham Electric Supply Co., Ltd. Mr. Fawcus, who was born in 1879, received his training under Messrs. Siemens Bros. & Co., Ltd., at Woolwich, and before taking up his position with the Altrincham company he was connected with various power and traction undertakings, including the Waterloo and City Railway, the Blackpool, St. Annes and Lytham tramways, also the Blackburn and Bath tramways. During the war Mr. Fawcus rendered service in connection with the Ministry of Munitions and Coal Mines Control.

Sir Wilfrid Stokes.—We regret to record the death, which occurred on Monday last at the age of 66 years, of Sir Wilfrid Stokes, the well-known engineer and the inventor of the Stokes gun. He will be remembered by our readers as one of the early presidents of the British Engineers' Association and a very active and valued member of the Inventions Branch of the Ministry of Munitions during practically the whole of the war. Sir Wilfrid was also a vice-president of the Federation of British Industries.

Mr. C. Brooker.—The death took place, on January 28th, at the age of 57 years, of Mr. Charles Brooker, who had for nearly 20 years been on the staff of the Marconi Wireless Telegraph Co. at Chelmsford.

Sir James Kemnal.—On Tuesday morning Sir James Kemnal, M.I.E.E., managing director of Messrs. Babcock & Wilcox, Ltd., who had been ailing for some time, died at Bournemouth. The funeral takes place to-day.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Dormer & Wadsworth, Ltd.—Private company. Registered January 31st. Capital, £1,000 in £1 shares. Objects: To adopt an agreement with Engineering Supplies, Ltd., and to carry on the business of general engineering tool makers, formerly carried on by that company at 57a, Denbigh Street, Pimlico, and that of electrical and radio engineers, &c. The first directors are:—H. A. Dormer, 18, Westcliff Parade, Westcliff-on-Sea (director of Engineering Supplies, Ltd.); L. H. Wadsworth, Mount Lodge, Upland Road, Sutton, engineer. Qualification: £100. Remuneration, as fixed by the company. Secretary: G. Dickson, 11, Queen Victoria Street, E.C.4. Solicitors: Tatham, Oblein & Nash, 11, Queen Victoria Street, E.C. Registered office: 57a, Denbigh Street, Pimlico, S.W.1.

J. L. Maughan & Co., Ltd. — Private company. Registered February 2nd. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electrical, mechanical, and wireless engineers, manufacturers of, and dealers in electrical apparatus, cables, wires, conduits, accumulators, batteries, motors, generators, mining machinery and apparatus, lamps, accessories, &c. The subscribers (each with one share) are:—J. Maughan, Look Out Farm, Seaton Delaval, grocer; J. Maughan, Junr., 43, Bywell Terrace, Seaton Sluice, electrical engineer. The first directors are not named. Secretary: J. Maughan, Junr. Solicitors: Keenlyside and Forster, Lloyd's Bank Chambers, Collingwood Street, Newcastle-on-Tyne.

Charnock & Walker, Ltd.—Private company. Registered February 4th. Capital £500 in £1 shares. Objects: To carry on the business of manufacturers and patentees of electric, clockwork, novelty and sky signs, wireless lights and other signs, advertising contractors, &c. The permanent directors are:—J. E. Charnock, Little Hey, Pirbright, consulting engineer; D. D. Walker, Ravensknowle, Springfield Drive, Westcliff-on-Sea, advertising expert. Qualification £100. Secretary: J. E. Charnock. Solicitors: Marcus and Francis, 47-48, Broad Street Avenue, E.C.2.

Howarth, Green & Co., Ltd. — Private company. Registered February 3rd. Capital, £1,000 in £1 shares. Objects:—To carry on the business of importers and exporters of electrical goods, &c. The first directors are:—F T. Green, J. W. Green, W. V. Green, and J. Green, all of Staveleigh House, Knott End, near Fleetwood. Secretary: F. T. Green. Solicitor: E. Napthen, 18, Winckley Square, Preston. Registered office: 12a, Starkie Street, Preston.

A. & C. Receivers, Ltd.—Private company. Registered February 5th. Capital, £100 in £1 shares. Objects:—To carry on the business of manufacturers of, and dealers in all kinds of apparatus, instruments, receiving or transmitting sets, electrical or mechanical parts, fittings and appliances, and all cabinet and other work connected with radio-telegraphy, &c. The subscribers (each with one share) are:—F. H. A. Gittins, Priory Street, Dudley, accountant; F. W. Mail, 214, Bordesley Green, Birmingham, radio mechanic. The first directors are not named. Secretary: F. H. A. Gittins. Solicitors: Loxton & Co., 15, Bridge Street, Walsall. Registered office: 12, Mountrath Street, Walsall, Staffs.

Official Returns of Electrical Companies.

Western Wireless and Electrical Co. (Salisbury), Ltd.—Particulars filed of £1,500 debentures authorised January 27th, 1927, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,300.

Rhondda Tramways Co., Ltd.—Satisfaction to the extent of £7,400 on January 13th, 1927, of charges dated March 24th, 1911, November 13th, 1912, and May 11th, 1915, securing £250,000.

Radio Communication Co., Ltd.—Satisfaction to the extent of £66,000 on January 28th, 1927, of debenture dated April 14th, 1926, securing £81,500.

City of Oxford Motor Services, Ltd. (formerly City of Oxford Electric Tramways, Ltd.).—Satisfaction to the extent of £1,800 on January 13th, 1927, of charge dated February 20th, 1914, securing £46,000.

Santon, Ltd.—Charge on 149 and 150, Dock Street, Newport, dated January 14th, 1927, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd., not exceeding £1,800.

Brundall and District Service Co., Ltd. (195,956).—Capital, £4,000 in £1 shares. Return dated October 29th, 1926. All shares taken up. £3,750 paid. £250 considered as paid. Mortgages and charges, nil.

English Cable Supplies, Ltd. (195,754).—Capital, £2,500 in £1 shares. Return dated August 18th (filed October 2nd), 1926. 465 shares taken up. £465 paid. Mortgages and charges, nil.

City Notes.

Yorkshire Electric Power Co.

The accounts which will be submitted at the annual meeting at Leeds, on February 15th, are as follows:—

	1924.	1925.	1926.
	£	£	£
Net profit after payment of interest and debenture stock discount charges	182,764	205,012	257,416
Balance brought forward ...	34,640	46,053	55,051
Total	£217,404	£251,065	£312,467

The dividend on the cumulative preference capital of 6 per cent. (less income tax) absorbs £59,615; a dividend on the ordinary capital at the rate of 8 per cent. (less income tax) (of which 3 per cent. was paid in August) amounts to £102,592; £60,000 is to be placed to general reserve, increasing

the fund to £294,000; £25,000 is to be put to plant renewals fund (increasing it to £75,000); and £65,260 is to be carried forward. Owing to the coal dispute and the general strike the cost of supplying electricity was greatly increased, but the increased revenue and economies made have enabled the company to pass satisfactorily through a very difficult period. There has been a large increase in the number of agreements made with new and old consumers and, granted the restoration of normal trade conditions, a considerable increase of output may be anticipated. Large extensions of mains have been made and many sub-stations built and extended. These new mains include important additions to the 33,000-volt transmission system, enabling the company to deal with the increasing demands for electricity in the most economical way. The Thornhill and Barugh power stations have been fully employed, and the new plant installed at Thornhill is effecting the economies anticipated. The completion of the initial installation of 50,000 h.p. at Ferrybridge power station during the year was delayed by the contractors' difficulties in obtaining materials. The machinery has since been set to work and is now in operation. In February last, 773,000 six per cent. cumulative preference £1 shares were allotted to the shareholders at 21s. each and applied for nearly twice over. A Bill has been deposited in Parliament to authorise the increase of the nominal capital of the company from £4,000,000 to £6,000,000, with power to borrow on mortgage or by the issue of debenture stock up to one-half the total capital. "The Electricity (Supply) Act, 1926, received Royal Assent in December last, after amendments had been made to the Bill originally introduced, which may, it is hoped, make it a workable measure, but some time must necessarily elapse before the scheme of the Central Electricity Board can be brought into operation."

Fife Tramways, Light and Power Co., Ltd.

The report for the year ended December 31st, 1926, states that the trading profits of the undertakings owned and operated by the company amounted to £75,606. Of this sum there was reserved in the accounts of these undertakings an aggregate amount of £10,169. After payment of this company's administration expenses, taxation, &c., there remains at credit of profit and loss account (including £9,694 brought forward) £64,043. Loan interest and interest on debenture stock absorbs £17,409, dividend on preference shares £24,000, and there is transferred to debenture stock redemption account £4,488, leaving £18,145. The directors recommend a dividend on the ordinary shares at the rate of 3 per cent. per annum, less tax, £12,000, leaving £6,145 to be carried forward. The earnings of the power and lighting properties were seriously affected by the complete dislocation caused by the coal dispute in the county of Fife. The working costs and output of these properties are now almost back to normal conditions. The Power Company's generating station is being interconnected with the adjoining undertaking of the Scottish Central Electric Power Co. by a trunk transmission line, which will be completed early in the current year, and a supply in bulk will be given to that company.

Speaking at the annual meeting on February 4th, Mr. Wm. Low (chairman) said that the company had now distribution powers for lighting as well as for power purposes over the whole of the county of Fife, with the exception of the burghs of Kirkcaldy and St. Andrews. It was the intention of the directors to extend the network of mains into the new area during the current year and to commence supply in districts from which urgent demands had been received.

Prospectus.

North Metropolitan Power Station Co., Ltd.—This company was formed to undertake, *inter alia*, the construction of the new Brimsdown power station for the North Metropolitan Electric Power Supply Co. On Monday last it issued a prospectus offering for subscription £850,000 of 5 per cent. debenture stock (at £100 10s. per cent.), representing the whole of the company's capital, with the exception of 100 shares of £1 each. This issue is guaranteed as to principal and interest by the Government under the Trade Facilities Acts, and is redeemable over the years 1931 to 1957 by a cumulative sinking fund operating by annual drawings and/or purchase. The list was to close on or before Wednesday last, but it actually closed at 3.30 p.m. on the day of issue.

An interesting section of the prospectus was that relating to the contracts which have been placed. The contract for "the construction and co-ordination of works" has been awarded to the Foundation Co., Ltd. Other contracts mentioned were:—Turbo-generators and condensing plant (£148,570), C. A. Parsons & Co., Ltd.; part of Foundation Co.'s contract (£74,321), International Combustion, Ltd.; 33,000-V outdoor switchgear and protective equipment (£14,350), Ferguson, Pailin, Ltd.; 11,000-V switchgear (£5,575), A. Reyrolle & Co., Ltd.; transformers (£7,890), British Electric Transformer Co., Ltd.; circulating-water pumps (£5,666), W. H. Allen, Sons & Co., Ltd.; and coal-handling and storage plant (£20,033), Babcock & Wilcox, Ltd.

Traction and Power Securities Co., Ltd.

The annual meeting was held last week. Mr. H. A. Vernet (chairman), who presided, said that a valuation of the company's investments showed them to be £96,000 above the book cost. The net revenue had increased and, in addition to transferring £10,000 to reserve, they had decided to pay an ordinary dividend of 14 per cent., as against 13 per cent. for 1925. After referring to the brighter prospects, the chairman said that, although the company was originally a finance company, it had become an investment trust. Accordingly, the directors proposed to change its title to "The Traction and General Investment Trust, Ltd." The report was adopted and the change of name approved.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted:—

Chili Telephone—30,000 shares of £5 each, fully paid, Nos. 150,001 to 180,000.

North Wales Power—£200,000 four and a-half per cent. guaranteed debenture stock, 1930-53.

German Electrical Companies.

The net profits of the A.E.G., which, as mentioned last week, were 10,760,000 marks for 1925-26, compared with 8,363,000 marks in the previous year. The dividend is to be 7 per cent., as compared with 6 per cent. in 1924-25.

The Bank for Electrical Securities of Berlin, which is a financing organisation of the A.E.G. group, intends to increase its share capital by £434,000 to £1,210,000, for the purpose of participating in new business. It is said that the additional funds are to serve for the financing of electricity works abroad, as the work of erecting new stations in Germany is now so far under public control that little room is left for private enterprise.

Yorktown and Blackwater Gas and Electricity Co.

At the recent annual meeting, the chairman (Ald. D. Sparvell) said that the profits for the year enabled the directors to declare dividends of 12½ per cent. and 8¾ per cent. upon the original and additional shares respectively. The revenue from the sale of electricity had increased from £3,754 to £6,266. Their supply, which was received from London, was sold at a favourable rate to consumers.

Marconi's Wireless Telegraph Co., Ltd.

The membership of the Advisory Committee which has been appointed to report upon the future control and conduct of this company, and has been approved by the directors, is as follows:—Sir Hugo Hirst, Bart.; Lord Ashfield; Lord Buckland; and Mr. F. A. Szarvasy. The first meeting was to be held on Monday last.

Chatham and District Light Railways Co.

The revenue for the year ended December 31st last was £73,040 and the expenses £60,048. After providing for depreciation, rent, &c., and adding £1,596 brought forward, there is a balance of £5,862. It is proposed to pay the preference dividend and one of 2½ per cent. on the ordinary shares, leaving £962 to be carried forward. Meeting: February 17th.

Mexican Light and Power Co., Ltd.

It is reported that the board has prepared a funding scheme for the payment of the arrears of interest upon the company's second mortgage bonds and the discharge of the arrears of dividend upon the 7 per cent. preferred stock. The plan will be presented to the stockholders at an early date.

Shawinigan Water and Power Co.

A *Reuter* dispatch from Montreal states that the company has exchanged the old shares of $100 par value for new shares of no par value, on the basis of four new shares in exchange for one old share.

Crossley Bros., Ltd.

Dividend of 3½ per cent. on the preference shares, making 7 per cent. for the year.

Stocks and Shares.

MONDAY EVENING.

THE outstanding financial feature of the present time is the manner in which investment absorbs all the good stock offered. No matter from what quarter the appeal for capital comes, it finds a ready response, provided the security is sound, and that the price asked is in accordance with the general level occupied by similar issues. Money is pouring into stocks and shares in a volume which suggests that trade is less resilient than some of the authorities claim, for capital should be going into industrial channels, rather than into Stock Exchange securities, if there were actually such re-awakening of national industry as Bank chairmen, for example, have been talking about at the recent meetings of proprietors. China is a factor of restraint to some extent, but, apart from causing an occasional spasm of depression, the Far Eastern news does not weigh very heavily.

It has been generally understood that no more loans made under the Trade Facilities Act would be issued. This week, however, there have appeared prospectuses of T.F.A. stocks for a railway in Sudan, and £850,000 in 5 per cent. debenture stock of the North Metropolitan Power Station Company. Both were offered at 100½, and carry, of course, the guarantee of the Imperial Government.

Mexico has gladdened the hearts of her creditors by remitting the sum due for meeting interest obligations for 1926. This brought about substantial rises in the utility companies' bonds and shares. Mexican Light & Power preferred has jumped 12 points, and the common 6½. The bonds of the various concerns are 1 to 2 points higher. The feeling is that Mexico, having given this tangible evidence of her intention—as well as ability—to keep faith with her bondholders, it is reasonable to expect a just settlement of the amounts outstanding between the utility companies and their debtors. A more cheerful sentiment is now prevailing than has been the case for a long time past, although the cynic may possibly recall that Mexico has provided many a disappointment by shattering hopes which previously have appeared to be on the point of fulfilment.

Brazilian Tractions keep steady around 118. Brussels and Montreal continue to be ready supporters of the shares on any decline, but the recent excitement in the market has given place to quieter conditions. British Columbia Electric Railway stocks are again harder, the deferred gaining 4½ points. Colombo Electric Tramways & Lighting Company is said to have received, and refused, an offer from the Ceylon Government for the purchase of its plant and distributing system. The Ceylon Government was prepared to pay £250,000. The Company's 5 per cent. first mortgage debenture is quoted about 88, and stock changed hands last week at 89.

While Metropolitan Railway ordinary has rallied a little, after its steep fall on the dividend disappointment, other Tube railway stocks are heavy. Districts shed 1½, and Undergrounds have drooped. The Metropolitan announces that, in order to cope with its ever-increasing traffic, new arrangements are in contemplation for the installation of a huge additional power unit at Neasden. This has encouraged the hope that last year's poor dividend of 3 per cent.—as compared with 5 per cent. for 1925—was due to the coal stoppage and other industrial conditions which should not recur. A slight demand for London United Tramways debenture served to advance the price 3 points, to 45½; on the other hand, London and Suburban preference fell back to 6s. 6d. British Electric Traction hardened to 145½.

Of debenture stocks that are obtainable in the market, mention may be made of City of London Electric fives at 99¼, free of stamp and fee, January and July interest, and exceedingly well-covered; North Metropolitan Electric Power fives at 97; London Power fives at 98⅜, free of stamp. English Electric 6 per cent. convertible debenture can be bought at 102, to give a flat yield of £5 17s. 6d. per cent. on the money. The conversion terms are that until July this year a £100 debenture can be exchanged for 100 ordinary shares; until July, 1930, for 90 ordinary; and until 1933 for 80 ordinary shares. Perak River Hydro-Electric Power 7 per cent. debenture, which carries participating rights, is obtainable at 92, to yield £7 12s. per cent. Interest on this stock is payable, we may repeat, out of capital during construction of the works. A small amount of Llanelly and District Electric 5 per cent. first mortgage debenture stock is available at 93½, to give £5 6s. 9d. now and 5½ per cent. taking redemption into account. Interest payments are due in January and July.

Bournemouth and Poole ordinary have developed a little activity around £3. Both Bournemouth and Poole have recently issued Corporation loans, and apparently this has revived the expectation that the Electric Supply Company may receive an offer for its undertaking. Improvement in Primitiva Gas shares is ascribed to the desire on the part of the electric lighting authorities to obtain possession of the gas companies' mains for use in conjunction with the supply of electric current to the town. Several English provincial electric power shares are better. Newcastle-on-Tyne ordinary and Yorkshire Electrics are 6d. up. The latter company proposes to seek powers for raising its capital to £6 000,000. County of London ordinary improved a shade, but City Lights have gone back. There is nothing much doing in the market for shares in the London lighting list. New Shropshire A snares are being marketed this week at 25s. 3d.

Henleys are again 1/16th up, at 4½, and the yield on the money is now a shade under 4½ per cent. Brush shares are better at 28s. 3d. The weakness of British Aluminium is still noticeable, the price going back a florin to 46s. 3d. Telephone Manufacturing are a dull market at 7s. 7½d. Siemens' reverted to 30s. Coal and iron shares continue depressed, and the rubber market is in an uninteresting state.

Cable stocks and shares lean to the lower side, Anglo-Americans and Great Northerns being down on the week. Eastern Telegraph ordinary lost 2. Oriental Telephones and United River Plates went back 1/16th each. Marconis attract attention—and a wide diversity of dealings—upon publication of the names of an advisory committee of which Lord Ashfield and Sir Hugo Hirst are amongst the members.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1924.	Dividend. 1925.	Price Feb. 7 1927.	Rise or fall.	Yield p.c
	£					
Bournemouth and Poole	1	14	14	£0 9	—	4 12 0
Brompton Ordinary	1	10	10	25/-	—	5 12 0
Charing Cross Ordinary	1	15	15	25/-	—	5 12 0
do. do. 4½ Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	25/-	—	5 12 0
City of London	1	15	15	2 1/16	—1/16	... ...
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/6	—	5 12 4
County of London	1	15	15	28/-	+6d	... ...
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/8xd	—	6 2 0
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	30/6	—	6 11 2
Kensington Ordinary	1	15	15	24/-	—	5 16 8
Lancs. Light and Power	1	7½	7½	24/-	—	6 2 5
London Electric	1	10	10	24/-	—	5 17 8
do. do. 6% Pref.	5	6	6	5 7/8	—1/8	5 10 4
Metropolitan	1	11	11	26/-	—	5 7 8
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 8
Newcastle-on-Tyne Ordinary ...	1	7	7	20 6	+6d	6 16 7
do. 5% Pref. ...	1	5	5	17/6	—	5 14 3
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	24/-	—	5 16 8
South London	1	15	15	24/6	—	6 9 0
South Metropolitan Pref.	1	7	7	1¼	—	6 3 0
Urban Ordinary	1	4	7	1 3/16	—	5 17 11
do. 6% Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	24/6	—	5 14 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	1	8	8	28/-	+6	5 14 4

Home Rails.

Central London Ord. Assented ...	Stock	4	4	70	—	5 14 4
Metropolitan	,,	5	5	61½	+1	4 18 4
do. District	,,	8½	8½	55	—1½	6 7 3
Underground Electric	£1	Nil	Nil	12 6	—6d	Nil
do. do. Income ...	Bonds	6	6	103	—1	£5 16 6

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	100	—½	6 0 0
do. Def.	,,	1½	1½	24	—¼	6 5 0
Automatic Telephone	1	8	10	2⅝	—	8 12 9
Chili Telephone	5	5	6	6½	—	4 12 4
Cuba Sub. Ord.	10	5	5	7	—	7 5 6
Eastern Extension	10	10	10	17⅝	—	£5 13 4
Eastern Tel. Ord.	Stock	10	10	172½	—2	£5 16 0
Globe Tel. and T. Ord.	10	10	10	18⅜	—	£5 6 8
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	22	20	26½	—½	7 11 0
Indo-European	25	8½	10	41½	—	£5 7 6
Marconi	1	10	Nil	15/-	—	... ...
Marconi-Marine	1	10	7½	1¼	—	6 13 4
Oriental Telephone Ord.	1	12	12	5⅜	—1/16	£5 1
United R. Plate Tel.	5	8	8	8 3/16	—1/16	£8 17
Western Telegraph	10	10	10	17	—	£8 17

Home and Foreign Trams, &c

Anglo-Arg. Trams First Pref. ...	5	5½	5½	2⅞	+1/16	9 11 6
do. do. 2nd Pref. ...	5	6	6	2¼	—	10 8 8
do. do. 5% Deb. ...	Stock	5	5	69½	—1	7 4 0
British Electric Traction Ord. ...	,,	7	8	145½	+1	5 10 0
do. do. 6% Pref. ...	,,	6	6	109	—	5 10 1
Brazil Traction	100	4	5	118	+1	5 1 8
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	88½	—1	5 13 0
do. do. Preferred ...	,,	96/-	136/9	124½	+1½	£5 0
do. do. Deferred ...	,,	129/5	8	158½	+4½	5 1
do. do. Deb. ...	,,	4¼	4¼	81½	+1	5 4 4
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	6/6	—6d	Nil
London United Tram. Deb. ...	Stock	4	4	45½	+3	8 16 0
Mexico Trams, 5% Bonds	—	5	5	65½	+1½	7 12 8
Mexican Light Common	100	Nil	Nil	40	+6½	Nil
do. Pref.	100	Nil	Nil	92½	+12	Nil
do. 1st Bonds	—	5	5	65½	+1	7 12 8
Yorkshire (West Riding)	1	5	—	10/-	—2/6	... ..

Manufacturing Companies.

Babcock & Wilcox	1	12	13	58/9	—	4 16 8
British Aluminium Ord.	1	5	10	46 3	—2/-	4 6 7
British Elec. Transformer Pref. ...	1	Nil	7	18/3	—	7 13
British Insulated Ord.	1	15	15	70/-	—	4 5 0
Brush Ord.	1	10	10	28 3	+9d.	7 1 7
Callenders	1	15	15	8½	—	4 5 9
do. 6½% Pref....	1	6½	6½	23/9	—	5 9 1
Crompton Ord.	1	Nil	Nil	10/-	—	... ..
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	84	—	5 19 1
Electric Construction	1	10	10	31/3	—	6 8 0
Enfield Cable Pref.	1	7½	7½	1¼	—	6 6 4
English Electric	1	5	Nil	15/-	—	... ..
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	5	7½	31/6	—	4 15 8
Henley	1	16	20	4½	+1/16	4 9 0
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1	—	£5 0 0
Johnson & Phillips	1	10	17½	2 1/2	—	5 19 1
Met.-Vickers Ord.	1	8	8	28 3	—	5 13 8
do. Pref.	1	8	8	2 1/16	—	6 18 4
Siemens Ord.	1	7½	7½	30/-	—6d.	5 0 0
Telegraph Construction	12	20	10	29¼	—	£4 0 8

Dividends paid free of Income Tax.

The Import Trade of China.

THE present situation in China gives the following statistics a topical interest; they are, moreover, a guide to the trend of trade. The effects of the political and industrial disturbances which commenced in 1925 are clearly indicated by the preponderance of decreases shown in the last column of our table. It is noteworthy that machinery for electric power stations continued its upward course; the shares of Great Britain and Japan advanced, while that of the United States was almost halved. It is probable that a great deal of the trade credited to Hong-Kong was transacted with the United Kingdom. The Haikwan tael fell in average value from 3s. 7 15/16d. in 1924 to 3s. 5¾d. in 1925.

Country whence imported.	1924. Taels. (thous.)	1925. Taels. (thous.)	Inc. or dec. Taels. (thous.)
Brass and yellow metal; bars, sheets, wire, &c.—			
	1924.	1925.	Inc. or dec.
Total	1,526	1,377	− 149
Hong-Kong	553	305	− 248
Great Britain	96	59	− 37
Japan	671	911	+ 240
Belgium	14	14	—
United States	3	11	+ 8
Germany	168	72	− 96
France	—	7	+ 7
Copper bars, rods, sheets, plates, nails, and wire.—			
Total	1,063	923	− 140
Hong-Kong	39	41	+ 2
Great Britain	91	90	− 1
Japan	758	617	− 141
Germany	159	38	− 121
Belgium	8	1	− 7
United States	6	128	+ 122
Electrical materials and fittings.—			
Total	8,195	6,890	−1,305
Hong-Kong	647	421	− 226
Great Britain	1,236	1,199	− 37
Italy	81	65	− 16
Japan	2,171	2,367	+ 196
Canada	7	14	+ 7
United States	1,215	851	− 364
Sweden	13	14	+ 1
Belgium	315	123	− 192
Holland	367	283	− 84
France	52	122	+ 70
Germany	2,171	1,393	− 778
Machine tools.—			
Total	455	221	− 234
Great Britain	34	22	− 12
Denmark	1	2	+ 1
Japan	132	61	− 71
United States	177	59	− 118
Germany	71	44	− 27
Belgium	28	21	− 7
Propelling machinery, such as boilers, turbines, &c.—			
Total	1,963	1,920	− 43
Great Britain	1,041	892	− 149
Japan	90	93	+ 3
United States	271	296	+ 25
Sweden	282	65	− 217
Germany	164	275	+ 111
Belgium	52	281	+ 229
Italy	48	13	− 35
Telegraph and telephone material.—			
Total	1,053	958	− 95
Hong-Kong	39	45	+ 6
Great Britain	323	194	− 129
Japan	124	255	+ 131
Canada	2	6	+ 4
United States	77	76	− 1
Sweden	252	118	− 134
Germany	222	167	− 55
Belgium	4	8	+ 4
Scientific instruments and apparatus.—			
Total	1,237	988	− 249
Great Britain	101	128	+ 27
Germany	323	228	− 95
Belgium	10	4	− 6
France	25	29	+ 4
Japan	357	321	− 36
United States	281	203	− 78
Machinery for electric power stations.—			
Total	808	858	+ 50
From Great Britain ...	224	345	+ 121
,, Germany	222	167	− 45
,, Japan	5	105	+ 100
,, United States ...	208	113	− 95

The Import Trade of Siam.

THE following figures, showing the imports of electrical and similar goods into the port of Bangkok during the year ended March, 1926, are taken from the recently-issued official trade statistics; the figures for the year ended March, 1925, are included for the purposes of comparison, and notes of any increases or decreases are given. Imports stated to be from Singapore and Hong-Kong are for the most part the products of other countries shipped *viâ* these two ports:—

	1924-25. Ticals. (Thousands.)	1925-26. Ticals. (Thousands.)	Inc. or dec. Ticals. (Thousands.)
Electrical goods and apparatus.—			
Total	796	819	+ 23
From United Kingdom ...	279	240	− 39
,, Germany	127	115	− 12
,, United States	119	100	− 19
,, Singapore	19	19	—
,, Sweden	22	22	—
,, Italy	23	3	− 20
,, Holland	22	32	+ 10
,, France	22	42	+ 20
,, Japan	86	102	+ 16
Lamps.—			
Total	591	575	− 16
From Singapore	88	51	− 37
,, Hong-Kong	46	20	− 26
,, United Kingdom ...	80	65	− 15
,, United States	37	41	+ 4
,, Japan	76	103	+ 27
,, Germany	203	250	+ 47
,, Sweden	45	31	− 14
Scientific instruments and apparatus.—			
Total	249	283	+ 34
From United Kingdom ...	77	48	− 29
,, Germany	32	87	+ 55
,, France	10	8	− 2
,, Japan	39	57	+ 18
,, United States	35	30	− 5
Prime movers, other than locomotives, marine, military, and agricultural machinery.—			
Total	165	296	+ 131
From United Kingdom ...	75	166	+ 91
,, United States	6	31	+ 25
,, Germany	32	51	+ 19
,, Denmark	6	1	− 5
,, Sweden	—	27	+ 27
Machine tools.—			
Total	186	136	− 50
From United Kingdom ...	71	45	− 26
,, United States	46	23	− 23
,, Denmark	6	39	+ 33
,, Germany	55	27	− 28
Machinery, unenumerated, including detached parts, and not including agricultural, textile, or sewing machines.—			
Total	1,765	717	−1,048
From United Kingdom ...	602	337	− 265
,, Japan	4	12	+ 8
,, United States	102	105	+ 3
,, France	27	34	+ 7
,, Denmark	810	32	− 778
,, Germany	139	131	− 8
Railway material.—			
Total	1,949	877	−1,072
From United Kingdom ...	154	47	− 107
,, Belgium	357	75	− 282
,, France	1,417	686	− 731
Cars or trucks for railways or tramways.—			
Total	241	942	+ 701
From United Kingdom ...	202	235	+ 33
,, United States	32	57	+ 25
,, Belgium	4	200	+ 196
Rubber manufactures, other than tires.—			
Total	374	508	+ 134
From Singapore	279	392	+ 113
,, United Kingdom ...	50	46	− 4
,, United States	15	23	+ 8
,, Japan	4	7	+ 3
,, Germany	9	20	+ 11

NOTE.—Tical = 1s. 10½d.

A Cathedral Lighting Scheme.

The electrical installation in the St. Magnus Cathedral, Orkney Islands.

IN our issue of March 14th, 1924, reference was made, in the description of the generating station at Kirkwall, Orkney Islands, to the intention to install electric lighting in the fine old St. Magnus Cathedral, fig. 1. This work has now been completed and we are able to give below some particulars of the scheme.



Fig. 1.—St. Magnus Cathedral, Kirkwall.

The lay-out of the building is on the usual cross design, with main, triforium, and clerestory arcades. As is always the case in installing electric lighting in such buildings, the antiquity of the structure and the ecclesiastical associations presented difficulties not met with in everyday work. Every effort has been made to obtain harmony with the surroundings, so that the clash between the 12th and 20th century products is minimised as much as possible.



Fig. 2.—Nave and Clerestories, Illuminated.

The nave lighting is arranged by means of 16 four-light fittings suspended from the centre of the main arches, eight on each side. The fittings are of circular design, and are placed about 12 ft. from the floor level. They each contain four 60-W lamps arranged on two different circuits. Rod suspension is employed for the fittings, and is carried out by a special bayonet catch arrangement to save the making of joints and facilitate the taking up and down of the fittings for cleaning purposes. The arrangement in the choir is exactly similar to that in the nave. A 13-light electrolier is provided over the nave and transept junction at about 30 feet above the floor level. The lamps are arranged in two tiers of six, with one lamp serving as a pilot light on the top of the fitting. This is controlled either from the main switchboard or from the entrance door, so that some light in the building may be obtained independently of the main switches. Each of the transepts is lit by four three-light fittings of semicircular design, and the higher regions by four lights placed on the tie-rods.

In the nave and choir clerestories, a shaded lamp is placed in the apex of each window arch; when these are lit and the nave and choir lights extinguished, a very impressive effect is obtained and the magnificent groining of the cathedral can be seen to advantage, as shown in fig. 2.

The triforiums are lighted by shaded lamps placed in alternate bays; 10-A plugs are fitted to the other bays to provide for temporary decorative illumination when required. The six vestibules are lighted with bowl fittings of the inverted type, and provision has been made for four outside pillar lights at the main entrances.

The vestry, session house, stairs, passages, and so on, are provided with lighting points throughout, and not the easiest part of the work was the lighting of the two spiral staircases leading by some 200 steps to the tower.

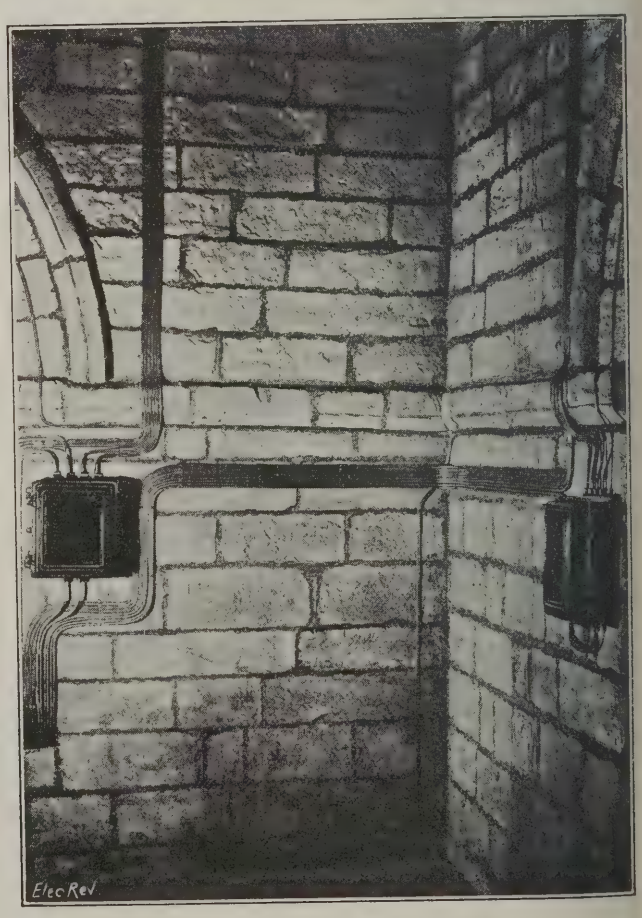


Fig. 3.—Wiring in Square Tower.

The supply is taken from the public mains at 440 V and

is split into two balanced 220-V circuits at the main switchboard. This measures 7 ft. long by 5 ft. high, and accommodates the control gear and measuring instruments mounted on siluminite panels, covered in with sliding plate-glass doors. The outside is suitably finished to match the carved oakwork of the cathedral interior.

The Stannos system of wiring was adopted on account of the salt-laden atmosphere. The wiring has been very successfully concealed practically throughout the cathedral, but where this could not be done it has been painted to match the surrounding stone work. Fig. 3 shows the wiring and sub-fuse boards in the square tower, which is the centre of the distribution. In the clerestories, where very rough walls were met with, oak slips were fixed to the walls on which to clip the wiring. The whole of the fittings were made to special designs in real bronze by Messrs Holders, Ltd., and the Edison Swan Electric Co., Ltd. The installation work was carried out by Messrs. Rendall & Wylie, local contractors, under the supervision of the consulting engineers, Messrs. J. A. Liddle & D. Miller, B.Sc., who were responsible for the preparation of the scheme, and to whom we are indebted for the foregoing notes.

Kiosk-Type Sub-Stations.

New structural designs of Messrs. Switchgear & Cowans, Ltd., eliminating the necessity for interior doors by interlocking the main doors.

HAVING benefited by the primary advantages of the kiosk sub-station, engineers are now demanding further economies for such installations, both with regard to the cost and the space occupied. In this connection it is interesting to learn of some improved models which have been recently introduced by Messrs. Switchgear & Cowans, Ltd.

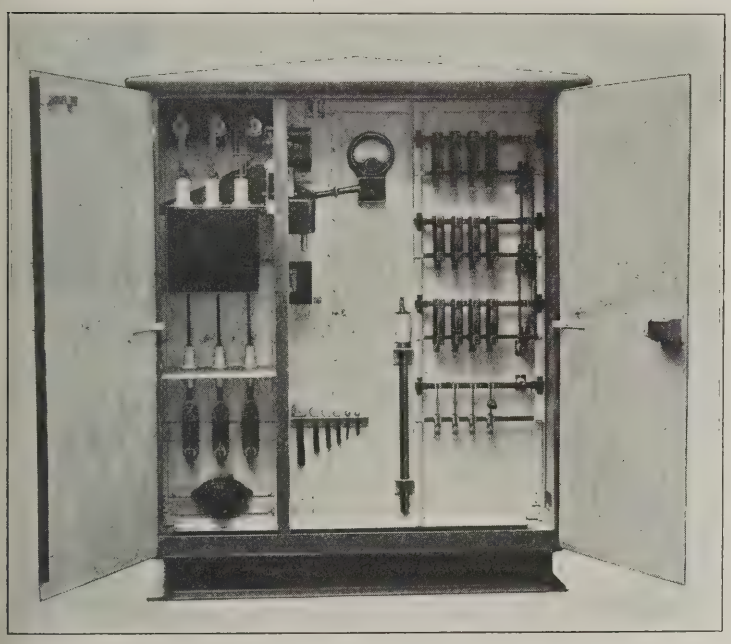


Fig. 1.—100-kVA Terminal Kiosk ; Switchgear Compartments.

In the usual form of kiosk sub-station the h.p. and l.p. compartments are arranged on separate sides of the structure, and interior doors are fitted to the h.p. compartment as a protection against exposed live parts. In the new design by the above firm interior doors have been eliminated by interlocking the main doors, thereby considerably simplying the construction. The h.p. and l.p. compartments are situated both on one side of the kiosk, as shown in fig. 1, which illustrates a terminal feeder sub-station of 100-kVA capacity. Two half doors serve these compartments and the one giving access to the l.p. equipment is secured by a strong Yale lock. The l.p. circuits are distributed through patented unbreakable fuse carriers mounted on steel rods insulated with micanite, no china, slate, or other fragile material being used. The operating handle of the e.h.p. oil circuit breaker is accessible from the l.p. compartment. While the circuit breaker is in the "on" position the door of the compartment cannot be opened, it being interlocked with the circuit-breaker operating gear. It is also secured by a padlock arranged inside the l.p. compartment.

A steel wall separates the two classes of apparatus, and the result is a high degree of compactness with adequate accessibility, it is claimed, for the instruments, tools, operating levers, and easy operation. At the back of the switchgear a large compartment provides for the transformer equipment, occupying the full depth of the kiosk. The two doors of the transformer compartment are interlocked with the h.p.-apparatus door, so that it is impossible to gain access to the transformer until the circuit breaker is in the "off" position and all the live parts are dead. Further, the circuit breaker cannot be closed while the transformer doors are open. Rails are provided for accommodating the transformer wheels.

Similarly arranged kiosk sub-stations for ring-main systems are obtainable; fig. 2 illustrates the transformer compartment side of such a kiosk with an additional compartment accommodating the isolating switches controlling the incoming and outgoing feeder circuits. The structures are well ventilated by louvres at the bottom and a space all round under the eaves of the roof. A feature is the absence of any protruding parts from the exterior which would invite youthful climbers to get on the roof.

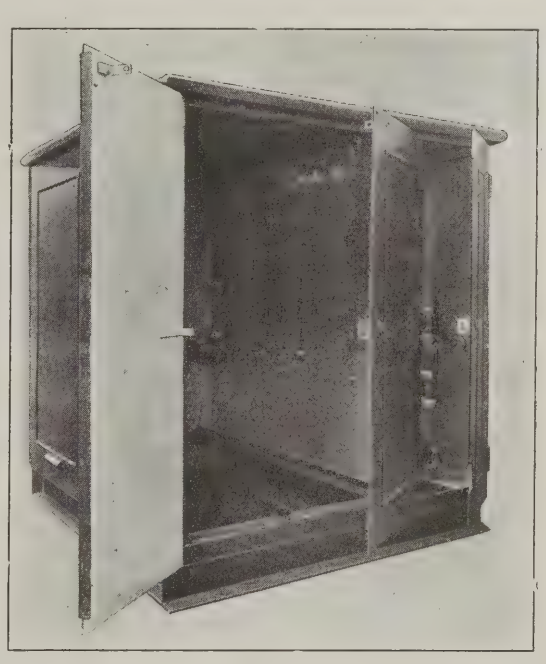


Fig. 2.—Ring-Main Kiosk.

Fires on Electrical Installations.

In order to secure closer co-operation between the fire brigade and the electrical power station in the event of fires affecting electrical installations, the German Association of Electro-Technicians has issued instructions under which all the important distributing stations must have trained men who can be sent at the request of the fire brigade to the place where the fire occurs. On the other hand, the fire brigade must have special electricians trained by the electrical authorities to carry out electrical work. The use of electric lighting in fire fighting is advocated, as it serves its purpose in smoke-filled rooms and facilitates rescue work. Only non-conducting extinguishers, driven by non-conducting means, may be used, and in case of wooden poles catching fire, when water has to be used, the electrical conductors must be made dead before extinguishing the fire, to avoid the risk of electri shock from the stream of water. When the work is over all parts of the undertaking affected by the fire must be completely cut off before anyone is allowed to enter.

A.C. Measuring Instruments.

The more important developments in the design and construction of indicating and recording, as distinct from integrating, meters; and an account of some of the authors' investigations.

By Lieut.-Col. K. EDGCUMBE, R.E. (T.A.), Vice-President, and F. E. J. OCKENDEN, GraduateI.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers.)

THE writing of the paper has been prompted by the large amount of valuable material produced during the last few years, but little of which has been put into such a form as to make it available to the designers of electrical measuring instruments. During the past 35 years only two papers dealing with the subject in a general way have been read before this, or any kindred, body.

The number of different sizes of meter shows a tendency to decrease, concentration being on the 6-in. or 5-in. round sizes for general industrial use, and on the 6-in. or 8-in. sizes for switchboards; for many industrial purposes, 3-in. or 2-in. round instruments are all-sufficient, and are economical in respect of both first cost and space occupied.

The general tendency in construction is to eliminate handwork as far as possible, with the result that stampings and die-castings have largely taken the place of machined parts, thus giving a standardised product which is both cheaper and better than heretofore. It may be well to emphasise the importance of avoiding the use of aluminium, and still more the use of zinc, in their preparation. An alloy containing zinc is almost certain to prove unstable and will sooner or later give trouble, particularly in tropical climates; white-metal die-castings are absolutely stable, even under the most adverse conditions, provided that the use of the above two metals is avoided.

A similar process of evolution has been going on as regards working principles.

It seems safe to prophesy that, in the near future, industrial a.c. requirements will be met as follows:—

Quantity to be measured.	Type of meter.
Current	Moving-iron, with or without current transformers
Low voltages	Moving-iron, directly connected
Moderate voltages ...	Moving-iron, through voltage transformers
Extra-high voltages ...	Electrostatic
Power	Electro-dynamic
Radio-frequency current	Thermo-couple, or thermo-expansion (hot-wire)

A scale subtending an angle of about 120 deg. instead of 90 deg. has now become almost universal in round instruments; probably this has largely contributed to the elimination of the induction type, since the only advantage which can be claimed for the latter is its 300 deg. scale, but it is useless to increase the exactness with which a certain deflection can be read if the inherent errors of the instrument are such that the correctness of the deflection itself is in doubt. The stress in the material of a given spring is proportional to the angle turned through, so that a 300 deg. deflection involves a stress 2½ times as great as that of the 120 deg. This necessitates the use of a thinner spring, with its attendant disadvantages and difficulties of construction. Much progress has been made of late in the design of meters having scale shapes appropriate to the service for which they are intended. In B.S.S. No. 89 of 1926, it is stipulated that the suppressed portion of the scale shall not exceed one-half of the whole.

A feature which is only now beginning to receive the attention it deserves is "ruggedness." The lighter the moving parts, the better will a meter withstand rough treatment; it was at one time believed that a criterion of excellence in this respect was the ratio of the torque (T) corresponding, with a given angular deflection, to the weight (W) of the moving parts; however, an instrument with light moving parts may have a lower "torque/weight" ratio than would be satisfactory for one with a heavier system. It is agreed, in fact, that the "pivot factor" may be expressed as T/W^n, but authorities differ as to the value to be given to n. The pivot factor, if expressed as torque/$W^{1.5}$, should not be less than 0.0004 when T is expressed in gramme-cm. per degree of deflection and W in grammes.

Moving-Iron Ammeters and Voltmeters.—The authors felt convinced that the moving-iron principle, if properly applied, would lead to the construction of a precision ammeter or voltmeter, as good as or better than the electro-dynamic type and suitable for use indiscriminately with a.c. and d.c.; accordingly, the possibilities were carefully explored. That the double iron affords a higher torque for a given expenditure of power than the single, the authors believe to be a fallacy. In any case, it was found that for a given torque the volt-ampere consumption could be made lower with the single iron, owing to the reduced mean length of each turn, and with a single iron of nearly circular shape, so pivoted that it could be drawn into a narrow slot in the centre of an oval coil, as shown diagrammatically in fig. 1, the relative change of self-inductance could be made larger and the product I^2L smaller than with any other form of movement, thus confirming the wisdom of the choice. The authors' coil and moving iron when tested on the Anderson bridge showed an inductance of 0.06 henry with a change of inductance of as much as 30 per cent. from zero to full deflection. The product I^2L was 1,500, the current I and the inductance L being measured in c.g.s. units. An oval coil with an overall width of 1½ in. and a length of ⅝ in. was ultimately decided upon, and by suitably shaping the iron disk and taking advantage of the distorted field given

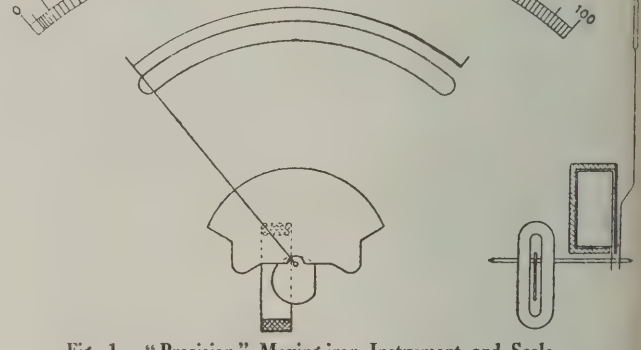


Fig. 1.—"Precision" Moving-iron Instrument and Scale.

by so short a solenoid, it was found possible to obtain a scale of the shape indicated in fig. 1, which, except for the first 10 per cent., is sensibly evenly divided, but exhibits a desirable closing up of the divisions towards the upper end.

Practice has differed greatly as regards the flux density in the iron, values ranging from 500 to 5,000 gauss being found in representative moving-iron meters. It was found that the torque could be increased by as much as 25 per cent. without increasing the weight of the iron, by "dishing up" its edges so that they presented a larger surface to the air where the magnetic lines passed from the one to the other; and it seems probable that any small increase of torque which may result from a thickening of the iron is due principally to this cause.

Moving-iron meters in which the iron was worked at a very low flux density, say, in the neighbourhood of 500 gauss, invariably gave a higher reading with a.c. than with d.c., more especially towards the upper end of the scale. Investigation showed that this was due to the shape of the B/H curve, which is reasonably straight above 1,000 gauss, but below this flattens out considerably. In fact, the permeability of the iron at a flux density of 570 gauss is about 30 per cent. greater than that at 400 gauss, as shown by the slope of the B/H curve at these flux densities. The effect will be clear if it is assumed that a d.c. of 4 amperes, flowing through an ammeter winding, magnetises the iron to 400 gauss; an a.c. of 4 amperes (r.m.s.) will have an instantaneous peak value of about 5.7 amperes, which will carry the flux up to a part of the curve in which the permeability is much greater, so that the meter will read slightly high, as compared with direct current. It is the excursion of the sinusoidal a.c. wave into regions of higher permeability which accounts for the results obtained. That it is due to the wave-form and

not to reversal is shown by the high readings obtained when the iron is magnetised by commutated a.c. These considerations indicated the disadvantages of too low a flux density, but there must also be an upper limit, since the B/H curve flattens out again at higher values of B and it is essential that the density should not be so high that a peaky wave of current would carry it over the knee of the B/H curve. The iron represents a negligibly small part of the total magnetic reluctance, and so long as the peak value of the wave does not greatly exceed 8,000 gauss, the saturation effect, and with it any wave-form error, will be inappreciable.

Taking these facts into consideration, a flux density of 2,000 gauss (r.m.s.) would represent a satisfactory figure; even should the peak value reach 10,000 gauss this could only introduce an error representing a small fraction of 4 per cent. This effect, whilst the exact converse of that previously alluded to, is likely to be less important since then it was the major portion of the wave which was in the region of reduced permeability due to low flux density, whereas now it is merely the peak of the wave which is in the region of reduced permeability due to high flux density.

In an a.c. instrument hysteresis will cause a lag of the flux in the iron behind the magnetising force producing it, and it follows that the net torque at any instant is proportional to BH cos θ, where H is the r.m.s. magnetising force, B the r.m.s. flux density in the iron, and θ the angle of lag between the magnetising force and the flux. A direct measurement of this angle was made: taking as an example a flux density corresponding to full-scale value (B=2,020), the angle of lag was 33 minutes, so that the decrease in the reading due to a.c. hysteresis would be $(1-\cos\theta)100=0.005$ per cent., a negligible amount.

That hysteresis should not cause the reading to be appreciably smaller with a.c. than with d.c. appeared to be so much at variance with the generally accepted view, that it was thought desirable to check the measured angle against the angle calculated from the known characteristics of the iron.

The result showed that the conclusions arrived at in the preceding paragraph are justified. Having eliminated hysteresis as a source of appreciable error, the reason for the undoubted fact that certain moving-iron ammeters do read considerably lower on a.c. than on d.c. was ultimately found to be due almost entirely to eddy currents—a source of error which does not appear to have been sufficiently appreciated in the past, quite undue prominence having been given to hysteresis. For example, a small copper plate only 1 mm. thick placed 10 mm. from the moving iron and normal to the flux, introduced an error of 1 per cent. in the reading, and if brought up to 1 mm. the error increased to 14 per cent. These tests were made at 700 cycles per second; at 50 cycles per second the error in the latter case amounted to 1½ per cent. These comparatively large errors are undoubtedly due to the fact that the flux in the moving iron emerges from it at a high density, forming a sort of jet of flux, a form which is, of all others, best calculated to generate eddy currents. In any case, the selection and heat treatment of the iron require the utmost care, and it is now possible to construct moving-iron instruments which, for all practical purposes, exhibit no hysteresis error whatever, even with direct current.

In the paper are set out in detail the observed characteristics of meters constructed upon the principles enunciated, and the maximum error due to any of the causes enumerated (in the paper) does not exceed 0.1 per cent. in the case of the voltmeter (0-150 V, 7.5 watts) at power frequencies, and in the case of the ammeter (0-10 A, 0.5 watt) at any frequency up to 700 cycles per second, a result which the authors believe to be unique for a moving-iron instrument, and superior to that attainable with an electro-dynamic voltmeter or ammeter of equivalent range and power consumption. A further advantage possessed by this "Precision" instrument lies in the scale shape, fig. 1.

There is no difficulty in producing for any moderate current a single-range ammeter having this degree of precision, so long as care is taken to avoid eddy currents in the mass of the conductors. The design of a multi-range ammeter presents a number of difficulties. Now that truly "precision" current transformers are available the most satisfactory arrangement, so far as a.c. measurements are concerned, is to use a multi-range current transformer. A limited change of range can be effected by winding the coil in sections, which are connected in series or in parallel, as required, but the practical limit of range is, at present, 1 to 2 or 1 to 4. The self-inductance of the ammeter considered is, however, so small as to enable the range to be increased by means of shunts without impairing the accuracy for either direct or alternating current. Possibly the reason for the past neglect of the moving-iron type is that the electro-dynamic principle lends itself so readily to theoretical and mathematical treatment, and has advantages which, however difficult to realise in practice, are sufficiently convincing when discussed in the abstract.

Measurement of Rectified Current.—Rectified a.c. is now used for many purposes, so that its measurement is a matter of some importance. It must not be assumed that a rectified current, because unidirectional, can be treated in all respects as a direct current. A permanent-magnet moving-coil ammeter will measure the d.c. component and will ignore the a.c. component, that is it will measure the mean value of the wave. An induction type ammeter, on the contrary, will measure the a.c. component and will largely ignore the d.c. component, whilst an electro-dynamic or moving-iron ammeter will measure the r.m.s. value of the whole wave. Strictly speaking, therefore, it depends upon the nature of the load which form of ammeter should be selected. All things considered, the moving-coil ammeter, owing to its intrinsic advantages, is to be preferred for the measurement of rectified current under normal conditions.

Electrostatic Voltmeters.—For higher voltages than 7,000 V, owing to the cost and size of voltage transformers, the electrostatic voltmeter has many advantages. Cases also frequently arise in which the current passed by the transformer-operated voltmeter puts it out of court (*e.g.*, for some leakage indicators); again, when portability is important the electrostatic voltmeter has much to recommend it. It is usually preferable that electrostatic voltmeters for alternating voltages exceeding 5,000 V should be connected in series with condensers, by which means the range can be extended as required; it is advisable that the voltage across the meter itself should not be more than, say, 3,000 volts at full deflection. If properly designed, series condensers are quite satisfactory for voltages up to, say, 30 kV, so long as one terminal of the voltmeter can be earthed. For laboratory voltmeters, where a number of series condensers of ample capacity can be used and the conditions are well under control, such voltmeters have been satisfactorily used up to 250 kV above earth, or 500 kV in all.

The direct-connected air-insulated electrostatic voltmeter is entirely free from errors due to frequency, wave-form, temperature, earthing, or otherwise, of either terminal, and so forth, and is available up to 500 kV or more. For laboratory use electrostatic voltmeters have been constructed in which air (or, still better, nitrogen) is used at a pressure of about 150 lb. per sq. in., under which conditions it has a breakdown voltage of some 200 kV per cm. In such meters the control is usually electro-dynamic so that the whole moving system can be enclosed in the high-pressure chamber, the electrostatic element being brought back to zero by varying the current through the electro-dynamic portion.

It is often necessary to determine the peak value of a voltage as well as its r.m.s. value. The simplest method of so doing is by means of the neon tube in conjunction with an Abraham or other extra-high-voltage, air-insulated, electrostatic voltmeter.

Electrostatic voltmeters are liable to damage through overvoltages due to surges, and a fuse alone is unreliable as a means of protection; such meters should be protected by a resistance in series with each pole. The capacity current taken by the voltmeter at power frequencies is so small (of the order of 30 micro-amperes for all ranges at 50 cycles) that a resistance of several megohms will not appreciably affect the reading, so long as the instrument is correctly designed. Protective resistances usually take the form of rods of carbon having an admixture of some substance which increases their specific resistance. It is important that the protective resistance should not be such that its resistance decreases greatly with high voltages or rising temperature, as is sometimes the case.

Thermo-Expansion Instruments.—It is usually assumed that thermal meters, whether of the thermo-expansion (hot-wire) or thermo-couple type, are equally accurate with d.c. and a.c. at any frequency, but such a statement cannot be accepted without considerable qualification where radio-frequency currents are concerned. So long as a single heater is employed, error is limited to that introduced by the increase of resistance due to the Kelvin skin effect, and for small conductors this is usually inappreciable. For example, a single wire suitable for carrying 3 amperes at full scale can be used up to a frequency of 5,000,000 cycles per second without the error due to this cause exceeding 1 per cent. For currents greater than 5 amperes the hot wire becomes so large as to introduce thermal sluggishness, and it is usual to employ two wires in parallel, only one being coupled to the pointer. To measure currents greater than can be carried by two reasonably small wires, it has been customary to arrange a number of such wires or strips round the circumference of a cylinder (squirrel-cage), only one of them being coupled to the pointer. So long as the conductors leading the current into and out of these wires are exactly coaxial with them, the current distribution will be uniform at radio frequencies, and if the ohmic resistances of all the wires are identical the indications will be independent of frequency; these two conditions are, however, extremely difficult to fulfil. A method of securing the necessary even distribution of current at radio frequencies which has not, so far as the authors are aware, been employed, is to arrange the leading-in conductors concentrically, the inner one passing down the axis of the squirrel cage. Even then, the difficulty of ensuring equality of ohmic resistance between the different wires still remains, not to mention constructional complications. The "shuntless" hot-wire ammeter in which a single active wire is divided up into three or five parallel sections, the current being led to and from it by means of flexible ligaments attached to the wire at the appropriate points, has proved fairly successful at power frequencies, but when applied to radio-frequency measurements the difficulty of making the several parallel paths sufficiently symmetrical is enormous.

In general, where radio frequencies are concerned a current of 6 amperes is as high as it is possible to measure direct with any degree of accuracy. Above this, the use of a radio-frequency current transformer is greatly to be preferred. They are now available for any current up to 1,000 amperes, or

more, and give equally accurate readings on all ranges. Moreover, the power consumption is small and they can be fixed in positions in which it would be impossible to install an indicating instrument.

Graphic Meters.—The moving-coil type has been found the best for d.c., whilst for a.c. the ironclad electro-dynamic system is to be preferred. Considerable improvements have been made of late years in the inking arrangements, and pen friction may be eliminated either by allowing the pen point to swing clear of the chart, on to which it is pressed at intervals so as to leave a record of its position, or by causing the electrical movement to operate the pen indirectly, through some form of relay. The "thread recorder" has been considerably used for temperature measurements, but is unsuitable for dealing with rapidly varying quantities such as are met with in most electrical work. The "relay" arrangement for a great many purposes probably represents the most satisfactory form. The latest is that due to Mr. E. I. Everett, and is available for the measurement of comparatively rapidly varying quantities and is, moreover, a deflectional instrument.

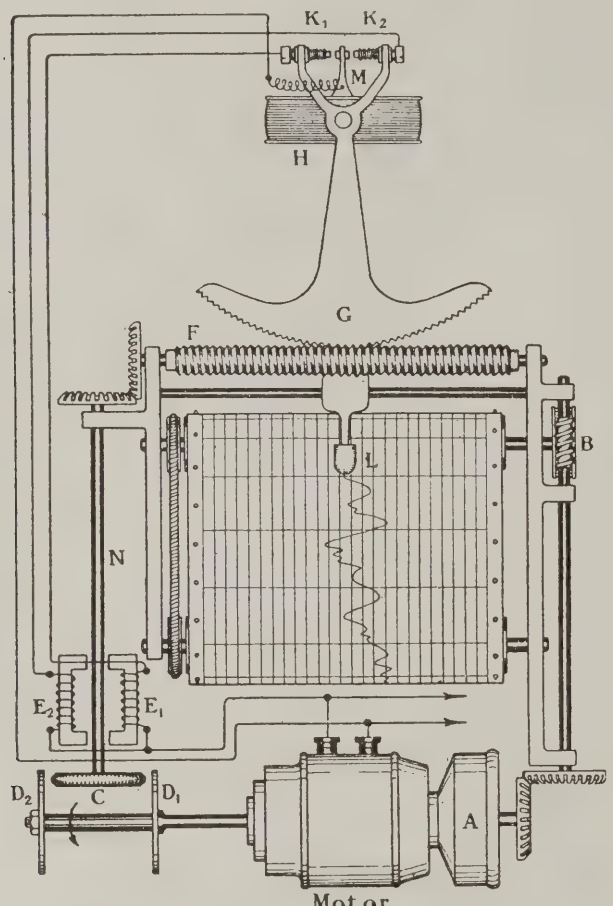


Fig. 2.—Relay Graphic Meter.

The working principle will be clear from fig. 2: H represents the controlling electrical movement which carries a contact arm M; should this arm deflect to the left, for example, it will make contact with K_1, and so cause a current to flow through E_1, which attracts the rod N, thus pressing the leather-rimmed wheel C into contact with the motor-driven disk D_1. The wheel C is thereby driven in a clockwise direction and causes F to rotate in such a sense as to carry the pen (L) towards the right. At the same time G is moved towards the right, thus tending to cause the contacts M and K_1 to part; this will actually occur when the coil H has reached its point of equilibrium, and at once E_1 ceases to keep C in contact with D_1, so that the travel of the pen stops until M once more makes contact with either K_1 or K_2, as the case may be. The motor carries an adjustable centrifugal governor (A) and serves also to drive the chart by means of the vertical spindle and worm B. The governed-motor principle is equally applicable to alternating-current or direct-current systems, but for the former the Warren synchronous motor is to be preferred.

(To be concluded.)

Discussion in London.

Dr. C. V. Drysdale congratulated the I.E.E. on having accepted such a paper, saying he found himself in substantial agreement with its contents from end to end. He had no serious fault to find with anything in it, and was glad that the authors had put some of his own ideas into practice. He agreed with the authors' list of types of instruments which would survive: the hot-wire expansion instrument would not, for the thermo-junction pattern was the better; the dynamometer voltmeter would endure for testing purposes, but the induction indicating types had seen their day. The new nickel-iron element would create a revolution in all electromagnetic instruments and make possible the use of iron where it had formerly been impossible; moreover, for shielding purposes to reduce the internal field it would be very useful indeed, and he hoped it would be universally employed; its possible applications were many. He congratulated the authors on having obtained a very long instrument scale, and was glad to know they appreciated the electromagnetic efficiency of instruments, although the inductance method of looking at the subject was useful for designing the right type of scale. Having to do a great deal of testing, he was, naturally, favourably inclined towards an instrument which would measure equally well both a.c. and d.c. He had been considering for a long time how such a meter could be made, for it would be an extremely useful device: by means of specially formed copper-strip coils (the arrangement of which the speaker demonstrated with the aid of models and lantern slides) which could be connected in series-parallel as required by a cam shaft, avoiding soldered joints altogether, it was possible to devise an instrument that would serve the purpose.

Mr. F. H. Nalder thought the authors had crystallised many of the ideas which had been before instrument makers for some time. He did not agree that long-range instruments were going to die just yet awhile, neither was he in agreement with the authors' contentions about springs: they all had to make suppressed scales. The slightest deformation of a coil would be disastrous in the case of a narrow scale. The paper would afford much food for thought in the future.

Prof. G. MacGregor Morris was of the opinion that the paper could have been divided into three parts and each discussed on a separate night, as there was so much in it. With regard to the driving of the chart of a graphic meter by means of a motor, if the supply of electricity failed the motor would stop, and it seemed therefore that something was needed to tide over such an occurrence. He agreed with the authors' list of meters that would survive; a number of workers were at present engaged upon the investigation of the neon tube electrostatic voltmeter, and he was confident that that type of instrument would be greatly developed, but not many people would care to put their heads near the telephone indicated in the authors' illustration. Dr. Drysdale had anticipated him on several points; he supported him and put in a plea for the logarithmic scale: that was what was wanted in the laboratory, but it was difficult to convince makers and their customers, too, that it was the desirable scale. It was a very great achievement of the authors to have reduced the error of instruments that would measure both a.c. and d.c. to "nil" (*i.e.*, well under 0.1 per cent.). Had the authors had any difficulty in obtaining the proper types of materials for making the disks of moving-iron instruments? He asked that question because certain experiments had indicated that the flux was jerky; it did not move into the iron uniformly, which phenomenon was perhaps due to the grain of the iron.

Mr. A. F. Harris did not favour the use of series condensers for extending the range of electrostatic voltmeters, and he thought the latter could be made smaller than was indicated in the paper.

Mr. S. T. Short was happy to hear that the hot-wire instrument was dying, and the sooner the better. There could be little doubt about the accuracy of the authors' list of types that would survive, but he was sorry to see that the 120-deg. scale was superseding the other; was there some definite angle which, if exceeded, would introduce a definite error? He would like the authors' experiments with moving-iron instruments extended and the disk shaped into the form of a cup, which might be an improvement. It was difficult to appreciate some of the remarks in the paper with regard to the use of shunts in conjunction with moving-iron instruments.

Mr. R. W. Paul pointed out that nothing had been said about damping, which might be more serious to contend with than eddy currents. He was not hopeful about the use of condenser multipliers for electrostatic voltmeters. Instrument makers would like to know more about methods of construction and the general internal arrangement of the instruments.

Mr. C. L. Lipman thought the paper would be helpful to designers, but when its various sub-head sections were considered it appeared to be behind the times in several respects. He referred to the space economy that resulted from the adoption of rectangular instruments, and also to the several advantages of a new type of induction ammeter of high accuracy, quoting figures, but was unable to detail constructional features at the moment; its description would be published, however, as soon as possible. His opinion was that the 300-deg. scale had several advantages and was superior to any others. In the making of satisfactory transformers the metallurgist played an important part.

Mr. W. Phillips alluded to the importance of the new metal, and stated that with the disk pattern of moving-iron instruments he had obtained results similar to those outlined in the paper. In the case of current transformers, he could fully endorse all the authors had said. The great advantage of the new metal was the fact that the curves were so flat; there was not much variation in the error from zero to full scale. When making shields the exercise of great care was necessary, as it was possible for an instrument to be worse with a bad shield than without it; the new metal was extremely susceptible to heat treatment, and it must be treated after having been mechanically handled.

Dr. W. H. Eccles, the president, remarked that the scarcity of papers on the subject before them seemed to be the result

of national neglect of the subject: they had been too busy with other things, which was the more surprising when they considered the great changes that had come about in the quantities to be measured. Recent new instruments were merely variations or combinations of ideas that had been known for 50 years or more; the only really new thing physically was thermionic emission controlled by the third electrode of the valve. With that and the new metal which had been referred to they could look forward.

Lieut.-Col. K. EDGCUMBE, in reply, said that the main bone of contention appeared to be the induction type of instrument; if they wanted a "Big Ben," to be seen anywhere in the engine room, let them use that pattern by all means, but his idea was that the moving-iron type was the better; to-day the control engineer never entered the engine room. The results claimed by Mr. Lipman could, no doubt, be obtained, but what about the weight ratio? Were such instruments really wanted? "We will wait and see."

Mr. F. E. J. OCKENDEN also spoke briefly in reply to some of the points raised, remarking that damping did introduce difficulties, but if the moving system was kept away from the box sufficiently they could be guarded against.

Electrical Installations in Mines.

Precautions that minimise the risk of "open sparking"; and the use of discriminative protection devices.

By J. A. B. HORSLEY, H.M. Electrical Inspector of Mines.

(Abstract of a Paper read before the MANCHESTER GEOLOGICAL AND MINING SOCIETY.)

THERE is no essential difference in the precautions that must be taken on either h.p. or l.p. electrical mining systems if the risk of "open sparking" is to be minimised, and these precautions may be considered under two headings, design and maintenance. The former covers not only the suitability of the apparatus, but also the lay-out of the installation, including the selection and application of the automatic and other devices which are provided to control the system. The British Engineering Standards Association has recently defined flameproof enclosure for electrical apparatus, and has prescribed the tests which should be applied to prove compliance with that definition. The specification will soon be published as B.S.S. No. 229, and it should be studied by those who are concerned with this problem. It makes it perfectly clear that the flameproof quality of the enclosure is limited to conditions of operation within the rating of the apparatus, including recognised overloads.

It would not be commercially practicable to construct apparatus that would resist the destructive effect of an internal short-circuit when the source of energy was relatively very large and when there was but little impedance in the intervening circuit to limit the violence of the fault. Complete automatic protection is not possible without a high standard of maintenance of insulation. To avoid inconvenient interruptions of service, there is a temptation to tamper with the automatic protective devices, and such interference appears to be regarded as a laudable exercise of ingenuity. A working approximation to absolute continuity can be realised by duplicating important feeder cables and items of plant and by subdividing and applying automatic protection to the cable branches in such a way as to limit the interruption, on the occurrence of a fault, to the defective branch. Maintenance of insulation resolves itself into the application of tests to discover incipient faults before a breakdown occurs, either in the cables or apparatus. The ordinary indicating instrument, unless it is under continuous observation, is of little practical value, but the leakage indicator might be useful to this end.

It is not as generally known as it might be that leakage indicators can be applied effectively to earthed systems, excepting only the earthed concentric system in which it is not possible to distinguish between currents due to leakage and those that are normal to the system. A method of leakage indication used by some electric power companies for small transformer sub-stations consists in earthing the neutral point of the secondary winding of the transformer through a small fuse which is shunted by a suitable number of ordinary incandescent lamps connected in series. If an earth fault occurs on the consumers' circuits, the small fuse is blown and the lamps are lighted so long as the fault continues.

This is a very cheap way of obtaining fault indication, but the blowing of the small fuse removes the low-resistance path to earth just at the moment when it is most urgently required to ensure the operation of the automatic protective devices upon the consumers' installation. Such a method may be good enough for small surface installations, but reliable and complete automatic protection is so important for a colliery installation below ground that it should never be accepted for a mine system. The information obtained by the use of a leakage indicator must be supplemented by actual insulation tests of parts of the circuit; and if such tests were made systematically at sufficiently short intervals of time it should be possible to locate and remedy defects before they developed into serious faults; a graphic recorder should be of value in exercising control of this work. Assuming that the apparatus to be protected is capable of withstanding the mechanical stresses arising from the magnetic forces due to abnormal current, and ignoring the destructive effects of the electric arc when there has been a complete failure of insulation, there remains the question of limiting the temperature that the conductors may attain to a value which will not entail permanent injury. This temperature is a function not only of the current, but of the time. Fuses to some extent possess this time-temperature characteristic, and if they were not so much at the mercy of their environment would appear to offer a simple means for limiting the current flowing in the normal path to a predetermined value.

In practice fuses can only be used to cater for short-circuits, and cannot be applied generally so as to prevent a cable or a motor from becoming overheated due to a sustained overload. A ventilated motor built to comply with B.S.S. No. 168-1923, and having a continuous rating, must be capable of being worked at 25 per cent. overload for a period of from 30 to 120 min., 50 per cent. for 1 min., and 100 per cent. for 15 seconds, in all cases without injury to the motor. It will be obvious that no ordinary fuse could prevent an extension of the period of the sustained overload first referred to or distinguish between the permissible and dangerous duration of the short-period overloads. This criticism of the fuse is with reference to mining practice. The author is aware of attempts that are being made with more or less success to produce fuses that may properly be described as instruments of precision, and those who are interested should refer to a paper, entitled "High Power Fusible Cut-outs," by L. C. Grant, published in the *Journal* of the Institution of Electrical Engineers for September, 1926 (Vol. 64, No. 357) [ELECTRICAL REVIEW, April 2nd, 1926, p. 558.]

The ordinary circuit breaker equipped with an overload trip device can be set with greater precision and certainty than can be hoped for with the fuse, but otherwise it shares the limitations of the latter. To allow for starting rushes of current and for overloads which are quite innocuous if not sustained or repeated at too brief intervals, it is necessary to set up the trip of the circuit-breaker so that it shall not trip at less than, say, three times the normal full-load current of the motor that it protects. If a standard continuously rated motor is to be adequately protected against overheating due to a sustained overload, the protective device should operate when the sustained load exceeds the normal full load by more than 25 per cent. These antagonistic requirements can be met quite simply by adding a device, such as an oil-immersed dash pot, which will retard the action of the trip. The delay may either be definite or it may have an inverse time characteristic, which means that the greater the overload the less will be the delay introduced by the device.

For the control of individual motors the variable type of time lag is more suitable, while for protecting a cable system when there are two or more circuit-breakers in series the fixed type of time lag may be used if it is desirable to make the overload protection selective.

A well-known switchgear firm has recently introduced an ingenious adaptation of its standard time lag to meet the case

where the starting torque is abnormally great in proportion to the running torque. This consists in the addition of a "pilot" dash pot, controlling a by-pass valve in such a way that the normal lag is increased for a sufficient length of time to allow the motor to run up to speed. The by-pass then opens and the time lag functions normally.

With "overload" protection alone it is difficult to limit the interruption of service to the branch circuit upon which the overload has occurred if there are several circuit-opening devices in series. It is not always realised that the current which may flow momentarily to a fault through a fuse or a circuit-breaker equipped with an overload trip is not determined by the size of the fuse or the setting of the trip, but by the size and type of the supply plant and the resistance or impedance of the intervening cables and apparatus. There can be no certainty, therefore, that a fault which causes the opening of an overload protective device near the boundary of the electrical system will not simultaneously operate similar protective devices near the source, although the setting of the latter may be 10 times that of the former.

It must also be recognised that the fault current may be limited by the impedance of the circuit to a value below that at which the circuit-breaker is set to operate, but may yet result in local overheating sufficient to originate a fire.

The remedy lies in the use of leakage protection, and if this is applied so as to be selective in action, not only is the interruption limited to the faulty sub-circuit, but in most instances the fault is isolated in its initial stages, *i.e.*, as a single-pole or single-phase fault to earth, before it has developed into a short-circuit between the poles or phases.

Leakage protection, if it is applied so as to interrupt the supply to the whole installation on the occurrence of a fault at any point, is of no practical value. Complete selectivity can be secured upon a.c. systems by the use of pilot wires which are employed to balance the voltage or current at the two ends of the circuit. Even without pilot wires it is possible to secure selective leakage protection for overhead lines, or for two or more cables working in parallel, by the arrangement known as split-conductor protection. The method is easily applied to overhead lines, and it ensures that if one of the wires composing a split should break and fall, the circuit-breaker would be instantly tripped.

The three essential conditions to the safety of apparatus in mines are as follows:—The apparatus must be safe for use within the limits of its rating, in the presence of an explosive mixture of firedamp and air; "the (automatic) protection of the circuit must be such as to ensure, as far as practicable, that the highest recognised overloads for the apparatus shall not be exceeded, having regard to the amount of destructive energy available at the apparatus, calculated from the size of the generating plant and the impedance of the circuit between it and the apparatus" (B.S.S.); the standards of maintenance and discipline must be such as to ensure, in general, that the electrical equipment involved shall be kept as nearly as possible in perfect condition and, in particular, that there shall be no improper or ignorant interference with the essential parts of any flameproof enclosure, nor with the adjustment of the automatic protective devices that are associated therewith.

The third condition is perhaps the most difficult of fulfilment, but it would be nothing less than criminal folly to install and use electricity in a place where firedamp is likely to occur in a dangerous quantity unless those responsible for its introduction were prepared not only to procure the most suitable equipment, but to so organise the supervision of the plant as to ensure, as far as possible, that it should be maintained in its original integrity

Institution of Electrical Engineers.

The Annual Dinner of the Mersey and North Wales (Liverpool) Centre.

ABOUT 80 members and guests were seated at the annual dinner of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers, which was held in Liverpool on February 2nd, when Mr. P. J. Robinson, chairman of the Section, presided, and some interesting speeches and an excellent musical programme resulted in an enjoyable evening for all present. The usual loyal toast was given, after which "The City of Liverpool" was proposed by Col. J. F. LISTER, C.M.G., chairman of the South Midland Centre. He said that Liverpool had one of the oldest electric railways in the country, and that the North Country was ahead of other parts in that connection. Great credit was due to the Liverpool electricity undertaking for its low supply charges. The city had nothing much to gain by the new Electricity (Supply) Act. He agreed that the "grid" would be useful within reasonable areas, but not if taken to such parts as North Wales. In Egypt some years ago he saw knife and scissor grinders using electricity to drive their grindstones, which showed that the people were anxious to take an electricity supply if they could get it cheaply.

In reply, the Rt. Hon. the Lord Mayor of Liverpool, Councillor F. C. BOWRING, pointed out that Liverpool was responsible for one-third of the import and export business of the country. Corporations were becoming great trading concerns, and the electricity supply departments were by no means the least important. He paid a tribute to Mr. Frank C. Wilson, J.P., chairman of the Liverpool Tramways and Electric Power and Lighting Committee, and regretted the absence of Mr. H. Dickinson, chief engineer of the electricity undertaking, who was ill. He understood that the much-criticised 25,000-kW set at the Lister Drive station was doing remarkably well.

"The Institution of Electrical Engineers" was proposed by Mr. TOM WHITE, chairman of the Liverpool Housing Committee, who outlined his conception of the objects of the electrical industry, received during a year of office when deputising for Mr. Wilson. If this country mobilised a great army to release us from the thraldom of trade depression, then the general staff should consist of electrical men. In the drawing up of the Electricity Act more opportunity should have been given for electrical men to exercise their abilities. He could not think that the results of the proposed unification of frequency would warrant an expenditure of £10,000,000. He had recently converted his private house to "all-electric," and had received a shock in finding that his quarterly consumption was 4,000 kWh, but he did not grudge the increased expenditure, for he had proved he was getting it back in increased health and comfort. He had induced Liverpool to build 250 all-electric houses, and he was depending on the electrical engineers to bring down the bills. In referring to the waste of sunshine due to the uneconomic methods of burning fuel, he said that the sooner we had collaboration between the medical and electrical professions, the sooner we should have an A1 nation. He had seen the great electrical manufacturing works at Newcastle, Birmingham, Manchester, and Rugby, and they seemed to him as sentinels waiting to defeat trade depression. Eighteen thousand persons had visited the electrical exhibition house at Liverpool in one week. It was an enterprise granted to the City by builders and contractors without a cost of one penny to the community. He was sure that what Liverpool had accomplished electrically could be achieved all over the country by the co-operation of the I.E.E. In 1913 the number of consumers in Liverpool was 10,000; in 1926 the figure was 41,000. Forty-eight million kWh were sold in 1913, and 172 million in 1926. To-day their plant capacity was 103,000 kW, and another 25,000-kW set would be installed next year. Liverpool now headed the list of the great towns of this country as regarded the percentage increase in the consumption of electrical energy.

Dr. W. H. ECCLES, president I.E.E., responded. He reminded Councillor White that he could have added to the laurels of his city by pointing out that Liverpool was the birthplace of wireless telegraphy. Forty years ago Sir Oliver Lodge was working in the Liverpool University on an experimental apparatus which he evolved for transmitting and receiving electrical waves over a distance of two yards. In 1897 Lodge developed a scheme of connections which foreshadowed the progress of the next 14 years. To-day an amateur with apparatus costing only a few pounds could speak to remote parts of the earth. He agreed that Liverpool was not likely to benefit much by the Act, but thought the less said on the matter the better. Perhaps the people would lose a little in patriotically helping the rest of the community. Londoners paid four times as much for their electricity, and said "come on the grid." He was glad to see that power lines were beginning to appear on the landscape in the Liverpool district. The beauty of the Swiss mountains was apparently not discovered until the power lines appeared; it was a matter of psychology. The electrical profession must try and work out that there was beauty in power lines. It was recorded that last year this country exported electrical material to a greater extent than any other country. Britain might well be described as the electrical workshop of the world. The rapid growth of the membership of the Institution was a sign of the electrical expansion in this country.

In proposing "Our Guests" Mr. E. M. HOLLINGSWORTH warmly welcomed the visitors, and the toast was responded to by Councillor Frank Wilson and Mr. H. Wade Deacon, Pro-Chancellor and President of the Council of the University of Liverpool. Mr. WILSON did not think we advertised our wares sufficiently. The average price per unit of electricity used in his house last quarter worked out at 0.728d. He paid a tribute to Mr. Robinson. In a humorous speech, Mr. WADE DEACON expressed great admiration for the vigour of the Institution.

Mr. A. E. MALPAS proposed "The Chairman," and described Mr. Robinson as one of the liver birds of Liverpool.

In reply, the CHAIRMAN referred to the great help he had received from Mr. Oscar C. Waygood, hon. secretary of the Centre.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Electric Flood-lighting.

I notice your review on this subject in the current issue of your paper, and as I have perused the contribution in question presented before the Illuminating Engineering Society at the Lighting Service Bureau recently, perhaps a few comments may be added, by one who has had an extensive practice in the use of the parabola for a period of forty years, and probably knows something of the optical characteristics which define its legitimate and successful application.

The paper referred to principally deals with the illumination of plane surfaces by means of concave reflectors with circular apertures, of parabolic or allied construction, for projecting round beams of light for use on high distance ratios.

The optical characteristics totally prohibit successful application to efficient illumination in broad and even effects over plane surfaces, whether with or without asymmetrical distribution, and the paper consists of the compilation of figures which support this view, indicating quite clearly the defective results to be obtained where such apparatus is used for lighting extensive surfaces such as building frontages, large posters, &c.

An arbitrary figure of 3 ft. 6 in. is given as the minimum projection of the lamp from the surface, but the depth of the surface is not given for such projection. The maximum projection allowed by the L.C.C. is 4 ft. from building line to light source for any depth of surface for lighting frontages. It is well known that such limited projections involve the practice of high distance ratios, and a surface of 40 ft. deep on the L.C.C. limitation would have a distance ratio of 10 to 1, while if the surface was 50 ft. deep the distance ratio would be 12.5 to 1.

Neither round projected beams of light nor asymmetrical projection can be used to give satisfactory results on such practice, and that is why wherever these are found in use the illumination is a failure from the point of view of uniformity.

In theory the apparatus recommended in the paper is totally unsuitable for the purpose, while the results give the impression that the professional is relying upon the immature conception of the amateur.

The lighting of building frontages requires the practice of the very highest art in illumination, and optical knowledge beyond that of projecting distorted beams of light, if the architect is not to have his creation spoiled by artificial lighting. What may please the novice will not satisfy the artistic tastes of the architect, who is interested in good illumination. Good results are what he requires, not light and shade.

Hall's System of Controlled Illumination.
John I. Hall.

Kingston-on-Thames, *February 5th*, 1927.

Power Supply for Wireless Receivers.

I am very sorry that I appear to have annoyed Mr. Turner with my previous letter; it may possibly have been my incautious reference to a certain loud-speaker, or some other matter, but I trust that he will suffer me to point out an inaccuracy in one of his statements.

I did not state that it was entirely my own opinion that the receivers in question were distortionless, but that I was also relying on the opinion of others who were certainly quite competent to judge—competent, that is, if Mr. Turner will admit that the ear of an eminent musician is competent to judge. If we agree that no human ear can be relied upon to decide whether a broadcast receiver is distortionless or not, what is the use of striving after perfect reproduction? Should we not rather try to attain pleasing reproduction?

In reply to Mr. Turner's question—on what tests or facts I based my opinion—I can only point to satisfied users of the receivers in question, who had hitherto rejected all others offered them on the score of quality of reproduction. The opinion recently passed by a Mus. Bac., F.R.C.O., was: "What perfect reproduction!" I put it to Mr. Turner that this is a competent ear within the meaning of my letter, and could safely be used as a standard by anyone purchasing a broadcast receiver.

I am, however, going to amend the statement contained in my first letter, in the hope that I shall get Mr. Turner to answer my main question regarding low-frequency transformers and h.p. consumption, and say that I am getting pleasing reproduction with these receivers, pleasing to myself and to certain professional musicians, of no mean standing, and that I am getting it by means of *three* transformers in the low-frequency amplifier and a maximum h.p. consumption of 8 mA. There is no doubt that Mr. Turner knows quite well to which receivers I am referring, and my only object in writing my first letter was to point out that at least one other firm of vast experience in telephone and radio research work does not apparently agree with Mr. Turner that it is necessary to eliminate the low-frequency transformer in order to obtain good reproduction over the audio frequency range.

I am not in the least interested in museum specimens, my idea being that ordinary broadcast receivers were being discussed, and I should be very glad if Mr. Turner would answer my question as to how it is that I can get "distortionless" (his own word, not qualified in any way in his letter in your issue of January 7th, although he now states that there is probably no such thing as an absolutely distortionless receiver) reproduction with four valves and an expenditure of 8 mA. only, when he has laid down the law that it is impossible, and also that according to him I am merely piling one form of distortion on another.

Leaving all question of competent ears, &c., out of the discussion, my contention is that I can get "distortionless" reproduction with an expenditure of 0.75 watt d.c. supply to the anodes certainly equal, and probably superior, to that obtained by other receivers with 3 to 4 watts d.c. supply.

February 5th, 1927. **Interested.**

[This letter has been shortened.—Eds. Elec. Rev.]

Perhaps this discussion could be rendered less diffuse, and valuable space saved, by more use of definite figures.

The 2-valve loud-speaker sets mentioned by me use 9 milliamperes in the h.p. supply. Taking dry cells first, it has been found that a battery of one of the three leading makes, of 100 or 108 volts, is down to 75 or 80 in one month, and 50 in three months, on the average. The battery costs a little over £1. Now, at the end of three months what is the user to do? He has had an *average* voltage of probably 70 to 80, insufficient for proper loud speaking (100 is low, in fact), and must now replace, and pay £4 to £5 a year for an average of 70 to 80; or buy a 60-volt to put in series with the 50, and put up with the increased internal resistance of the 50 as well. The accumulator, with a first cost of £3 15s. (or less) runs at least two months, and then costs, say, 2s. 6d. for re-charge, or 15s. a year—to which must be added capital charges—and gives practically 100 volts all the time. Capital charges do not bring it anywhere near the £4 to £5 a year for less voltage.

Nothing in this world is perfect, and mention of certain precautions in my former letter should not be taken to imply that I do not consider the drawbacks of the dry battery to be very much greater. At all events, the above figures represent my own experience with 2-valve loud-speaking sets.

As to 3-valve sets, on my own, with one valve reflexed, I get commonly on loud notes a peak amplitude on the grid of the last valve of 18 to 20 volts (swing 36 to 40), and occasionally, as an extreme, 23. This has been measured carefully and repeatedly by the slide-back and another method. That is on 2ZY at 45 miles. This really overloads a DE5A with 150 volts as third valve, but even at that the current is 20 milliamperes. Add 9 to these 20; and I shall be glad to hear of an economical dry battery for this service.

A. O. Griffiths.

Caergwrle, *February 5th*, 1927.

Extra-High-Pressure Transmission.

The article by Mr. Scott in your issue of January 28th certainly raises points of interest. A super pessimist has some use in a community. He makes our flesh creep and does no real harm—so long as he is not taken too seriously.

There are two kinds of reliability—the one implying a freedom from all breakdown, and the other a practical freedom. Neither underground nor overhead transmission can give the former. If absolute reliability is desired it can only be obtained by a duplicated system—whether overhead or underground—supplied from two different sources quite unconnected, and not interconnected as he suggests. The consumer is provided with change-over switches. Such a system is available in some parts of London and is made use of by certain theatres. Outside such conditions, rarely obtainable, we have to imagine that the power station does not fail, and that it is a question of the relative reliability of overhead and underground transmission. Thank heaven it is not a question of a 90 per cent. supply, but of 99.9 per cent., even with a single overhead line, which we aim at. This means one-third of a day a year, during which the consumers' fuses are "dead."

It is not clear why the overhead line is considered by the author to be inferior in reliability to the underground. A duplicate overhead line can be obtained at the cost of a single underground line! With a single underground line one has a probability of a three days' or even a week's failure, due to a single fault, whereas with overhead work we cannot contemplate any one failure lasting more than 12 hours (*i.e.*, the hours of darkness, when it is difficult to do pole work). With a duplicate overhead line the time of failure would not exceed that with a duplicate underground line, and the capital cost would be approximately one-third to one-half. We must add to this disadvantage of the underground main the uncertainty as to the life of underground cable at 33,000 volts and over, and the certainty that a replacement means a cost equal to the original capital outlay, which would ruin any ordinary undertaking concerned in a considerable length of e.h.p. cable.

On the other hand, the whole of the insulators on an overhead line can be changed, if necessary, at about £3 to £5 a pole in a short time, and one has a complete new system of insulators at about £70 per mile. Can it be wondered that those who have to make the choice "plump" for the duplicate overhead line, which may pay its way and is as safe as the duplicate underground line which will rarely, if ever, pay where load centres are a fair distance apart?

I am not so sure that even in time of war the overhead line is in the end more vulnerable than the underground, when time of failure is taken into account. I heard of only one case in England of aircraft injuring a public supply during the war. A bomb blew a piece clean out of an underground cable at Hertford in 1915. If this had been a 33,000-volt cable it would have been a three days' job to rejoint it. If it had been an overhead line the supply would have been on again in a few hours, even if a pole had been struck.

Mr. Scott confuses the frequency of failure with the seriousness of the stoppage. One can have a dozen failures of overhead insulation with less inconvenience to the public than that due to one e.h.p. underground fault. I have just arranged to run 3½ miles of overhead country line to obviate the serious loss of credit which a cable fault will cause on a certain length of underground cable, if one should occur. We cannot face the three days' stoppage which might result.

For the rest, Mr. Scott's elementary schooling of those who are in a position to design 33,000-volt lines, is rather amusing. Imagine an engineer who sends out a window-cleaning gang each week or so to clean the insulators! Why not send someone to change the insulators for a more suitable quality in those localities subject to bad conditions?

Mr. Scott quotes the Post Office policy. Does he *know* that they in general put their trunk lines underground? If they would do so it would be a great relief to us.

W. Fennell.

Northwich, *February 1st*, 1927.

Purchase of Coal to Specification.

The statement in the second paragraph of your leader of January 21st, to the effect that "the importance of buying coal to specification is not fully realised by electrical engineers," seems to me to be of a somewhat sweeping nature, and savours of hasty conjecture rather than considered judgment.

The true situation to-day, and particularly since the war, is quite the reverse. Engineers, as a body, fully appreciate the importance of the subject, but so also do the coal suppliers, who, unfortunately, refuse, most emphatically in certain areas, to enter into any contract based upon calorific value. I have intimate knowledge of several large electricity supply undertakings scattered throughout this country which have made pioneer endeavours to purchase coal on this basis, without, however, any success at all worthy of the vast amount of care and thought required to draft a specification in terms attractive to the suppliers. The matter has been raised from time to time, not only in the technical Press, wherein, especially in the United States, splendid schemes (from the purchaser's point of view!) have been propounded, but also before the I.M.E.A., and the I.E.E., and each time the obstacle has been the suppliers' reluctance.

On the other hand, in all fairness, the reasons for this reluctance are fully appreciated by those who have had anything to do with the purchase of large quantities of coal. At the same time, however, the inherent difficulties of the situation do not, as you state, "compel purchasers to burn anything that will burn, regardless of its calorific value." Coal can always, even during strikes, be obtained from somewhere at a price, however high, in proportion to its size and quality (the latter factor being judged by experienced purchasers by other considerations than a futile analysis of a tiny sample, whose very source and method of choice are even frequently doubtful), and consequently the policy quoted would be one of false economy.

With the context of your references, however, I am in entire accord, and I should like to see the problem tackled, as it will have to be sooner or later, not in a one-sided manner as hitherto, but jointly by the suppliers and the purchasers. Even then the results will still be nil, until the purchasers realise the futility of trying to enforce a contract, with a penalty clause (and perhaps also a bonus clause, if the suppliers are good boys!) based entirely and solely upon such an unstable and utterly uncontrollable factor as calorific value.

The subject of coal is one about which it can truly be said that the more one knows about it the more one realises how little one actually does know.

Maxwell.

January 31st, 1927.

Employment for Unemployed Power Station Engineers.

Being a regular reader of the Electrical Review, and being unemployed, without the dole, I first open the middle page of this journal, *viz.*, "Situations Vacant," and I get busy and spend hours writing out applications for any vacant situation. I should like to say that I, like many more out of work, have had considerable experience, and it is really heart-breaking writing week in and week out without results.

I also look at the Personal Column of the Electrical Review, where it is most interesting to learn of the promotions, &c., of certain engineers. I notice many times in the Personal Column that charge engineers of one station have been appointed as charge engineers at another station. Good luck to them if they require a change, but I am sure my brother engineers who are still out of work, will agree with me that if these jobs were filled by unemployed engineers first, it would shorten the list of unemployed, and naturally they would become E.P.E.A. members. Of course, I am speaking for myself, but I should say my unemployed brothers would do the same. If the chief engineers and E.P.E.A. would go into this together, perhaps the E.P.E.A. would allow non-members to have a list of vacant appointments with a view to becoming members, when they are so fortunate as to obtain employment.

I shall be pleased if something can be done in this way to help the power station engineers who are still out of work.

Unemployed.

January 31st, 1927.

Legal.

The General Engineering Development Trust, Ltd.

Mr. Justice Romer, in the Winding-up Court on February 1st, again had before him the petition of Walter Hill & Co., Ltd., for the compulsory winding up of this company, which is interested in the development of an electrical route indicator known as the "Pathfinder." It was said at the last hearing that the device was successful and in use at a number of places. Mr. Swords asked that the petition should be adjourned for eight weeks, as, he said, a scheme of arrangement was under consideration. His Lordship assented.

British Thomson-Houston Litigation.

In the Chancery Division, on February 4th, Mr. Justice Astbury had before him a motion in the case of the British Thomson-Houston Co., Ltd., against Braidwood for an injunction to restrain the defendant from infringing plaintiffs' two patents relating to leading-in wires and gasfilled electric lamps.

Mr. B. L. O'Malley, for the defendant, said this was a very humble offence. His client was a small shopkeeper at Barnet.

His Lordship: They generally are.

Counsel said he was willing that the motion should be treated as the trial of the action, and consent to the injunction. The defendant had had only six dozen of the infringing lamps, and there was no evidence this had been going on for any length of time.

His Lordship: These defendants are all trying to humbug the plaintiffs.

The motion was treated as the trial of the action, and his Lordship granted a perpetual injunction with the usual costs, ordered delivery up of all infringing lamps in defendant's possession, and an inquiry as to damages unless the parties agreed on a sum.

Mr. Justice Tomlin, in the Chancery Division, on February 4th, again had before him the motion by the B.T.-H. Co., Ltd., for an injunction restraining alleged infringements by J. G. Ritchie, trading as the West Yorkshire Electric Co., of Woodsley Road, Leeds, of plaintiffs' lamp patent. Mr. Trevor Watson, for the plaintiffs, said his Lordship had granted an *ex parte* injunction restraining the defendant from parting with possession of the alleged infringing lamps. He read an affidavit by Percy Freeman, who said he bought a dozen lamps at defendant's premises, Ritchie himself handing them to him and telling him that he had lamps of various voltages in stock, and he would be glad to supply him.

Mr. Ritchie, who appeared in person, read an affidavit to the effect that not only had he not infringed the plaintiff company's patents by selling lamps, but that he never sold any lamps to their representative at all.

His Lordship said this raised a serious issue of fact which he could not try on a motion.

Defendant said this was a serious matter for him, as it was holding up his living.

His Lordship said he would grant facilities for an early trial of the issue, and in the meantime the interim injunction would drop.

Handcock v. Routledge.

According to an Irish newspaper report, Mr. Justice Meredith recently delivered his reserved judgment in the case of Ernest C. Handcock, electrical engineer and commission agent, of Dublin, against Frederick Routledge, also of Dublin, on an application made by the plaintiff for an order for discovery of documents. The action was brought for an account of all orders placed with the defendant as agent for electrical house service meters made by the Dr. Paul Meyer, A.G., of Berlin, and for other electrical material manufactured by the Deutsche K.A. Gesellschaft, of Berlin, as a result of the work and canvassing of the plaintiff, directly or indirectly; an account of all commissions credited or paid to the defendant on account of all such orders, and payment of 50 per cent. of the commission. The plaintiff alleged that under an agreement of March, 1924, with the defendant he was to be paid, as agent, demonstrator and canvasser, 50 per cent. of the commission received by the defendant on all orders for such goods placed with him resulting from the plaintiff's work, directly or indirectly, or in any way influenced by the plaintiff during the continuance of the agreement to September 20th, 1925. The plaintiff had been advised that for the successful carrying on of his action it was essential to have discovery of the docu-

ments in the defendant's custody, as he had no documentary information on the subject. The defendant denied that the agreement mentioned was entered into or was in operation during the time specified, or at all.

Mr. JUSTICE MEREDITH stated that he was by no means satisfied that the question with reference to the rights of the plaintiff could be satisfactorily tried without discovery, and he accordingly made an order for discovery, limited to the period of the continuance of the agreement, as stated by the plaintiff from March, 1924, to September 20th, 1925 .

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

507. "Electric motor starters." Igranic Electric Co., Ltd., and F. Bergmann. October 7th, 1925. (263,584.)

12,055. "Automatic telephone systems." Standard Telephones & Cables, Ltd. (G. Deakin, L. Polinkowsky, and W. Hatton. July 8th, 1925. (263,596.)

17,226. "Wireless signalling apparatus." Soc. Lerolle et Cie. July 5th, 1924. (236,587.)

22,485. "Electric switches." J. C. White. September 9th, 1925. (263,908.)

22,562. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). September 9th, 1925. (263,909.)

24,596. "Receiving systems for wireless telegraphy, telephony, and like purposes." R. H. Elleray. October 2nd, 1925. (263,918.)

24,628. "Picture transmission systems." Standard Telephones & Cables, Ltd. (Bell Telephone Laboratories, Inc.). October 2nd, 1925. (263,919.)

24,754. "Electric remote-control systems." Coventry Automatic Telephones, Ltd., and N. C. Smart October 5th, 1925. (263,926.)

24,810. "Apparatus for the reception of wireless signals." N. Lea and Radio Communication Co., Ltd. October 5th, 1925. (Addition to 240,899.) (263,931.)

24,885. "Dynamo-electric machines." English Electric Co., Ltd., J. C. Wilson, and J. W. Howard. October 6th, 1925. (Cognate application 4,686/26.) (263,940.)

25,010. "Spark plugs." A. Renaudin. October 8th, 1924. (241,204.)

25,011. "Self-exciting synchronous dynamos and motors." J. L. Matabon and C. M. Foucault. December 26th, 1924. (245,068.)

25,023. "Aerial systems for use in wireless telegraphy and telephony." C. S. Franklin. October 7th, 1925. (263,943.)

25,126. "Variable electric condensers." J. R. Spink and J. B. Langley. October 8th, 1925. (263,948.)

25,329. "Telephone transmitters." Standard Telephones & Cables, Ltd. (Bell Telephones Laboratories, Inc.). October 10th, 1925. (263,954.)

25,343. "Electromagnetic relays." British Thomson-Houston Co., Ltd., and E. L. E. Wheatcroft. October 10th, 1925. (263,956.)

25,346. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). October 10th, 1925. (Addition to 169,698, as modified by 195,928.) (263,958.)

25,420. "Electric switchgear." British Thomson-Houston Co., Ltd., H. Trencham, and C. W. Wood. October 12th, 1925. (263,960.)

25,504. "Means for the intermittent operation of electric circuits." F. G. Brettell (R. N. Gardner). October 13th, 1925. (263,961.)

25,567. "Telegraphy and telephony of the kind employing high-frequency oscillations." A. C. L. Turpain and Soc. des Etablissements Gaumont. October 13th, 1924. (241,237.)

25,903. "Electric transformers." British Thomson-Houston Co., Ltd., and J. G. Wellings. October 16th, 1925. (263,967.)

27,168. "Electrical signal lamps." J. A. Orange and Metropolitan-Vickers Electrical Co., Ltd. October 29th. 1925. (263,973.)

27,951. "Electric lamp bulbs." Edison Swan Electric Co., Ltd., and G. A. Percival. November 6th, 1925. (263,979.)

27,987. "Synchronising systems for interconnecting electric distribution circuits." British Thomson-Houston Co., Ltd. (General Electric Co.). November 6th, 1925. (263,980.)

29,391. "Electromagnetic change-over switch for wireless aerial circuits." G. S. Holland. November 21st, 1925. (263,990.)

29,871. "Wireless receiving apparatus." H. W. Cole. November 26th, 1925. (263,991.)

30,995. "Portable electric lamps." A. R. Willmott and A. R. Willmott and Co., Ltd. December 8th, 1925. (263,999.)

31,177. "High-frequency electric signalling systems." Wired Radio, Inc. May 19th, 1925. (252,317.)

32,043. "Electric distribution systems." British Thomson-Houston Co., Ltd., and H. W. C. Liddiard. December 18th, 1925. (264,006.)

17,779. "Means for and methods of electric power transmission." A. M. Taylor. July 11th, 1925. (Cognate applications 18,996/25, 22,189/25, and 23,593/25.) (Addition to 232,275.) (263,952.)

17,880. "Electric switching device for electric luminous advertisements." M. Lautner. July 13th, 1925. (264,195.)

18,133. "Electric power transmission." A. M. Taylor. July 16th, 1925. (Cognate application 451/26.) (264,196.)

23,227. "Electric storage batteries." C. E. Linebarger. September 17th, 1925. (264,205.)

23,468. "Electric switchgear." Anderson, Boyes & Co., Ltd., and H. H. Guthrie. June 14th, 1926. (264,206.)

25,162. "Wireless transmission." M. Kubierschky. October 8th, 1925. (264,209.)

25,208. "Method of winding air-spaced inductance coils." J. Craig. October 9th, 1925. (264,211.)

25,419. "Control of dynamo-electric machines." British Thomson-Houston Co., Ltd., and A. A. Pollock. October 12th, 1925. (264,215.)

25,444. "Apparatus for the rapid quenching of sparking between electrical conductors, produced by excessive voltage." M. Buchholz. October 11th, 1924. (241,230.)

25,463. "Electrically heated hot-plates and other electric heating devices." E. L. Wiegand Co. October 15th, 1924. (241,554.)

25,535. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). October 13th, 1925. (264,222.)

25,603. "Electric lighting and igniting apparatus for motor vehicles." K. A. Barenyi. October 13th, 1925. (264,228.)

25,610. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and F. Tench. October 13th, 1925. (Addition to 227,510.) (264,229.)

25,711. "Thermionic valves." G. Marconi and C. S. Franklin. October 14th, 1925. (264,234.)

25,727. "Electric remote control and indicating systems, and apparatus used therein." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). October 14th, 1925. (264,235.)

25,728. "Telephone systems." Standard Telephones and Cables, Ltd. (G. Deakin). October 14th, 1925. (264,236.)

25,784. "Frequency meters, wave-meters, and other measuring instruments for high-frequency electric oscillations, applicable to other wireless apparatus." J. K. Im Thurn and L. S. B. Alder. October 15th, 1925. (264,239.)

25,845. "Electric fuse-boxes." F. W. Abbott. October 16th, 1925. (264,243.)

26,001. "Electrical transformers and like devices for transferring energy from one circuit to another." Secret Wireless, Ltd., and J. D. Chisholm. October 17th, 1925. (264,251.)

26,014. "Draw-out type electric switchgear." G. Pailin and Ferguson, Pailin, Ltd. October 17th, 1925. (264,252.)

26,504. "Process of introducing potassium or caesium or rubidium into electric discharge tubes." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 22nd, 1925. (Cognate application 1,693/26.) (264,258.)

26,936. "Electrical circuit-interrupters." P. L. Harlow and Metropolitan-Vickers Electrical Co., Ltd. October 27th, 1925. (263,217.)

27,198. "Switching mechanisms for automatic telephone systems and the like." Siemens Bros. & Co., Ltd., and A. E. Caswell. October 29th, 1925. (264,268.)

27,388. "Crystal apparatus for use in connection with electric oscillations." J. Wilcockson and H. W. Roberts. October 31st, 1925. (264,270.)

29,066. "Method and means for communicating with submarines especially and for wireless communication generally." Q. C. A. Craufurd. November 18th, 1925. (264,281.)

29,513. "Accumulator cells." J. Stone & Co., Ltd., and A. H. Darker. November 23rd, 1925. (264,284.)

30,096. "Electrical switchgear." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. November 28th, 1925. (264,291.)

30,349. "Electrically-illuminated advertising apparatus, and control devices therefor." Scintillating Sign Co., Ltd., and C. E. H. Fitch. December 1st, 1925. (264,292.)

31,935. "Electric heaters." J. Stone & Co., Ltd., and C. D. Skinner. December 17th, 1925. (264,296.)

32,151. "Automatic telephone systems." Siemens Bros. & Co., Ltd., and W. G. Patterson. December 19th, 1925. (263,306.)

32,716. "Electric fuses." E. Dobson. December 28th, 1925. (264,306.)

1926.

1,440. "Electric switches." Hart Manufacturing Co. January 17th, 1925. (246,178.)

1,445. "Thermionic valves for wireless sets." W. H. Murad. January 18th, 1926. (264,016.)

1,560. "Method of generating high frequency three-phase currents." C. Lorenz Akt.-Ges. February 23rd, 1925. (247,925.)

1,821. "Attachments for electric pocket-lamps for the purpose of exhibiting opaque objects." R. W. Law and H. H. Uphill. January 22nd, 1926. (264,019.)

2,639. "Electric heating elements." General Electric Co., Ltd., A. Kinnes, and M. H. Hunt. January 29th, 1926. (264,023.)

2,676. "Duplex method for telegraph cables." Dr. H. W. G. Salinger. February 10th, 1925. (247,545.)

3,040. "Apparatus for examining electric sparks and their effects." G. Loutz and E. H. S. Sinclair. June 12th, 1925. (253,479.)

4,316. "Braking systems for electric motors." British Thomson-Houston Co., Ltd. February 14th, 1925. (247,607.)

4,321. "Headlights for road vehicles." G. P. M. Henrion. March 12th, 1925. (249,087.)

4,343. "Thermionic valves for wireless reception or transmission." R. L. Howard Flanders. February 16th, 1926. (264,031.)

5,354. "Lead-in devices for wireless apparatus." P. Elphick. February 25th, 1926. (264,037.)

8,113. "Photometers." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). March 24th, 1926. (264,039.)

11,555. "Alternating-current rectifiers." E. R. Gill. May 1st, 1926. (264,051.)

11,556. "Means for rectifying alternating currents." E. R. Gill. May 1st, 1926. (264,052.)

11,643. "Electric cables" Pirelli & Co. May 4th, 1925. (251,670.)

11,671. "Hollow-stranded conductors for electric high-tension overhead lines." E. C. R. Marks (Felten & Guilleaume Carlswerk Akt.-Ges.). May 3rd, 1926. (264,053.)

11,677. "Double-range voltmeters." Weston Electrical Instrument Corporation. August 26th, 1925. (257,572.)

11,869. "Electric meters." International General Electric Co., Ltd. May 13th, 1925. (252,154.)

11,954. "Regulating systems for dynamo-electric machines." British Thomson-Houston Co., Ltd. May 9th, 1925. (252,010.)

13,038. "Phonograph adjunct for radio sets." Marconi's Wireless Telegraph Co., Ltd. June 2nd, 1925. (253,096.)

14,856. "Apparatus for feeding oil to high-tension cables." Pirelli & Co. July 11th, 1925. (255,034.)

17,031. "Electrode structures for thermionic devices." British Thomson-Houston Co. July 8th, 1925. (255,069.)

17,380. "Starting and regulating devices for single-phase-fed induction motors." F. Krupp Akt.-Ges. August 25th, 1925. (257,580.)

17,412. "Alternating-current electro magnets." British Thomson-Houston Co., Ltd. July 10th, 1925. (255,105.)

17,473. "Automatic winding devices for electric or other cables, cords, or the like." W. H. Sturge. July 13th, 1926. (264,075.)

19,021. "Circuit protection." British Thomson-Houston Co., Ltd. August 20th, 1925. (257,246.)

24,061. "Sound-reproducing devices." British Thomson-Houston Co., Ltd. July 26th, 1926. (264,103.)

26,889. "Incandescent electric lamps." Y. Sakakura. November 11th, 1925. (261,358.)

924. "Time switches." G. Colledge. January 12th, 1926. (264,317.)

1,210. "Electric accumulators." W. Haddan. January 15th, 1926. (264,318.)

1,369. "Holders for gas globes, electric light shades, reflectors, and the like." A. C Peak. January 18th, 1926. (264,319.)

1,628. "Lighting arrangements for road vehicles." W. A. Wyllie. January 20th, 1926. (264,323.)

1,736. "Brush holders for dynamo-electric machines." English Electric Co., Ltd., and E. H. H. Hassler. January 21st, 1926. (263,321.)

2,625. "Wireless receiving apparatus." S. L. Forbes. January 29th, 1926. (264,332.)

5,575. "Electrical earthing connections and the like." J. P. Laker. February 27th, 1926. (Cognate application 27,203/26.) (264,349.)

5,983. "Method of and means for assisting in the construction of wireless sets and apparatus." A. Barringer. March 3rd, 1926. (263,395.)

6,139. "Electric traction." Soc. Technique d'Etudes et d'Entreprises pour l'Industrie and A. Huguenin. May 27th, 1925. (252,675.)

6,709. "Bases for current-collectors for electric railways." J. de Fischer. March 10th, 1926. (264,358.)

7,191. "Manufacture of electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 28th, 1925. (249,847.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 2nd :—

Metco. No. 476,208. Class 8. Electric cables.—Metropolitan Electric Cable and Construction Co., Ltd., Fuller Works, Grove Road, Chadwell Heath, Essex.

Electricon. No. 473,600. Class 13 Plugs, sockets, switches, connectors, and screws.—Barnard Alfred Spaull, trading as Barnard A. Spaull, 62, Fore Street, London, E.C.2.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Inclusion in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALFRETON.—Housing scheme (54), for the U.D.C.; surveyor, King Street.

ASHTON-UNDER-LYNE.—Housing scheme (92), Oakfold Estate, for the T.C.; J. Rowbottom, borough surveyor.

BARNES.—Conversion of Barnes Theatre into a kinema; the Palaseum Co.

BEBINGTON.—Housing scheme (218), Stanton Estate, for the U.D.C.; surveyor.

BECKENHAM.—Extension, Cottage Hospital; governors.

BILSTON (Wolverhampton).—Additional housing schemes (178), for the U.D.C.; F. B. Sidwick, surveyor.

BINLEY.—Housing scheme (150), Binley Colliery Co., schools, for Warwickshire E.C.; director of education, Warwick.

BIRKENHEAD.—Offices for Water Department of Corporation; Collin & Son.

BIRMINGHAM.—164 houses, Acocks Green; H. Boot & Sons, Ltd. 118 houses, Hall Green, 862 at Tyseley Farm; Edwards (Birmingham), Ltd.

BLACKBURN.—Extension of the Technical College; school at Roe Park and proposed schools at Intack Mill Hill and Audley; director of education.

BLACKPOOL.—Housing schemes, Layton, St. John's Estate and Bispham (155); borough engineer.

BOLTON.—118 houses, Higher Swan Lane and 312 at Moorfield estate; borough engineer.

BROADSTAIRS.—Residence, North Foreland (£100,000), for Sir Edmund Vestey.

BROMLEY (Kent).—Additional 94 houses, for the R.D.C.; L. O. Wall, clerk, Church House.

BROWNHILLS (Staffs.).—Housing scheme (100), for the U.D.C.; surveyor.

BURSLEM.—500 houses, Holden Hill; Stoke city engineer.

CAERPHILLY.—Houses (50), Senghenydd site, for the U.D.C.; A. J. Rossiter, builder. Mining institute, for Glamorganshire E.C.; Davies & Lloyd, builders.

CAMBERLEY.—Secondary schools (£24,000), for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

CANADA.—Canadian company is making additions to office buildings over a period of five years ($6,000,000); manufacturers of electric motors, switchgear, pumps and motors, boiler equipment, piping, &c., can obtain particulars from the Department of Overseas Trade, 35, Old Queen Street, S.W. (CX 2190.)

CARSHALTON.—Houses (99), for Sawyers & Co. Houses (64), Carshalton Place, for Tysoe & Harris. Housing scheme (166), Stanley Road, for the U.D.C.; Hugh Macintosh, architect.

CHERTSEY.—Additional housing scheme (200), for the U.D.C.; surveyor.

CHRISTCHURCH. (Hants).—Development of Homelands Estate, with 70 houses; Curry, Ltd.

COVENTRY.—Hospital extensions, for the B.G.; the clerk.

DUMFRIES.—Cold storage factory; J. Henderson, solicitor. Extension of premises for Magneto Accumulator and Electro-Plating Co., Leafield Road; the manager.

DUNFERMLINE.—Operating theatre, orthopædic, X-ray, &c., department and heating installation at the Dunfermline and West Fife Hospital; Hospital Board.

FALKIRK.—Omnibus garage and shop (£2,800) for Walter Alexander & Sons, Camelon; the manager.

GLASGOW.—Reconstruction scheme, Wellington Arcade; Smith (Glasgow) Ltd. Students' Union in University Avenue; Mr. J. K. Hunter, Ayr, assessor of plans. Schools (£300,000); clerk, Education Authority, Bath Street.

GRAVESEND.—192 houses, Kings Farm; J. G. Bennett, Corporation architect.

HEBDEN BRIDGE.—Refuse destructor; surveyor to the Council.

HEMEL HEMPSTEAD.—Extensions, West Herts Hospital; H. Fletcher, secretary.

HIGH WYCOMBE.—Chair factory, Dashwood Avenue, for Worley Bros. & Co. Housing scheme (102), West End, for the T.C.; T. J. Rushbrooke, borough surveyor.

HOCKERGATE.—Secondary school, Townley Estate; Durham County Education Committee.

HULL.—Extensions, Grammar School; Holliday & Barker.

LEOMINSTER.—Senior schools (£9,000), for Herefordshire E.C.; director of education, Hereford.

LEEDS.—X-ray installation, Tuberculosis Dispensary; chief clinical tuberculosis officer of the Corporation. Workshops and offices for Corporation Gas Department, New York Road (£110,000); G. W. Atkinson, architect. 750 houses, York and Selby Estates; city architect. Motor-'bus garage, Goodman Street and Donisthorpe Street; city engineer.

LIGHTWOOD (Staffs.).—Shopping centre, Stone Road; Beckett & Bloore, architects.

LITHERLAND.—Central school; Lancashire Education Committee.

LONDON (L.C.C.).—Electric light installation at the following schools: Holland Road, Brixton; Britannia Road, Fulham; Highbury Hill, Highbury; Brecknock School, Highgate; Springfield School, Kennington; Sirdar Road, Kensington; Carmac Street, Norwood; Bromley Hall Road; Upper North Street, and Janet Street, Poplar; Magdalen Road, Wandsworth; L.C.C. Education Committee.

(Ilford, E.).—300 houses, Springfield Drive Estate; Suburban Developments, Ltd.

(E.C.).—Proposed improvements to the Guildhall (£250,000); City Corporation.

(Deptford, S.E.).—Reconstruction of premises, High Street, for Selfridge & Co., Ltd.

(Lewisham, S.E.).—Additional 128 houses, Grove Park, for the T.C.; borough surveyor.

(Peckham, S.E.).—Reconstruction Crown Cinema, High Street, Biocolot, Ltd.; architect, E. A. Stone.

(Southwark, S.E.).—Building on Stamford Street site; G. Hamblin Fox, 34, Crutched Friars, E.C.

(Holborn, W.C.).—Reconstruction of warehouses, Cockpit Yard, Holborn; Welch & Hollis.

LUTON (Beds.).—Extensions, Bute Hospital (£18,500), for the Board of Management; secretary.

MACCLESFIELD.—Extensions, Westpark Hospital, for the B.G.; Whittaker & Bradburn, architects, 19, King Edward Street.

MALDENS & COOMBE (Surrey).—76 flats, Thorne Road site, for the U.D.C.; R. H. Jeffes, architect, New Malden.

MANCHESTER.—Extension of Exhibition Hall, Liverpool Road; city architect, Town Hall.

MELTON MOWBRAY.—Senior boys' school (£13,000), for Leicestershire E.C.; director of education, Leicester.

MIDDLETON.—Housing scheme (158), Boarshaw Estate; J. H. Randall, Ltd., builders, Sheffield.

NEWARK.—Technical institute, Notts Education Committee.

NEWBURY (Berks).—Roman Catholic church (£16,000); Wilfred C. Mangan, architect, Preston. Hoskings Bros., builders.

NORTHAMPTON.—84 houses, Weedon Road; borough engineer.

PLYMOUTH.—208 houses, Higher Mount Gold Estate (£100,000), for the T.C.; J. Wibberley, borough surveyor.

RAWMARSH (Yorks).—104 houses, Clay Pit Lane site; J. A. Tonge, architect, Council Offices, Parkgate, Yorks. Kinema, High Street, for the Heeley Amalgamated Cinemas, Ltd.

ST. ALBANS.—Central boiler station for heating institution (£10,000), for the B.G.; the clerk.

ST. HELENS.—Tuberculosis dispensary, Hardshaw Street; Lancashire C.C.

SALFORD.—Maternity home and welfare centre, Landseer Street; city engineer.

SALISBURY.—90 houses, Stratford Road; borough engineer.

SEISDON.—Additional 58 houses, for the R.D.C.; surveyor.

SHEFFIELD.—Corporation houses, Longley Estate (111); S. Higton & Son, 30 houses; M. J. Gleeson, Ltd., 63 houses; W. C. W. Alflat, 18 houses.

SURBITON.—Combined dispensary, welfare centre, and school clinic, South Place; Surrey C.C.

WALLINGTON (Surrey).—Houses (39), Coldharbour Estate, for T. Markwick & Co. Housing scheme (114), Bute Road, for the U.D.C.; surveyor.

WARSOP.—Additional 103 houses, with electrical work, Church Warsop, for the Staveley Coal & Iron Co., Ltd.; Structural Contractors, Ltd., builders, Victoria Street, London.

WARWICK.—Heating and lighting services, Hatton mental home (£35,638), for Warwickshire C.C.

WHISTON.—Schools (£28,200), for Lancs. E.C.; director of education, Preston.

WHITEFIELD.—Secondary school for girls; Lancashire Education Committee.

YORK.—Houses (80), for the T.C.; A. V. Clerey, builder, Sunderland.

The

Electrical Review

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Contents:

	PAGE
Our Supplement for Retailers	241
Electrical Travellers	242
Libraries and Information Bureaux	242
The Shannon Power Scheme	242
The I.E.E. Dinner	242
British Empire Electrical Research	243
The Electric Vehicle	243
The Central Electricity Board *(illus.)*	244
Wireless Export Trade *(illus.)*	246
Electrical Developments at Gt. Yarmouth—II. *(illus.)*	247
A Radio Crystal-Detector Circuit, by Thomas Carter *(illus.)*	249
Standard Performances for Electrical Machinery, by F. T. Chapman	250
British Electrical and Allied Industries Research Association	252
Reviews	253
Business and Industrial Notes	254
Lighting and Power Notes	258
Tramway and Railway Notes	260
Telegraph and Telephone Notes	260
Radio Notes	261
Contract Information	262
Forthcoming Events	263
Notes	263
Institution Notes	266
Our Personal Column	266
Financial Section—	
New Companies Registered	267
Official Returns of Electrical Companies	268
City Notes	268
Stocks and Shares	269
The Electrical Imports of Peru	271
Machinery Imports of the Belgian Congo	271
The British Industries Fair—I. *(illus.)*	272
A.C. Measuring Instruments, by Lieut.-Col. K. Edgcumbe and F. E. J. Ockenden *(illus.)* *(concluded)*	276
Selected Radio-Telephone Apparatus *(illus.)*	278
The Electromobile Association	279
The Institution of Electrical Engineers	280
Correspondence—	
Electricity Supply Tariffs	281
A Knotty Problem	281
River Water—or Cooling Towers?	281
Power Supply for Wireless Sets	282
A Handicap to Electrical Progress	282
The Tricity Restaurant	282
Local Exhibitions and the Public	282
Electricity Supply Tariffs	282
Legal	283
Published Specifications	283
Trade-Mark Applications	283
New Work for Contractors	284

Our Supplement for Retailers.

WITH every copy of the ELECTRICAL REVIEW this week we are circulating the first of a series of Special Supplements dealing with matters that are of direct interest to retail electrical traders, small electrical contractors, men who are in charge of or engaged in the electrical departments of large central and local stores, and staffs engaged in the showrooms of contracting businesses and electricity supply undertakings.

Events are moving very rapidly in the electrical supply development section of the industry, and it is not desirable that the electrical retailing trade, which can do so much to ensure progress along sound but enterprising lines, should be left to conduct its operations in a haphazard or casual sort of fashion. It is felt that, because there have been so many large matters upon which interest has of necessity been concentrated, the class of trader mentioned has been overlooked at the heart of things. This may be true in some measure, though the affairs of the small trader have always received attention in these pages, but whatever may have happened in the past, the recent growth of general interest in electrical products for everyday use suggests that the time has fully arrived when the retail trader should be brought authoritatively into touch with those whose interests are similar to his own, and should be acquainted in ordered form with the great range of electrical manufactures and materials that our producers and wholesale traders have prepared for him to sell to the electricity-using public.

Many estimates have been made regarding the number of shopkeepers and others in the country who are dealing in electrical goods either as a sole or a supplementary line. The influx is so large that we hesitate to express our own opinion. Everywhere one goes electrical goods are finding their way into shop windows and new dealers are beginning operations. Unfortunately in recent years too many such businesses have passed out ignominiously by way of the bankruptcy or liquidation courses through inexperience, mismanagement, unwise trading, &c.

We mentioned last week the determination of one

large company in the Midlands to add an electrical section to its business because of the general movement everywhere noticeable among ironmongers and hardwaremen to turn their enthusiasm in this new direction. It has found, as we reported, that "the thousands of ironmongers with whom it did business throughout the country were to some extent extending their operations to the sale of domestic electrical appliances."

We know that the number of new recruits to the electrical trade runs into many thousands, and we feel that the moment is suitable for placing this Supplement at their disposal.

The regular reader of the Electrical Review receives the Supplement in addition to what is also an enlarged number of the Review, owing to the space required just now for describing the exhibits at the British Industries Fair. Efforts will be made to reach newer retailers who are not already regular readers of the Review, and we venture to ask the co-operation of our supporters in making the Supplement known to those whom they consider likely to profit from a study of its contents. In the first number we give a large place to a review of electromedical apparatus suitable for use in the home, a special class of trade which, we believe, will be new to many retailers, but which should prove to be both popular and profitable.

Let us bring all the outlying units into central communication so that the electrical forward movement may proceed in orderly fashion. We know of no way for this to happen other than through the intelligent study of ideas, measures, and manufactures in the Press.

Electrical Travellers.

There were so many other interesting things covered in the speeches delivered last Friday at the annual dinner of the organisation of commercial electrical travellers that there was little opportunity to dwell upon the actual progress that has been made since the last similar function was held a year ago. The evening was more in the nature of a festival, an occasion for friendliness, than anything else. The two speeches which were of real value from a business point of view were those of Sir Hugo Hirst, Bart., the president, and of Mr. A. E. Iliffe, one of the vice-presidents, and their main interest to the general body of commercial readers of the Electrical Review lies in the emphasis that both speakers put upon the need for commercial electrical travellers to improve themselves in every possible way so that they may become the more efficient salesmen that the electrical trade requires to-day. The commercial traveller has to remember that he is an ambassador, on behalf of his company or firm, to the trade buyer; that he may do much to make or mar the reputation of his employers; that while the judicious making of friends is a part of his occupation, he must equip himself with a sufficient measure of technical information to make himself a creditable representative. We understand that the Association has made substantial progress in membership during the past year and, in the hope that it will, as the result of co-operative action, improve the standard of commercial electrical travelling throughout the land at a time when intelligent touch with the trade buyer is becoming an increasingly important matter, we wish it continued success and commend the body to the sympathetic interest of concerns not yet identified with it.

Libraries and Information Bureaux.

Everyone, at some time or other, finds himself in urgent need of an item of information which, he knows, must be available somewhere—but where? To judge by the thousands of inquiries that our Service Department annually receives—the vast majority of which are promptly answered, by post—such an emergency is neither rare nor easy to deal with. In the past we have discussed the possibility of forming a central bureau to which at least one copy of every trade catalogue should be sent, just as other copyright publications are filed at the British Museum and other official centres, such copies to be kept on file and available for inspection by anyone. A small fee might be charged, which, supplemented by a nominal subscription from each firm represented, would cover the cost of accommodation and enable a competent and helpful staff to be provided.

In London the Patent Office Library has long been the rendezvous of those who desire to consult technical literature; and the various engineering and other scientific institutions possess their own reference libraries, to which non-members can obtain access if properly accredited. The large provincial cities are similarly more or less adequately provided with library facilities—but the whole thing has been unorganised and without system, and consequently inefficient.

Less than three years ago a conference was held at which the subject of collecting and utilising information was discussed, and a committee was apointed which, with the assistance of a grant of £1,500 from the Carnegie United Kingdom Trustees, convoked further conferences, with the result that in March last year the "Association of Special Libraries and Information Bureaux" was inaugurated, "to facilitate the coordination and systematic use of sources of information in science, industry, commerce, public affairs, &c." The chairman of the Council is Mr. J. G. Pearce, B.Sc., M.I.E.E., director of the British Cast Iron Research Association, and the vice-chairman Mr. P. K. Turner, A.M.I.E.E., head of the research department of Burndept Wireless, Ltd. As the grant made by the Carnegie Trustees ended on December 31st, the Association is seeking to enrol new members as speedily as possible. It is preparing a directory of the special sources of information that exist in Great Britain and Ireland, which will be ready next summer, and will be circulated to the members, who will also be entitled to use the services organised by the Association. Such an institution will go far towards meeting the want that we have referred to, and we believe that its claim to the support of institutions of all kinds, as well as libraries, manufacturers, and individuals interested in the control or operation of statistical or information services, is worthy of the serious consideration of our readers.

The Shannon Power Scheme.

The Bill for the administration of the Shannon Power Scheme has been further postponed; its introduction in the Dail cannot take place just yet. It is a very large and technical measure, and one likely to occasion a good deal of discussion. Its main feature will be the constitution of a semi-independent Board, or Commission, on the lines recommended by the Continental experts who were called in to advise the Government in the early stages of the scheme. The decision to establish this Board finally disposes of the idea that the Government was likely to sell or lease the scheme. Naturally, particular interest will attach to the provisions in the Bill for dealing with existing electrical undertakings in the Free State, owned by municipalities, companies, &c. A good deal of anxiety has existed amongst proprietors of Free State electricity concerns as to the intentions of the Government in this regard, and more than one deputation has waited on the Minister for Industry and Commerce for the purpose of making representations on the subject.

The I.E.E. Dinner.

The Institution of Electrical Engineers, incorporated by Royal Charter, was honoured on the occasion of its annual dinner and reunion last week by the presence of H.R.H. the Prince of Wales; there was an unprecedented demand for tickets on the part of the members, so that there was no room for guests other than those officially invited by the Council, and, in fact, there was an overflow into an adjoining room, the total number present being over 600. Evidently the members of the Institution were determined

to seize the opportunity of demonstrating their loyalty to the Crown and their affection for the Heir Apparent who, in return, proposed the health of the Institution in happy phrase, with many humorous references. The keynote of the Prince's speech was the achievement of transatlantic wireless telephony last month, by which, as he put it, his year of office as President of the British Association had been rendered noteworthy, and the Post Office engineers who were present were naturally, and justly, gratified by this apt allusion to their success.

The response of the President, Dr. W. H. Eccles, to the toast was noteworthy for the remarkable optimism which it displayed with regard to the present status and future prospects of the electrical engineering industry in this country. Only three months ago Dr. Eccles addressed the Institution in a pessimistic vein, lamenting the alleged backwardness of our electrical industries in many respects, whereas he now surveys the situation through rose-coloured glasses—a change which we heartily welcome.

The proceedings were marked by a dignity and restraint worthy of the Institution, and in every way the function was a notable success.

British Empire Electrical Research.

The British Electrical and Allied Industries Research Association, under the direction of Mr. E. B. Wedmore, M.I.E.E., justified its existence long ago by investigations which have proved of enormous value to the electrical industries, and consequently to the general public; and the report for the year 1925-26 which was submitted to the sixth annual general meeting last Friday shows that its work is being carried on with unabated zeal and ability, stimulated, moreover, by the favourable report of the Committee of Investigation which examined the work of its first five years, on behalf of the Department of Scientific and Industrial Research.

The researches which it has in hand cover a very wide field, and in some cases are carried on in collaboration with other bodies interested in their subjects. It is pleasing to learn that the Association was never in a stronger position than at present, and that sufficient financial support is available to cover the minimum requirements of its programme. The ordinary members now represent about 85 per cent. of the capital employed in electrical manufacturing, and the associate members representing the electricity supply industry are responsible for about half the total national output. Evidently, therefore, the value of its work is gaining the recognition that is its due; but the fact that money expended on research is both a profitable investment, and essential to the maintenance of our industries, as was declared by the Empire Research Sub-committee last year, is not yet fully realised either by the Government or by the industries concerned—if it were, there would be no lack of funds. As things are, whilst the Association can carry on, it has had to defer many needed investigations, and the policy of the Department of Scientific and Industrial Research, which involves a gradual withdrawal of financial support, renders it imperatively necessary to increase the flow of funds from the industries themselves. In this connection the practice successfully adopted by E.D.A. might well be followed—namely, that of inviting its supporters to contribute annually a fixed percentage based on output or turnover, a trifling amount in comparison with the bulk, but sufficient in the aggregate to provide the Association with an assured revenue not only for the year in prospect, but for the years to follow.

It is difficult to set bounds to the results that might be obtained if adequate funds were provided. Even under present conditions, working on the "minimum scale," the Association records, for instance, successful results arising from its researches on oil switches; errors in current practice have been revealed, and means have been found, by experiment, for definitely reducing the energy released on breaking circuit, under the severest conditions obtainable at Carville, in the ratio of 7 : 1! "The methods now being experimentally developed show promise, therefore, not only of marked increase in rupturing capacity applicable to the heaviest source, but of a degree of control of commercial performance far in advance of anything hitherto attained."

This is indeed cheerful news. Those who are familiar with power-station design are aware of the great space required for high-pressure switchgear, the heavy cost of the plant and buildings, and the liability of the gear to suffer damage in the performance of its duties, involving costly maintenance. If these factors can be reduced in anything like the ratio above mentioned, the whole cost of the six years' work of the Association will be abundantly repaid by the success of this research alone. This is a matter of special interest to the Central Electricity Board, which commences work on March 1st.

Hardly less important was the announcement made by Mr. Ll. B. Atkinson at the luncheon which followed the general meeting—namely, that as the result of collaboration with the National Physical Laboratory the problem of measuring small electrical losses (such as those in the dielectrics of high-pressure cables) had been solved; uncertainties, sometimes amounting to as much as 50 per cent., had been eliminated, and now a degree of accuracy had been reached, by three or four different methods which had formerly given contradictory results but now were in absolute agreement, which had not been attained by any other association or laboratory in the world. This achievement, combined with the erection of a "million-volt" testing plant at the N.P.L. (now in progress), would place in the hands of British manufacturers an instrument unequalled throughout the world.

Such results as these must be regarded as highly satisfactory; we hope they will induce manufacturers, supply authorities, and the Governments of this country and the great Dominions to provide the funds which will enable the Association to multiply its labours and their fruits and, as Mr. Woodhouse suggested, to serve the whole Empire, as the "British Empire Research Association."

The Electric Vehicle.

Despite all that has been said and done in the past, and the progress that is being made abroad, the electric vehicle in this country has not kept its place in the forward march of electrical development. The Electric Vehicle Committee of Great Britain, now associated with E.D.A., still publishes its useful periodical, the *Electric Vehicle*, but further evidence of its activities is not available, and its functions do not appear to include the organisation of meetings at which storage-battery traction can be discussed.

The formation of the Electromobile Association last autumn, therefore, must be regarded as a forward movement which is likely to prove of great value to this industry. We understand that it is in no sense competitive with the Electric Vehicle Committee; on the contrary, their objects are identical, and its operations will supplement the work of the Committee, bringing the subject of storage-battery traction before a wider public, and enabling all persons who are in any way interested in it, whether technical or non-technical, to meet and discuss the problems which arise.

As the chairman at the informal meeting last week—Mr. J. H. C. Brooking—pointed out, the principal obstacles to progress are the high price of electric vehicles, and the lack of charging facilities. Much could be said on both these topics; for the moment we shall only add that the secretary, Mr. J. C. Elvy, in opening the discussion, made out a strong case for the electromobile, and we hope to see the new Association grow in membership and influence until its object is attained, and the electric vehicle comes into its own.

The Central Electricity Board.

Sir Andrew Duncan (Chairman) and his Colleagues.

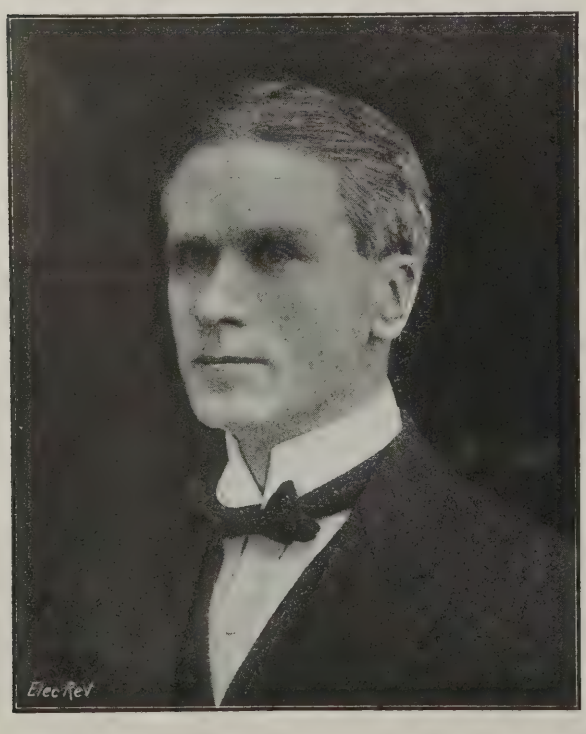
THE formation of the Central Electricity Board marks an epoch in the history of electricity supply in Great Britain. Hitherto, however much the industry has been fostered—or hampered—by legislation, the supply undertakers have been left free to manage their own affairs; in future their operations will in large measure be controlled by the Board, whose powers, taken in conjunction with those of the Electricity Commissioners, will be very wide in scope and stringent in execution. Hence we deem it appropriate to introduce the members of the Board to our readers, at least so far as the limitations of paper and printing permit.

Some of these gentlemen, it is true, who are members of the Institution of Electrical Engineers, need no introduction. Sir Duncan Watson, who has occupied positions of responsibility and influence in the electrical industry for many years, has been chairman of the Joint Electricity Authority for London and the Home Counties for some 15 months, and has thus added materially to the experience which he gained as chairman of the Marylebone Electricity Committee; Sir James Devonshire has also been most intimately associated with electricity supply in the Metropolitan area for an extended period, his conduct of the affairs of the North Metropolitan Electric Power Co., Ltd., being marked by commercial shrewdness allied with public-spirited enterprise; and Alderman W. Walker, who has done splendid work on the social side of the industry, besides taking a prominent part in the management of electricity supply in South Lancashire, is too well-known to require introduction to an electrical public.

But the chairman of the Board, Sir Andrew Duncan, is a newcomer in the electrical field: he will have a very heavy task, calling for the display of the highest administrative capacity and exceptional powers of organisation and control. Fortunately, Sir Andrew has already made his mark in other fields, and if he is taking up the study of a new

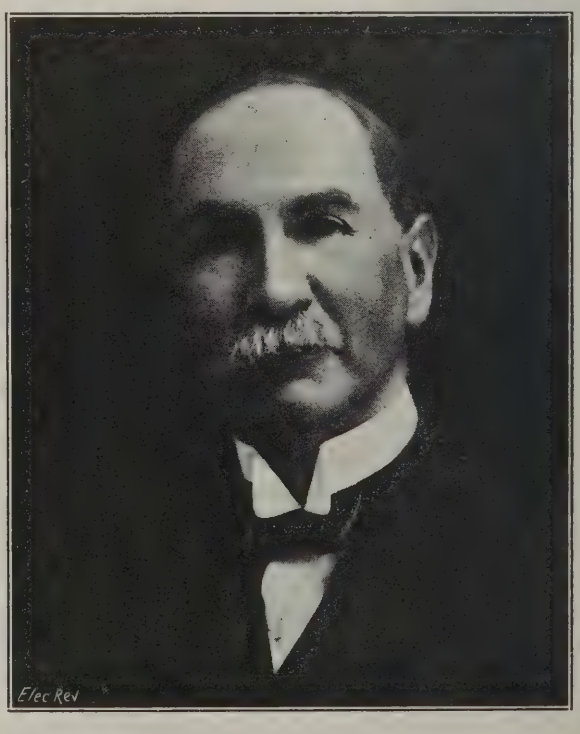


Elliott & Fry] **Sir Andrew Duncan.** [*London.*



Hana] [*London.*

Sir Duncan Watson.



Russell & Sons] [*London.*

Sir James Devonshire.



Lafayette [*London*

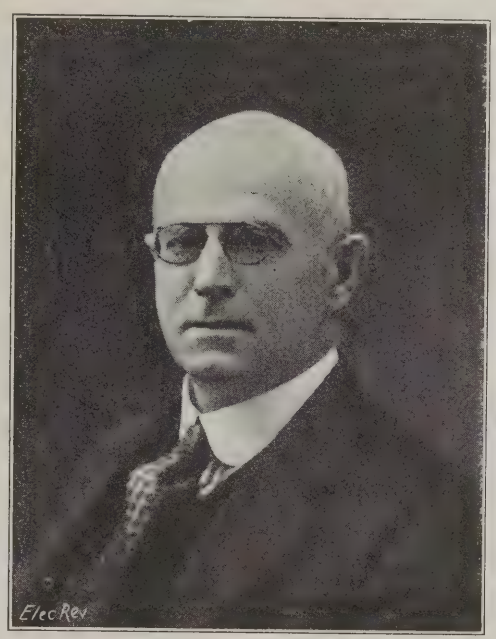
Mr. W. K. Whigham.



Elliott & Fry [*London.*

Sir James Lithgow.

subject, he brings to it a proved ability to acquire new knowledge and to use it with effect. Sir James Lithgow and Mr. Frank Hodges are intimately acquainted with the coal-mining industry, and with labour problems; the former is an employer on a large scale, and has made a study of industrial questions, while the latter, no less expert from the employés' point of view, has gained a reputation for sane opinions and economic insight, and is an enthusiastic advocate of electrical development. Mr. Whigham, a director of the Bank of England, and of a great railway company, will guide the Board in matters of finance, and Colonel Willey, a former president of the Federation of British Industries, may be relied upon to "pull his weight"; his personal study of the industrial situation in the United States a year or two ago will be recalled by our readers, and the interest that the F.B.I. has taken in the relation of electricity supply to British industry is common knowledge.



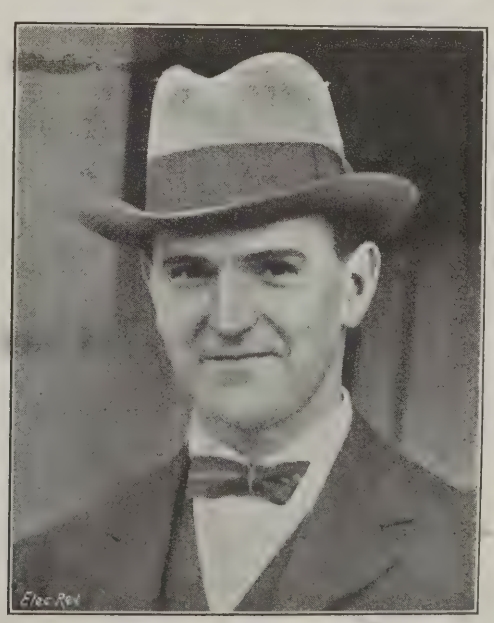
Ald. W. Walker.

The Board will take up its duties on March 1st; by that time time, no doubt, temporary accommodation will have been found for it, and the members will be able to commence operations directly they have appointed their staff and equipped their offices, for it is credibly reported that the Electricity Commissioners have already prepared certain schemes for the Midlands and for the industrial area of Scotland which will immediately be submitted to the consideration of the Board, and will, no doubt, be put in hand with the least possible delay.



Lafayette [*London.*

Col. the Hon. Vernon Willey.



Topical Press Agency [*London*

Mr. Frank Hodges.

Wireless Export Trade.

Last year's unsatisfactory British position.

(Communicated.)

OFFICIAL figures which have just become available show that during the past year the total British exports of manufactured wireless apparatus and valves declined in value to £1,266,384 from the 1925 total of £1,289,749. This is not a large drop, but it is unsatisfactory because the trend of export trade in this branch has shown a strong upward movement of late years, although not so marked as in the case of the United States. The figures for the British exports of wireless apparatus during the past few years have been:

1921	...	...	£155,273
1922	...	...	376,777
1923	...	...	300,156
1924	...	...	465,292
1925	...	...	1,106,445

It is not possible in a survey taken over five years to include the additional figures relating to valve exports, as for a portion of the time they were classified with other goods, and it was only during 1925 that separate figures became available.

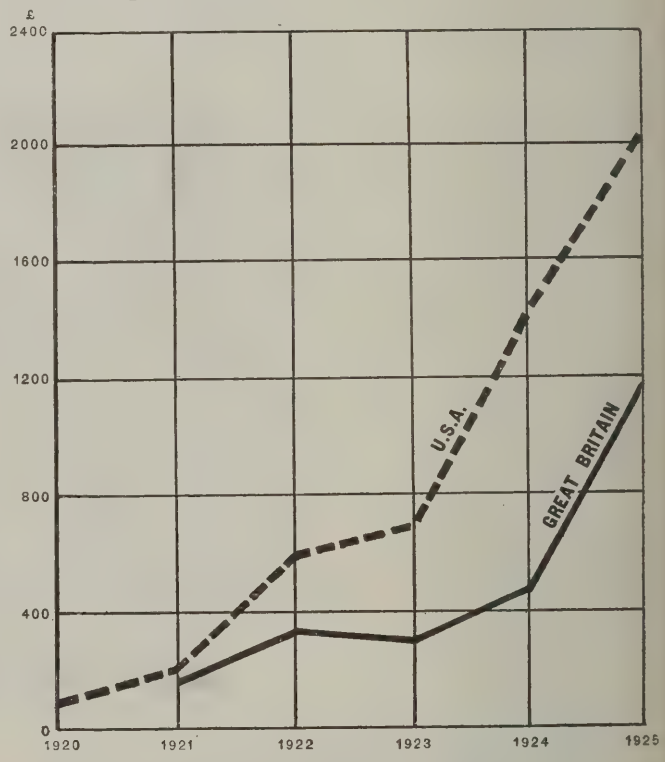
In the case of the United States, our principal competitor in many overseas markets, the total exports of wireless material of all kinds during the same period are officially valued at:

1921	...	...	£208,401
1922	...	...	597,484
1923	...	...	710,889
1924	...	...	1,243,487
1925	...	...	2,042,018

During the whole of the period it will be seen that each year's exports have shown a steady advance. Owing to the changes of classification already mentioned, it is not possible to make an *exact* comparison in the export trade of the two countries, but this may be set out roughly in the form shown in the adjoining chart. If it were possible to give exact figures relating to British exports of valves over the foregoing period, our returns would be improved somewhat. American exports definitely exceed British in the case of Asia, Africa, and Australia.

The set-back in British wireless exports last year cannot be put down entirely to the effects of the coal stoppage, as it is doubtful whether any industry is likely to suffer less from any increase in fuel prices. A more likely reason is to be found in the keener competition which is now to be encountered in oversea markets, joined to the fact that as a large proportion of British wireless manufacturers are only in a comparatively small way of business, they are not able to cultivate export markets on the same large scale as some of the American wireless corporations. To this there are, of course, notable exceptions. The "Amplion" loud-speaker, for instance, is selling largely in such highly-protected countries as the United States and Germany; Ferranti transformers are likewise entering the same markets, while the activities of such firms as Burndept and Sterling are world-wide. But on the whole, in spite of notable exceptions, the individual wireless manufacturer lacks the appreciation, the organisation, and the necessary data upon export markets which are features of the older-established electrical trade.

The patent position also has not been without its effect upon British export trade in wireless. Under the terms of the licence which is granted to the majority of makers of wireless receivers for the use of patents, the export of these instruments is expressly forbidden. If, therefore, the receiver is regarded as the logical unit of the wireless trade, we are faced with the fact that here is a large industry which has grown up although export, to all intents and purposes, is banned. The manufacturer whose main trade is in receiving instruments therefore has to organise an entirely separate trade in component parts before he is able to think of cultivating export markets!



The Export of Wireless Material.

Whatever may be the reason for the decline, the marked fall in last year's figures is one which merits the most serious attention of all manufacturers connected with the wireless industry. A trade which has in the short space of five years grown practically from zero to more than a million and a quarter sterling is one whose possibilities and future are deserving of the most unremitting study and cultivation.

Electrical Prospecting in Ore Fields.

A Canadian correspondent states that electrical prospecting has lately come greatly into favour with mining companies, and is now very largely employed in the exploration of copper and gold properties in the Rouyn area of Quebec; a Swedish electrical company has been operating there for some time with marked success. Mr. Sherwin F. Kelly, mining engineer and geologist, and a licensee of the French Schlumberger patent for electrical prospecting, is now in the field, under a contract with the Boischatel Mines, to prospect their property. Mr. Kelly, who has had a wide mining experience, is said to have operated the Schlumberger system very successfully in several of the Canadian mining districts, and recently has done important work for the Ontario Department of Mines. A number of other companies, both in Ontario and Quebec, are arranging to use the Schlumberger system; extra equipment has been ordered from France, and experienced operators have been engaged to go to Canada.

Electrical Developments at Gt. Yarmouth.—II.

A new e.h.p. and l.p. transmission system, with eleven new overground sub-stations, to meet the requirements of the change-over scheme from single-phase, 83 cycles, to three-phase, 50 cycles.

IN our last issue, under the above heading, it was mentioned that in connection with the change-over scheme for the system of distribution at Yarmouth from single-phase, 83 cycles to 3-phase, 50 cycles, a new e.h.p. and l.p. transmission system was sanctioned, involving the installation of eleven new sub-stations. This work is now completed, and the sub-stations are all on load. The actual change-over work is also well advanced, the old l.p. network being utilised for the consumers' supply at 200 V.

The lay-out of the town is not so favourable to the design of a distribution system as that of most places, the concentrated area being long and narrow and in two portions, one on each bank of the Yare. By a careful study of the various districts, however, relative to the loadings and future requirements, a satisfactory system has been put down to give the maximum economy compatible with supply continuity. The e.h.p. transmission is at the generating pressure, 3,850 V. Six feeders serve the whole area in the form of four ring-main systems, two or more sub-stations being supplied by each feeder, and interconnecting cables employed for linking up the "subs." The ring in each case is normally broken at one end of one of the interconnecting mains, which is left connected but not on load. The main feeders are of 0.1 sq. in. section, and the interconnectors 0.05 sq. in., all being suitable for 6,600-V working.

Four of the sub-stations serve the area on the Gorleston side, and the two feeders supplying these involve submarine cables at the river crossing. These are designed for 33,000-V working in order to provide for future developments. The sub-stations are of brick and concrete construction and of a uniform design.



Fig. 1.—Exterior of one of the Sub-stations.

Fig. 1 shows the exterior of one of the buildings. Separate compartments are provided for the transformers and the switchgear, served by a communicating doorway, the elevation of the transformer section being such as to provide for the additional ventilating and lifting requirements. The e.h.p. and l.p. switchgear are arranged on either side of the relative compart-

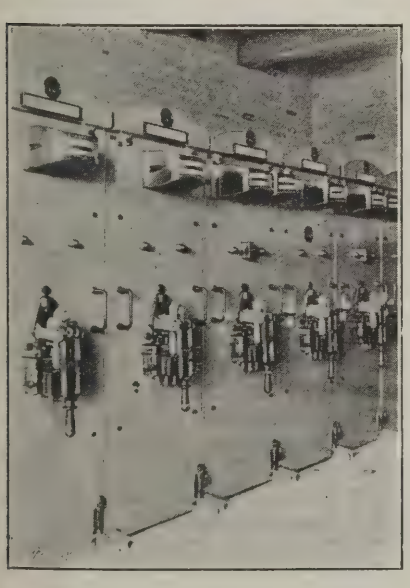


Fig. 2.—E.h.p. Sub-station Switchgear.

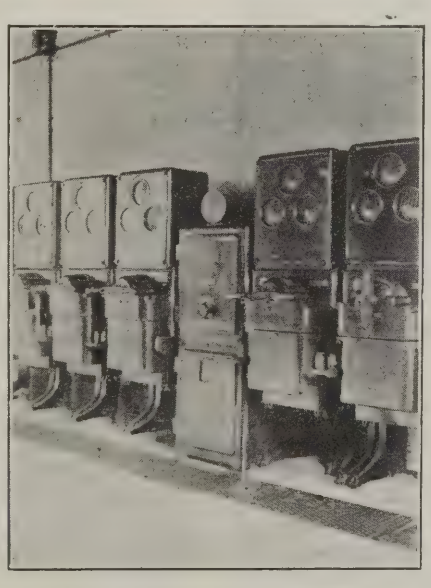


Fig. 3.—Pedestal-type l.p. Switchgear.

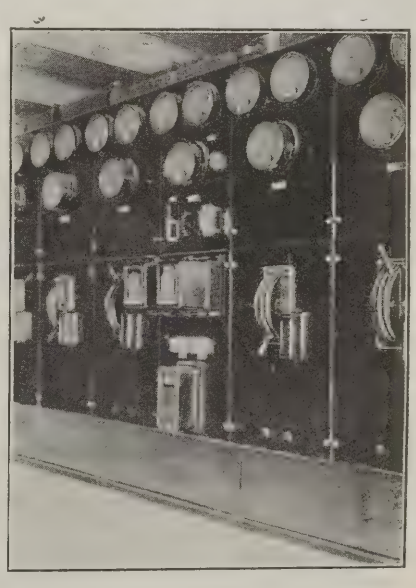


Fig. 4.—L.p. Panel Equipment.

ment, a wide gangway being provided between the two classes of equipment, and ample working space at the back of each switchboard. Suitable roller-shutter doors are arranged opposite the transformers, fig. 1.

A standard capacity of 250 kW has been adopted for the transformers, and, according to the actual load demands, two or more of these provide for total sub-station loadings up to 1,000 kW.

Truck-type cubicle switchgear, supplied by the British Thomson-Houston Co., Ltd., has been adopted throughout for dealing with the supply on the e.h.p. system. Fig. 2 shows the equipment of this type installed in one of the "subs." On the l.p. side

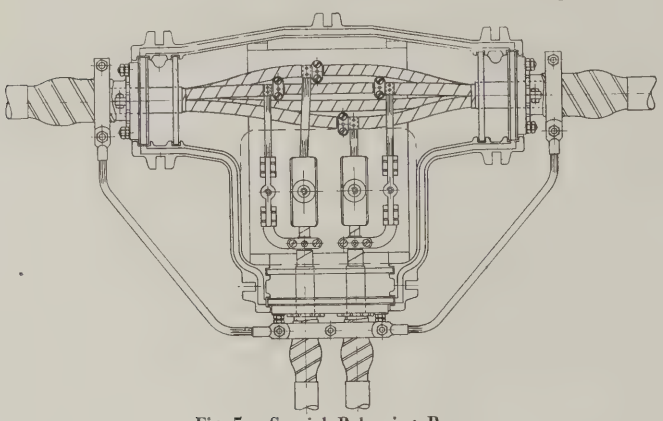


Fig. 5.—Special Balancing Box.

varying types of switchgear have been installed, including panel equipment by Messrs. Johnson and Phillips, Ltd., Messrs. Crompton & Co., Ltd., and the B.T.-H. Co., Ltd., and also pedestal-type switchgear by the English Electric Co., Ltd. Fig. 3 shows the last mentioned equipment, which is provided with draw-out type oil circuit breakers. Fig. 4 is a view of the l.p. switchgear in one of the sub-stations employing the panel equipment. The apparatus is made up of from four to seven units, panels or pillars, in each case, including a summation unit equipped with the necesary recording and indicating instruments for the sub-station supply.

The main l.p. distributors are arranged in the form of a complete ring in each of the Yarmouth and Gorleston areas, looping in and out of all the sub-stations in each case; but the cables are normally disconnected at suitable intermediate points between the supply sources, so that each local feed is entirely



Fig. 6.—L.p. line at Hopton.

separate. Four-core 0.2-sq. in. cable is used for these mains throughout.

Where possible, the old underground static sub-stations of the original single-phase system have and are being used as connecting chambers between the 3-phase distributors and the single-phase network, a practice which has proved of great advantage both with regard to economy, obviating in many cases the installation of street pillars, and in facilitating the work of balancing up on the old concentric mains. In most cases street-pillar type, 3-phase, 4-way distribution units are adopted in these disconnecting chambers, the leads to the outers of the old network cables being bunched on the neutral bar.

Of particular interest is a method adopted to overcome the difficulty of balancing up where a long length of concentric cable is employed between two of these chambers. A special 4-way box, designed by the mains engineer, Mr. A. J. Hastings, is employed in these cases. This serves as a straight-through connection for the 4-core main and provides for two concentric T connections with a fuse and a link switch in each. The concentric cable is split, and each end is connected to a different phase. It will be seen that by using two of these boxes between two supply points the concentric can be balanced on the three phases and each section fed from both ends. Fig. 5 shows the arrangement of this box, for the drawing of which we are indebted to Messrs. British Insulated Cables, Ltd. Each of these boxes is installed in a suitably covered manhole in the pavement. For extensions to the old single-phase network twin cables are employed; four-core cables are laid in entirely new sections.

It is of interest to note that two recent extensions, to Hopton and Caister, involve schemes for rural electrification. In each case overhead lines are employed for the l.p. distribution, wooden poles being employed with the lines carried on porcelain insulators. Fig. 6 shows a section of the line at Hopton. This district is served by a sub-station of the steel-kiosk type, fig. 7, supplied by Messrs. Johnson & Phillips, Ltd., which houses a 50-kW transformer and the necessary e.h.p.



Fig. 7.—Kiosk-type Sub-station.

and l.p. switchgear, and is fed by means of an underground cable from the Gorleston ring.

The undertaking has adopted assisted-wiring schemes in certain parts of the area, and some methods of running the house services in these and other cases are notable for their simplicity and the resulting economy. To take a typical example of a dozen houses, all supplied, a 4-core service main is run to a mid-way point at the base of the houses, in the front garden, a 4-way fuse box (3-pole and link) being housed in a wooden cupboard on the wall. From this point C.T.S. singles are run in a pipe up the wall, and along the guttering boards by means of porcelain cleats. In other instances the wires are suspended between the chimney blocks by means of insulated brackets.

When completed, the change-over will have involved the rewinding of and rewiring for some 600 consumers' motors, the recalibration or changing of about 6,000 supply meters, and the changing of approximately 130,000 lamps in districts where the supply on the old system was at 100 V.

The cables employed throughout for both the e.h.p. and l.p. systems, involving some 60 miles, were supplied by Messrs. British Insulated Cables, Ltd., and Messrs. Johnson & Phillips, Ltd. The transformers, including those employed at the works, were supplied by the Brush Electrical Engineering Co., Ltd., the English Electric Co., Ltd., the Hackbridge Electric Construction Co., Ltd., Messrs. Bruce Peebles & Co., Ltd., and Messrs. Johnson & Phillips, Ltd. The lay-out for the whole system was designed by the engineer and manager of the undertaking, Mr. P. G. Campling, A.M.I.E.E.

A Radio Crystal Detector Circuit.

The importance of correct arrangement is not always realised; a simple change of connections, the necessity for which is not apparent at first sight, often improves reception.

By THOMAS CARTER.

KNOWLEDGE, even considerable expert knowledge, of the behaviour of heavy electrical engineering plant is no sure and instinctive guide to a realisation of the way to arrange wireless-telephony apparatus in a circuit so that the best possible results shall be obtained. I found a fresh instance of this a little time ago, when by a simple change in connections, the necessity for which I was naturally the first to say I ought to have seen before, I succeeded in greatly improving reception where it had previously been bad when listening to headphones connected at the end of long extension wires. A wireless engineer of large practical experience and others interested in wireless work have agreed that, like me, they never before realised the importance of correctly arranging the circuit I was dealing with: and I certainly am not aware of any published reference to it. It may be that the right way is thought to be so obvious that the disadvantage of the wrong way is not worth mentioning; but evidently it is not altogther so, and the following notes may be of use to others.

My receiving set is about two miles and a quarter from the Newcastle (5NO) transmitting station; it works with a comparatively short inside aerial A and earth wire E, and consists merely of a variometer V, a crystal detector R, and terminals M and N for headphones T, all arranged, until recently, as shown in fig. 1. A link L was provided, when the set was first put together, to make it easy to try the effect of connecting a condenser in series with the aerial; by removing it and leaving its terminals unconnected, the aerial could be cut off entirely. Excellent results were obtained on several sets of headphones in parallel when the connections of fig. 1 were used, and no trouble of any kind was experienced until an attempt was made to carry extension wires for the headphones, as shown in fig. 2, from M and N to terminals P and Q in another part of the house, on the same ground-floor level as the room in which the detector and the variometer are fixed. The extension was taken across partly at ceiling height and partly along a chair-moulding on the wall about 3 ft. above the floor, and when it was in use nothing could be heard clearly at all because of a rushing noise in the headphones. The diagram shows that the wire MQ acts as a second aerial, connected to the proper aerial between L and V, and the noise was apparently an interference effect due to the presence of two dissimilar aerials, it being impossible to tune the set to suit both at once. The extension was not often required at first; when it was, the removal of the link L left only one aerial MQ, and moderately good reception could be obtained by altering the variometer setting; MQ, however, being at a fairly low level, necessarily gave distinctly poorer results than A, which extends to the top of the house. It afterwards became necessary to use the extension almost as often as not, and something had therefore to be done to improve reception at PQ, and at the same time to avoid the inconvenience of having frequently to take out and put in the link L and retune the circuit by altering V. It suddenly occurred to me (I hope it would have done so much earlier, had the need arisen) that interference between MQ and A could be got rid of by connecting R to the aerial side of V instead of to the earthed side, and, consequently, T to the earthed side instead of to the aerial side. The change from the arrangement shown in fig. 2 to that shown in fig. 3 was therefore made, and at once the results were as good at PQ as at MN, except that at PQ only there was a very slight, not at all disturbing, extraneous noise, due to the passage of MQ and NP near some of the electric light wires of the house, which are fed from an a.c. supply.

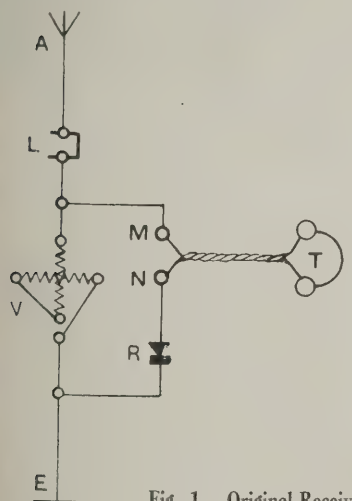


Fig. 1.—Original Receiving Circuit.

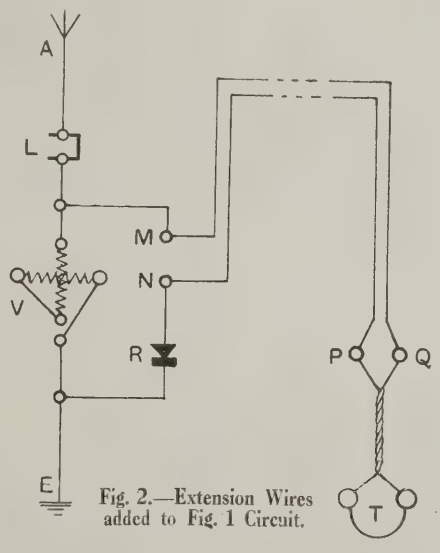


Fig. 2.—Extension Wires added to Fig. 1 Circuit.

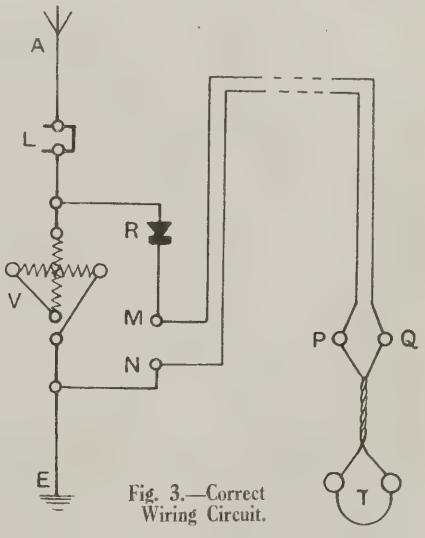


Fig. 3.—Correct Wiring Circuit.

Although I have never seen any previous reference to the matter, I do recollect reading advice to the effect that headphones should be connected to the earthed end of the aerial circuit, because the capacity of the listener's body may tend to spoil reception in some way, even with a crystal circuit. Whether or not this is likely, I do not know; I have not come across any such result to a noticeable degree; but, for what is presumably the much more important reason my recent experience has made me aware of, headphones should certainly be connected to the earthed end of the circuit if there is any likelihood that extension wires may be used. So everything points to the usefulness of adopting the connections of fig. 3, which are always safe, in preference to those of fig. 2, which, in some circumstances quite likely to occur, may lead to annoyingly imperfect reception.

Standard Performances for Electrical Machinery.

A critical review and some observations on Specifications Nos. 169 and 226, dealing with the working requirements of motors and generators, of the British Engineering Standards Association.

By F. T CHAPMAN, D.Sc.

A USER who has purchased an electrical machine will generally expect from it a certain definite performance. At the same time he will desire to obtain this performance at an annual cost which approaches the minimum, although he can rarely afford to lay out sufficient capital actually to reach that figure. The annual cost depends, on the one hand, on the efficiency of the machine and, on the other, on the rate of deterioration or on the natural life of various parts of the machine, under working conditions.

The output obtainable from a given machine is limited only by its powers of endurance in certain directions (if we except very small machines), but beyond a fairly definite point the rate of depreciation is so high that the service rendered by the machine becomes unduly expensive. The deterioration which occurs is due mainly to the gradual destruction of the insulation through its exposure to high temperature, but sparking at commutators and mechanical deterioration must also be guarded against.

It is known that if ordinary fibrous insulating materials be subjected to temperatures of the order of 150 deg. C. they deteriorate very rapidly, whereas if their working temperature does not exceed 50 deg. C. their life, under otherwise favourable conditions, will be indefinitely long. Between these two limits the working temperature and duration of life will be connected by some inverse relation of an indefinite and unknown character, and there is clearly scope for wide differences of opinion as to the optimum temperature in any given case.

In order to ensure for his machine a reasonably long life, the purchaser or his adviser usually specifies the results which must be obtained from a test or series of tests which are carried out before its acceptance. At one time the specifications adopted by various prominent authorities differed from each other in important details. The manufacturer could not produce a set of machine designs to be made up wholly, or in part, from stock, in the certainty that they would meet the requirements of the majority of his prospective customers, so for his standard designs he adopted a specification which he regarded as sound in itself and as likely to commend itself at any rate to a large proportion of buyers.

While insulating materials and the methods of employing them were in the process of development, and while little was as yet known of the powers of resistance to higher temperatures which the materials possessed, very conservative figures for the limits of temperature rise were adopted in some cases, such as 35 deg. C., for instance.

Insulating materials were rapidly improved, however, better methods of applying them and of handling them were adopted, and research indicated that they could withstand considerably higher temperatures than had been allowed hitherto. But the actual safe temperature remained a matter of opinion and, as this changed, the position in regard to specifications became more difficult than before, until, in 1915, an authoritative pronouncement was made in the "Standardisation Rules" (No. 72) issued by the British Engineering Standards Committee, as this body was then called. These rules embodied the opinions of a large number of representative men, and they said, in effect, that if certain working temperatures were not exceeded, with certain specified types of insulating materials, a satisfactory economic length of life could be depended on. They also stated the maximum temperature of the surroundings in which a machine would be normally employed, and so by difference they obtained the temperature rise which was compatible with a reasonably long working life.

These temperature limits met with very general acceptance by those concerned, but the wide adoption of improved methods of measuring temperatures in large machines by means of embedded temperature detectors, and some other matters, have made a further revision necessary, especially as in one respect the Rules ran counter to established practice. They contemplated only two test ratings: (*a*) a continuous rating, whereby a machine was rated according to the output it could maintain continuously without its temperature exceeding the specified limit; this is widely accepted abroad, and its simplicity is a strong recommendation for it, and (*b*) a short-time rating.

Previous to the issue of these Rules there had come into wide use in this country a rating which involved an appreciably lower temperature rise, and permitted an overload to be carried for a considerable time after the steady temperature due to the rated load had been reached, the final temperature remaining within the limits of safety. Thus, to take a definite example, a motor rated at 100 h.p. might be specified to give a temperature rise of 40 deg. C. when run continuously at that load, and a further rise of, say, 15 deg. C. when overloaded 25 per cent. for two hours immediately on the completion of the test at 100 h.p. In another form of specification the second temperature is not given definitely, but is defined as "safe." It cannot be seriously contended that this specification is a good one in itself, but it had acquired some vested interests, and the path of the British manufacturer was made somewhat easier when it turned the tables on Rules 72 and appeared in February, 1923, as the "British Standard Continuous Rating" in Specification No. 168, applicable to motors and generators of industrial sizes from 1 b.h.p. per 1,000 r.p.m. upwards. However, when specifications were prepared for large generators and motors (exceeding 2.5 b.h.p. per r.p.m.), the British Engineering Standards Association spoke with two voices and issued simultaneously at the end of 1925 two specifications, namely, No. 169 and No. 226. In the former the hazy "safe" overload is perpetuated while, according to the latter,

a machine is rated at a load which it will carry continuously with the maximum safe temperature rise. The existence of these two specifications is almost certain to lead to some confusion; we can imagine, for instance, a man responsible for the operation of a machine rated in accordance with No. 226 overloading it 25 per cent. for two hours, or until warned by unmistakable signs of distress, under the impression that No. 226 is the specification which permits overloads. And what about the foreign buyer? When he wants a 100-h.p. motor such as he buys elsewhere, the British manufacturer has no such standard machine to offer, but can supply a 110-h.p. machine British standard rated at 100 h.p. and very safe for two hours at 125 h.p. The British manufacturer has our sympathy in these circumstances, but the remedy is in his own hands—for the B.E.S.A. is his own instrument.

The purpose of standardisation in a case like this is to improve the economy of manufacture and thereby to cheapen the product, to the general benefit of the whole community. With some types of manufacture it is possible to standardise form and dimensions as well as performance, but the manufacture of electrical machinery has not yet reached that stage. The maker must design the machine and give it a rating, but a standard can be set for its performance at that rating, in certain particulars which are of fundamental importance to the purchaser as affecting the annual cost. The fundamental purpose of the standard specification of performance is to enable a very definite meaning to be assigned to the rating applied to a machine by the maker. It informs the purchaser, or, at any rate, it is intended that he should be informed, with some exactness what he may expect of the machine.

One of the items in the performance of the machine which is definitely standardised by the Association is the temperature rise. A purchaser who has read and understood the appropriate specification will realise that he will be unwise in working the machine in such a way that the temperature of any part of the insulation exceeds for any length of time a certain figure which he can deduce from the specification. For Class A insulation (impregnated fibrous materials, &c.), this limiting temperature for the hottest point appears to be 105 deg. C., and for Class B insulation (compound mica insulation, &c.) 125 deg. C.

The tables of permissible temperature rise at accessible points are based upon a cooling air temperature of 40 deg. C., and various differences between the temperatures measurable and those which may be expected to exist at the hottest points in the machine. The figures which have been taken have high authority behind them, and no exception can be taken to them. Armed with these tables of permissible temperature rise, the user of a machine may check its operation under working conditions and ascertain whether he is overloading it.

The questions arise: "Does it matter to the purchaser that his machine has been rated according to this specification or to that?" and: "Is more information conveyed by one than by another?"

Let us suppose that a user is contemplating the purchase of a machine which he will require to run for an ordinary type of working day extending over ten hours and to develop for the most part about 1,000 h.p., with two peaks of about one hour's duration at the commencement and at the middle of the day respectively, each running up to 1,100 h.p.

If only Specification No. 169 were in operation he might consider purchasing a machine rated at 1,000 h.p., which would run continuously at this load with a temperature rise not exceeding 40 deg. C. on a certain part, and would sustain a further load of 1,250 h.p. for two hours without exceeding the safe temperature. Such a machine would obviously not reach the maximum safe economical temperature when run under the desired conditions. Probably a cheaper machine rated at 950 h.p. according to this specification would fill the required rôle adequately.

On the other hand, he might consider purchasing a machine rated at 1,000 h.p. according to Specification No. 226 which, when run at 1,000 h.p. continuously and at this output, would attain a temperature rise of 55 deg C. This machine would obviously be too small, but a machine rated in this manner at 1,050 h.p. would probably be right.

So far as the information conveyed by the rating is concerned, it cannot be said that one specification is better for our hypothetical purchaser than the other, since his problem can only be solved by the aid of further information supplied by the manufacturer in either case; but the number of purchasers who will want machines to withstand 25 per cent. overload at the end of a day's work must be much smaller than that of those who want them to run continuously at a sensibly constant load. Specification No. 226, therefore, appears to have greater chances of straightforward application than No. 169, and it is both simpler and more direct.

The case for the specification permitting overloads, from the manufacturer's point of view, is that the standard frames which were in use before the issue of No. 226 were designed with an overload specification in view, and that they do not lend themselves to a well-graded set of ratings on the continuous basis. This argument, as applied to large machines, is not very strong, though it may be of some importance in the case of machines of smaller sizes coming within the range of operation of Specification No. 168, and it is clearly desirable from the point of view of the electrical community as a whole that as little unnecessary capital as possible should be sunk in alterations to standard frames upon the development of which large sums have been spent already. A policy of changing over to a continuous maximum rating as standard lines become obsolete appears to be the right one, each frame having two sets of ratings assigned to it in the meantime.

(To be continued.)

French Colliery Electrification.

Before a recent meeting of the French Society of Civil Engineers, M. Guerre, general director of the Courrieres Mining Company, discussed at some length the measures adopted for restoring the collieries in the Nord and the Pas de Calais which were devastated during the period of the great war. Except where some reason existed for preserving a few steam-power installations, he stated that the essential characteristic had been the general electrification of the pits. The electrical concessions had been unified on the basis of a 3-phase system at 45,000 volts, 50 periods, for transmission to a distance, 15,000 volts for the internal networks of the companies, and 3,000 volts for the distributing services. This had led to the establishment of steam power stations; that of the Lens mines at Pont-a-Vendin supplied 50,000 kW with a reserve of 10,000 kW; that at the Noeux mines furnished 16,000 kW, and this capacity was being doubled; the Beuvry station fed at 45,000 volts the Drocourt mines, the Société Electrique du Nord-Ouest, and the Compagnie Electrique du Nord, and at 15,000 volts the Noeux mines and the Société des Materiaux de Construction de la Loisne. Near the town of Harnes the Courrieres station was to be of a capacity of 80,000 kW, divided into eight turbo-alternator sets of 8,000-10,000 kW, five of the sets being already in operation. Installed at Sin-le-Noble the Aniche mines station was to be equipped with four sets of 10 000 kW and two sets of 5,000 kW, of which three sets and one set respectively were in service. Moreover, the old station of the Anzin mines had simply been reinstated pending the construction of a large new station. All the stations were equipped with most recent plant, permitting of a large saving in manual labour.

Electricity in Gasworks.

Electricity is produced as a by-product in gas manufacture at the Beckton works of the Gas Light and Coke Co. under a scheme which consists of taking heat from burnt producer gases which are exhausted into the atmosphere and using it to raise steam. The power so obtained is used to generate electricity at a power house in the works. In this way energy which would otherwise be wasted is made available for works' service. After 12 months' operation the scheme has proved extremely successful, and an additional 2,500-kW generating set for the power house has now been ordered from the Metropolitan-Vickers Co., which supplied the original equipment, says the *Financial Times*. When the extensions are completed the generating station will be capable of producing power sufficient to drive motor totalling well over 6,000 horse-power.

British Electrical and Allied Industries Research Association.

Annual Luncheon, and Report of the Council for 1925-26.

THE annual luncheon, in connection with the annual general meeting, of the B.E.A.I.R.A. was held at the Savoy Hotel, London, on Friday, February 11th, Mr. W. B. Woodhouse, the newly-elected president, being in the chair.

Proposing the toast of "The E.R.A.," Dr. W. H. Eccles, F.R.S., President of the Institution of Electrical Engineers, said that electrical engineering was the most exact and the most mathematical of all branches of engineering, and the safety factors in respect of the design of electrical plant were not comparable with the five or ten of the civil or the mechanical engineer. Therefore, it was appropriate that electrical engineering should have a closer touch with pure science, as the E.R.A. had, than any of the other engineering research associations. When they compared the standards of living to-day as between different countries, his observations had led him to the conclusion that the standard was higher in America and in Northern Italy, where the development of the use of electricity had been carried to a higher degree than in Great Britain. These comparisons suggested that we were not doing as much as we ought in this country with regard to research generally, or even in electrical research. In scientific discovery the British nation had always been most fertile, but we had been slow in working the inventions out; too many inventions were in use in this country to-day which had been purchased from abroad, but which had had their origin in this country. That arose from the fact that there was too little co-operation between pure and applied science. It should be the task of the E.R.A. to form some working liaison between the two. He did not expect industry to finance pure scientific research; that was a national matter, and more money ought to be spent by the nation than had been spent hitherto. Industry, however, should spend more money upon research for its own quick profit, but there must be co-operation between the two.

Mr. Ll. B. Atkinson, supporting the toast, after commenting in general terms upon the necessity for prosecuting research in order to cope with the evil of unemployment, spoke of the development of the research associations under the Government scheme and of the co-operation that had taken place between them and the universities, technical colleges, and manufacturers' research laboratories, as well as the National Physical Laboratory, which co-operation made it possible to call upon the services of the trained observers who were essential. He laid special stress upon the immense assistance the Association had had from the N.P.L. in connection with work laid out by committees of the Association, but carried out by the trained staffs at Teddington. One instance related to the problems of insulation, which were becoming increasingly important. The measurement of small electrical losses was an exceedingly important matter, and all kinds of reports had come in concerning it from all parts of the world. Until recently, however, there had been enormous uncertainties and inaccuracies, even as much as 50 per cent., and it had been the task of one of the committees of the E.R.A. to try, in conjunction with the N.P.L., to solve the problem. To-day, through the assistance of the N.P.L., a degree of certainty and accuracy in this matter had been reached which had not been achieved by any other association or research laboratory in the world. It was now known that three or four different methods could be used which would give absolutely coincident results instead of, as in the past, contradictory results. Further, the N.P.L. decided some time ago to put in plant for tests up to a pressure of one million volts. Nothing of that kind existed in this country, although it did in other countries. So far, perhaps, we had not felt handicapped, but the State had now taken upon itself the responsibility for a general distribution scheme which was going to involve pressures roughly four times as great as those generally used in this country, and it was absolutely necessary that manufacturers should have facilities for working to those higher pressures. This testing plant was in course of erection at the N.P.L., and when it was in full operation, manufacturers would have an instrument at their disposal the like of which existed in no other country, and which would give them a better technique than that which existed in any other part of the world. His point was that, as the State had accepted responsibility with regard to electricity supply and also for research, the opportunities should not be crippled by cutting down the financial assistance for the National Physical Laboratory. If he were right that in research there lay a flanking movement against unemployment, then the great research laboratory at Teddington, which belonged to the State, ought to be backed up to the uttermost by the State, instead of spending our funds on unemployment relief.

Mr. W. B. Woodhouse, replying to the toast, referred to the annual report of the Association, which stated that the Association was never in a stronger position, and that the result of the work it had done was to bring about a recognition that the important services it performed could not be obtained without the organisation of such a co-operative institution. That, however, did not at all mean that those connected with the Association were satisfied that it was working on the scale it should be. As the financial support grew, so could the work be extended. After a reference to some of the important researches which the Association had initiated, prominent among which was mentioned the heating of buried cables, attention was called to work to be done on switchgear. He supported Dr. Eccles's plea for such co-operation that immediately a difficulty was met or a discovery made, the men of science and the practical men should work together, because it was only by team work that rapid results could be achieved. If the funds of the Association could be increased tenfold, he was satisfied personally that the results would be increased more than tenfold. The Association was endeavouring to do what the Prince of Wales had mentioned at the dinner of the Institution of Electrical Engineers on the previous evening—namely, to "back up invention." This country had the talent and the men with the inventive brains, and the Association was there to back them up and get the result of their efforts into commercial use as rapidly as possible. A point mentioned in the foreword to the annual report by the chairman of Council, Mr. Everest, was that the Association was entitled to look for support from all interests throughout the Empire which participated in the results directly or indirectly. He personally wished to emphasise that this was the British Electrical Research Association; it might more properly be called "the British Empire Research Association," and co-operation on the part of the Dominions overseas would be welcomed. It would be inefficient and uneconomical at the moment to set up small research associations in the Colonies, and therefore he looked for greater support for the Association from the Dominions.

Mr. A. R. Everest briefly proposed the toast of "The President," which Mr. Woodhouse acknowledged.

Annual Report.

The sixth annual report of the Council to the Association, for the year ended September 30th, 1926, was presented to the annual general meeting on Friday last week. It states that the year was one of great activity, following upon the stimulus given by the favourable report of the Committee of Investigation which examined the work of the first five years. Special attention is drawn to work on insulating materials and electric control apparatus. The former has resulted in the preparation of a number of proposals for standard purchasing specifications in a field in which this class of work was urgently required. Investigations into the nature of the breakdown of insulation and methods of measurement of the properties which are essential in good insulation now show great promise, substantial contributions to knowledge and technique having been made during the year.

The researches on electric circuit breakers have yielded a number of reports, not yet ripe for the use of members, which, however, establish a number of new facts of great importance, the industrial applications of which have been made the subject of further applications for patents. One series of experiments is especially notable as showing a remarkable reduction in the energy released and corresponding stresses on opening heavy circuits by the use of devices incorporating features of design based on the discoveries made.

With the limited funds at disposal it is impossible to materially extend the field covered, but in the expectation of further support from interested sections of the industry, preliminary work has been put in hand for the improvement of magnetic materials and work which should prove of value to the radio industry.

The Association was never in a stronger position. Its aims and objects are now better understood, the success of its

methods is beginning to be recognised, and it is realised that the important services it performs could not be obtained without the organisation of such a co-operative institution.

The financial support promised and in sight is now adequate to meet the bare requirements of the minimum scale of working. Nevertheless, to keep the work within the limitations of the present income it has been necessary to defer many promising programmes indefinitely, and in view of the diminishing scale of contributions made by the Department of Scientific and Industrial Research, it is recognised that efforts to increase the Association's income must be actively continued if the present restricted scale of operations is to be maintained. Those in closest touch with the work are best able to appreciate the great possibilities of the future and the great advantages which will accrue to the industry when the Association is able to extend its operations in the present fields and open up hitherto untrod paths to progress.

Progress has been made in the study of the breakdown of electrical insulation from the standpoint of pure physics. A committee has been formed to deal with the properties of dielectrics at radio frequencies, and a report on the thermal resistivity of dielectrics has been issued. The researches on insulating papers, varnishes, and filling compounds have enabled purchasing specifications to be drafted, covering the factors of importance. The effect of oil on hard composite dielectrics, and tests on synthetic resins, have been the subjects of reports published during the year, and the work necessary for the revision of the B.E.S.A. specification for the purchase of insulating oils has been completed; the previous work of the E.R.A. has made it possible to raise the standards materially.

The results of dielectric loss measurements on cables have been analysed at the National Physical Laboratory, with a view to the elimination of discrepancies; and experimental work on pole foundations has been carried on. Investigations conducted at the Carville power station on oil switches and circuit breakers have explained large variations observed in previous tests; the results obtained have already revealed errors in current practice, and now point the way to new methods of circuit-breaking. Experimental designs of a simple nature have been developed in which the energy released on breaking circuit under the severest conditions obtainable at Carville has been definitely reduced about 7 : 1. The methods now being experimentally developed show promise, therefore, not only of marked increase in the rupturing capacity applicable to the heaviest source, but of a degree of control of commercial performance far in advance of anything hitherto attained.

Researches on steam condenser tubes and steam turbines have been carried on in co-operation respectively with the Institute of Metals and the Institution of Mechanical Engineers. Other investigations deal with magnet steel, instrument springs, die-casting, &c.

There are 15 sectional committees and 50 sub-committees and panels, supervising the various investigations, and over 50 Government departments, engineering institutions, research associations, universities and colleges, and companies have co-operated in the work.

Reviews.

Successful Crystal and One-Valve Circuits.—By J. H. Watkins. Pp. xi+104; figs. 86. London: Sir Isaac Pitman & Sons, Ltd. Price, 3s. 6d. net.

Sixty circuits are described, all of which, with one or two exceptions, can be made up for an expenditure of about five pounds. Constructional drawings are not given, but the circuit diagrams and explanations should enable the average amateur experimenter to make up any of the sets.

By confining himself to crystal and one-valve circuits, the author is able to deal simply with the principles of all the latest arrangements which usually appear to be very complicated, mainly through the multiplication of valves, and this, we think, is the aspect of the book which may make it useful to amateurs who would otherwise be discouraged at the start from tackling many of the latest circuits.

Mr. Watkins has devoted very little space to fundamental theory, and the novice would do well to commence by reading up some fuller introduction to the subject. We do not feel able to recommend this book to our readers.

Electrical Technology.. By H. Cotton, M.Sc. London: Sir Isaac Pitman & Sons, Ltd.

This work was issued in eight weekly parts from October 23rd, 1926 (price 1s. each), and is written in two sections, Direct Current and Alternating Current, with an introduction dealing with the fundamental units. It is intended primarily for the aid of the electrical student in the preparation for examinations, but judging from the synopsis of the chapters and the first weekly part of the book, it is of a nature which should be of considerable assistance to the practical student. In chapter I, The Magnetic Circuit, for instance, in which are given the usual text-book magnetisation curves and calculations, is described and illustrated a heavy-type electro-magnet used for the lifting of irregular scrap. Chapter III opens the work on d.c. machines and deals immediately with the constructional features of the machines and their parts; this will probably appeal to many practical students who often find themselves at sea when "diving" into a highly-mathematical text book for some information wanted hurriedly. Other chapters which should prove of particular interest are: Chapter X, Illumination; Chapter XXIII, Phase Advancing; and Chapter XXV, Electrical Oscillations. According to a preface by Mr. Cotton, the last-mentioned chapter is the exception in the book, in that advanced mathematics are used, differential equations being necessary.

We understand that if the idea of publishing the book in weekly parts has met with sufficient response, the publishers will issue other text books in a similar form.

The Theory of Electricity. By G. H. Livens, M.A. 2nd Edition. Pp. 427; figs. 46. London: Cambridge University Press. Price, 16s. net.

This book is a revised version of "The Theory of Electricity," by the same author, published in 1918, so that most of those readers who interest themselves in the theoretical aspect and mathematical treatment of the subject will be already aware of the general character of its contents. They will, however, be concerned to know what changes the author has found it expedient to make, in the light thrown by the developments of science during the last eight years, and by the maturing processes of his own thought. The present book is smaller than its predecessor, by the exclusion of special problems which are concerned not so much with the theory of electricity as with the application thereof, and by the omission of much that was specially addressed to aspects of the theory at that time inadequately considered and now no longer so. In its more compact form the book is all the better adapted to the needs of those who nourish the hope, and desire to be able, to think consistently about electricity—that is to say, to those who dislike having to think about electricity in terms of beliefs that mutually conflict one with another. Such persons are, of course, very far from full attainment of the object of their hope and desire, but the author does his best for them. Without adopting the electron theory of electricity as a constant underlying conception throughout the book, he frequently makes use of it and goes into many details of its development. He shows from time to time how it harmonises with the earlier conceptions of electricity and elucidates them. Thus a "point charge" in his treatment of the subject can be regarded very much as we do a "mass particle" in ordinary mechanics, and he looks to find a parallel to the processes of an electromagnetic field, in a system of masses supposed to be moving in accordance with the accepted laws of motion.

The mathematical development of the reasoning is admirably entered upon and, in every case, seems to grow out of the literary treatment, by a natural extension of language to include the symbols invented by mathematicians to economise in sentences. The theory, as it is built up, becomes a gorgeous edifice, and its top reaches to the clouds: its top is, indeed, hidden among them, as is the case with all comprehensive theories in physical subjects, since the introduction of *Relativity* and *Quanta*. The whole of the equations in which the theory is comprehended are seen to be expressible in a form that involves the four independent variables of space and time in a perfectly symmetrical manner; now that form remains precisely the same whether the equations are referred to fixed axes or moving ones, so that we can come to no conclusion as to whether we are moving relatively to the ether, or whether we are at rest, and therefore we can never know what is the correct or normal mass of any body whatever, or what are its true dimensions. And, as the author observes in his final pages: "It is quite impossible for us to attempt to examine space apart from its material content." "We may fit on to any distribution of matter, any theoretically possible kind of space, be it curved or flat; but we must not pretend it is anything more than a fiction of the imagination." He very pertinently points out that *space* is "something that can be occupied by matter," and all we can recognise in any theory are the related performances of pieces of matter, only to be described by reference to a material framework (real or imaginary).

With all these qualifications the theory of electricity still contains many lacunæ, as readers of the book will soon discover. We are, for example, entirely in the dark concerning the nature of positive electricity; the very name is no more than a confession of ignorance, as our author is obliged to admit.

If one chapter can be distinguished as more interesting than another it is perhaps the one appended, on *the mechanism of metallic conduction*. But when all is said and done we have still to think about electricity in terms of beliefs that so mutually conflict, one with another, that whatever we may doubt in regard to it, there is one thing we may be sure of, namely, that there must be something wrong about these beliefs; they cannot be all true. No one interested in the theory of electricity can afford to remain unacquainted with this treatise.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

The organisers' report for the week ended February 12th states that four demonstration houses were opened during the period at Birmingham, Glasgow, Carlisle, and Bournemouth, while others at St. Albans, Peterborough, and Ipswich are in course of preparation. The Carlisle house is the eleventh to be opened in the North-East Coast Area. The Bournemouth house, which is centrally situated, was opened by the Mayor, who was supported by Dr. Hosker, of the Bournemouth and Poole Electric Supply Co., Ltd. The dwelling is officially commended as an example of what a demonstration house should be. New and additional demonstrations have been arranged at the new Birmingham house, which is situated at Erdington. Sheffield reports that about 650 people are visiting its house daily. The average attendance at the Glasgow flats was 1,555 during the first five days. Exhibitions are being held at West Hartlepool, Yarmouth, and Dumfries. During the first six days of the Hull exhibition 5,000 visitors attended, and between seven and ten thousand people inspected the Falkirk show. The North-East Coast Committee says that it intends to open many other demonstration houses during the next few weeks, and that its children's competition is proving very successful. The Carlisle demonstration house has been purchased by the Chief Constable. It is reported that in all districts builders and furnishers are eager to co-operate in the arranging of demonstration houses.

The hon. secretary of the Exeter and District Circle (Mr. A. H. Brooking) says that the demonstration house which was opened at Exeter on February 4th, comprises a hall, drawing and dining rooms, bedroom, lounge, bathroom, and kitchen, all of which are thoroughly equipped electrically. The opening ceremony was performed by the chairman of the Electricity Committee (Mr. A. Brock), the city electrical engineer (Mr. H. D. Munro), who is also chairman of the Circle, presiding. During the first five days over 7,000 people inspected the house. The Circle covers Exeter, Dawlish, Exmouth, Exton, Honiton, Lyme Regis, Topsham, and Woodbury, and electricity suppliers and contractors in all these districts are co-operating.

On the opening day nearly 1,000 people visited the second Glasgow all-electric house demonstration in Shawlands. The two houses are of the most up-to-date type of labour-saving tenement dwellings, and have been erected by the Corporation. There is only one fireplace, that in the living room, the other rooms being heated by electricity. Messrs. L. G. Hawkins & Co., Ltd., and Siemens & English Electric Lamp Co., Ltd., were responsible for most of the fittings. In the kitchenettes "Hotpoint-Falco" cookers are installed.

The Bournemouth house, which was opened on February 12th, is certainly an excellent example of its kind. The house is an old, detached residence situated near a centre of activity of the town, and is being well patronised. It is of fair size, enabling the electrical equipment to be shown to the best advantage, and it has been re-decorated throughout and furnished in attractive style. Ten rooms are thoroughly equipped, and landings, vestibule, &c., have also been attended to. The display was organised by the local Circle, consisting of the following, practically all of whom are members of the Electrical Contractors' Association:—Messrs. Aish & Co., the Bournemouth and Poole Electricity Supply Co., Ltd., Bacon & Curtis, Ltd., Dormer & Co., Edwards & Co., J. & G. Gould, S. T. Meggitt, Rogers & Kirkby, Shears & Sons, Ltd., F. Sparshott, F. H. Vivian, and A. L. Wilson. The furniture, decorations, &c., have been provided by Messrs. Bobby and Co., Ltd., Lines & Co., Shears & Sons, Ltd., and Kennedy's (Bournemouth), Ltd. The "Kaleeco" (Callender's) wiring system has been used for lighting, and the "Henley" system for power. Members of the Circle are providing demonstrators in rotation, and the instructions given to these guides deal fully with the cost and operation characteristics of all the equipment displayed. In the kitchen Messrs. Belling and Co.'s lady demonstrator gives daily exhibitions of electric cooking. Reference was made at the opening ceremony to the cost of electricity in Bournemouth, and Dr. Hosker, for the Bournemouth and Poole Electricity Supply Co., promised that when the company's position was more established substantial reductions would be made in the price of energy.

Registered Electrical Contractors.

At a meeting of the Executive Committee of the National Register of Electrical Installation Contractors, on February 11th, applications for registration made by the following were accepted:—

Bennett, A., Harpurhey, Manchester.
George, S., Rock Ferry, Birkenhead.
Wilson, E., Wolverhampton.
Hepworth & England, Batley.
Prendergast, J. F., London, W.1.
Pratt, H., Ltd., Aston, Birmingham.
Butler & Dickinson, Erdington, Birmingham.

At the same meeting one application was declined.

Committee on Industry and Trade.

The Committee of Industry and Trade, which was set up by Mr. Ramsay MacDonald in 1924, has this week issued its third report, entitled "Factors in Industrial and Commercial Efficiency." The factors in efficiency which the Committee found convenient to deal with as a whole, apart from all factors peculiar to certain trades, group themselves roughly under four headings:—(1) Factors affecting industrial structure; (2) factors affecting quality of production; (3) factors arising from the relation of the State and public authorities to industry and trade; (4) certain aspects of the questions of industrial profits, burdens, and costs. The Committee points out that one of the most important forces tending to enlarge the unit of business has been the growth of joint stock enterprise, which has greatly lessened the difficulty of financing large business by bringing in the general public as investors. The paid-up capital of joint stock companies quadrupled between 1885 and 1905, and more than doubled between 1905 and 1925. With regard to the question of scientific research, the Committee refers to the very great amount of research being carried out in other countries, and gives some account of the measures adopted by the British Government for the encouragement of research of a kind beyond the means of single firms. The results so far achieved by the research authorities formed by various industries in collaboration with the Department of Scientific and Industrial Research, while promising for the future and amply justifying the establishment of the associations, are, for the most part, rather of an educational value to the industries concerned than of a kind which can be assessed in terms of actual monetary saving and gain, though such saving and gain have undoubtedly been achieved. The Committee quotes a representative of the engineering industry who told it that "the difficulty is to finance research over the interval that elapses between incurring expenditure and producing results that the rank and file will recognise."

Export Selling.

This is the title of a paper to be read before the Institution of Rubber Industry at the Engineers' Club on Tuesday next, at 8 p.m., by Sir William Clark, Comptroller-General of the Department of Overseas Trade.

Improvements in the Radio Industry.

A good response has been received by the Radio Manufacturers' Association to the circular letter on "The Maintenance and Improvement of the Sale of British Radio Apparatus" recently issued to the trade. Classification of the replies shows that the majority consider that, amongst the many things now adversely affecting the prosperity of the British radio industry, are the nature of the B.B.C. programmes, the heavy royalty fees, and the indiscriminate granting of trade discounts. Other matters adversely commented upon include price cutting; the large number of types of valves on the market; foreign competition; standardisation, &c. The Council of the R.M.A. has referred the matters raised in these replies to committees, which will examine in detail the criticisms and suggestions put forward and will recommend to the Council what action, in their opinion, is desirable.

Our Foreign Electrical Trade.

The following were the values of imports and exports of electrical goods and machinery during January :—

	January, 1927.	Inc. or dec.
Imports—	£	£
Electrical goods and apparatus	347,956	− 5,040
Machinery	1,307,667	+284,378
(Electrical machinery) ...	130,144	+ 45,946
Exports—		
Electrical goods and apparatus	1,096,935	+207,179
Machinery	3,994,509	+145,798
(Electrical machinery) ...	613,323	+139,753
Re-exports—		
Electrical goods and apparatus	12,165	− 3,878
Machinery	104,069	− 48,885
(Electrical machinery) ...	6,589	+ 825

Business Efficiency Exhibition.

The annual Business Efficiency Exhibition was opened last week at the Central Hall, Westminster; it remains open until to-morrow (Saturday). The stands show the steady progress that is being made to eliminate unnecessary labour and wastage of time in office work, and a noticeable feature is the greater use to which electricity has been put. Machines ranging from large book-keeping machines to small dictaphones, all taking their power from the mains, are exhibited, and in addition there are several distinct developments, such as electrically-operated typewriters. Among the exhibits is the "Hollerith" electric tabulating and accounting machine, made by the British Tabulating Machine Co., Ltd. This stamps and sorts cards at the rate of 350 per minute, and tabulates them at 150 per minute. A similar type of machine is exhibited by the Accounting and Tabulating Corporation of Great Britain, Ltd. Mechanical book-keeping is one of the principal features of the exhibition, and one of the most remarkable appliances is a typewriting book-keeping machine, which is a combination of an electrically-operated automatic book-keeping machine with a standard typewriter. All tabulation, whether for description or value, is controlled by one key only. The Pitney-Bowes postage meter machine shown represents a great saving of time and labour. It is a postal franking machine which entirely obviates the use of adhesive stamps. There is also a postage-stamping machine, exhibited by Universal Postal Frankers, Ltd., which sticks ordinary postage stamps on letters, counts the number of stamps used, moistens the envelope flaps, and seals them down at the rate of 250 per minute. In the dictating machine section class, several alterations and improvements in design and construction are noted. The "Ediphone," marketed in this country by Messrs. Thomas A. Edison, Ltd., has been much improved by the addition of a new correction device and by a new electric control which enables the typist to stop, start, and in other ways control the machine without lifting her fingers from the typewriter keyboard. The "Dictaphone," manufactured by the Dictaphone Co., Ltd., is also shown. The "Mercedes Electra" electric typewriter was shown at the exhibition last year; this year it faces the competition of the "Woodstock Electrite," manufactured by the Woodstock Typewriter Co., Ltd. Several types of house or private telephone systems are exhibited, among them being the "Dictograph" control system, manufactured by Dictograph Telephones, Ltd. This is a very suitable system for large concerns, for, constructed without receivers or mouthpieces, it obviates all delay or the necessity for having a central exchange operator. Other companies exhibiting house or automatic telephones are the British Home and Office Telephone Co., Ltd., New System Private Telephones, Ltd., and the Reliance Telephone Co., Ltd. A very comprehensive display of labour-saving office equipment, most of it designed to work electrically, is shown by the Burroughs Adding Machine, Ltd.

Social Events.

On February 2nd, at the Victoria Hall, Leatherhead, a social was held by the staff of the Leatherhead and District Electricity Co., Ltd. A good gathering spent a most enjoyable evening, which included dancing, songs, competitions, &c. Mr. G. W. F. Horner, chief engineer and manager, and Mr. W. E. Owen, his assistant, were present. Messrs. H. F. Brown and H. Birch, of the mains department, were the organisers.

The Wiring Supplies Department of the British Thomson-Houston Co., Ltd., recently held a very successful social evening at the Union Helvetia Club, W.1. Over 150 members of the staff were present, including many from other departments, and a number of visitors. The evening opened with an informal dinner, presided over by Mr. R. A. Lower, acting manager of the department. After dinner there was a dance and song programme arranged by Mr. Harris. Nearly all the singers were members of the staff.

Calendar.

Messrs. ANDERSON, BOYES & CO., LTD., Motherwell, have sent us a calendar of the "perpetual" type. The centre-piece is a cardboard model of a chain-type coal cutter, the head of which rotates over a circular scale numbered from 1 to 31. In openings at the sides appear the day and the month.

New Lamps for Old.

The suggestion is made by Councillor A. Stott, of the Bradford City Council, that the Electricity Department should replace lamps free of charge for all domestic consumers of electricity. This, he urges, would prove remunerative to the Corporation, inasmuch as at present considerable revenue is lost from many of the poorer consumers, hundreds of whom never buy a new lamp until they are absolutely compelled to. The proposal reminds us of the far-off days when Mr. A. H. Gibbings, as borough electrical engineer of the same city, brought forward his proposals for free lamps for consumers. It is also proposed that the Corporation should undertake the wiring of houses upon a deferred-payment plan.

Indian Tariff Revisions.

The *Board of Trade Journal*, dated February 10th, contained a schedule of revisions in the British Indian import tariff. Among the items noted are the following :—Electrical control and transmission gear for circuits rated at less than 10 A and 250 V; bare or insulated copper wires with conductors less than $\frac{1}{8}$ sq. in. in area, and other cables with equivalent dimensions; certain wiring materials for other than industrial use; all of which are subject to a duty of 15 per cent. *ad valorem*. Certain classes of machinery, including prime movers, boilers, and power-driven machines, as well as copper and other cables, and wires, poles, troughs and other transmission apparatus, are subject to a duty of $2\frac{1}{2}$ per cent. *ad valorem*. Telegraphic instruments and apparatus imported by a railway company are admitted free of duty.

Belgian Duty on Electric Irons.

The "coefficient of increase" applicable to the duty upon electric irons (weighing less than 10 kg. each) upon importation into Belgium has been raised from 4 to 5.2 per cent.

Commercial Electrical Travellers.

The second annual dinner of the Electrical Trades Commercial Travellers' Association was held at the Holborn Restaurant on Friday, February 11th. Mr. Arthur S. Markes occupied the chair. The fraternal spirit predominated, and there were speeches enough to appease those afflicted with the most insatiable thirst for after-dinner oratory, notwithstanding the forethought which placed the words "Brevity is the soul of wit" prominently on the printed list of toasts. Sir Hugo Hirst, Bart., responded, as president, to the toast of "The President and Vice-President," Mr. A. E. Iliffe and Brig.-Gen. P. S. Boucecault replying on behalf of the vice-presidents. Sir Hugo was reminiscent and story-telling. He began by remarking that he started in the same rank as was held by them now. Engineers had great problems, and we admired their skill, but they did not know what knowledge, diplomacy, tact, skill, judgment, and other equipment was necessary in getting rid of their goods. He recalled the interesting, but to-day peculiar, conditions which obtained when he once called himself a commercial traveller—when there were no central stations, when he had to go round and make friends and study their wants, when he (40 years ago) prepared a catalogue of electrical goods, when simple electrical diagrams had to be included in such publications. Nowadays everybody was more or less an amateur electrical engineer, and the commercial electrical traveller must have a knowledge of technicalities so as to improve his efficiency in salesmanship. Mr. Iliffe also touched upon the importance of their aiming at a high standard of trained commercial electrical traveller. Referring to the Association, he mentioned the advantages of associated working as a means to producing good trained men. The industry should support the Association so that travellers should be up to standard and should be afforded opportunities to progress to the full extent of their knowledge. The new Electricity Act would call for a higher quality of salesmanship than we had hitherto had. Brain power had to be diverted from the generation of electricity to the selling of goods. An interesting item not on the official programme was a presentation to Mr. E. A. Joyce, the late chairman of the Association, in recognition of the excellent and self-sacrificing work that he had put into the organisation as chairman during the first 18 months of its existence.

Fire.

The Times reports that damage amounting to about £300 was done by a fire which broke out on February 12th at the works of Messrs. Johnson & Phillips, Ltd., Charlton. The fire was confined to a one-floor brick building used for storing jute, about two-thirds of which was destroyed.

Industrial Welfare.

The increasing confidence in a revival of trade has resulted in a considerable growth in the number of inquiries which the Industrial Welfare Society receives on matters relating to staff welfare and the management of *personnel*. By pooling the experience of its 700 member firms this organisation is able to give trustworthy advice on the many activities associated with industrial welfare work, and is thus able to fulfil the important function of a clearing house for information of this kind. In order that the service may be kept up-to-date it is very desirable that as many firms as possible should co-operate. Employers who are willing to give others the benefit of their experience are invited to communicate with the Society at 51, Palace Street, S.W.1.

Unemployment.

There was a further decrease (17,220) in the number of unemployed during the week ended January 31st. The total at that date was 1,331,500, as compared with 1,348,720 on January 24th, and 1,174,978 on February 1st, 1926.

Trade Announcements.

With reference to our review of Wade's Tables (Overhead Electrical Transmission Lines), Electrical Review, February 4th, 1927, Mr. Christopher Wade, A.M.I.E.E., asks us to state that he is the sole representative for the Hull branch of Gabriel Wade & English, Ltd., for telegraph, telephone, and overhead poles and accessories. His address is: 46a, Ashburnham Road, Bedford.

The change of name of Vickers-Petters, Ltd., to Petters (Ipswich), Ltd., has now been officially sanctioned, and the new name is being used forthwith.

A new company, Gwynnes Pumps, Ltd., has been formed to take over the centrifugal-pump and other machinery manufacturing business of Gwynnes Engineering Co., Ltd. By an arrangement with Messrs. William Forster & Co., Ltd., the manufacturing side will ultimately be transferred to their Lincoln works. In the meantime the company is carrying on at the Hammersmith Iron Works.

The Oxford Wireless Telephony Co., Ltd., 11, New Road, Oxford, is removing the manufacturing side and battery service of the business to new premises in Titmouse Lane.

New Catalogues and Lists.

The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.1.—An illustrated and priced pamphlet describing the "K.L.1" valve, together with a book of instructions for building a receiver incorporating three of these valves and a coloured poster advertising the "K.L.1." Applicants for the instruction book are asked to remit 6d. in stamps.

Electric Fires, Ltd., Heatrae Works, Norwich.—Catalogue sheet, describing, illustrating, and pricing a new electric paraffin wax bath for vulcanising.

The Great Northern Telegraph Co., Ltd. (of Denmark), 5, St. Helens Place, E.C.3.—A price list for use with a catalogue of telephone and other apparatus which was issued by the company last year.

Messrs. Cecil Hodges & Co., Ltd., Empire Works, Dalston.—Folders 109/2 and 132, illustrating and describing "Empirelight" small lighting sets. Priced.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—February calendar-blotter, advertising "Jackson" electric cookers for hiring schemes.

International Time Recording Co., Ltd., 112, Strand, W.C.2.—Pamphlets advertising the company's time-recording apparatus.

The Jeary Electrical Co., Ltd., 26-28, Lamb's Passage, Chiswell Street, E.C.1.—A net trade price list of electrical accessories, including cables, wires, switch- and fuse-gear, bells, &c.

Graham Amplion, Ltd., 25-26, Savile Row, Regent Street, W.1.—Three illustrated pamphlets, describing the "Amplion" public speech and band repeater equipment, and referring to public occasions upon which it has been used.

Messrs. James McMillan & Co., 17, Surrey Street, Strand, W.C.2.—An illustrated catalogue of "Rex" heating, cooking, and other domestic apparatus.

The Quasi-Arc Co., Ltd., 15, Grosvenor Gardens, S.W.1.—Two illustrated pamphlets, describing work carried out by the company's welding process—a gasholder and engine seatings in motor vessels.

Orion Lamps, Ltd., 15-17, Eldon Street, E.C.2.—A folder giving prices of vacuum and gasfilled lamps.

The Weinbau Electrical Co., 327-329, Commercial Road, E.1.—A trade price list of electrical materials and accessories.

Messrs. S. G. Brown, Ltd., North Acton, W.3.—The "Brown Budget" for February, containing illustrated notes upon the company's activities.

Messrs. E. Brook, Ltd., Empress Works, Huddersfield.—Catalogue No. 149, dealing with the construction of the company's motors. Illustrated.

Siemens & English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, E.C.4.—February price list of electrical appliances and accessories. Illustrated.

The British Vacuum Cleaner & Engineering Co., Ltd., Parsons Green, S.W.6.—Illustrated pamphlets dealing with the "Goblin," "Turbinet," and "Brivac" vacuum cleaners.

Electricity Services, Ltd., 27, Martin Lane, Cannon Street, E.C.4.—A card advertising the company's installation business, &c.

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.—A coloured cardboard cut-out 18 in. high and 11 in. wide, advertising "Mazda Pearl" lamps.

The Swedish General Electric, Ltd., 5, Chancery Lane, W.C.2.—List No. A 30, containing illustrations, details and prices of single- and polyphase motors.

The National Gas Engine Co., Ltd., Ashton-under-Lyne.—Catalogue No. 2516, containing fully-illustrated details of "National" self-starting heavy-oil engines.

Pneumatic Conveyance & Extraction, Ltd., Moor Street, Wilmslow Road, Manchester.—A brochure describing the company's "Pneuconex" system of conveying, extracting and cleansing for boiler installations, &c. Fully illustrated.

Bankruptcy Proceedings.

A. W. Pegrum (trading as Economia), electrical contractor, 258, High Holborn, W.C.—An order of discharge subject to a suspension of 12 months was granted to this bankrupt on February 9th at the London Bankruptcy Court. The Official Receiver reported that the applicant failed in August, 1926, with provable claims of £4,434 and assets of £11. In March, 1923, he formed a limited company to manufacture and sell a patent electric grill, but the venture was not a success. The failure was further attributed to bad trade and heavy overhead charges.

H. A. Mills, 1, Lorne Villas, Old Windsor, Berks., electrical engineer, tobacconist, &c.—The public examination of this debtor was held recently at Windsor. The statement of affairs showed liabilities of £452 against assets of £177, leaving a deficiency of £275. Debtor attributed his position to labour troubles and the ill-health of his wife. The examination was adjourned to be closed.

Albion Electric Co., 112, Albion Street, New Brighton, Chester.—Receiving order made February 2nd on a creditor's petition.

G. R. Sim, motor and electrical engineer, Hartlepool Street, Thornley, Durham.—First meeting held February 17th at the Official Receiver's office, 14, John Street, Sunderland. Public examination March 1st at the County Court, Durham.

R. H. Atkinson, electrical engineer, 33, Prince's Avenue, Old Trafford, Manchester.—Bankrupt discharged January 11th, 1927.

J. O. Joyce, electrician, 7, Parade, Leamington.—Trustee, Mr. C. J. Band, Official Receiver, 9-11, High Street, Coventry, released January 31st.

E. Cowley (trading in co-partnership with G. Hill and G. Noble, as G. Hill & Co.), electrical engineer, 22, Chantry Lane, Great Grimsby.—Application for discharge to be heard March 17th, at the Town Hall, Great Grimsby.

G. C. Barnes, electrical engineer, 3, Swift Street, and Regent Electrical Works, Barnsley.—Last day for proofs for dividend, February 26th. Trustee, Mr. B. S. Briggs, Official Receiver, 21, King Street, Wakefield.

J. V. Figgins, plumber, sanitary and electrical engineer, 97, Fore Street, St. Marychurch, Torquay.—Last day for proofs for dividend, February 26th. Trustee, Mr. W. R. Cocks, Official Receiver, Exeter Bank Chambers, 67, High Street, Exeter.

C. E. F. Parker, electrical engineer, Greendale, Privett Road, Gosport.—Adjudication order annulled and receiving order rescinded on February 3rd, debts having been paid in full with 4 per cent. interest.

Company Liquidations.

Wareham Electric Supply Co., Ltd.—A petition for the winding up of this company has been presented to the High Court by Mr. W. E. Weston, of 54, Spring Grove Road, Hounslow, a shareholder, and will be heard in London on February 22nd.

Fladbury Electric Light & Power Co., Ltd.—Winding up voluntarily. Liquidator, Mr. W. G. Day. Meeting of creditors, February 19th, at 51, Foregate Street, Worcester.

Claremont, Johnson & Co., Ltd.—Meeting of creditors, February 28th, at Winchester House, Old Broad Street, E.C. Particulars of claims by February 19th, to Messrs. W. Wilson and J. H. Walter, joint liquidators, 26 and 27, Union Bank Buildings, Holborn Circus, E.C.

Dissolution of Partnership.

E. Parkin & Son, plumbers, electric lighting and sanitary engineers, 35, Malpas Road, Newport, Mon.—Messrs. E. and R. H. Parkin have dissolved partnership. Mr. R. H. Parkin will attend to debts and continue the business under the old style.

Reduction of Capital.

Contraflo Engineering Co., Ltd., and Reduced.—A petition has been presented to the High Court for the confirmation of the reduction of the capital of the company from £80,000 to £43,725, and will be heard in London on February 22nd.

Prices of Materials.

Messrs. F. Smith & Co. report, February 15th:—Copper (electrolytic) bars, £61 10s., 20s. increase; do., do., sheets, no change; do., do., wire rods, no change; do., do., h.c. wire, 9⅛d., ⅛d. increase.

Messrs. James & Shakespeare report, February 15th:—Copper bars (best selected) sheet and rod, £86, £2 decrease; English pig lead, £29 10s., 30s. increase.

Messrs. Edward Till & Co. report, February 15th:—No change in the price of india-rubber, Para fine.

Reporting on the lead market on February 12th, Messrs. James Forster & Co. recorded an advance on the week of 23s. 9d. a ton. "An appreciation in values of 12s. 6d. in one day scared those consumers who had not covered their requirements, and considerable buying then took place in this country and in Germany, and also in the United States, which sent up prices a further 11s. 3d. a ton. . . . Lead is gradually getting on to a sounder basis, stocks are not unduly heavy, and demand from consumers in this country is broadening. . . . The prospect is for firmer markets with a rising tendency."

G.E.C. Exhibitions.

Messrs. A. E. Dunkley, Margate, in conjunction with the General Electric Co., Ltd., exhibited a complete range of "Magnet" household electrical appliances at the Pavilion and Winter Gardens, Margate, from February 5th to 12th. The General Electric Co., Ltd., is conducting a series of demonstrations in the showrooms of Messrs. John Barker and Co., Ltd., Kensington, W., with a number of "Magnet" household electrical appliances. Two demonstrators are engaged throughout a period of probably three weeks (the opening day was February 7th) in assembling and breaking down for re-assembly such varied appliances as irons, kettles, hair dryers, and boiling plates, giving ocular proof of the ease and simplicity with which readjustments and replacement of elements can be effected. A complete range of the "Magnet" household electrical appliances is exhibited adjacent to this demonstration stand.

Floodlighting for Nightwork.

We are informed by the British-Thomson-Houston Co., Ltd., that the address of Messrs. Bell Bros., who are the electrical contractors for the work mentioned in our last issue under the above title, is 7, Camomile Street, E.C.3., and not Cannon Street as originally stated.

Belgian Activity in Poland.

Under the auspices of the Société d'Entreprises Electrique en Pologne, a Belgian undertaking, new companies have lately been formed to exploit electric power concessions in the towns of Czenstockowa, Kielce and Piotrkow, Poland.

Recent Contracts.

The Metropolitan-Vickers Electrical Co., Ltd., has been awarded a contract for the electrification of part of the Higher Walton Mills of Messrs. G. & R. Dewhurst, Ltd. Group drive has been adopted and eight motors ranging from 350 h.p. to 10 h.p., and totalling 820 h.p., are to be installed to replace beam engines driving machinery in two weaving sheds with 1,600 looms, a mule spinning room with about 11,000 spindles, a size-mixing room, warehouse, and workshops. The larger motors are to be of the slip-ring type, and the smaller motors of the squirrel-cage type. Suitable control gear and a 5-panel switchboard are included in the order.

Messrs. E. Bennis & Co., Ltd., have now received a contract for the complete equipment of mechanical chain grate stokers for Stirling boilers, and mechanical coal-handling plant for the new generating station of the City of Coventry. This comprises:—16 Bennis chain grate stokers (induced draught type), two barge-unloading telphers, hopper weighing machine, U-link chain conveyors, jib crane and track, rotary truck tipper, and weighbridge and accessories.

Since the beginning of February the Electric Furnace Co., Ltd., 17, Victoria Street, S.W.1, has received orders from British firms for 15 75-kVA Ajax-Wyatt electric induction furnaces for melting brass. These furnaces will be capable of melting an aggregate of about 50,000,000 lb. of brass per annum.

A Gas Company and the Electricity Act.

At the recent annual meeting of the Gas Light & Coke Co., Mr. D. Milne Watson (chairman) said that it remained to be seen what the effect of the new Electricity (Supply) Act would be on the electrical industry. In any case, he felt quite confident that, if gas undertakings would only do their duty by the public and see that the supply of gas was always satisfactory, there was little to fear from the shareholders' point of view as to the future. The gas industry did not oppose the Bill in principle, but exerted itself to obtain certain amendments, which had been embodied in the Bill, so that the Electricity Act, from their point of view, was a much fairer measure than it was when it was introduced into the House of Commons.

United States Electrical Exports.

The total value of the electrical goods exported from the United States during November, 1926, was $9,072,042, as compared with $8,035,710 in November, 1925. There were a number of very large increases, the outstanding one being a rise in the value of exported steam turbo-generator sets from $9,397 to $352,191. Primary batteries rose from $177,562 to $364,417; storage batteries from $181,002 to $301,132; mining and industrial locomotives from $19,955 to $144,906; motor-driven household devices from $90,060 to $135,617; domestic heating and cooking devices from $109,879 to $231,504; and power transformers from $67,534 to $338,873. The decreases were fewer in number and of less importance; the classes affected were transmission and distribution apparatus, electrical porcelain, furnace electrodes, railway locomotives, insulated iron and steel wire, and insulated copper wire and cable.

The exports for the first eleven months of 1926 totalled $89,178,896, as compared with $77,753,987 for the corresponding period of 1925.

Manchester Retailers and Municipal Selling Powers.

In the report presented at last week's annual meeting of the Manchester Retail Traders' Association, a strong protest was made against the powers to sell electrical apparatus recently granted to the City Electricity Department. A letter has been addressed to the City Council upon the subject.

Railway Concession for Exhibitors.

It has been the practice of the railway companies to charge half rates upon exhibits returned from agricultural shows. In response to representations by the Association of Chambers of Commerce, the companies have now agreed to extend this concession to exhibitors at the Shipping and Engineering Exhibition, the Olympia motor vehicle shows, and other exhibitions.

New Burmese Companies.

Several new companies have recently been formed in connection with electricity supply in Burma. Among them are the Tawateintha Pagoda Electric Light Association, organised at Tawateintha Pagoda, Myaungmya, with a capital of 50,000 rupees; the Toungoo Electric Supply Co., No. 1 Street, Toungoo, capital, 100,000 rupees; and the Magme Electric Supply Co. (1926), Ltd., Natmank Road, Magme Town, capital, 50,000 rupees.

Beckenham and Electrical Contractors.

The Beckenham Electricity Committee recommends the following arrangements with local contractors:—The contractors are to give the Council the names of all their clients taking electricity for any purpose and to assist in every way in developing the domestic and cooking loads. In the case of clients thus introduced by the contractor the Council is to provide the contractor with fittings, accessories and stores at the usual trade terms, plus 10 per cent., and a guarantee that all immediate business resulting from a visit to the showrooms by his client, or a call by one of the Council's representatives for the purpose of securing business, shall benefit the contractor to the full amount of the bill chargeable, less a share amounting to 10 per cent. on cost, which the Council is to receive. In consideration of a cooker being hired out by the Council as an immediate result of such an introduction, the work of wiring for the cooker shall be carried out by the contractor making the introduction, at agreed schedule rates. These arrangements are to apply only when the first contact with the consumer is through the contractor.

Foreign Electrical Loans in America.

Commerce Reports, in an article on foreign loans floated in the United States during the last quarter of 1926 shows that among these were the following loans of an electrical nature: Unterelbe Power & Light Co., $2,500,000; Berlin Electric Elevated & Underground Railway Co., $12,000,000; Berlin Electric Co., $15,000,000; and the Montreal Light, Heat and Power Co., $9,000,000.

Strike at Bermondsey.

On February 10th, about 40 men employed by the Bermondsey Borough Electricity Department ceased work as a protest against the employment of a man stated to be a non-trade unionist. The strike affected only casual employés engaged on outside work; the power station men are not involved.

It was explained to the Press on behalf of the Council that a rule exists that men engaged must be trade unionists or undertake to join a union within a week of engagement. The man who was the cause of the dispute had given such an undertaking, but in spite of this a strike was called, the Electrical Trades Union stating that the man was not eligible for membership.

Yorkshire Lead Mines Reopened.

The Times reports that lead mines at Greenhow, near Harrogate, have been reopened after being closed for 60 years. Some of the old steam-winding equipment has been recovered and put into use again. At various depths workings through rich lead veins are known to radiate in all directions from the shaft.

New Municipal Showrooms.

The Paisley Corporation Electricity Department has opened showrooms at 4, Abercorn Street, Paisley, and is showing a special range of domestic electrical appliances.

Book Notices.

"Rotary Convertors, their Principles, Construction, and Operation," by E. P. Hill. Pp. xiii+329; figs. 247. London: Chapman & Hall, Ltd. Price 25s. net.

"Surface Water Supply of Canada: St. Lawrence and Southern Hudson Bay Drainage (Eastern Section), Quebec. Climatic Years 1923-24 and 1924-25." 168 pp. and map. Ottawa: F. A. Acland, Government Printer.

"The Practical Telephone Handbook," by J. Poole. Seventh edition. Pp. xxv+870; figs. 687. London: Sir Isaac Pitman & Sons, Ltd. Price 18s. net.

"Home Fires Without Smoke." Edited by Cyril Elliott, B.Sc., and Marion Fitzgerald. Pp. 58+xvi. London: Ernest Benn, Ltd. Price 3s. 6d. net.—A number of contributions to this work amount to a general attack on the old coal-fired kitchener and open-type coal grate. A chapter on "Electricity and Smoke Prevention," by Major F. H. Masters, O.B.E., M.I.E.E., with an introduction by Miss C. Haslett, in non-technical language, puts the case well for the different electrical appliances required for various household services, and at the same time stresses the advantage of the combined use of electricity for all purposes.

For Sale.

By direction of Messrs. Alfred Herbert, Ltd., Messrs. Edwards, Son & Bigwood will sell by auction at Blic Works, Cheston Road, Aston, Birmingham, on March 8th and following days the remaining plant of the British Lighting and Ignition Co., Ltd., together with other machinery, including machine tools, lathes, drilling machines, power presses, electric motors, &c. Sutton Coldfield Electricity Department has for disposal surplus generating plant, now installed at the Riland Road Electricity Works. Rochdale Board of Guardians invites offers for surplus generating plant and scrap metal. By order of the joint receivers and liquidators of Eastwood, Swingler & Co., Ltd., engineers, &c., of Osmaston Road, Derby, Messrs. Richardson & Linnell will sell by auction on March 8th, at St. James' Sale Rooms, Derby, the freehold property, plant and machinery, &c. Mr. H. J. Shaw will sell by auction on February 23rd, at 13, High Holborn, wireless and electrical stocks. (See our advertisement pages to-day.)

Local Exhibition.

An electrical exhibition will be held in the Town Hall, Marlborough, on March 3rd, and manufacturers and others desirous of taking part in the exhibition are invited to communicate with the Council's engineers, Messrs. A. Hugh Seabrook & Partners, 146, Bishopsgate, E.C.2.

Wages in the Engineering Industry.

The February *Journal* of the Amalgamated Engineering Union deals with the brighter prospects of the engineering industry. It is noted that during the November-December period the Union's unemployment figure fell by 3,673, and all indications show a further decline. "It is with these factors in mind that we venture to suggest the time has arrived when the question of an increase of wages to those engaged in our industry should be revived. We have, on occasions, referred to the fact that sections of the industry have been for a considerable time past in a position to well afford an increase of wages to their workpeople, and now that the industry in general is showing a decided tendency towards improvement, we claim that this question should receive attention."

The *Daily Herald* reports that the London Joint Engineering Council has decided to recommend the district committees of the 18 unions concerned to make application for an advance of 3d. per hour (roughly, 12s. per week).

Lighting and Power Notes.

Australia.—Victoria.—According to the *Australasian Electrical Times*, under a Bill presented to the State Parliament in December additional capital expenditure on the State electricity schemes, totalling £1,593,331, was authorised. Among the principal items were: Sugarloaf-Rubicon scheme, £350,000; country and extra-metropolitan supply, £250,000; supplies to centres not served by present or proposed transmission lines, £40,000; extending metropolitan h.p. system, £130,000; additional generating plant, £10,000; Yallourn power station, £150,000; open cut workings, £270,000; extending briquetting works, £50,000; Yallourn township, £106,000; service buildings, equipment and minor works, £90,000; working capital for overburden removal, open cuts, £60,000; accommodation, roads, streets, and electric light at old open cut settlement, £10,000; interest and other expenditure, £70,000. On conversion of certain metropolitan areas to 3-phase supply, &c., £325,000 will be expended.

Barnsley.—Mains Extensions.—The Electricity Committee is to carry out extensions to mains at a cost of £3,000.

Barnstaple.—Loan.—The Town Council has applied for sanction to a loan of £1,800 in connection with the relaying of the feeder cable in High Street.

Overhead Lines.—The Ministry of Transport has consented to the use of overhead lines for supplying electricity outside the borough.

Barrow.—Electricity Extensions.—The borough electrical engineer has submitted a report to the General Purposes Committee on an interview with the Electricity Commissioners on January 26th, with regard to the proposed extension of the plant at the Buccleuch Street works, at an estimated cost of £60,000, when the deputation was informed that if it could be shown that by carrying out the proposed extension the supply would be obtained at a lower price than that offered by Messrs. Vickers, the Commissioners would be prepared to sanction the extension. It was resolved that the report be approved, and that the Council be recommended to make application for sanction to the borrowing of £60,000 for extensions at the electricity works, made up as follows:—One 6,000-kW turbo-alternator, switchgear, pipework, and auxiliary plant, £30,000; boiler and auxiliary plant, £16,750; coal-handling plant and bunkers, £3,000; cooling tower and foundations, £2,000; pipework, £2,500; engine room cranes, £750; contingencies, £5,000. The Town Council has approved the Committee's proposal.

Supply to Cark and District.—The Council has also agreed to the proposal of the Electricity Committee to supply electricity to the Cark and District Electricity Co., Ltd., the latter to take the supply from the Corporation's main transmission line between Ulverston and Grange, where a pole transformer will be erected, and to construct a line from this point to its own generating station. The company is prepared to take not less than 25,000 kWh per annum for a period of five years.

Bristol.—Inquiry.—An inquiry was held by Col. T. C. Ekin, for the Electricity Commissioners, on February 8th and 9th into applications for Special Orders by Bristol Corporation to supply electricity in parts of the rural districts of Chipping Sodbury, Thornbury, Walmley and Keynsham, and by the Warmley Rural District Council in respect of its area. For the Corporation it was stated a supply could best be given from Bristol, where over £2,000,000 had been invested in the undertaking, and over 600 miles of cables had been laid. Owing to shortage of plant it was not possible at present to give a bulk supply to the Warmley rural area. Sir Seymour Williams, for the Warmley Council, stated that the Corporation's scheme was not *bona fide*, but designed to stake out an area and prevent any other authority from supplying in it, and that if the Corporation was prepared to lay mains as shown by the Warmley Council, the latter authority might come to terms. Objections were also made by other local authorities. At the suggestion of Col. Ekin, the contending parties decided to confer with a view to further considering the matter, and the inquiry was closed.

Bridge of Allan.—Transfer of Order.—The Town Council has signed an agreement for the transfer of the Bridge of Allan Electricity Supply Order, 1925, to the Scottish General Electric Power Company.

Brownhills.—Electricity Agreement.—The Urban District Council has decided to enter into an agreement with the Cannock Chase Colliery Co. to provide electricity for lighting the houses at Norton Canes.

Bugle (Cornwall).—Electricity Scheme.—Mr. Stamp, manager of the St. Austell and District Electric Lighting and Power Co., Ltd., attended a public meeting on February 7th called to consider the question of electric lighting, a previous meeting of the residents having voted in favour of the scheme. Mr. Stamp stated that the cost of conveying electricity to and through the Bugle area would be £4,500, and the minimum charges to consumers would be 10s. 10d. per quarter during the summer months and 15s. during the winter months. The meeting decided to ask the Parish Council to issue pamphlets to householders giving details of the proposal, and it was also decided to canvass the area to ascertain if the neighbouring villages of Stenalees and Penwithick would join the scheme.

Canvey Island.—Electricity Supply.—The Urban District Council recently sent a deputation to the Southend-on-Sea Corporation Electricity Committee in connection with the proposed erection of a generating station on the island. The deputation intimated that if Southend would apply for power to erect the station and give a bulk supply on reasonable terms, the Urban District Council would accept the supply and apply for an Order to become distributor in its own area. The Council has approached the County of London Electric Supply Co., Ltd., and the East Anglian Electricity Co., with a view to securing a clause in their Bills agreeing not to oppose the application by any local authority for a Special Order to distribute electricity within the urban area.

Carlisle.—Inquiry Result.—As the result of a recent inquiry the Town Council has received the consent of the Ministry of Transport to the use of overhead lines over certain property for the supply of electricity.

Mains Extensions.—The Council is to carry out mains extensions at a cost of £2,230.

Caterham.—Hospital Supply.—The Metropolitan Asylums Board has adopted revised plans for improving the lighting arrangements at Caterham Mental Hospital, provision now being made for wiring for electricity, electric motors for the laundry, and automatic telephones, at a cost of £10,550, and the erection of a sub-station at a cost of £500.

Continental.—Sweden.—A new hydro-electric power station has recently been completed at Norrforsen on the River Ume. It has a capacity of 37,000 h.p., with facilities for further extensions. The energy generated is supplied to the town of Umea and several sawmills and pulp mills in the vicinity.

Russia.—The Soviet Government has recently drawn up a five years' scheme of new electric power station construction in Northern Caucasia. The scheme provides for the construction of five large stations with a total capacity of 420,000 kW, two stations totalling 11,000 kW, and a series of small country stations aggregating 12,000 kW. The first of the five large stations will be erected at Shachty, and is intended for the supply of power to Rostov, Schachty, Konstantinowskaja, Nowotscherkask and Sulim. A second will be a hydro-electric plant at Mineralaye Wody to supply the pleasure resorts in the district, and also power for the railway connections to the harbours. The third station will be erected on the river Bjelaja, and will supply electricity to the naphtha industry in the Krasnodar district. The fourth plant will be at Noworossisk, and will supply electricity to the local cement works, while the fifth will be at Grosny.

BELGIUM.—The Société d'Electricité de la Campine is engaged on the construction of a new central station at Moll, near the canal connecting the Rivers Meuse and Scheldt. The plant, which, in the first instance will comprise two steam turbo-generators each of 10,000 kW, will be connected by a 50,000-V overhead transmission line to the distribution system of the Société de l'Electricité de l'Escaut, of Antwerp, and by 26,000-V underground lines to the Beeringen and Helchteren-Zolder collieries.

Dewsbury.—ELECTRICITY IN BULK.—The Corporation Electricity Committee has entered into agreement with the Yorkshire Electric Power Co., for a supply of electricity in bulk for 15 years. Sub-stations are to be erected near the Thornhill Council offices and at the Thornhill housing estate, subject to an initial payment by the Corporation of £700, in order to supply electricity to the Thornhill area.

LOANS.—The Town Council has applied for sanction to loans of £650 for the erection of three sub-stations, and £2,850 for laying mains and services to Thornhill.

East Anglia.—OPPOSITION TO BILL.—The Corporations of Ipswich, Beccles, and Lowestoft have decided to oppose the Bill promoted by the East Anglian Electricity Supply Co., Ltd., relative to the supply of electricity in Essex, Norfolk and Suffolk.

East Ham.—RENTAL SCHEME.—The electrical engineer has suggested the institution of a rental scheme, the consumer to be charged a fixed quarterly sum plus 0.9d. per kWh for all electricity consumed, and the Electricity Committee has recommended the wiring of approximately 200 houses under this scheme.

WATER HEATERS.—The committee has also recommended the purchase of 100 electric geysers for loan to consumers under the domestic tariff system, providing the consumers pay the cost of installation.

PRICE REDUCTION.—It is proposed to remove the increase of 10 per cent. made on the electricity charges which was imposed as a result of the coal dispute.

Folkestone.—ELECTRICITY SUPPLY.—The Town Council has arranged with the Folkestone Electric Supply Co., Ltd., for a supply of electricity to the new Leas Cliff Hall, the company guaranteeing that for the first year the cost of electricity shall not exceed £1,388. For display lighting additional electricity will be supplied at 2d. per kWh.

Gainsborough.—ELECTRICITY SUPPLY.—The Council's consulting engineers, Messrs. A. Hugh Seabrook & Partners, report that the electricity undertaking should be ready to commence supply by about the end of March.

Gillingham (Kent).—LOAN.—The Town Council has applied for sanction to a loan of £10,000 for mains and services.

OVERHEAD LINES.—Application has also been made for approval to use overhead cables for converting some of the street lamps in the borough from gas to electric lighting.

Halifax-Huddersfield.—LINKING-UP COMPLETED.—The linking-up between the electricity undertakings of the Halifax and Huddersfield Corporations has been completed at a cost of £85,000, and tests have proved satisfactory. The connection will prevent such stoppages of supply as have occurred several times recently at Huddersfield. The scheme has been carried out on the recommendation of the Electricity Commissioners, as an alternative to extensions of the power station at Huddersfield.

Hazelgrove and Bramhall.—LOAN.—The Urban District Council has applied for sanction to the borrowing of £35,000 for extensions and for l.p. mains for the next three years.

Ipswich.—NEW PLANT.—According to the *East Anglian Daily Times*, at a meeting of the Corporation on February 9th, the Electric Supply and Transport Committee reported that the maximum load on the station during the winter had increased to such a level that it was necessary to consider the question of installing another turbo-alternator, and it recommended the substitution of a 1,000-kW, d.c. Willans turbine set by a 5,000-kW Brush-Ljungström turbo-alternator, which would bring the equipment to two 5,000-kW and two 3,000-kW sets. This, with the necessary boiler plant, would entail an expenditure of £60,700. To keep pace with the demands, it would also be necessary to spend £14,038 on new mains, sub-stations, &c. The Committee further reported that, owing to the exhaustion of existing borrowing arrangements, further powers were necessary to the extent of £66,500.

ELECTRICITY IN BULK.—The Committee reported that agreements had been arranged for the supply of electricity in bulk to the Woodbridge & District Electric Light Co., Ltd., and an East Suffolk company. The total cost of laying the mains, &c., was £12,700. The capital charges would be borne by the two companies, Woodbridge paying £300 per annum, and the East Suffolk company £900. For the energy the Woodbridge Company would pay a minimum of £500 for the first year, and £1,000 every subsequent year, and the East Suffolk company £500 for the first year, £750 for the second year, and £1,000 every subsequent year.

The reports were adopted by the Corporation.

Irish Free State.—ENNISCORTHY (Co. WEXFORD).—The Urban District Council's electricity undertaking was formally inaugurated on February 10th. The plant includes two semi-Diesel engines, and already 4½ miles of overhead lines have been erected. The cost of the scheme was £11,500.

Keighley.—ELECTRICITY CHARGES.—The Electricity Committee has recommended to the Town Council that for the half-year from September 30th, 1926, to March 31st next, all classes of lighting consumers other than occupiers of private dwellings be charged 1d. per kWh for all electricity consumed for lighting, heating, and cooking in excess of the quantity consumed during the corresponding six months of the previous year, and that all such accounts for the half-year be subject to a discount of 7½ per cent. for prompt payment.

Kirkham.—PROPOSED ELECTRICITY SUPPLY.—At a recent meeting of the Urban District Council the question of providing an electricity supply for the district was considered. It is proposed to obtain a supply from Preston Corporation, a cable being laid to connect up with the one now under construction between Preston and Blackpool. The Council decided to issue a questionnaire with a view to ascertaining the number of residents who would be prepared to take a supply.

Kingussie.—ELECTRICITY SUPPLY.—The secretary of the Grampian Electricity Supply Co. has informed the Town Council that the provision of a supply of electricity for the town is part of the company's programme, and that the necessary works will be put in hand in time for next winter. It is suggested that Newtonmore should be included in the scheme.

Lincoln.—ELECTRICITY EXTENSIONS.—In connection with the Electricity Committee's recommendation to provide a supply of electricity in the south-west part of the town, at an estimated cost of £40,000, the City Council has decided that expert advice be taken as to the proposed extensions and as to the policy to be adopted in regard to future developments of the electricity undertaking.

Llanfairfechan. — ELECTRICITY SCHEME. — The consulting engineer to the Urban District Council (Mr. Price White) is preparing a report on an electricity scheme for the town.

London.—BATTERSEA.—The Electricity Committee has prepared a scheme for additional mains on the Latchmere housing estate in order to provide electricity for heating and cooking. Only part of the estate will be dealt with in the first instance, the cost of mains being £2,000.

FULHAM.—The Finance Committee has recommended that application be made for sanction to a loan of £2,535 for sub-station equipment, mains, &c.

Long Eaton.—NEW PLANT.—The electrical engineer has recommended to the Town Council that two 500-kW motor convertors be installed at the electricity works, one to be installed immediately and one later. Application is to be made for sanction to a loan of £18,386 to cover the cost of the scheme.

Marlborough.—ELECTRICAL PROGRESS.—Practically all the street lamps have now been changed from gas to electric lighting, and good progress is being made with the wiring of the houses on the Council's estate.

Mexico. — HYDRO-ELECTRIC DEVELOPMENT. — Work has started on a scheme for supplying electricity in the Federal District of Mexico by utilising the waters of the River Lerma. The first installation will consist of two sets of 30,000 h.p. each, provision being made for extensions as needed for one or two additional sets of the same size. It is hoped to increase the sales of electrical energy before the end of the current year to 1,000 million kWh, the present output of the company holding the concession being approximately 600,000,000 kWh.—*Reuter's Trade Service* (Mexico City).

Newhaven.—INQUIRY.—The Electricity Commissioners have intimated to the Rural District Council that an inquiry is to be held at Brighton on March 15th with regard to the Telscombe and Piddinghoe Special Order which is being applied for by the Peacehaven Electric Light & Power Co., Ltd.

Northern Ireland.—PORTADOWN (Co. ARMAGH).—The electricity supply failed on February 8th as the result of an explosion, which was followed by an outbreak of fire at the local power station. The explosion was reported to be due to the bursting of the exhaust pipe of one of the engines. The outbreak was got under control by the fire brigade, but not before a considerable amount of damage had been done, including the destruction of the dynamo.

Nottingham.—LOAN.—The City Council has adopted a report of the Electricity Committee authorising application for sanction to borrow a further sum of £150,000, which is required for the general extension of mains in the city and district, transformers and switchgear in connection with the h.p. service, the erection of sub-stations, and for meters.

Palestine.—ELECTRICAL DEVELOPMENT.—In a report on the economic and financial situation of Palestine, issued by the Department of Overseas Trade, Mr. K. W. Stead, the Director of Customs in Palestine, gives some particulars of the growth of electrical power in that country during and up to 1925. The most important stimulant to local industry, he says, has been the establishment of electrical power stations at Tel-Aviv, Haifa, and Tiberias by the Palestine Electrical Co., Ltd. So great has been the demand for electricity at Tel-Aviv and Jaffa that the two engines, each of 500 h.p., which were first installed there, had to be supplemented by a third one of 250 h.p., and later by a fourth of 1,000 h.p.

Power is now supplied from the Tel-Aviv station to Petah Tikvah, the largest Jewish colony in the neighbourhood. The work of establishing a hydro-electric station on the Jordan was to be put in hand immediately. The first hydro-electric station, when completed, will have an output of 24,000 h.p.; others will be added as the necessity arises, up to a total capacity of 300,000 h.p.

Reigate.—Street Lighting.—The Highways and Works Committee has recommended the Town Council to instruct the electrical engineer to prepare a report upon the question of central overhead street lighting at Reigate and Redhill.

Spalding.—Special Order.—The Urban District Council has instructed its consulting engineers to take the necessary steps in conjunction with the Parliamentary agents to procure a Special Order authorising it to supply electricity in the rural district of Crowland and the parishes of Borough Fen and Newborough.

Special Orders.—Application has been made to the Electricity Commissioners for Special Orders by the following authorities:—The Weald Electricity Supply Co., Ltd., for the supply of electricity in certain parishes in the rural districts of Uckfield, Hailsham, Tonbridge, Maidstone, and Hollingbourne; Messrs Drake & Gorham, Ltd., to supply in parts of the rural districts of Chailey, Hailsham, and Uckfield; Mr. F. R. Hunter, in the urban district of Halesworth, and the parish of Holton; the Electric Supply Corporation, Ltd., to supply in parts of East and West Sussex.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Farnham Gas and Electricity Co. to supply electricity in the parish of Dockenfield and part of the parish of Frensham.

Thame.—Inauguration of Supply.—An electricity supply for the district was formally inaugurated by the wife of the chairman of the Urban District Council on February 10th. The supply is obtained from Aylesbury Corporation.

United States.—Hydro-Electric Development.—According to the *Electrical World*, the city of Seattle has filed with the Federal Power Commission an application for a licence covering its Skagit River development. According to the data submitted, the Ruby Dam, for which authorisation is sought, will produce a reservoir of 3,500,000 acre-ft. capacity. The head would be 445 ft. and the primary capacity 83,000 h.p. It is planned, however, to install six 54,000-h.p. sets. The Diablo Dam, forming part of the project, will back up the river to the Ruby Dam. The primary capacity is estimated at 108,000 h.p. Six 47,000-h.p. sets would be installed there. The Gorge Dam will create a reservoir holding 6,000 acre-ft. This water is to be used in the existing Gorge power plant. The primary capacity there is 150,000 h.p. At present 75,000 h.p. is installed. The ultimate installation proposed, however, is eight 37,500-h.p. sets.

Walton-le-Dale.—Street Lighting.—The Urban District Council on February 9th decided to ask the Lancashire Electric Power Co. to quote a price for converting the street lamps from gas to electric lighting.

Worcestershire.—Electrical Development.—During 1926 the Shropshire, Worcestershire and Staffordshire Electric Power Co. laid a total of 97 miles of cable. It is understood that the company's programme for cable laying during the current year will exceed this figure by at least 50 per cent.

Tramway and Railway Notes.

Aberdare.—Abandonment of Railless Cars.—The *Financial News* states that the Urban District Council is promoting a Bill this session to relinquish and discontinue permanently the whole of the railless-car routes within its district in respect of which Parliamentary powers have been obtained and the requisite overhead electrical equipment provided. The preamble of the Bill declares that "the running of trolley vehicles has been found impracticable and uneconomical." It is proposed to substitute motor-omnibuses on the routes authorised for railless cars.

Burnley.—New Cars.—The tramway manager has reported on the question of increasing the number of tramcars, and the Town Council has been recommended to authorise the purchase of five double-deck cars.

Bradford.—Fare Scheme Defeated.—The scheme for increasing the 1½d. fares to 2d. and reducing long-distance fares to an all-round figure of 3d., which has created considerable opposition, was defeated at a recent meeting of the Tramways Committee. The City Treasurer stated that some means must be found to stabilise the department's finances, as it is still faced with an increase of several thousands of pounds in its electricity bill for the half-year ended December last, and a loss in revenue of £15,000 during the general strike and coal strike periods.

Track Renewal.—The Tramways Committee has decided (subject to approval by the Corporation Estimates Sub-Committee) that the Leeds Road tramway track between Rushton Road and the Thornbury depôt shall be reconstructed, at an estimated cost of £2,709.

Railless Cars.—The Finance Committee has refused to consider a proposal that the substitution of railless cars on the Allerton tramway route should be deferred for a three-months' trial of motor-'buses.

Parliamentary Bill.—The Shipley Urban District Council has decided to support the Corporation's Parliamentary Bill for powers to extend its railless-car and motor-omnibus services to several districts beyond the city boundaries.

Continental.—Spain.—The Barcelona correspondent of the *Daily Mail* reports that the Northern Railway of Spain has recently placed an order for 22 electric locomotives. The electrical equipment is to be constructed in Switzerland and the mechanical parts in Bilbao by the Euskalduna Company. The locomotives are to be employed on the electrified lines from Barcelona to Manresa and to San Juan de las Abadesas, in the Pyrenees. Large sums are being spent on transport improvements in the country, and on the railways all main lines are to be provided with two roads. Large electrification schemes are being prepared, electrical energy being obtained by utilising the water-power resources of the country. The railway from Cerbère to Barcelona is to be electrified, as well as the coast line from Barcelona to Empalme.

Ipswich.—Railless Cars.—The *East Anglian Daily Times* reports that at a recent meeting of the Corporation the Electric Light and Transport Committee reported that the conversion of the gear for the use of the railless cars had entailed an excess expenditure over the estimates (£10,000) of £1,800. The extensions of the system to Grove Lane, Foxhall Road, London Road, Felixstowe Road, and Bramford Road had entailed an expenditure of £13,380. The needs of the service had also called for more vehicles than provided in the Act. In all, 35 vehicles had been purchased, at a cost of £53,500, and there were occasions when there were no spare vehicles available. The borrowing powers amounted to £45,000 for 30 vehicles, leaving an excess of £8,500, towards which £1,892 had been contributed out of revenue, leaving £6,608 to be provided by loan. The Committee anticipated that in order to cope adequately with the additional passengers and the new routes, and to provide spares for emergency, six further vehicles would probably be required in due course, at an estimated cost of £9,600. The Committee had had under careful consideration the occasions when interruptions to the service had occurred, and it had been found that these had been mainly due to the old feeder system being inadequate to meet the demands. It recommended the installation of a duplicate system of feeders throughout the system, at a cost of £2,130. The Committee asked for sanction to apply for loans amounting to £13,743 in connection with the system. The report was adopted by the Corporation.

Japan.—Railway Electrification.—It is reported that the Central Government has granted the application of the Toyama Prefectural Office for permission to electrify its railway, and work on the construction of the sub-station will commence shortly.

Sunderland.—Track Renewal.—The Town Council has decided to relay the tramway track in Fawcett Street, at an estimated cost of £9,000. The remainder of the carriage-way will also be laid with lithocrete, at an estimated cost of £4,250.

Telegraph and Telephone Notes.

Belgium.—Short-Wave Radio-Telegraphy.—The Société Belge Radio-Electrique, of Brussels, in its report for last year, states that it has established a short-wave wireless telegraph service between Belgium and the Belgian Congo, which is now working satisfactorily.

Canada.—Long-distance Telegraph Line.—The Canadian Pacific system has started work on a second trans-Canada telegraph line, 3,000 miles in length, extending from Montreal to Banfield, on Vancouver Island, passing through Sudbury, Fort William, Winnipeg, Moose Jaw, Calgary, Nelson, Penticton, Vancouver and Alberni. At Banfield the line will connect with the second Pacific Cable Board undersea circuit that goes to Fanning Island, Suva, Auckland, and Sydney. The work will be completed in about two months, at an estimated cost of about $423,520, says the *Financial News*, and will forge another link in the chain between Great Britain, Canada, New Zealand, and Australia.

Germany.—Cheaper Telephones.—Telephone installation fees are to be greatly reduced, and monthly rentals are to be cut from 5 to 12 marks to from 3 to 9 marks per month. Forty free calls will be allowed, after which the price per call will be 10.9 or 8 pfennigs per call, according to the zone, instead of a flat rate of 15 pfennigs as at present. Trunk calls for distances of 15 to 75 kilometres are to be reduced from 45, 90 and 120 pfennigs, to 40, 60 and 90 pfennigs, and after the expiration of the usual three minutes, conversations will be charged for per minute, instead of periods of three minutes. Between 7 p.m. and 8 a.m. long-distance calls are to be charged at two-thirds the day rates.—*Reuter* (Cologne).

Gibraltar.—New Telephone Line.—The Spanish Government has approved of the establishment of a telephone line between La Linea and Gibraltar.

Guatemala.—Telephone and Telegraph Systems.—The telegraph and telephone systems are operated by the Government as one unit. The combined systems reported a deficit of 13,477,666 pesos for the year 1925 (the latest figures available), says *Commerce Reports*. There were 261 telegraph offices operating in the Republic at the end of the year, of which 5 were inaugurated in 1925; the 11 new central telephone stations opened during the year brought the total in operation in the country to 87. Telegraph lines aggregated 6,871 kilometres, and the national telephone lines had a combined length of more than 3,603 kilometres. At the end of 1925 there were 1,992 telephones in use in the Republic, representing an increase of 775 instruments since 1923. Work on the new automatic telephone system in the capital city has begun.

Irish Free State.—Wireless Advisory Committee.—The preliminary arrangements are being made for the establishment of the Free State Advisory Committee under the provisions of the Wireless Telegraph Act. The Provisional Advisory Committee already in existence will be superseded by the new body. The Ministries for Education, for Lands and Agriculture, and for Posts and Telegraphs, are to be represented on the Committee.

Transatlantic Telephony.—Satisfactory Working.—The first month's operation of the Transatlantic radiophone service has been a commercial success, according to the management, which states that the receipts satisfactorily exceeded the expenditure, adding that Americans lived up to their reputation as extravagant telephone users, having made an average of nine calls for every five British calls.—*Reuter* (New York).

A commercial telephone service between Chicago and Detroit and London was inaugurated on February 12th.—*Reuter* (New York).

The Telephone Service.—New Belfast Exchange.—Negotiations for the sale of a very large block of property in Belfast have been completed, the purchaser being the British Postmaster-General, who requires the premises for a new central telephone exchange, and it is understood that the automatic system will also be brought into operation.

Radio Notes.

Belgium.—International Conference.—The engineers who met recently in Brussels under the chairmanship of M. Raymond Braillard, president of the Technical Commission of the International Radiophony Union, examined the subject of transmission interference on long wavelengths; provisional regulations were decided upon and a detailed programme of tests arranged. Another matter discussed was electrical interference caused by tramways, lifts, illuminated signs, &c., says *World Radio*. The Conference coincided with meetings of the Bureau and of the Juridical Commission of the Union, presided over by Herr Giesecke and Dr. Sourek respectively, and Radio Belgique entertained the delegates (among whom were representatives of Russian broadcasting).

Denmark.—Licence Fee Reduced.—The law relative to annual licence fees was recently revised: according to *Commerce Reports*, all apparatus acquired or constructed after October 1st, 1926, is subject to a fee of 5 crowns in the case of a crystal set and of 7.5 crowns in the case of a valve set, or set in which valve amplifiers are used. These figures represent a reduction of 50 per cent.

Germany.—Licences.—At the end of 1926 a total of 1,376,564 licences had been issued, the number of applications during December having been 39,442. Unlicensed listeners are said to be fewer in Germany than in any other country. The fee is payable monthly (2s.).

Licences.—P.O. Ruling.—In a written reply to a question in the House of Commons, Lord Wolmer, Assistant Postmaster-General, is reported to have said: "A receiving licence entitled the licensee to use apparatus in the premises occupied by him. One licence will cover any number of sets installed in the same premises for the use of the licensee, his family, or his servants, but any other person occupying a portion of the same house under a separate tenancy and desiring to install receiving apparatus must take out a separate licence. When a licensee runs telephone leads from his set to the house of a neighbour, or to any premises other than those in his own occupation, for the purpose of conveying broadcast programmes thereto, a separate licence is necessary for such premises."

Poland.—New Station.—The latest addition to European long-wave stations is that at Warsaw, transmitting on 1,013 metres with an input of 10 kW to the main oscillator valve, which was built by Marconi's Wireless Telegraph Co., Ltd. The transmitter (a QD8 set) was designed on the same lines as that at the Daventry station, the six main units being contained in aluminium frames: four are open and contain the valves for the independent drive, main oscillator, modulator and rectifier circuits, and the two enclosed units are the speech transformer and the coupling unit for the drive main oscillator grid circuit. The station belongs to the Polish Broadcasting Co., and has been built at Fort Mokotow on farm land belonging to the municipality. Power is obtained from the city supply at 3,000 volts, three-phase, being transformed at the station to 210 volts. The rectifiers, main modulator, and main oscillator valves are of the Marconi cooled-anode type, and the drive and sub-modulator of the glass air-cooled type. The aerial is carried on two self-supporting lattice steel masts 75 metres high, and the aerial current is 30 amperes. The range of reception in Poland is 75 miles with a crystal receiver and 375 miles with a two-valve receiver; the station has been heard in this country, when the B.C.C. stations were closed down, on a 2-valve receiver. Short wood poles were used to carry an earth screen which was erected to compare results with those obtained with an "earth" proper, and the latter was found to give the better performance.

Reality in Reception.—Birmingham Demonstration.—The second of the series of talks which Mr. Colin H. Gardner has been giving from the Birmingham station was particularly interesting. The first talk was accompanied by demonstrations by which it was hoped listeners would be enabled to ascertain what distortion was being caused in their receivers; a large number of reports of reception were received, which showed that in all probability only a very small proportion of listeners get from their sets anything like the degree of purity and full range of musical values that is possible with a well-designed instrument. One of the test transmissions comprised the notes of instruments which register a very low pitch, and the great majority of reports stressed the unsatisfactory nature of these notes. Only in cases of listeners using resistance-capacity coupled receivers in conjunction with loud-speakers of the cone type was satisfactory reception reported.

South Africa.—Johannesburg Station Closed.—Amid expressions of regret and appreciation, the Johannesburg broadcasting station, the most important in the Union, closed down on January 31st.

As the result of a conference of those interested in the resumption of broadcasting, three schemes have been submitted to the Minister of Posts and Telegraphs, who had promised to issue a licence for any scheme chosen by a representative committee. *The Times* understands that the Minister favours the proposal of the Mayor of Johannesburg that the cost of broadcasting shall be borne by the Reef municipalities. He is definitely of opinion that sooner or later the service must become a State-aided enterprise. While negotiations are proceeding, the Transvaal Radio Society undertook to resume the service from February 7th.

United States.—New Station.—New York City's newest station (WGL) was opened on January 30th, and marked the inauguration of the activities of the International Broadcasting Co., which operates the station; its power is 1 kW, and wave-length 442 metres, which figure may be changed to 422 m. if interference occurs.

New Company.—The new Atlantic Broadcasting Corporation, with headquarters in New York, has purchased the Grebe group of stations, including the new 5,000-watt transmitter WABC. The new organisation has its studio and reception rooms in Steinway Hall; all transmitters are located at Long Island. An elaborate mixing or fading system in connection with a large number of microphones, permits, says the *T. and T. Age*, the proper blending of the various elements of the broadcast presentation. The frequency control system of the 5-kW transmitter is of such stability that a change of even one-tenth of one per cent. in wave-length is not likely to occur.

Legislation Compromise.—A tentative agreement has been reached at Washington, where conferences have for months been considering the problem of air control and order. The agreement appears to have the support of adherents of the White Bill, which the House of Representatives passed, and of those favouring the Dill Bill, which the Senate passed. According to *World Radio*, it contains no provision for censorship, calls for the creation of a commission of five, the members of which are to be appointed by the President of the United States, and to serve for six years; each commissioner will represent one of five zones created. The Commission will have jurisdiction as to granting, renewal and revocation of all station licences and making regulations for a period of one year, at the end of which the Commission shall decide only controversial matters which the Secretary of Commerce of the United States places before it and appeals from decisions he has handed down. The decrees of the Commission are to be final, to be reviewed only by the courts. Complete control over operators and the issue of their licences is given to the Secretary of Commerce. All administrative functions are entrusted to him. After one year he will be given original jurisdiction over the granting and renewal of station licences in relation to which there is no controversy or appeal. The Commissioners will receive $10,000 a year for the first year, and thereafter $30 a day and travelling expenses.

Wireless Organisations Committee.—High-Power Stations.—At its second meeting on February 14th, the Wireless Organisations Committee decided to ask the Postmaster-General to take an early opportunity to assure listeners that a system of high-power regional distribution effective for the transmission of alternative programmes will be fully expedited so far as his department is concerned. The next meeting of the Committee will be held on February 28th.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—SYDNEY.—April 6th. New South Wales State Railways. One 7,500-kW turbo-alternator. (B.X. 3179.)*
March 2nd. Wires and cables. (B.X. 3232.)*
MELBOURNE.—April 5th. Postmaster-General's Department. Condensers. (B.X. 3215.)*
March 30th. Victorian Railways. Lightning arresters. (B.X. 3213.)*
BRISBANE.—April 13th. Brisbane City Electric Light Co., Ltd. Transformers. (B.X. 3218.)*

Bedford. — February 28th. Electricity Department. Twelve months' supplies of e.h.p. and l.p. cables and incandescent electric lamps. (February 11th.)

Belgium.—SAINT GILLES, BRUSSELS.—March 1st. Municipal Council. Armoured cables, junction boxes, and electricity meters. Particulars (Cahier des Charges) for 5 fr. each lot from Service de l'Electricité, 40, Rue de Bethléem, Saint Gilles.

Bristol.—February 24th. Board of Guardians. Electrical fittings for six months. Mr. T. S. Lamb, clerk, St. Peter's Hospital.

Canterbury.—February 21st. Electricity Department. L.p. lead-covered and armoured feeder cables. (February 4th.)

Cardiff. — February 23rd. Electricity Department. Twelve months' supply of paper-insulated cables. (February 4th.)

Cheadle and Gatley.—March 1st. Electricity Department. Annual contracts for lamps, meters, and wood covering boards. (See this issue.)

Croydon.—March 3rd. Electricity Department. 12,000 tons of coal suitable for use on chain-grate mechanical stokers. (February 4th.)

Dublin.—March 2nd. Great Northern Railway (Ireland). Stores for nine months, including electric fittings, lamps, cable and wire. (See this issue.)

Dundee.—February 28th. Education Committee. Electrical installation for the new secondary school, Perth Road. Messrs. Thoms & Wilkie, architects, 21, South Tay Street, Dundee.

Egypt.—Egyptian State Railways, Telegraphs and Telephones. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, Westminster, S.W.1. Telegraph and telephone materials.—*Reuter's Trade Service* (Cairo).
CAIRO.—March 3rd. Ministry of Public Works. Two internal-combustion engines and accessories for the Egyptian Army Flour Mills, Tura, near Cairo. (A.X. 4187.)*

Harrogate.—February 28th. Electric lighting installation for St. Mark's Church, Leeds Road. Particulars from the Verger.

India.—March 22nd. India Store Department. Two 250-kW Diesel-engine alternator sets, with switchgear, transformer, &c. (See this issue.)

Leeds.—March 2nd. Tramways and Transport Committee. Materials, including electrical sundries required during year ended March 31st, 1928. General manager.

London.—METROPOLITAN ASYLUMS BOARD.—February 23rd. Installation of electric lighting at Millfield, Rustington, near Littlehampton, Sussex. (February 4th.)
STEPNEY.—March 3rd. Board of Guardians. Electrical fittings for 6 months. Mr. S. McClelland, clerk to the Guardians, Bancroft Road, Mile End, E.1.

Littlehampton.—March 8th. Sussex Electricity Supply Co., Ltd. One 150-kW Diesel engine and generator with auxiliaries, switchgear and cables. (See this issue.)

Long Eaton.—February 24th. Electricity Department. One 500-kW convertor set and one switchboard platform. (February 4th.)

New Zealand.—WELLINGTON.—March 4th. Poverty Bay Electric Power Board. Switchgear and transformers. (B.X. 3160.)*
April 26th. Public Works Department. Secondary battery for the Lake Coleridge scheme. (B.X. 3202.)*

Newark-upon-Trent.—February 22nd. Electricity Department. Gasfilled electric lamps for street lighting for 12 months. (February 11th.)

South Africa.—JOHANNESBURG.—March 19th. Municipal Council. Transformers. (B.X. 3219.)*
March 3rd. South African Railways and Harbours. Overhead line material. (B.X. 3224.)*
CAPE TOWN.—March 9th. Electricity Department. Insulated wire. (B.X. 3233.)*

South Elmsall.—March 19th. Electric lighting installation at Westfield Lane Council School. Education Department, County Hall, Wakefield.

Stoke-on-Trent.—March 8th. Electricity Department. De-aerating plant and electrically-driven boiler-feed pumps. (See this issue.)

Spalding.—February 26th. Urban District Council. 28 sets of centrifugal pumps (for sewage pumping), including electric motors, automatic starters, floats, valves, pipes, &c. Mr. C. F. Murphy, Lloyd's Bank Chambers, Morpeth.

Torquay.—March 11th. Electricity Department. Two water-tube boilers with chain grate stokers, induced draught plant, pipework and economisers. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Coventry.—Board of Guardians. Accepted:—
Two electric ovens (£187), one 2-pan fish fryer (£63), two 6-gallon hot-water urns (£24).—Jackson Electric Stove Co., Ltd.

Chesterfield.—Electricity Committee. Accepted:—
Cable (£1,360).—Hogan & Wardrop, Ltd.

London.—ADMIRALTY.—
Resistance rods.—Edison Swan Electric Co., Ltd.

LONDON COUNTY COUNCIL.—*Correction.*—We regret to find that in the list of tenders for the Lomond Grove School installation published here last week, through a printer's error we gave the amount of Messrs. Anderson, Angell & Co.'s tender as £327 instead of £322. This made it appear that the tender of Messrs. Dean & Co., Ltd., was the lowest submitted, although it was not accepted. The accepted tender was for £322, but Messrs. Dean's quotation was £324.

ELDER DEMPSTER LINE.
Twelve months' contract for the supply of "Osram" lamps.—General Electric Co., Ltd.

ST. PANCRAS.—Electricity Committee. Recommended:—
Cable (£967).—Standard Telephones & Cables, Ltd.

Portsmouth.—Education Committee. Recommended:—
Installation of electric lighting at Futcher School.—Southey, Ltd.
Electricity Committee. Recommended:—
Low-pressure cable (£575).—Johnson & Phillips, Ltd.
Repairs to 500-V battery (£807).—Tudor Accumulator Co., Ltd.
Plant, &c., at generating station:—

Name of tenderer.	Boiler.	Stokers, induced and forced draught plant.	Overhead bunker.	Steel building.
	£	£	£	£
Babcock & Wilcox, Ltd. (Recommended.) ...	**19,600**	**8,650**	2,785	5,015
Vickers Boiler Co., Ltd. ...	19,500	10,010	2,042	4,490
John Thompson Water Tube Boilers, Ltd. ...	20,940	6,328	3,157	4,032
Clarke, Chapman & Co., Ltd.	19,938	7,568	3,760	6,888
Simon Carves, Ltd. ...	24,503	6,789	1,827	4,277
Fraser & Chalmers Engineering Co. ... ... (a)	29,104	12,054	1,778	6,433
Ditto ditto ... ... (b)	24,799	11,487	1,778	6,433
British Niclausse Boiler Co., Ltd.	14,275	6,600	3,250	6,500
Peirson & Co., Ltd. (Recommended.)	—	—	**1,650**	**4,200**

East Ham.—Electricity Committee. Recommended:—
Two switches (£128).—A. Reyrolle & Co., Ltd.

Gravesend.—Electricity Committee. Recommended:—
Boiler (£12,647).—Babcock & Wilcox, Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended:—
1,100 electric lighting poles, with wrought-iron tubes (£6,592).—V. Soper.
5 gross fuse carriers (£290), 1,000 street lighting fittings (£1,134), 1,000 street lighting tube sets (£101).—Griffin Engineering Co., Ltd.
6,000 galv. spindles (£115), 500 stay rods (£259), 5,000 shackle insulators (£215).—British Insulated Cables, Ltd.
5,000 insulators (£102), 3,000 lb. tinned copper binding wire (£133).—British General Electric Co., Ltd.

Tenterden.—Town Council. Accepted:—
Installing electric light at 24 houses (£165).—G. E. Wallis and Sons, Ltd.

Tring.—Urban Council. Accepted:—
Installing electric lighting at the market house and fire station.—Ackerman & Crawford, Leighton Buzzard (£40).

Weymouth.—Housing Committee. Accepted:—
Wiring 100 houses on the Westhan Estate (£5 8s. for parlour type and £4 16s. for non-parlour type).—Mr. P. W. Child.

Electricity Committee. Accepted:—
Distributor cables for Goldcroft Estate (£825).—Johnson and Phillips, Ltd.

Forthcoming Events.

British Electrical Development Association.—Friday, February 18th. Royal Society of Arts. 7.30 p.m. "Assisted Wiring Schemes." Mr. W. F. T. Pinkney.

Junior Institution of Engineers.—Friday, February 18th. 39, Victoria Street, S.W. 7.30 p.m. "Modern Concrete Construction." Mr. L. Turner.

Royal Society of Arts.—Monday, February 21st. 8 p.m. Cantor Lecture. "Photo-elastic Measurements of Stress Distribution." Prof. E. G. Coker, F.R.S.

British Industries Fair.—February 21st to March 4th. White City, London, W., and Castle Bromwich Aerodrome, Birmingham.

Institution of Electrical Engineers.—INFORMAL MEETING.—London. Monday, February 21st. 7 p.m. "National Busbars of Central Europe." Mr. R. O. Kapp.

(Mersey and North Wales (Liverpool) Centre).—Monday, February 21st. University, Liverpool. 7 p.m. "Recent developments in Radio Reception." Mr. J. H. Reyner.

(North-Midland Centre).—Tuesday, February 22nd. Hotel Metropole, Leeds. 7 p.m. "Notes on the 60,000-V Underground Network of the Union d'Electricité." Col. E. Mercier.

(North-Western Centre).—Tuesday, February 22nd. College of Technology, Manchester. 7.30 p.m. Faraday Lecture. "What is Electricity?" Prof. W. M. Thornton.

(Western Centre).—Joint meeting with the South Wales Institute of Engineers, &c. Tuesday, February 22nd. Cardiff. 4 p.m. "Electro-Farming or the applications of Electricity to Agriculture." Mr. R. Borlase Matthews.

Wednesday, February 23rd. Swansea Corporation Electricity Department Showrooms. 6.30 p.m. Mr. R. Borlase Matthews will repeat the lecture on "Electro Farming."

(South-Midland Students' Section).—Tuesday, February 22nd. Grand Hotel, Birmingham. 8 p.m.-2 a.m. First Midland Student Engineers' Ball.

Paisley Association of Electrical Engineers.—Tuesday, February 22nd. Town Hall, Paisley. 7.30 p.m. "Electricity in Medical Practice." Dr. W. J. C. Watt.

Illuminating Engineering Society.—Tuesday, February 22nd. Royal Society of Arts. 6.30 p.m. "Artificial Lights as an Aid to Aerial Navigation." Mr. H. N. Green.

Electrical Power Engineers' Association.—Wednesday, February 23rd. Engineering and Scientific Club, Wolverhampton. 7 p.m. "Boilers, Past and Present." Mr. G. W. L. Wolland.

Association of Consulting Engineers.—Wednesday, February 23rd. St. Stephen's Club, Westminster. 7 p.m. Annual dinner.

Electrical Wholesalers' Federation.—Thursday, February 24th. Savoy Hotel, Strand, W.C.2. 7.30 p.m. Annual dinner.

Birmingham Electric Club.—Friday, February 25th. Grand Hotel. 7 p.m. "Wireless Telephony." Mr. C. G. A. McDonald.

Institution of Engineering Inspection.—Friday, February 25th. Royal Society of Arts. 7.30 p.m. "The Economic Production of Steam by Electricity." Mr. C. J. Wharton.

Physical Society.—Friday, February 25th. Imperial College of Science, S. Kensington, S.W. 5 p.m. Guthrie Lecture. "Atomic Nuclei and their Transformations." Sir Ernest Rutherford, F.R.S.

National Association of Supervising Electricians.—Saturday, February 26th. Holborn Restaurant. Annual dinner.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

MAGICOLOUR system of lighting
FARRINGDON lamp locking rings.
Moulded glass letters for use on illuminated signs.

We also have a request for the address of Messrs. Silcock and Tongue, formerly of Aston, Birmingham.

Notes.

The Electrical Engineers' Ball.

The twenty-third Electrical Engineers' Ball was held at the Hotel Cecil, on Friday, February 11th, and, as usual, was a splendidly organised and most enjoyable function, in which a large number of well-known members of the electrical profession took part. The arrangements made for the pleasure and comfort of the guests left nothing to be desired, and Messrs. A. M. Sillar and C. W. Hill, with their Executive colleagues, may be most heartily congratulated on having achieved so completely successful a result.

Iron and Steel Trades Development.

Sir William J. Larke (director of the National Federation of Iron and Steel Manufacturers), at a general meeting of the Birmingham Chamber of Commerce last week, spoke of the gradual recovery of the iron and steel industry. There were, he said, 150 blast furnaces working in this country at the end of January, and this was more than before the general strike. According to the incomplete figures available, the production of steel in January reached 720,000 tons, whereas in January, 1926, it was 640,000 tons. He said, however, that they must not imagine that because they had a period of four or five months of activity to look forward to, they were positively finished with industrial depression. It might be so; but a great deal depended upon themselves—upon whether they could found on this period of activity a complete and permanent industrial revival. He suggested that the Government should devote more aggressive attention to the export trade. Speaking of the development of the iron and steel industry within the Empire, Sir William emphasised the importance of pursuing a policy of co-operation with the Dominions and Dependencies. The Empire already absorbed 50 per cent. of the iron and steel exported from this country. The best thing for the industry in this country was that businesses of a similar kind in other parts of the Empire should be developed along the most economic lines possible.

Electrical Survey Costs.

Included in a Supplementary Estimate issued last week was an item of £14,000, representing the additional amount of fees and expenses of consulting engineers, and expenses of the technical survey for a general scheme of generation and transmission of electricity in Great Britain, including field surveys of Central England, and the Glasgow and Clyde Valley areas, carried out by the Ministry of Transport, making a total of £23,200. These fees are recoverable from the Central Electricity Board. Against the extra expenditure there is a saving under other sub-heads of £6,290, and increased appropriations in aid of £7,700, so that the net increase of the estimate is only £10.

National Association of Supervising Electricians.

At the annual general meeting of the Association on Tuesday last, the report of the Board of Control for the past year was submitted. It stated that the position of the Association was again improved, both financially and numerically. Many lectures had been delivered to the members, and many visits paid to works, &c. The competitions for the W. E. Highfield Shield, the N.A.S.E. Scholarships, and the Economic Premiums had been exceptionally successful. The number of members registering with the Employment Bureau was about 1 per cent. of the membership, and the positions secured through the Bureau carried salaries of £250 to £1,000 a year. Through the Operatives' Section 147 operatives were placed. New rules were drafted, and were to be settled at last Tuesday's meeting.

Lectures.

Prof. C. T. R. Wilson, University Reader in Electrical Meteorology at Cambridge, recently lectured on "Thunderclouds" at the Leeds University, explaining that between one and two thousand thunderstorms were generally, at any moment, in action in some place or other on the earth, producing more than a hundred flashes of lightning per second. Thunderstorms consequently formed an important factor in the physics of the earth and atmosphere. Photographs were shown of the apparatus used at Cambridge for measuring electrical phenomena. Automatic records of thunderstorms, says the *Yorkshire Post*, indicated the destruction of electric fields induced in the earth, and the record showed also the way in which the field was regenerated after such destruction. Flashes of lightning made a difference in the charge of the earth under a thundercloud of the order of 10,000 volts a metre. It was due to these sudden charges that one commonly felt very uncomfortable. The ordinary thundercloud consisted of a stratum positively electrified, separated by a neutral stratum from one negatively electrified, discharging by flashes of the order of a kilometre in length; the positive pole was at the top and the negative below. About a million kilowatt-hours was expended in a single flash of lightning, an enormous waste of useful energy, but one need hardly worry, remembering that it was only the 10,000th part of the energy which the sun supplied in the same time.

Mr. Henry McEwen read a paper on the effects of longitude in relation to electric lighting at a recent meeting of the Glasgow Corporation Electricity Department Engineering Society. He pointed out that in America, with its large extension in longitude, co-operation was arranged among power stations in neighbouring longitude zones where the times of largest demand were different. At Copenhagen electrical energy was obtained from Sweden across the 11 miles of the Little Belt. The problem of the mutual use of English and Irish power stations might be dealt with at some future time, though in that case submarine transmission of 50 miles was involved.

Appointments Vacant.

Linesman for the Bethesda Urban District Council; assistant mains engineer (£285) for the Lincoln Corporation Electricity Department; workshop superintendent for the Burma Electric Supply Co., Ltd.; mechanical engineer (£600) for the River Shannon Hydro Electric Development. (See our advertisement pages to-day.)

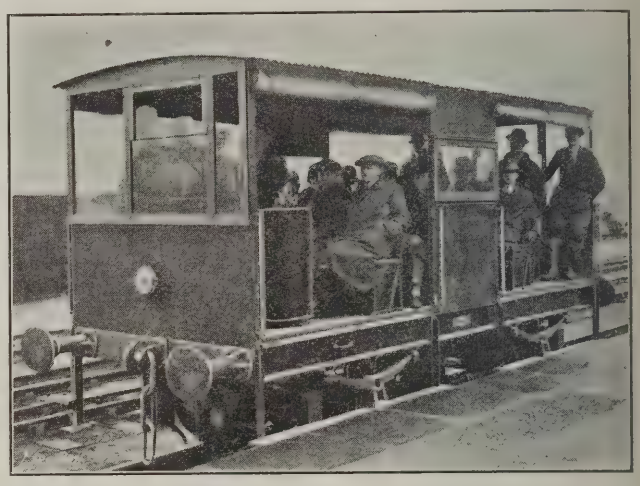
Extensions at Great Yarmouth.

The extensions to the generating plant and distribution system at Great Yarmouth, which are described in our last and this issue, were officially inaugurated by Alderman W. G. Knights, chairman of the Great Yarmouth Electricity Committee, on February 10th. At a celebration luncheon after the ceremony the Mayor of Lowestoft referred to the agreement which had recently been arrived at between Yarmouth and Lowestoft for the former town to supply the latter with electricity in bulk. Lowestoft had not the water facilities at its power station that Yarmouth had. The chairman, in reply, pointed out the advantages to both towns which would accrue from the arrangements. Mr. P. G. Campling, the engineer and manager of the undertaking, said that the total expenditure on the extensions would amount to something like £250,000. All the new plant was British. On behalf of the contractors, Mr. A. T. Brotherton, of the Brush Electrical Engineering Co., Ltd., presented the chairman with a suitably inscribed silver salver. Mr. J. Andrew Lee, of the Electricity Commission, paid a tribute to Mr. Campling for the work he had done on the undertaking.

The "Otley" Rail Car.

An electric rail car that will carry sixteen passengers and cost little to run, the invention of Electromobile, Ltd., was recently put on to the railway at Otley and, following preliminary runs, it carried a load of passengers to Pool, where it was inspected by representatives of the railway companies. Later it will go to Shoeburyness, where it will be used by the War Office on a branch line for conveying artillerymen to the gun ranges. The car is entirely self-contained. The traction battery which supplies the motive power is divided into sections which occupy the space beneath the passengers' seats. Whenever the car is waiting at a terminus, it can be put on charge simply by inserting a charge plug. The "Otley" car has open sides with side curtains, because it has been built to the specifications of the War Office. For ordinary passenger traffic, it could be fitted with an enclosed body, and for winter use electric radiators could be fitted. The firm is now engaged on the construction of a locomotive of similar type, but much heavier, required by the War Office for hauling naval guns. It will be capable of drawing a dead weight of 300 tons.

These vehicles are of interest at the present time when our railways are having to give serious consideration to the problem of retaining and winning back branch-line traffic. What is required is a vehicle with the seating accommodation of one or two 'buses, of which the running costs are very low, which can work with the ordinary rolling stock if necessary, so that a frequent service of small units can combat 'bus competition. It is to meet these conditions that the "Otley" rail car has been built: apart from the driver's



The "Otley" Rail Car.

seat at either end, with the brake and control gear, no useful space is taken up by the driving mechanism. The two electric motors are carried beneath the main frame, where each of them drives an axle through a countershaft. Each motor with its countershaft is carried on a bracket, pivoted at one end on the main axle and supported at the other end between helical springs that take up the initial torque at starting and stopping, and absorb the jar. In addition to screw brakes acting on the wheels, electrical braking is provided. The Exide-Ironclad battery makers are prepared to enter into a long maintenance contract, if required, so that costs can be accurately forecast. Below are the main dimensions of the car:—

Gauge	4 ft. 8½ in.
Wheelbase	9 ft. 0 in.
Wheel diameter	3 ft. 1 in.
Length over buffers	20 ft. 6 in.
Height over roof	10 ft. 7½ in.
Maximum width	8 ft. 2 in.
Weight, complete	10 tons
Tractive effort, maximum	2,000 lb.
Tractive effort, continuous	400 lb.
Battery capacity	33 kW
Average discharge pressure	200 volts
Number of cells	108
Capacity, ampere-hours	161
Speed at one hour rating	17 m.p.h.
Haulage capacity	6 tons

Ex-British Westinghouse Association.

On March 11th the ninth re-union dinner of this Association will be held at the Hotel Cecil, Mr. L. R. Morshead presiding. Tickets (12s. 6d.) can be obtained from Mr. W. E. Warrilow, 40, Mildred Avenue, Watford, Herts.

Long Service.

The Siemens Magazine for February records a presentation to three members of the staff of Siemens Brothers & Co., Ltd., who had simultaneously completed 50 years' service with the firm—Messrs. A. Watts, W. Marsh, and A. Chard. Including these veterans, 26 men have served the company for half a century, and there are nine men at work still whose total period of service amounts to 464 years.

Research in the United States.

The annual report of the Director of the U.S.A. Bureau of Standards (Misc. Publication No. 75) covers a very wide field of activities. During the year ended June 30th last the Bureau tested 62,648 items for the public, involving 205,789 determinations, the fees amounting to $52,033. Tests for Government Departments and State institutions numbered 68,930, involving 253,671 determinations, valued at $301,833; and for the Bureau itself, 11,865 items, 33,532 determinations, valued at $66,192—grand totals, 143,443 items, 492,992 determinations, $420,058. The Bureau, in addition, inspected 1½ million incandescent lamps for other branches of the Government, and for its own work of research and standardisation tested 36,406 items, making 166,866 determinations, the value of which would amount to $254,988. Salaries amounted to $516,760.

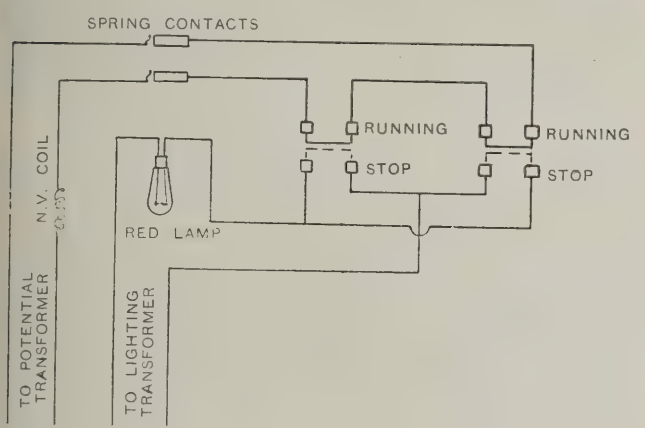
Out of the many subjects dealt with we note that a special blue glass was developed for the use of workmen engaged in electric or acetylene welding and cutting, furnace work, and the like, which afforded sufficient contrast between the melt and the furnace walls whilst cutting out the harmful ultra-violet rays. Much valuable work was done in connection with the standardisation of radio apparatus, automobile headlights, dry cells, and other items. The use of chromium for plating steel printing plates was developed, the life of the plates being greatly increased thereby. New power plant and operating equipment costing $500,000 was urgently needed. The total expenditure during the year was $1,968,333.

Franklin's Rod.

A small portion of St. Paul's Cathedral has been sent "as a gift" to America. It is a section of the old iron lightning rod fixed under the supervision of Benjamin Franklin, and now superseded, says the *Evening News;* it connected the existing metal work between the ground level and the cross of the cathedral, and the specimen piece is about ten and a half inches long and weighs nine and a half pounds. Mr. E. J. Bolwell, clerk of works, said: "It will not be missed, and our friends on the other side expressed a keen desire to have this specimen of Franklin's work in a museum.

A Remote Safety Device.

The accompanying illustration shows the arrangement which has been adopted at the Birmingham works of Messrs. Henry Wiggin & Co., Ltd., for the remote safety control of a 750-h.p., 5,000-V, a.c. motor, driving a three-high rolling mill. The motor did not originally include any device for remote control, nor was there any interlock between the liquid starter and the truck-type switch panel, so that the switch could be



closed with the starter "on." It soon became evident that it was highly desirable that the men at the rolls should be able to stop the motor from one or more points within the mill, and that some safeguard should be provided against inadvertently closing the switch before opening the rotor circuit by turning the starter to the "off" position. The method adopted is to continue the no-volt release circuit to the various points from which it is desirable to stop the motor. At each of these points, connected in series, is a small change-over switch with two positions marked "running" and "stop." When the motor is stopped from one of the control points the change-over switch is reversed from the "running" to the "stop" position, thereby opening the no-volt circuit. This also closes a circuit in which is a red lamp placed so as to be easily seen by the operator at the motor switch. The liquid starter must be turned "off" before the lamp is extinguished by restoring whichever remote control switch has been used to the "running" position. The main switch may then be closed. The system was devised by Mr. H. Williamson, the works engineer.

B.E.S.A. Publication.

The British Engineering Standards Association has recently issued a specification for switchgear cells and cubicles constructed of moulded stone. It is divided into two parts, one dealing with cubicles constructed from pre-cast units, and the other with cubicles constructed in position. It defines the terms "concrete," "slabs," and "mouldings," and indicates the materials to be employed and the method of mixing in the preparation of "concrete." It also defines the finish of "slabs" and "mouldings," and lays down acceptance tests to be made at periods of from 4 to 12 weeks in the age of the slabs. In the case of mouldings, tests are to be taken on slabs taken from the same mix as the mouldings. The tests consist of the application of an evenly distributed load on a central area over the width of the slabs and parallel to the ends where they are freely supported. The general principles to be followed in the design of cubicles are also indicated. The specification is of special interest to all switchgear purchasers and manufacturers, since the sound construction of cells is of the utmost importance in connection with modern switchgear, when complete phase separation and also the separation of individual apparatus are essential features, which can only be properly attained by the use of good-quality materials employed in a suitable manner. Copies of this new B.S. specification may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, S.W.1. Price 2s. 2d. post free.

Association of Special Libraries and Information Bureaux.

On Wednesday, February 23rd, a meeting will be held at the Royal Institute of British Architects, at 6.30 p.m., when Mr. G. F. Barwick, late Keeper of Printed Books at the British Museum, who is supervising the compilation of a directory of sources of specialised information, will give an address on the progress of this work. The meeting is open to all persons interested; invitation cards can be obtained from the Secretary, 38, Bloomsbury Square, London, W.C.1. In order to hasten the completion of the first edition of the directory, libraries and other organisations, firms, and individuals who have special information on any subject are invited to communicate with the editor as soon as possible.

Before the address there will be an informal discussion on "Public and Special Libraries: their spheres of service and potential relationship," to be opened by Mr. J. D. Stewart, F.L.A., and Mr. J. G. Pearce, M.I.E.E. (chairman of Council).

The Central Electricity Board.

In the House of Commons, on Tuesday last, the Minister of Transport announced that the salaries attached to positions on the Central Electricity Board were as follows:—Chairman, £7,000 a year; other members of the Board, £750 a year.

The Basle Fair.

During the past year the new permanent Fair buildings at Basle have been completed, and consequently the annual Fair, which is to be held from April 2nd to 12th, will be larger and more comprehensive than before. The groups into which the exhibits will be classified include electrical supplies; lighting, heating, and sanitation; inventions and patents; and transport. Full information regarding the Fair can be obtained from the Commercial Division, Swiss Legation, 32, Queen Anne Street, W.1.

Mining Accidents.

In a preliminary statement issued by the Mines Department of the number of deaths caused by accidents in and about the mines and quarries of Great Britain during 1926, the total number of fatal accidents is given as 707, resulting in 728 deaths. Due, of course, to the prolonged coal stoppage, the figures are very low, as compared with those for 1925, which were 1,145 and 1,233, respectively. The number of deaths for 1926 is made up as follows: 648 for the mines under the Coal Mines Act, 1911; 13 for the mines under the Metalliferous Mines Regulation Act, 1872; and 67 under the Quarries Act, 1894. Only three deaths are attributed to the use of electricity; these occurred in the coal mines, two underground and one on the surface.

A New Cable Insulation.

For use in certain situations where abnormal conditions prevail, it has been found necessary to evolve a different class of insulation for cables to that used for the ordinary rubber-insulated ones. In this connection it is interesting to learn that Messrs. W. T. Henley's Telegraph Works Co., Ltd., have produced a compound insulating material, "Henlex," which is claimed to be capable of withstanding such drastic conditions as are met with in railway work and other situations where heat and cold vary over a wide degree, and also where the conductors are subjected to deposits of condensed moisture containing sulphur, salts and acids. The new material is tough and has a high tensile strength and dielectric resistance. Cable insulated with it is capable, it is claimed, of withstanding the pressure tests prescribed by B.S.S. No. 7. A sample of "Henlex"-insulated cable was immersed in a solution of caustic soda while it was subjected to a pressure of 500 V continuously for four months. At the end of that time the cable was examined and found in as good a condition as it was before the test. As a result of this experiment a length of 3-core 0.1 sq. in. "Henlex" cable was laid along a route where another type of cable had previously to be replaced every three or four months, and where salt water is present in the ground. The cable has been recently examined *in situ* after having been in constant use for over twelve months, and found to be in perfect condition. Other samples have been immersed, under working conditions, in solutions of sulphuric, hydrochloric, and nitric acids, ammonia, caustic soda, and common salt, in no case with deterious effects. Samples have also been boiled for five hours in a 10 per cent. solution of caustic soda, and others placed between wood blocks saturated with creosote for a period of one month, in each case with equally good results.

We have received a sample of single "Henlex" insulated wire from the makers. The conductor is covered with one thick coating of the insulation, which is protected similarly to that of ordinary v.i.r. cable by means of canvas taping and outside braiding. The exterior appears to have been treated with an unusually thick wax preservative, giving the cable an enamel-like appearance.

B.T.-H. Magnetos in Speed Record.

The car in which Capt. Malcolm Campbell recently created a new world's speed record (174.883 m.p.h.) was fitted with B.T.-H. polar inductor magnetos.

Late Legal.

NEUTRON, LTD.—Mr. Justice Romer, in the Companies Winding Up Court on February 15th, made an order for the compulsory liquidation of Neutron, Ltd., makers of crystal detectors for radio apparatus, on the petition of Macrae Bros., radio manufacturers, of Ealing, W. Mr. John Beaumont, for the petitioners, said the respondent company had a capital of £500, and owed his clients £538 on an unsatisfied judgment. There were other creditors for £2,600, and there was no opposition to the petition.

ELECTRIC LIGHT & POWER CONTRACTS FINANCE CORPORATION, LTD.—Mr. Justice Romer, in the Companies Winding Up Court on February 15th, dismissed the petition of Harold Saunders, Ltd., Birmingham, for an order for the compulsory liquidation of Electric Light & Power Contracts Finance Corporation, Ltd. Counsel for the petitioners said that their debt had been satisfied, and he knew of no support for the petition. He asked for the petition to be dismissed without costs.

CLAIM FOR METERS DESTROYED BY FIRE.—In the Mayor's City of London Court, before Mr. Registrar Dell, on February 10th, the City of London Electric Lighting Co., Ltd., made a claim against Mr. A. D. Soulsky, Mitcham, for £7 15s., the cost of two meters destroyed by fire. The plaintiffs' representative said that the loss occurred in a fire which took place at the defendant's factory in December, 1925. Under the contract the defendant became responsible for the loss. There was no appearance on behalf of the defendant, and judgment was entered for the plaintiffs for the amount claimed, to be paid in 14 days.

Institution Notes.

Institution of Electrical Engineers.

At the informal meeting held on Monday, February 7th, Mr. C. Lipman was in the chair, when Mr. R. Grierson opened a discussion on "Some Interesting Features in Modern Installation Work." He said he was a keen advocate of the Institution Wiring Rules, which he felt were a decided step towards a legal standard of material and workmanship. He made suggestions for their better understanding, but some of these, it transpired, had been anticipated, notably an abridged section dealing with installation work as distinct from standards for manufacturers.

Mr. Grierson's remarks were interesting and provocative, but the time at his disposal limited the survey chiefly to installations in conduit. The problems of condensation and earthing were presented in a bold manner, which readily created a topic for the subsequent speakers. Mr. J. F. Shipley said there was a demand for a cheap three-phase switch which would isolate a motor when one phase failed; these breakers had long been in service on the Continent. Mr. H. J. Cash, describing the official tests on tumbler switches, said that while practically all five-ampere single-way switches stood up, few of the two-way survived the same tests. Mr. F. C. Raphael thought there should be a smaller switch than the common five-ampere tumbler, as 95 per cent. of switches only controlled one light. Many others took part in the discussion.

At the informal meeting on Monday, March 7th, a discussion on "Wireless as a Factor in World Communication" will be opened by Captain P. P. Eckersley.

Institution of Public Lighting Engineers.

In connection with the forthcoming annual general meeting and conference to be held at Brighton from September 12th to 15th, it is proposed to hold an exhibition of street-lighting appliances (electric, gas, or other illuminant). Firms desiring to take part should make application forthwith to Mr. A. C. Cramb (President-Elect of the Institution), Electric House, 38, High Street, Croydon, stating their requirements as to floor space and if they require a supply of gas of electricity in connection with their exhibit.

Junior Institution of Engineers.

The Institution is incorporating in its weekly series of meetings a gathering of an unusual nature on March 4th. It recently celebrated its 46th birthday, and thus many of its original members are now "Seniors" in years if not in spirit, and in order that these may demonstrate their still youthful fervour the arrangements of the special gathering have been deputed to Mr. Walter T. Dunn, secretary for the first 27 years of the Institution's history, and a few other veterans. The exact nature of the programme has not been divulged, but in view of the prominent positions which many early "Juniors" now occupy in the profession, some interesting engineering and other experiences may be looked forward to.

On February 11th, Prof. K. Neville Moss, O.A.E., M.Sc. (honorary member) delivered a lecture to the Institution on the subject of "Physiology of Work Under High-Temperature Conditions." Referring in particular to experimental work carried out by himself in the mining industry, Prof. Moss described the effect of food, liquid, and air on the work done by a man, and explained for the purposes of his lecture the functions of respiration, metabolism, temperature regulation of the body, and sweating.

Institute of Transport.

EXAMINATIONS.—The Council of the Institute announces that examinations will be held in London and certain provincial centres on April 28th, 29th, and 30th, 1927. The last date for the receipt of applications is March 1st, and requests for the requisite forms should be addressed to the Secretary, 15, Savoy Street, Victoria Embankment, W.C.2.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. C. C. N. WALLICH, who until recently was station director at Plymouth for the British Broadcasting Company, has been appointed station director at Calcutta under the Indian Broadcasting Company, and will sail on March 4th. The Calcutta position is the senior station directorship of the Indian Company.

Mr. L. B. PAGE, of the Hull station, has been appointed station director of the Bombay station. He is also sailing for India on March 4th.

The Times contains the announcement of an engagement between Mr. JOHN MARRYAT, elder son of Mr. and Mrs. Howard Marryat, of 1, The Terrace, Richmond, and Miss MARIANNA AMY (Maisie), only daughter of Sir Edmund Nott-Bower, K.C.B., and the late Lady Nott-Bower, of Kelston, Richmond, Surrey.

The Prestatyn Urban Council has appointed Mr. W. R. KELLEY, of Lincoln, to the position of electrical engineer to the Council. There were 140 applications. Mr. Kelley is assistant mains engineer to the Lincoln Corporation.

Major F. H. MASTERS has relinquished the position of editor of the *Electrician* which he has held since 1919, and has joined the editorial staff of our contemporary *Engineering*.

The Manchester Corporation has appointed Mr. W. H DUNCAN, A.M.I.E.E., as mains engineer. Mr. Duncan joined the mains department staff of the Newcastle Electric Supply and Allied Companies in 1906, and since that date he has been associated with Mr. Charles Vernier (now chief engineer to the Macintosh Cable Co.) as a chief assistant mains engineer. Mr. Duncan, under Mr. Vernier, was in charge of the installation and subsequent maintenance of the first 3-core 20,000-volt cables laid in the world, and was also connected with the laying down of the Newcastle Electric Supply Company's extensive system of 20,000-volt overhead lines, and 6,000-volt and l.p. distribution networks. In 1917 he was appointed sectional mains engineer in charge of the Cleveland and Durham County Electric Power Company's system, which covers an area of 840 square miles. Since 1922 he has been closely connected with the installation of the first 66,000-volt underground and overhead transmission lines in this country.

Mr. C. L. DOUTHWAITE, late of W. T. Henley's Telegraph Works Co., Ltd., has been appointed manager of the joint Leeds branch of the London Electric Wire Co. & Smiths, Ltd., and the Liverpool Electric Cable Co., Ltd. He took up his duties on February 14th.

Fulham Borough Council electricity department recommends that Mr. E. T. HOWELL, of Tunbridge Wells, be appointed mains assistant.

The B.B.C. recently received a cable from Union Radio Station, Madrid, stating that Mr. LEE DE FOREST, who is in Europe, would address all European wireless transmitters on February 11th through E.A.J.7, Union Radio Madrid.

Mr. A. HILL, from the Western Point power station of the Salt Union, Ltd., has been appointed to the position of shift charge engineer to the United Alkali Co., Ltd., Widnes, recently advertised.

A presentation was made on January 29th to Mr. E. J. EDGAR on behalf of the staff and employés of the Belfast Corporation Electricity Department, at a smoking concert, by Mr. Johnstone Wright, the engineer and manager. Mr. Edgar has been appointed assistant executive engineer of generation to the Electricity Department of the Shanghai Municipal Council, and has been up to the present resident engineer at the Harbour power station, Belfast.

Obituary.—SIR JAMES KEMNAL.—The death of Sir James Kemnal, which was briefly reported in our last issue, occurred on February 8th at Sandbanks, Dorset. He had been ill since last September, and was in his 63rd year. He was born in London, a son of Mr. James Rosenthal, by which name he was known to electrical engineers for many years until he adopted that of Kemnal. His great interest in life was

the business of Babcock & Wilcox, Ltd., of which he was managing director. In addition to his connection with the British company of that name, he was a director of all the foreign B. & W. companies, also of Balfour, Beatty & Co., the Power Securities Corporation, the Power and Traction Finance Company (Poland), Ltd., and Worthington-Simpson, Ltd. He took a leading interest in matters relating to trade development in South America as president of the British and Latin-American Chamber of Commerce.

DR. J. R. ERSKINE-MURRAY.—We learn with feelings of deep regret of the death which occurred on February 12th, at Portsmouth, after a very short illness, of Dr. James Robert Erskine-Murray, F.R.S., the well-known authority on wireless telegraphy. He was 58 years of age. The funeral is to take place at Edinburgh to-day, Friday. We shall refer to Dr. Erskine-Murray's work more fully in our next issue.

HERR R. A. KOECHLIN-HOFFMANN.—The death is reported from Basle, at the age of 67 years, of Herr R. A. Koechlin-Hoffmann, president of the Swiss Co. for Electrical Industry.

MR. A. HANKINSON.—We regret to record the death, which occurred on January 24th, at Sydney, N.S.W., of Mr. Alfred Hankinson, aged 68. He entered the service of Messrs. Rd. Johnson, Clapham & Morris, Ltd., in 1875, and after being in their Manchester office for about 16 years, he went to Australia for reasons of health. In the early part of 1893, while on a visit to England, he arranged to open an office in Melbourne for his company, and owing to the success of this venture, offices were opened in Sydney, Brisbane, and Wellington (N.Z.). Mr. Hankinson was general manager of the Australian business of the company up to the time of his death, and in the course of his duties paid several visits to this country, being here as recently as last spring.

MR. T. W. BROADBENT.—We regret to record the death of Mr. Thomas William Broadbent, which, according to a Leeds paper, occurred on February 7th at his residence, Hillside House, Kirkheaton, near Huddersfield. Mr. Broadbent, who was 53 years of age, was the founder of the business of T. W. Broadbent, manufacturing electrical engineers, of Huddersfield, and he is described as the pioneer of electricity supply in a number of villages in the district. The business of T. W. Broadbent, Ltd., of which he was chairman and senior director, is being continued under the same style.

MR. T. F. DAVIES.—The death is announced of Mr. T. F. Davies, aged 34, of Laneside, Accrington, for several years electrical engineer to the Altham Colliery Co.

MR. W. H. DAVIES.—We record with regret the death, which occurred on January 26th, from pneumonia, of Mr. W. H. Davies, of Amersham, Bucks., representative of Messrs. Pritchett & Gold and E.P.S. Co., Ltd. He was district representative of the company for Northants., Bedford, Herts., Bucks., and Oxfordshire.

Will.—Mr. C. J. LEYLAND, a director of Parsons Marine Steam Turbine Co. and other companies, left £2,147 net personalty and £2,221 gross.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Carnegie & Watson, Ltd.—Private company. Registered in Edinburgh, February 9th. Capital £10,000 in 3,500 preference and 6,500 ordinary shares of £1 each. Objects: To acquire the business of Carnegie & Watson, motor and electrical engineers, 21, Mounthooly, Aberdeen. The first directors are:—A. H. Watson, 8, Seaforth Road, Aberdeen, engineer; Mrs. E. Carnegie, 28, Markland Road East, Aberdeen; W. Johnstone, 2, Strawberry Bank, Aberdeen, accountant. Secretary: W. Johnston. Registered office: 75, Spring Gardens, Aberdeen.

I. Kasha & Son, Ltd.—Private company. Registered February 4th. Capital £2,000 in £1 shares. Objects: To adopt an agreement with I. Kasha and L. Kasha, and to carry on the business of lamp shade manufacturers and metal workers formerly carried on by them as I. Kasha & Son, at Broadway Chambers, Hammersmith, W.6. The subscribers (each with one share) are:—I. Kasha, Broadway Chambers, Hammersmith, W.6; manufacturer; H. E. Needham, Broadway Chambers, Hammersmith, W.6, accountant. The first directors are to be appointed by the subscribers. Qualification, £100. Solicitors: H. R. Lamonby, 6, Portland Place, W.1.

N. Russell & Co., Ltd.—Private company. Registered in Edinburgh, February 8th. Capital, £2,000 in £1 shares. Objects: To carry on the business of electricians, mechanical, motor and general engineers, &c. The subscribers (each with one share) are:—N. Russell, 421, Great Western Road, Glasgow, electrical engineer; Alex. A. M. Turnbull, Great Western Road, Glasgow, electrical engineer. The first directors are not named. Qualification, one share. Registered office: 471, Great Western Road, Glasgow.

A. E. Ball & Co., Ltd.—Private company. Registered February 10th. Capital, £1,100 in 700 shares of £1 each and 800 shares of 10s. each. Objects: To carry on the business of radio and electrical engineers and manufacturers of and dealers in wireless apparatus and appliances, &c. The first directors are:—A. E. Ball, 125, Muswell Hill Road, N.10; J. B. Hobson, 19, Rokesley Avenue, N.8; Edith E. Ball, 125, Muswell Hill Road, N.10; Sarah C. Hobson, 19, Rokesley Avenue, N.8. Solicitors: Ernest W. Long & Co., 27, Lincoln's Inn Fields, W.C. Registered office: 10, Woodhouse Parade, North Finchley, N.12.

Peter Raven & Co., Ltd.—Private company. Registered February 9th. Capital, £3,000 in £1 shares (1,500 founders' and 1,500 ordinary). Objects: To acquire the business of an exporter and importer of and dealer in electrical and general engineering accessories, &c., carried on by J. Greenway, at 3, Stafford Street, Birmingham, as "Peter Raven & Co.," and to carry on this and the business of manufacturers of motors, wireless, and other appliances, &c. The permanent directors are:—J. Greenway, 3, Stafford Street, Birmingham, manufacturers' agent (chairman); T. E. Norton, 35, Russell Terrace, Leamington Spa, manufacturer. Qualification, £50. Solicitors: Orton & Son, Coventry.

King, Stringer & Co., Ltd.—Private company. Registered February 10th. Capital, £5,000 in £1 shares. Objects: To carry on the business of electrical, mechanical, and general engineers, electricians, suppliers of electricity for light, heat, power or otherwise, manufacturers of and dealers in wireless apparatus, &c. The permanent directors are:—A. C. King, 31, Somali Road, N.W.2, electrical engineer; J. S. Stringer, 21, Titchborne Street, W.2, dispatch superintendent; C. G. Hey, 104, Cromwell Road, S.W.7, consulting surgeon. Qualification, £50.

MacLean & Robb, Ltd.—Private company. Registered in Edinburgh, February 9th. Capital, £1,500 in £1 shares. Objects: To acquire the business of MacLean & Robb, plumbers and electricians, in Glasgow. The directors are:—E. MacLean, 496, Maryhill Road, Glasgow, plumber and electrician; A. Robb, 496, Maryhill Road, Glasgow, plumber and electrician. Qualification, £100 shares. Solicitor: T. Hay, 113, West Regent Street, Glasgow.

Stelmar Projection Lighting, Ltd.—Private company. Registered February 5th. Capital £5,000, in £1 shares. Objects: To adopt an agreement with L. J. Steele and H. Martin for the acquisition of patents relating to projection lighting, and to carry on the business of engineers, &c. The first directors are:—L. R. Moorshead, 78, St. George's Square, S.W.1, engineer; S. H. Rawlings, Devon Lodge, Clacton-on-Sea, engineer; C. S. Golding, 30, Julian Road, Folkestone, solicitor. Qualification, £20. Remuneration, £25 each per annum. Secretary: R. C. Palmer. Solicitors: Golding, Hargrove & Golding, 99, Cannon Street, E.C.4. Registered office: 99, Cannon Street, E.C.4.

Charles Mickleburgh, Ltd.—Private company. Registered February 5th. Capital £100, in £1 shares. Objects: To acquire the business of an electrical, gas, mechanical, and power engineer carried on by C. Mickleburgh, of 2, Woodfield Crescent, Paddington, W.9. The subscribers are:—C. Mickleburgh, Ivydene, 13, Portland Villas, Hove, engineer (retired), 99 shares; Miss D. M. Mickleburgh, 2, Woodfield Crescent, Paddington, W., 1 share. The first directors are to be appointed by the subscribers. Secretary: Miss D. M. Mickleburgh. Solicitor: N. Holman Boyns, 478, Harrow Road, W.9. Registered office: 2, Woodfield Crescent, Paddington, W.9.

Evalasio Distributing Agency, Ltd.—Private company. Registered February 5th. Capital £100, in £1 shares. Objects: To acquire the business of wholesale and retail wireless and motor accessory distributors heretofore carried on by E. F. Keal and W. H. Stevens as the "Evalasio Distributing Agency." The subscribers (each with one share) are:—Enid M. Horwood, 11, Heston Park Road, Heston, Hounslow, clerk; L. W. Parkin, 21, Albert Square, S.W.8, clerk. The directors are: E. F. Keal, W. H. Stevens, H. G. Evans, and G. H. R. Clements. Qualification, 25 shares. Remuneration, £10 each per annum (chairman £5 extra). Solicitor: W. H. Lane, 27, Chancery Lane, W.C.

Welwyn Wireless, Ltd.—Private company. Registered February 14th. Capital, £500 in £1 shares. Objects: To carry on at Codicote, Welwyn, Herts., and elsewhere, the business of wireless and general electrical engineers and manufacturers, &c. The permanent directors are:—E. H. Collingwood (managing director), Codicote, Welwyn, Herts., engineer; H. G. Cherry, Digswell, Welwyn, Herts., architect. Qualification, 10 shares. Solicitors: Rivington & Son, 1, Fenchurch Buildings, E.C.3. Registered office: High Street, Codicote, Herts.

J. T. Kemp, Ltd.—Private company. Registered February 10th. Capital, £6,000 in £1 shares. Objects:—To acquire the business of a manufacturer of and dealer in electrical equipment and appliances carried on by J. T. Kemp at 13, Derby Road, Nottingham, as "J. T. Kemp." The directors are:—J. T. Kemp, 15, Rolleston Drive, Nottingham; G. H. Hooke, 28, Florence Road, West Bridgford, Notts (both permanent managing directors, subject to each holding 1,000 shares). Solicitors: Huntsman & Donaldson, 1, Bridlesmith Gate, Nottingham. Registered office: 13, Derby Road, Nottingham.

Official Returns of Electrical Companies.

Horley and District Electricity Supply Co., Ltd.—Particulars filed of £5,000 debentures authorised December 30th, 1926, charged on the company's general assets, but excluding freehold office in Victoria Road, Horley, &c., the amount of the present issue being £2,500.

H. Lewis, Ltd.—Mortgage dated January 21st, 1927, to secure £1,000, charged on 4 & 5, North Street, Wisbech. Also debenture dated January 22nd, 1927, to secure £400, charged on the company's property, present and future, including uncalled capital. Holder: C. Saunders, "Ford," Norton Fitz-Warren, Somerset.

Barbados Electric Supply Corporation, Ltd.—Capital, £60,000 in 40,000 preferred and participating, and 20,000 ordinary shares of £1 each. Return dated December 17th, 1926. 35,172 preferred and 20,000 ordinary shares taken up. £34,672 paid on 34,672 preferred shares. £20,500 considered as paid on 500 preferred and 20,000 ordinary shares. Mortgages and charges, £19,000.

Reed, Evans & Co., Ltd. — Capital, £100,000 in £1 shares. Return dated December 31st, 1926. 92,292 shares taken up. £6,576 paid (being £1 per share on 657 and 4s. per share on 29,595 shares). £85,716 considered as paid (being £1 per share on 62,040 and 16s. per share on 29,595 shares). Mortgages and charges, nil.

Ejecta Valve Co., Ltd. — Capital, £5,000 in 3,000 ordinary and 2,000 participating preference shares of £1 each. Return dated December 31st, 1925 (filed January 20th, 1927). 360 preference and 2,008 ordinary shares taken up. £2,368 paid. Mortgages and charges, nil.

Atkins & Wallis, Ltd.—W. H. Clegg, of 31, Twyford Street, Caledonian Road, N.1, was appointed receiver and manager on January 21st, 1927, under powers contained in debentures dated February 26th, 1926.

Castle Fuse and Engineering Co., Ltd.—Satisfaction in full on January 25th, 1927, of charge on 72, Haigh Street, Liverpool, dated November 22nd, 1926, securing account current.

V. G. Middleton & Co., Ltd.—Satisfaction to the extent of £600 on December 31st, 1926, of debentures dated April 29th, 1920, securing £4,000.

British Di-Electric Co., Ltd.—Issue on January 17th, 1927, of £250 debentures, part of a series.

Pyramid Products, Ltd.—Particulars filed of £500 debentures authorised February 2nd, 1927, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Pickvance, Ltd.—Issue on January 31st, 1927, of £100 debentures, part of a second series already registered.

City Notes.

Metropolitan Railway Co.

The report for the year ended December 31st last records a gross revenue of £1,701,828 and a net income of £714,529. To the latter sum are added £51,402 brought forward, £50,000 from the general reserve towards the increased cost of coal and other expenses due to the coal stoppage, and £50,000 from provision made for income tax and not required for that purpose, making a total of £865,931. The balance available for ordinary dividend is £249,571. It is proposed to pay a final dividend of £1 10s. per cent. on the ordinary stock, making £3 per cent. for the year (as against £5 per cent. for 1925), leaving £22,211 to be carried forward. The Surplus Lands Stock dividend is £3 12s. 6d. per cent. for the year, as against £3 10s. per cent. In announcing the reduced dividend, the directors point out that, apart from the fact that 1926 was a difficult year, 1924 and 1925 were exceptional years on account of the revenue from the British Empire Exhibition traffic. The reconstruction of the Aldgate and Edgware Road stations was completed so far as the permanent way and platforms were concerned. In the case of the latter station, a contract has been let for new buildings on the street level. The company's Act authorising the construction of a relief line connecting the Harrow extension line with the Circle line was passed in August last. During the year one of the 5,000-kW turbo-generators at the Neasden power station was replaced by a 15,000-kW set with resulting economy. The report records the death of Mr. J. W. Wheeler-Bennett and the appointment to the board of Sir Edward Manville. The meeting was to be held yesterday (Thursday).

German Companies.

The report of the *Allgemeine Elektricitäts Gesellschaft* for the year ended September 30th, 1926, states that activity increased, and appeared to be a steady improvement. The "rationalisation" of working in various industries must have a favourable influence on the electrical industry. The year was entered upon with such a large stock of orders that it was possible to keep the works active at about 75 per cent. of their capacity. A favourable development of the inland business was probably to be expected from the rapidly growing purchasing power in the home market, the progressive electrification of industrial works, and the revival in the building trades. On the other hand, the foreign business continued to suffer from the new competition, and from the effects of the currency depreciation in France and Italy. The adaptation of the turbine works to the production of new types was carried out. The deliveries of steam turbines, turbo-generators, and allied machines were nearly double those of the previous year, but discretion was exercised in accepting new orders, as the prices obtainable were not always satisfactory. The orders in the turbine works represented a total of 600,000 kW. A main line electric locomotive was delivered to the Reich Railway Company, and other electric locomotives for the mountain sections in Silesia and Bavaria had proved satisfactory. The tramway department was well occupied. Important orders were received for driving motors and other equipment in connection with the decision of the Reich railway to electrify about 100 miles of the Berlin and suburban lines. Orders for generators of large and small output for hydro-electric works were received, and the production of l.p. cables was further improved. Large orders were received from the coal industry. It is considered that Germany is still only at the beginning of the consumption of electrical energy; a reduction in the price is necessary to secure a large increase in consumption. As previously reported, the net profits were 10,760,000 marks, as compared with 8,360,000 marks in 1924-25. It is proposed to pay 6 and 5 per cent. on the two classes of preference shares respectively, and 7 per cent. on the ordinary capital, the latter comparing with 6 per cent. in the previous year, leaving 465,000 marks to be carried forward.

The directors of the *Siemens and Halske Company* report gross profits of 16,120,000 marks for 1925-26, as against 9,590,000 marks in the previous year. After defraying general expenses, &c., there is a net profit of 15,350,000 marks, as compared with 8,890,000 marks in 1924-25. It is proposed to increase the rate of dividend from 6 per cent. to 10 per cent.

The *Siemens-Schuckert Works Company* earned gross profits of 13,360,000 marks, and the net profit is 12,170,000 marks, as against 8,950,000 marks; the dividend is 8½ per cent., as compared with 6 per cent. in 1924-25.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

North Metropolitan Power Station Co., Ltd.—£850,000 5 per cent. guaranteed debenture stock, 1957, issued at 100½ per cent., partly paid and fully paid.

Metropolitan Electric Supply Co., Ltd.—500,000 ordinary shares of £1 each, fully paid, Nos. 1,000,001 to 1,500,000.

Shawinigan Water and Power.—1,027,184 shares of no par value.

West Gloucestershire Power—£30,000 6½ per cent. participating preference stock.

The undermentioned have been ordered to be officially quoted:—

Shawinigan Water and Power Co.—1,027,184 shares of common stock of no par value.

Telephone Manufacturing Co., Ltd.—1,590,000 ordinary shares of 10s. each, fully paid, Nos. 410,001 to 2,000,000.

West Gloucestershire Power Co., Ltd.—£30,000 6½ per cent. participating preference stock.

The "Underground" Group.

Last week the companies forming this combine declared their final dividends for the past year. The total dividends are similar to those distributed in the preceding year, and the amounts transferred to reserve are also the same. The dividends are as follows:—

Metropolitan District Railway Co.—Ordinary stock: 2 per cent., making 3½ per cent. for the year. To reserve, £45,000.

London Electric Railway Co.—Consolidated ordinary stock: 1¾ per cent., making 3½ per cent. for the year. To reserve, £45,000.

City and South London Railway Co.—Consolidated ordinary stock: 1½ per cent., making 3 per cent. for the year. To reserve, £25,000.

Central London Railway Co.—Undivided ordinary stock and preferred stock: 2 per cent., making 4 per cent. for the year. Deferred stock: 4 per cent. (for the year). To reserve, £40,000.

Underground Electric Railways Co. of London, Ltd.—After making the full distribution upon its 6 per cent. first cumulative income debenture stock and 6 per cent. (free of tax) income bonds, this company proposes to pay 1½ per cent. upon its ordinary shares, the first distribution made upon these since the company's formation.

Westinghouse Brake and Saxby Signal Co., Ltd.

Lord Southborough (chairman), presiding at the recent annual meeting, said that in spite of difficulties engendered by the coal dispute they had managed to keep their works running. Several important contracts had been carried out during the year, including the apparatus for an electro-pneumatic signalling system at the Plaza Constitucional terminus of the Buenos Aires Great Southern Railway; and power signalling apparatus for the Charing Cross and Cannon Street stations of the Southern Railway. In the face of strong foreign competition they had been awarded the contract for the electrically-operated power-signalling installation at Cape Town and the provision of automatic signalling between Cape Town and Wynberg. Their associated company in India had received an equally important contract.

Singapore Traction Co., Ltd.

The first annual meeting was held on February 9th. Mr. L. W. Hawkins, the chairman, in presenting the report, said that the balance-sheet showed a strong financial position; it was believed that the cash in hand and British Government securities would be ample to finance the completion of the change-over to railless traction and certain extensions which might be found desirable. The directors did not regard it desirable to pay a dividend for the first year, even though the preference dividend was cumulative, as during the period of transition the current year's profits would be lower than those of the year under review. The report and accounts were adopted.

Chiswick Electricity Supply Corporation, Ltd.

The accounts for 1926 show a total revenue of £75,309, as against £73.804 in 1925. After providing £8,000 for depreciation there is a net profit of £19.852, to which is added £1,086 brought forward, making £20,938. It is proposed to pay a final dividend of 11 per cent., making 16 per cent. for the year (as compared with 15 per cent. for 1925); to refund £4,140 to consumers; to place £1,000 to general reserve; and to carry forward £1,658. The capital expenditure during the year was £11,865. The meeting was to be held yesterday (Thursday).

City of Buenos Aires Tramways (1904), Ltd.

The balance at credit of net revenue for 1926 was £82,614. It is proposed to pay a final dividend of 1s. 3d. per share (making 5s. per share, 5 per cent., for the year). The amortisation and general fund receives £5,500, and £15,114 is carried forward. Reference is made in the report to the adverse decision of Mr. Justice Rowlatt with regard to the payment of corporation profits tax by the company, and it is stated that the balance carried forward should more than cover the company's liability in this respect.

Companies to be Struck off the Register.

The names of the undermentioned companies will be struck off the Register at the expiration of three months, unless cause is shown to the contrary:—

Adnil Electric Co., Ltd.
"Cedes" Electric Traction, Ltd.
Electrical Industries, Ltd.
Leitner Electrical Co., Ltd.
Maxim Lamp Works, Ltd.
Portable Electric Motors (1919), Ltd.

Tyneside Tramways and Tramroads Co.

The report for the half-year to December 31st last records a surplus of receipts over expenses of £550. To this are added £914 brought forward and £500 from the special reserve, making £1,964. After deducting loan interest, &c., there remains £79. For the whole year there was a decrease of £6,520 in the traffic receipts, mainly due to the coal stoppage. The number of passengers carried fell from 7,230,581 to 6,167,679.

Power Securities Corporation, Ltd.

The report for 1926 shows a gross income of £99,905 and a net profit of £78,008. To the latter amount was added £12,944 brought forward, making £90,952. The directors propose to transfer £20,000 to reserve and to pay a dividend of 6½ per cent. on the ordinary shares (as in 1925), leaving £16,952 to be carried forward. The market value of investments is said to be in excess of the balance-sheet value.

North Metropolitan Electric Power Supply Co.

The directors recommend the payment of a dividend on the ordinary shares at the rate of 10 per cent. per annum, as last year. The reserve has been credited with £100,000 out of revenue, and £55,620, representing the premium on shares issued during the year, compared with £150,000 in the previous year.

Quebec Power Co.

The dividend on the common shares for the quarter ending March 31st has been raised to 1¾ per cent. (against 1½ per cent.), thus placing the shares on a 7 per cent. basis. Present holders are to be offered 23,784 new common shares (making $10,000,000) on the basis of three new shares for each 10 held.

Pennsylvania Water and Power Co.

The total revenue for 1926 was $3,103,673, and the amount available $1,424,626. After meeting interest, a total dividend of 8 per cent., depreciation ($230,052), and sinking fund, and contingent fund ($200,000), a balance of $34,877 is carried forward.

Electrical and Industrial Investment Co., Ltd.

The profit for 1926 was £21,635 (against £17,300), and to it is added £31,490 brought forward, making £53,125. After meeting the preference and preferred ordinary dividends a dividend of 9d. per share (75 per cent.) is declared on the deferred shares, and £36,750 is carried forward.

Montreal Light, Heat and Power Consolidated.

The report for 1926 shows a gross revenue of $18,907,382 and a net revenue, less fixed charges, of $7,082,567. Dividends absorbed $5,135,041, and $1,869,482 has been transferred to capital and surplus account. Reference is made in the report to the re-arrangement of capital made during the year.

Laurentide Power Co.

The report for 1926 shows a total revenue of $1,483,747 and an available balance (including the amount brought forward) of $730,344. Dividends totalling 5 per cent. have been paid and $100,000 is allocated to depreciation.

Uxbridge and District Electric Supply Co., Ltd.

It is proposed to pay a dividend of 8 per cent. on the ordinary shares for 1926, as for the previous year. £15,000 is put to depreciation fund, and £1,824 is carried forward.

London and Suburban Traction Co., Ltd.

The directors announce that they are unable to recommend the payment of the dividend on the 5 per cent. cumulative preference shares.

Armstrong, Whitworth Scheme Sanctioned.

In the Chancery Division last week, Mr. Justice Romer sanctioned the scheme of arrangement prepared by the board of Sir W. G. Armstrong, Whitworth & Co., Ltd.

Submarine Cables Trust.

The trustees announce that they have decided to distribute the trust funds among holders of coupons of reversion at the rate of £153 2s. 6d. per coupon.

Stocks and Shares.

Monday Evening.

The Home Railway dividends make an interesting feature in Stock Exchange markets that are, generally speaking, firm and active. No cessation is noticeable in the stream of capital which flows steadily into Stock Exchange securities. All the good stock finds a ready welcome. The new North Metropolitan Power Station fives, offered under the Trade Facilities Acts, and at the high price of 100½, were quoted at a discount when dealings started, but the scrip was quickly absorbed, and the price hardened to a small premium.

The Underground Railways of London has provided the pleasantest disappointment of the present Home Railway dividends, the company declaring a "maiden" of 1½ per cent. on its £1 shares. The District has done very well, maintaining its previous 3½ per cent. for the year. Similar dividends to those of 1925 are the London Electric's 3½ per cent., City and South London's 3 per cent., and Central London's 4 per cent. on the deferred, these all being for the full twelve months of

1926. The London General Omnibus dividend of 3 per cent., tax free, makes 6 per cent., tax free, for the year. The Associated Equipment will pay 8 per cent., tax free, on the ordinary, as against nil. These are good results, especially in view of the heavy cuts in their dividend rates made by the Great Western, "Brum," and Southern Railways. Districts have risen 3 to 58, Undergrounds ⅛ to 14s., and the income bonds to 104. Central Londons have put on a point, at 71.

Metropolitan consolidated, like Districts, also boasts a gain of 3, the price strengthening to 64½. The report for 1926 showed the receipts to be nearly £300,000 down, while expenses were reduced by £34,000. To pay 3 per cent. (as against 5 per cent. the year before) the Metropolitan has to take £100,000 from reserve and to carry forward £22,211, some £29,000 less than that in February, 1926.

There is a touch of quaint irony in the fact of 3 per cent. being paid for last year by the Great Western, London, Midland, Scottish, and the Metropolitan, the prices of which stand at 86, 76, and 64½, respectively; while Districts, upon which the company has paid 3½ per cent. out of its real earnings for the year, are quoted at 58. It need hardly be added that in the case of the first-named trio it is taken for granted that future results are not likely to be anything like so bad as the depressing dividends declared in respect of the general strike and the coal stoppage year. The whole of the Home Railway market has adopted a more cheery aspect than of late, on the assumption that, with the worst known, any change must be for the better. This consideration served to bring in a few buyers and to impart an all-round firmness to prices.

Mexicans have not repeated their dramatic advances of a week back, when the Light and Power Company's preferred gained 12 and the common 8½ points, but the prices are maintained, and the first mortgage bonds have put on 3. The seconds are higher at 89½; Mexico Trams have risen to 20½, and the 5 per cent. bonds to 67. Sidros have come into renewed demand, and are up to 14½. Brazilian Tractions jumped a further 4 points to 122. Barcelona Trams are higher at 43½. Amongst other dollar stocks, Shawinigans weakened a trifle; Montreal and Pennsylvania shares have gone ahead.

British Columbia deferred at 162½ is 4 higher, following its rise of 4½ last week. The preferred at 126½ is 2 better. Anglo-Argentine Tramways first and second preference have gone up 2s. 6d. to 3, at which price the seconds yield 10 per cent. on the money. The 5 per cent. debenture, which is quite a reasonable second-class investment, returns 7 per cent. at its enhanced quotation of 71½. Movements such as those mentioned in this and the preceding paragraph point plainly to the present-day demand for speculative investment and frankly speculative issues. It will be said, of course, that, in nearly all the stocks and shares enumerated, the markets are limited, and that, in consequence, a demand will cause movements disproportionate to the orders causing them. This is a just argument, but prices would not be put up so vigorously if there were not a pressing public demand for the stocks.

London and Suburban Traction preference are unchanged at 6s. 6d., the passing of the dividend causing no great surprise. Nothing has been paid on these since March, 1924. London United Tramways 4 per cent. debenture holds its price at 45½. British Electric Tractions have not altered.

Electricity supply shares are a quiet market. County ordinary at 28s. 6d. have gained another sixpence. The company's scheme for exchanging £100 first debenture and £100 second debenture for £115 and £112 new 4 per cent. Consols, respectively, goes before the stockholders' meetings on the Thursday in this week. Proprietors have the option of assenting or not, but there are sound reasons why they should effect a conversion that ought to turn out profitably for them. Idle speculation may intrigue its imagination with the possibility of the company making some new issue of its own after the debenture scheme is out of the way; no rumour of such a thing has been mentioned in the market.

Kensingtons are better at 24s. 6d., and Urbans rose to the same price. In the provincial list, Newcastle-on-Tyne ordinary at 21s. 3d. are 9d. better, and Yorkshire Electrics show 1s. gain at 29s. On the other hand, Yorkshire (West Riding) Trams are flat at 8s. 9d.

On the death of the Babcock & Wilcox managing director, Sir James Kemnal, the price of the shares dropped from 53s. 9d. to 52s., rallying later to 52s. 6d. The fall in the price is an eloquent testimonial to the faith which Babcock shareholders reposed in his remarkable powers. Very few changes have occurred in the list of manufacturing companies' shares. Enfields are a shade better at 75s. Automatic Telephones eased off to 53s. 9d. International Telephones are 44s. 6d., and the "B" shares 42s. Any declines in prices that occur, and for which no explanation is obvious, are nowadays attributed to the effect of sales by people who want to realise money for the purpose of putting the cash into the oil market, where a lively boomlet was in progress until reaction overtook the market to-day (Monday).

Nothing of importance is occurring amongst cable stocks and shares, where the disposition is somewhat dull. Great Northerns make an exception with a 5s. rise to 26¾. Marconis revolve narrowly around 15s., and Canadian Marconis keep about 3s. 6d. Rubber shares are quiet. Vickers had a crisp rise, and other issues in this group are better, upon trade prospects.

Share List of Electrical Companies.

	Nom.	Dividend. 1924.	Dividend. 1925.	Price Feb. 14 1927.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	60/9	—	4 12 0
Brompton Ordinary	£1	10	10	25/-	—	5 12 0
Charing Cross Ordinary	£1	15	15	25/-	—	5 12 0
do. do. 4½ Pref.	£1	4½	4½	17/-xd	—	5 6 9
Chelsea	£1	12	12	25/-	—	5 12 0
City of London	£1	15	15	2¹⁵/₁₆	—	... ...
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Clyde Valley	£1	8	8	28/6	—	5 12 6
County of London	£1	15	15	28/6	+6d	... ...
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	£1	7	8	26/3	—	6 2 0
do. 7% Pref.	£1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	£1	10	10	30/6	—	5 11 2
Kensington Ordinary	£1	15	15	24/6	+6d	5 14 3
Lancs. Light and Power	£1	7½	7½	24/-	—	6 2 5
London Electric	£1	10	10	24/-	—	5 17 8
do. do. 6% Pref.	£5	6	6	5⁷/₁₆	—	5 10 4
Metropolitan	£1	11	11	26/-	—	5 7 8
do. 4½% Pref.	£1	4½	4½	17/-	—	5 2 10
Midland Counties	£1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary	£1	7	7	21/3	+9d	6 11 0
do. 5% Pref.	£1	5	5	17/6	—	5 14 3
do. 7% Pref.	£1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	£10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	£1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	£5	17½	17½	24/-	—	5 16 8
South London	£1	15	15	24/6	—	6 1 0
South Metropolitan Pref.	£1	7	7	1¼	—	6 3 0
Urban Ordinary	£1	4	7	24/6	+9d	5 14 3
do. 6% Pref.	£1	6	6	20/6	—	5 17 1
Westminster Ordinary	£1	15	15	24/6	—	5 14 3
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	£1	8	8	29/-	+1/-	5 14 4
Home Rails.						
Central London Ord. Assented	Stock	4	4	71	+1	5 12
Metropolitan	£	5	5	61½	+3	4 13
do. District	£	3½	3½	58	+3	6 0 9
Underground Electric	£1	Nil	Nil	14/-	+1/6	2 2 10
do. do. Income	Bonds	6	6	104	+1	*5 15 5
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	100	—	6 0 0
do. Def.	£	1½	1½	24	—	6 5 0
Automatic Telephone	£1	8	10	2¹¹/₁₆	—¹/₁₆	3 14 3
Chili Telephone	£5	5	6	6½	—	4 12 4
Cuba Sub. Ord.	£10	5	5	7	—	7 5 6
Eastern Extension	£10	10	10	17⅝	—	*5 13 4
Eastern Tel. Ord.	Stock	10	10	172½	—	*5 16 0
Globe Tel. and T. Ord.	£10	10	10	18¾	—	*5 6 8
do. do. Pref.	£10	6	6	11	—	5 9 1
Great Northern Tel.	£10	22	20	26¾	+¼	7 10 0
Indo-European	£5	8½	10	46½	—	*5 7 6
Marconi	£1	10	Nil	15/-	—	... ...
Marconi-Marine	£1	10	7½	1¼	—	6 13 4
Oriental Telephone Ord.	£1	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	£5	8	8	8⁵/₁₆	×⅛	*4 16 3
Western Telegraph	£10	10	10	17	—	*5 17 8
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	3	+⅛	9 13 6
do. do. 2nd Pref.	£5	6	6	3	+⅛	10 0 0
do. do. 5% Deb.	Stock	5	5	71½	+2	7 0 0
British Electric Traction Ord.	£	7	8	145½	—	5 10 0
do. do. 6% Pref.	£	6	6	109	—	5 10 1
Brazil Traction	£10	4	5	122	+4	4 18 4
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	88½	—	5 13 0
do. do. Preferred	£	96/-	136/9	126½	+2	*4 18 10
do. do. Deferred	£	129/5	8	162½	+4	*4 18 6
do. do. Deb.	£	4¼	4¼	81½	—	5 4 4
London & Sub. Trac. 5% Pref.	£1	2½	Nil	6/6	—	Nil
London United Tram. Deb.	Stock	4	4	45½	—	8 16 0
Mexico Trams, 5% Bonds	—	5	5	67	+1½	7 8 2
Mexican Light Common	£10	Nil	Nil	40	—	Nil
do. Pref.	£10	Nil	Nil	92½	—	Nil
do. 1st Bonds	—	5	5	68½	+3	7 6 0
Yorkshire (West Riding)	£1	5	—	8/9	—1/3	... ...
Manufacturing Companies.						
Babcock & Wilcox	£1	12	13	52'6	—¹/₁₆	4 19 1
British Aluminium Ord.	£1	5	10	46/3	—	4 6 7
British Elec. Transformer Pref.	£1	Nil	7	18/8	—	7 13 5
British Insulated Ord.	£1	15	15	70/-	—	4 5 9
Brush Ord.	£1	10	10	28/3	—	7 1 7
Callenders	£1	15	15	3½	—	4 5 9
do. 6½% Pref.	£1	6½	6½	23/9	—	5 9 5
Crompton Ord.	£1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 *0
do. 5% Deb.	Stock	5	5	84	—	5 19 1
Electric Construction	£1	10	10	81/3	—	6 8 0
Enfield Cable Pref.	£1	7½	7½	1¼	—	6 6 4
English Electric	£1	5	Nil	15/-	—	... ...
do. do. Pref.	£1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	£1	6½	6½	23/6	—	5 10 8
do. Ord.	£1	5	7½	31/6	—	4 15 3
Henley	£1	16	20	4½	—	4 9 0
do. 4½% Pref.	£5	4½	4½	4¼	—	5 6 0
India-Rubber	£1	5	5	1	—	*5 0 0
Johnson & Phillips	£1	10	17½	2¹⁵/₁₆	—	5 19 1
Met.-Vickers Ord.	£1	8	8	28/3	—	5 13 3
do. Pref.	£2	8	8	2⁵/₁₆	—	6 18 4
Siemens Ord.	£1	7½	7½	30/-	—	5 0 0
Telegraph Construction	£12	20	10	29¾	—	*4 0 8

* Dividends paid free of Income Tax

The Electrical Imports of Peru.

THE following figures show the values of the imports into Peru of electrical goods and apparatus in 1925. Comparative figures for 1924 are also given, together with a note of increases or decreases. The Peruvian £ = about 20s.

	1924. £P	1925. £P	Inc. or dec. £P
Electrical accessories, e.g., switches, cutouts, plugs, lampholders—			
Total	37,000	33,000	− 4,000
From Germany	16,000	22,000	+ 6,000
,, Great Britain ...	2,000	1,000	− 1,000
,, United States ...	9,000	8,000	− 1,000
Accumulators and batteries—			
Total	14,000	15,000	+ 1,000
From Germany	2,400	1,000	− 1,400
,, United States ...	10,000	13,000	+ 3,000
Insulators and tubes—			
Total	20,000	29,000	+ 9,000
From Germany	5,000	11,000	+ 6,000
,, United States ...	9,400	8,000	− 1,400
,, Great Britain ...	3,000	1,000	− 2,000
Copper wire, covered, except with silk, up to 3 mm. in diam.—			
Total	13,700	24,000	+10,300
From Germany	3,300	11,000	+ 7,700
,, United States ...	5,300	10,000	+ 4,700
,, Great Britain ...	1,500	1,400	− 100
Ditto more than 3 mm. in diam.—			
Total	16,000	15,300	− 700
From Germany	2,600	3,500	+ 900
,, United States ...	11,000	9,500	− 1,500
,, Great Britain ...	1,500	1,700	+ 200
,, Italy	700	400	− 300
Telegraph apparatus, including wireless—			
Total	10,000	11,700	+ 1,700
From United States ...	1,200	1,800	+ 600
,, Great Britain ...	8,800	9,600	+ 800
Telephone apparatus—			
Total	4,000	6,500	+ 2,500
From United States ...	2,000	1,500	− 500
,, Great Britain ...	700	2,500	+ 1,800
Lighting fittings—			
Total	18,400	22,700	+ 4,300
From Germany	7,900	12,800	+ 4,900
,, United States ...	4,500	3,400	− 1,100
Heating and cooking apparatus—			
Total	6,000	3,600	− 2,400
From Germany	1,300	900	− 400
,, United States ...	3,500	1,900	− 1,600
Cables, Copper—			
Total	84,000	56,600	−27,400
From Germany	9,500	6,700	− 2,800
,, United States ...	7,400	3,500	− 3,900
,, Italy	24,000	14,400	− 9,600
,, Great Britain ...	31,000	24,000	− 7,000
Electric bells—			
Total	700	500	− 200
Insulating tape—			
Total	1,700	2,300	+ 600
Covered copper flex—			
Total	6,200	14,300	+ 8,100
From Germany	2,600	8,600	+ 6,000
,, United States ...	1,200	1,100	− 100
Meters and instruments—			
Total	4,100	4,600	+ 500
From Germany	1,400	2,200	+ 800
,, United States ...	1,800	2,000	+ 200
Metal filament lamps—			
Total	29,400	35,900	+ 6,500
From Germany	12,400	14,900	+ 2,500
,, United States ...	9,000	6,800	− 2,200
,, Holland	6,800	13,000	+ 6,200
Magnetos—			
Total	2,500	2,300	− 200
From Germany	400	800	+ 400
,, United States ...	1,700	1,100	− 600
Electric light meters, domestic—			
Total	1,900	600	− 1,300
From Germany	800	300	− 500
Motors up to 1 h.p.—			
Total	900	2,600	+ 1,700
Switchboards—			
Total	27,800	17,000	−10,800
From Germany	3,700	2,600	− 1,100
,, United States ...	21,400	12,100	− 9,300
,, Great Britain ...	100	800	+ 700
Fans—			
Total	2,600	700	− 1,900
From Germany	—	100	+ 100
,, United States ...	400	300	− 100
,, Italy	2,200	200	− 2,000
Current transformers—			
Total	28,000	32,300	+ 4,300
From Germany	1,500	1,400	− 100
,, United States ...	15,000	20,600	+ 5,600
,, Great Britain ...	2,200	3,500	+ 1,300
Total of electrical goods and apparatus	349,000	373,000	+24,000
From Germany	74,000	103,000	+29,000
,, United States ...	129,000	132,000	+ 3,000
,, Great Britain ...	57,000	61,000	+ 4,000
,, Italy	56,000	37,000	−19,000

Machinery Imports of the Belgian Congo.

THE following figures, showing the imports of electrical and industrial machinery into the Belgian Congo in 1925, are taken from the recently issued official statistics. The figures for 1924 are added for purposes of comparison and notes of any increases or decreases are given. It will be noticed that some very remarkable increases are shown.

Electrical machinery and apparatus.—

	1924. Thous. fr.	1925. Thous. fr.	Inc. or dec. Thous. fr.
Total	6,793	8,774	+1,981
From Belgium	4,829	6,393	+1,564
,, Great Britain	305	594	+ 289
,, United States	614	813	+ 199
,, France	149	311	+ 162
,, Union of S. Africa ...	235	291	+ 56
Power plant, other than locomotives, locomobiles and electrical.—			
Total	1,359	2,078	+ 719
From Great Britain	359	448	+ 89
,, Belgium	631	1,279	+ 648
,, United States	25	105	+ 80
,, France	26	105	+ 79
Machine tools.—			
Total	5,695	6,733	+1,038
From Great Britain	425	375	− 50
,, Belgium	3,105	5,332	+2,227
,, United States	1,669	310	−1,359
,, Union of S. Africa ...	117	241	+ 124

High-pressure Cable Practice.

An interesting paper, "Super Tension Cable Dielectrics," was recently read before the Engineering Society of University College, Southampton, by Mr. A. I. Tracey, A.M.I.E.E. The lecturer dealt with the necessity of keeping the size of high-voltage cables down to practical limitations and thereby subjecting the dielectrics to much higher relative stresses than had previously been the practice. Foreign matter in a highly-stressed dielectric, he said, had a cumulative effect which finally caused breakdown, either by the particle expanding or piercing it, or by starting a rise in temperature and causing breakdown in that manner. Several kinds of extra-high-pressure cables now in use were described and their relative merits compared.

The British Industries Fair.—I.

Exhibits at London and Birmingham.

ON Monday next, simultaneously in London and Birmingham, there opens what can be claimed to be the largest trade exhibition ever held in this country. This year's British Industries Fair eclipses all its predecessors in size and variety, and this is especially true of the electrical section at Birmingham, which is now thoroughly representative of the industry. The accompanying illustration (fig. 1) presents a view of the extensions which have been made to the Castle Bromwich buildings to cope with the greatly enhanced demand for more space by the electrical manufacturers. The extensions to this and the Hardware Section represent an additional floor space of 120,000 sq. ft.



Fig. 1.—Building Extensions at Castle Bromwich, Birmingham.

While the exhibition is not primarily intended for the introduction of novelties, being a demonstration of the staple products of British manufacturers, there are a number of inventions and devices which are making their first appearance.

The Fair is a means of demonstrating to buyers from foreign countries and the Dominions the capabilities of British industry, and it certainly does this in a very effective way. A strictly businesslike atmosphere prevails, and the public is only admitted on certain days and at certain times. Therefore a buyer who wishes to discuss business can do so unhampered by a crowd of mere sightseers. While the main object in view is the export market, the importance of the home buyer is not overlooked. Practically every day of the exhibition will be marked by visits of representative trade associations whose members are responsible for a large proportion of the home demand for all kinds of products. These Associations, while mainly attracted by the sections dealing with their own particular requirements, are put into touch with other sections, often to their mutual benefit. For instance, it will be seen from the official programme which we reproduce below that a number of Associations whose attendance should interest electrical exhibitors are paying official visits. We may mention in this connection the export merchants' organisations, and the ironmongers' and hardwaremen's associations. We consider that it will be worth the while of any of our readers to pay a visit to the show, and would remind them that a card of admission to the Birmingham Fair, combined with a voucher for reduced railway fares, was circulated with each copy of the ELECTRICAL REVIEW of December 31st last. Readers who have mislaid their cards can have others if they will apply to us. We commence below some notes upon this year's functions and exhibits; in both directions considerable improvement and extension is indicated.

THE BIRMINGHAM SECTION.

Official Birmingham Programme.

The following is the official programme of functions for the Birmingham section :—

February 21st.—Official opening by the Lord Mayor of Birmingham.

February 22nd.—Visit of the Prince of Wales; Sir Philip Cunliffe-Lister, K.B.E. (President of the Board of Trade); Lord Mayors, Lord Provosts, Mayors, Provosts and Town Clerks of other industrial towns; Birmingham Association of Building Trades Employers.

February 23rd.—Birmingham Consular Association; British Export Society, London Export Merchants; Birmingham Export Merchants; Manchester Export Merchants; Liverpool Export Merchants; Sheffield Export Merchants; Metal Thread Screw Manufacturers' Association; National Hardware Association.

February 24th.—Visit of the Prime Minister.

February 25th.—Association of Consulting Engineers; Association of Mining Electrical Engineers; Incorporated Association of Electric Power Companies; Institution of Electrical Engineers; Municipal Tramways and Transport Association; Tramways and Light Railways Association.

February 26th.—Electrical Power Engineers' Association; Meter Engineers' Technical Association; National Association of Supervising Electricians; Birmingham and District Association of the Institution of Civil Engineers; Institution of Electrical Engineers (Students' Section).

February 28th.—Council of Birmingham Chamber of Commerce; Electrical Contractors' Association; Electrical Contractors' Association of Scotland; Electrical Wholesalers' Federation; Illuminating Engineering Society; National Register of Electrical Installation Contractors.

March 1st.—Association of British Chambers of Commerce; Bankers and Bank Managers; Birmingham and District Master House Painters' Association; Gunmakers' Association; Midland Home Grown Timber Merchants' Association.

March 2nd.—Ironmongers' Federated Association; British Cast Iron Research Association; Birmingham and Wolverhampton Hardware Factors' Association; Retail Trade Section of Birmingham Chamber of Commerce; Lord Mayor's reception and dance to exhibitors and buyers.

March 3rd.—Electrical Association for Women; Institution of Quarry Managers; British Electrical Development Association; Incorporated Municipal Electrical Association; Provincial Electric Supply Committees of the United Kingdom.

March 4th.—Sir Worthington-Evans, Bt., G.B.E., Secretary for War; Birmingham Chamber of Commerce banquet.

The Exhibits.

British Thomson-Houston Co., Ltd.

On this stand are shown many electric motors and control equipments for industrial drives selected from the wide range which has been designed to meet to modern requirements of various industries. The whole of the company's exhibits, including "Fabroil" silent pinions, "Tungar" rectifiers in

various sizes for the charging of accumulators from an a.c. supply, as well as other items of electrical equipment, are displayed so that each piece of apparatus is seen by visitors approaching the stand from any direction. Concise particulars with reference to each exhibit are displayed adjacent to the exhibit. The motors shown are of various types, and range from fractional h.p. machines to representative examples of machines for group or individual drive of industrial plant. For single-phase a.c. circuits, the B.T.-H. repulsion induction motor is designed to start up easily under heavy load and run at high power factor at constant speed. Occupying a position of prominence on the stand is the "No-Lag" induction motor for three-phase circuits. This motor, in addition to possessing all the advantages of the ordinary slip-ring induction motor, is designed to run at unity or leading power factor.

A new range of motors (Type U) is represented by motors both for d.c. and a.c. circuits. These motors possess many interesting features, both mechanical and electrical, such, for example, as ball and roller bearings, spigoted end shields, special windings and brushgear. A.c. and d.c. motors of the same ratings identical in all essential dimensions can be supplied, if required. There are no joints in the rotor cage, and as only one metal is used, both for bars and end rings, the likelihood of fracture due to unequal expansion of

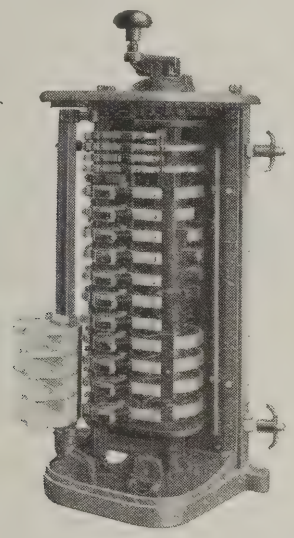


Fig. 2.—A B.T.H. Drum-type Controller.

dissimilar metals is avoided. The rotor is, therefore, practically indestructible under service conditions. The motor control gear exhibited comprises numerous types for a.c. and d.c. motors, and is mostly of the pillar type for floor mounting, although in many instances it can be supplied also for wall mounting. The equipments cover the requirements for all sizes of electric motors from 0.5 to about 250 h.p. Included in the range of motor-control equipments is a reversing drum controller of new design (fig. 2), which has been developed for use with a.c. or d.c. motors operating industrial equipment, such as cranes, hoists, and the like. When the front cover is removed, by the release of four spring catches, the whole of the inside of the controller is accessible. The cable space is claimed to be much larger than in any previous design, and other important points include a mica-insulated barrel shaft and finger bar, an easily removable cylinder, and large and renewable finger tips. Another interesting exhibit is that of a new type of light unbreakable resistance in which the grids are so graded that the appreciable temperature resistance coefficient usually associated with all unbreakable resistances does not adversely affect the equipment with which they are used. B.T.-H. control pillars are represented by examples for a.c. and d.c. motors. The arrangements in the "Type ATP" control pillars for slip-ring induction motors up to about 250 h.p. comprise a "dead man's handle," which must be firmly gripped during the starting operation; a drum-type starter with controller-type fingers; starting resistances; contactor-type circuit breakers with an improved form of blow-out and fitted with overload relays; triple pole, double break, isolating switch; complete safety interlocks; simplified wiring, and cable bushes or outlets for screwed conduit, the whole being mounted in a sheet-steel case. By the provision of a robust slow-motion device, starting up cannot be carried out too rapidly, and the gear is fully interlocked. An equipment of the oil-immersed pattern for starting slip-ring induction motors is also shown. This is for motors up to about 40 h.p., although larger panels are manufactured, and comprises an oil-immersed circuit breaker and oil-immersed rotor starter. An improved form of Y-delta air-break starter for squirrel-cage motors is also exhibited. A neat starting panel for d.c. motors up to about 18 h.p. is that designated "Type CDM." Contained in a dust-tight and weatherproof cast-iron case are a starting rheostat, line switch, two fuses, low-voltage release and overload relay. The cover is interlocked with the main switch, and the line terminals are shrouded. Switchgear for use where totally-enclosed, dust-proof and drip-proof enclosure is required is also shown, two patterns being exhibited—one, "industrial" and the other "flame-proof" for use in fiery mines. A complete switchboard may be assembled by bolting together the required number of units.

Metropolitan-Vickers Electrical Co., Ltd.

The display of this company and its associate Metro-Vick Supplies, Ltd., is designed to show the wide range of manufactures produced by the organisation. The parent company exhibits examples of its heavier equipment, including several types of motors. Standard d.c. motors for industrial service (Type X) form one part of the exhibit. These are made in sizes ranging from 0.5 to 250 h.p., and are particularly applicable to the driving of machine tools, either for long continuous periods or where there are frequent reverses and stops. Shunt, series, and compound designs are shown, each class having its particular applications. The squirrel-cage and slip-ring motors shown represent a recent development of design for general industrial use. Another special type of motor shown is described as a "Utility" motor. This is designed to have the same dimensions for approximately the same power, whatever type of circuit it is to be employed upon; the rating is about ¼ h.p., and ball bearings are employed. Closely related to the motor section is that comprising starting gear. The d.c. starters exhibited are the "S5D" for motors up to 0.5 h.p., and the "S8D" for powers of from 1.5 to 3 h.p. The smaller starter is of the protected type, fitted with no-volt release, arranged for wall mounting, and is manufactured on mass production lines. Incorporated in the larger pattern are no-volt and adjustable overload releases. The "SD" starters are also made in sizes ranging up to 50 h.p. (500 V). The "S.L.S." switch is a new design of air-break starter for squirrel-cage motors from 1 to 10 h.p. It can be connected as a star-delta, series-parallel, or direct starter for single-, two- or three-phase machines, giving protection against overload, interrupted service and incorrect operation. Simplicity is the main feature of its construction. The switch mechanism is of the drum-controller type, giving two breaks per pole. The starter can provide good service in many industries where individual motor drive is employed. Another interesting exhibit is a combined stator and rotor starting panel for industrial motors of up to 300 h.p. Here, again, the design has been simplified to reduce initial and maintenance costs. The switch mechanism is of the free-handle type, giving two breaks per pole under oil. The con-

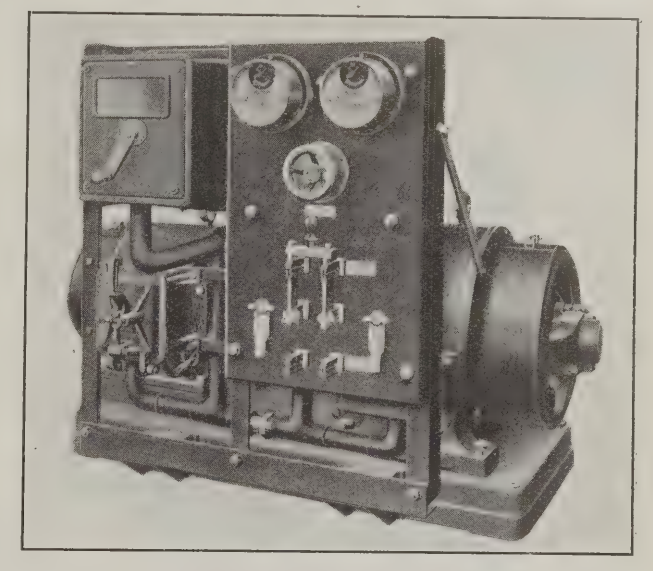


Fig. 3.—A M-V. Single-operator Welding Set.

tacts are of the rolling butt type and self-cleaning. Provision is made for the mounting of instruments. Our illustration (fig. 3) shows a single-operator arc-welding set complete with control gear and switchboard. The motor is arranged for either d.c. or a.c., and the generator has notable self-stabilising characteristics by which it maintains an arc giving constant heating effects without the use of a resistance. This saves energy and makes it easy for the operator to strike and maintain the arc. The company also makes up multiple-operator sets, in which case the supply to a number of welders is from a common set, and each welder has a separate stabilising resistance.

The company also displays its improved system of protection for coal-cutting machines. This comprises a special gate-end starting box, containing a main contactor with protective and re-setting devices, a control switch for mounting on the coal cutter and a standard form of trailing cable with suitable standard terminal plug. Complete control of the gate-end apparatus is effected by means of the control switch on the coal cutter.

The principal features of the Metro-Vick Supplies section of the stand are two "Cosmos" electric cookers. The smaller is suitable for a family of 4-6 persons, and the other for from 6-10 persons. Both models are fitted with the new "Cosmos"

boiling plate, which, upon test and in service, has proved to be very efficient and reliable. The main point in this plate is the use of a special insulating material, crystalline magnesium oxide (or hydroxide), which is made up in tube form to contain the coiled heating element. By a special process the material and the element are caused to come into intimate thermal contact. A later development is shown—a double-ring enclosed boiling plate. A number of "Cosmos" radiant fires are shown, as well as irons, jugs, toasters, fans, and wiring accessories. The last include "Emvee" lampholders, cord grips, switches, ceiling plates, &c., most of which have been described in our pages. "Cosmos" lamps and valves form another interesting section.

Gent & Co., Ltd.

Amongst the most interesting exhibits here are examples of "Pul-syn-etic" electric clocks for home, office, or industry, with automatic bell-ringing apparatus; "Reflex" control for existing workmen's recorders; "Duplex" control for existing turret clocks; "Tangent" electric motor sirens for large factories, workshops, or offices, in sizes ranging from ¼ to 4 h.p., and intended for fire alarm, time signals or any other emergency call signals. There is also shown a large selection of incombustible bells, hooters, and keys for industrial uses, and the mining engineer will be interested in the display of bells, relays, keys, telephones, &c., all of which are incombustible and flame-proof. The Parsons-Sloper telephone, which is displayed, is intended for intercommunication purposes and ensures secret conversation on an ordinary single-line wiring installation. The wireless exhibit includes the "Touchstone" loud-speaker, which is claimed to reproduce every note from the highest to the lowest. There are also battery eliminators and many other radio accessories. The company again shows its "staff locator," by means of which the attention of principals or staff in large or small factories can be attracted.

General Electric Co., Ltd.

This company again has a large and varied display of its manufactures which conveys a good impression of the manifold activities associated with the initials "G.E.C." It must be said, however, that the company's principal exhibit is its Witton works, to which all visitors to the Fair are invited. The stand has a length of 100 ft. and is divided into five sections, which are lettered from "A" to "E." Section A comprises a complete range of "Osram" lamps and valves. The lamp range embraces practically every type of lamp forming the regular output of the company's works at Hammersmith, *viz.*, lamps of standard vacuum and gasfilled type, automobile and ship types, sign and striplight lamps, &c., including the white, pearl, and colour-sprayed patterns. The range of valves covers both the transmitting and receiving types, and

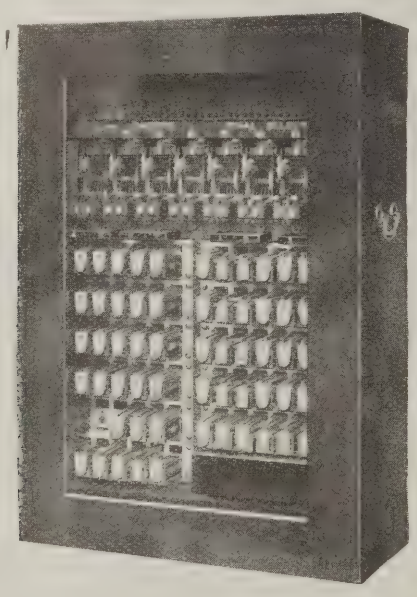


Fig. 4.—A "G.E.C." Automatic Exchange.

a number of "Gecovalves." The Osram receiving valves include the new D.E.P. 215, the D.E.H. 612, and D.E.L. 612 "Steep Slope" types, which have just been placed on the market. The K.L.1 type, embodying revolutionary principles, is shown. This has an indirectly-heated cathode, and is operated direct from a.c. supply mains. Section B comprises "Magnet" household electric appliances, which cover practically every ordinary home requirement. The items include electric irons, kettles, toasters, boiling plates, grillers, cookers, washers and wringing machines, cleaners, various designs in electric fires and electric fans, and the most recent addition to the list of "Magnet" household appliances, an electric refrigerator, which is shown in operation. Section C is used as a reception room and for staff purposes. In Section D a variety of the smaller electrical accessories is on view. Included among them are a number of electric lighting accessories, such as switches and fuseboards, and a working model of a motor-driven switch operator. Industrial electrical accessories are represented by recent developments in switches and fuses, circuit breakers, starters, and measuring instruments. A selection of samples of bakelite moulded insulation products, specimens of wires and cables, &c., also appears in this section. Section E contains a display of the company's telephone productions, such as the standard type, table type, wall type, intercommunication type, &c. In addition there is a varied show of electric bells and bell indicators—of the household, colliery, ship, and similar patterns; specimens of miners' lamps, and Leclanché and dry cells, batteries and accumulators. A selection of "Gecophone" wireless sets, components and accessories, is also on view in this section, including several of the most successful lines introduced this season. A 25-line automatic telephone exchange is shown in operation (fig. 4).

Mawdsleys, Ltd.

This company is showing various sizes of its patent d.c. dynamos and motors, including a vertical high-speed machine. It is also exhibiting examples of the "Creedy" patent binary convertor arranged to convert from a.c. to d.c. current in one machine. This machine consists essentially of a squirrel-cage induction motor and a d.c. generator in one frame, the d.c. side having all the characteristics of a separate generator. This result is obtained by a special method of winding, the rotor consisting of an ordinary d.c. winding with certain cross connections. The chief advantage of this convertor is that the d.c. side can be given all the characteristics which can be obtained from an ordinary generator, that is, it can be shunt wound for battery charging, compound wound, series wound, or with reverse compound characteristics such as are required for electric welding. An example of the binary convertor specially wound for welding is shown in operation. Other exhibits include an ordinary rotary convertor for use in welding, a small motor with self-contained reduction gear giving a reduction of 16 to 1, and the "Mawdsley" patent lightweight "showman's" dynamo.

Yorkshire Switchgear and Engineering Co., Ltd.

This company is showing two steel kiosk transformer substations. One of these is for a 3,000-V single-phase system, the other for 11,000-V, three-phase, and both are complete with all necessary gear. A variety of oil-immersed circuit breakers, for voltages up to 11,000, is shown, together with cubicle, pedestal, and other mountings for indoor use. There are examples of oil-immersed fuse isolators which cheapen the cost of connections to a h.p. system in the case of small consumers. A 30-A, 6,600-V, three-phase equipment is shown which may be used with ordinary wire fuses or with the company's patented spring fuse, and as the switch mechanism is of the quick-break type, the equipment may also be used as an oil switch to break its rated load. High-pressure specialities for outdoor use include fuses for 11,000-V circuits and quick-break automatic isolating switches with overload trip, whilst the low-pressure exhibits include a sub-station panel for 1,000 A at 500 V and steel feeder pillars for network subdivision. Examples are shown of the company's combined service switch-fuse and end strain, of which many thousands have been supplied for Home, Colonial, and foreign use on systems employing overhead distribution. A varied selection of the company's specialities for use on transmission line and railway electrification work is also on view.

M-L Magneto Syndicate, Ltd.

This exhibit falls roughly into three classes—small permanent-magnet generators, pneumatic-electric miners' lamps, and synthetic resin mouldings. The machines in the first class have a permanent magnet field system, and consequently no difficulties arise on high-voltage machines due to the fragile nature of the fine wire which would be necessary for the field windings. The constancy of the working flux in this type when used as a generator permits the voltage to be directly proportional to the speed, which will remain constant when supplied at a given voltage and under a given load. The direction of rotation can be reversed by reversing the polarity of the supply leads, which varies from the method with the orthodox type. A particular application of this type of machine is found in the M-L anode convertor exhibited, which forms a substitute for dry batteries normally used for supplying anode current to wireless receiving sets. This machine consists of a small motor-generator, with suitable l.t. and h.t. smoothing circuits, and regulating resistances contained in an aluminium case, the current being supplied from an ordinary l.t. filament battery. On account of the use of the permanent field, the current consumption is low and the drain on the battery small. The machine can be supplied for any secondary pressure up to 300 volts, and is also supplied with a tapping switch on the h.t. side, this permitting a simultaneous operation on a low-frequency amplifier at a high voltage and a detector or high-frequency amplifier at a reduced voltage; the voltages and the two circuits can be varied independently. The pneumatic-electric miners' lamps are a further development of the application of cobalt steel magnets to small generators. The lamps, which are capable of giving up to 100 c.p., consist of a small revolving-field alternator, direct coupled to a compressed-air turbine. They are fitted with a patent safety device which automatically short-circuits the generator in the event of any breakage or interference with the protecting glass over the lamp.

THE LONDON SECTION.

In the Fair as a whole this year nearly 1,600 British manufacturers are displaying their products: of that number some 600 are in the Birmingham Section, so that the London section, which is housed at the White City at Shepherd's Bush, consists of over 900 exhibitors. Of course, all the stands are not of electrical interest; of those that will appear electrically to the visitor, the great majority are featuring broadcast radio-telephone apparatus and accessories, the number of exhibitors in this class being about 60.

Brownie Wireless Co., Ltd.

The principal items on this stand are the No. 2 model crystal receiver and two-stage note magnifier (fig. 5), and a special appeal is being made to foreign and Colonial buyers; it is significant that the Company has found it necessary to publish instructions in booklet form in no less than 16 different languages. Part of the display is devoted to mouldings:

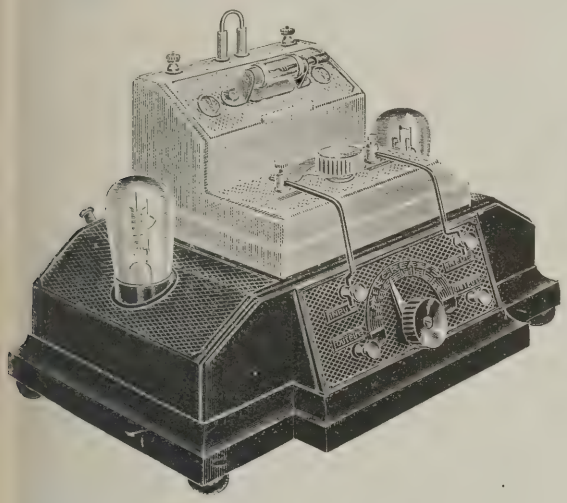


Fig. 5.—A Crystal Receiver and Two-stage Note Magnifier.

while ostensibly a manufacturer of wireless equipment, the firm has for some time had a special department which undertakes moulding by contract, in bakelite, fireproof and plastic. This department is equipped with machinery that includes special hydraulic presses working up to 750 tons pressure and capable of high-speed production.

Synchronome Co.

At the entrance to the Watch and Clockmaking Section, the Synchronome Co. has an impressive display of electrical impulse dials of all kinds and sizes, ranging from the domestic to the turret clock. The almost life-long devotion of Mr. F. Hope-Jones to the application of electricity to horology has carried the Synchronome system far, and the display is devoted to its commercial uses. To demonstrate the absence of mechanical clockwork, a turret dial of 10 ft. diameter is simulated, the figures being represented by twelve small electrical impulse dials in operation and the great hands driven by a movement which is so small as to be concealed by their central bosses. Weather-proof high-temperature enamelled dials are also exhibited, some shown mounted in pairs, back to back, to represent huge watches; they form effective bracket clocks, and the silent operation of electrical impulse dials is demonstrated by a reproduction of those used throughout the studios of the British Broadcasting Corporation at 2LO: placed close to the microphone, they advance in seconds and are of 18 in. diameter, yet they cannot be heard by the most sensitive receiver.

Dowsing Radiant Heat Co., Ltd.

Samples of special electrical heating appliances are on view, including irons for the use of tailors, dressmakers, laundries, and milliners, as well as branding irons, soldering irons, water heaters, radiators, and certain electro-medical appliances, such as the "Solarium" electric sun bath.

Mr. A. Hinderlich.

Devoted to crystals and their applications, on this stand detecting crystals are shown in great variety, also a re-issue of the most successful type of crystal detector, and an outstanding novelty is an actual 23-metre transmitting station, arranged for quartz control, which unit is shown in operation. Quartz crystals arranged as wave-length standards for the calibration of wave-meters, &c., on broadcast and short waves are featured as well.

Telegraph Condenser Co., Ltd.

The Company's range of condensers includes the Mansbridge and mica types; suitable patterns for use with radio battery eliminators, for "smoothing" at various voltages, and others for high-frequency work and for power-factor improvement purposes.

Mr. R. H. Dent.

The "Ardente-acoustique" devices shown represent improvements in electrical aids for the deaf. A new earpiece is the size of a shilling and the microphone is no larger than a florin, being as useful in a hall as in general conversation. The new auditorium type, for use in public halls, &c., where the acoustic properties are poor for deaf people, is very small, and so constructed that hearers can sit in any part of the hall. It is mellow and true-to-tone for music and words, meetings, &c.

Read Radio, Ltd.

This firm makes the 4-valve ".Real" receiving set, which is neat in appearance and, although it is portable, does not betray the fact that it is a wireless instrument when carried; it has one control and will receive the local station, Daventry, and Radiola at comfortable strength. The new 4- and 5-valve sets (fig. 6), described as very selective, have been designed

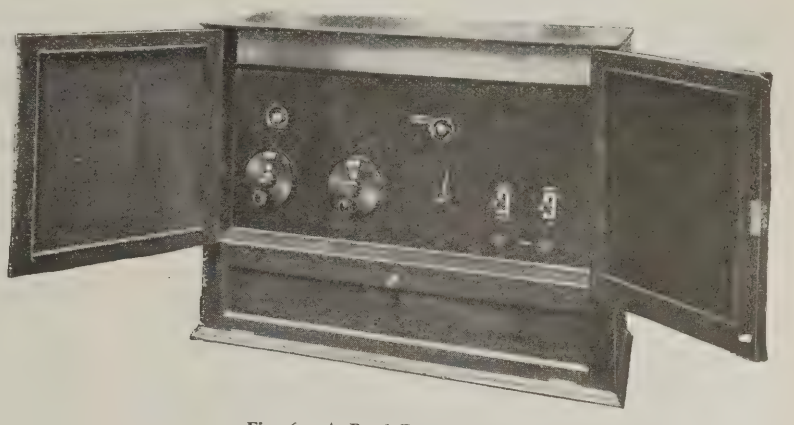


Fig. 6.—A Read Broadcast Receiving Set.

to enable the user, when situated at a reasonable distance from the local station, to cut it out and hear Continental stations. Both instruments embody two high-frequency valves that are claimed to be controlled in an original manner. No reaction is employed, and their manipulation is simple.

Ever-Ready Co. (Great Britain), Ltd.

The company has arranged two exhibits—a comparatively small stand is devoted to its range of wireless dry batteries and accumulators, whilst on a double stand is a display of the other manufactures, including batteries of all types, motor-car lighting accessories, and portable lamps.

Electrolux, Ltd.

The home cleaner bearing the above name yields high suction efficiency and calls for little physical effort on the part of the user in the course of work. There are no screws to adjust, the bag is totally enclosed, dust and dirt cannot get near the motor or fan, the suction will pick up solid bodies without affecting the machinery, and the user has no weight to carry. Without mechanical moving parts to call for attention and without noise or vibration, the company's refrigerator performs, in the home, the full duty of the most elaborate mechanical ice plant for the preservation of foodstuffs, beverages, and for the making of ice for the table or the sick room.

"Attracta" Electrical Co.

Various signs for window display and outside use are shown, including the "Flash-o-Graph" type which has the advertising matter embossed at the back of a polished plate-glass panel; the latter is mounted on a metal stand fitted with a 60-watt "Tubolite" lamp, and every time the auto-flasher operates the letters on the glass are effectively illuminated. The "Luminous" changeable letter sign consists of overlapping slats spaced apart and arranged to form a screen between the electric lamps inside the sign and the observer, so that the screen (on which the letters are hung) is illuminated while the light source is concealed from direct view. The "Nigrasine" animated sign has a design or wording outlined with glass tubing, through which is pumped (by means of small electric motor) coloured liquid and air bubbles, and is very effective by day as well as night; a new illuminated type is being shown for the first time, the advertising matter being stencilled out and backed with glass tubing arranged horizontally: coloured liquid courses through the tubes and is illuminated from behind, striking quite a new note in illuminated signs. The principle can be adapted to window reflector signs.

A.C. Measuring Instruments.

The more important developments in the design and construction of indicating and recording, as distinct from integrating, meters; and an account of some of the authors' investigations.

By Lieut.-Col. K. EDGCUMBE, R.E. (T.A.), Vice-President, and F. E. J. OCKENDEN, Graduate I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers.)

(*Concluded from page* 234.)

Synchronous Motor for Timing Purposes.—The advantages of driving the charts of graphic meters by means of a synchronous motor have been alluded to, but it is only recently that a sufficiently compact self-starting synchronous motor has become available. Such a motor, due to Mr. H. E. Warren (fig. 3) has a laminated field magnet A which carries a winding B and is provided with two short-circuited copper rings CC, which produce a rotating field in the air-gap. A steel disk D is caused to rotate in the air-gap under the influence of the rotating field, not owing to eddy currents generated in it, but to hysteretic drag. The speed increases until synchronous speed is reached, when north and south poles are induced at definite points in the steel ring and the coercive force is so great that considerable mechanical force is required to pull it out of step. The disk is geared to the spindle E in such a way that, at the working frequency, this spindle revolves once per minute. All the moving parts are enclosed in a dust-tight housing F, containing oil. The construction is such that the entire motor, together with its housing, can be removed and replaced by a new one, should occasion arise, without

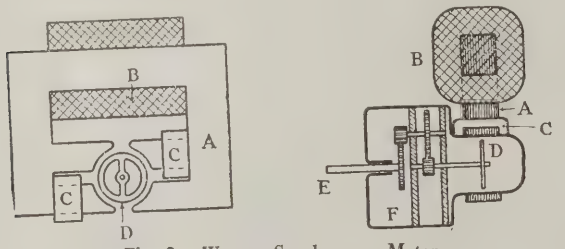


Fig. 3.—Warren Synchronous Motor.

disturbing any of the other parts. The overall dimensions are 2 in. by 2½ in. by 2½ in., and the power consumption is normally about 3 watts at a power factor of about 0.4. The torque exerted at the spindle E, before the rotor will drop out of synchronism, is well over 500 gramme-cm., which is about 1,000 times as great as the normal torque of a powerful spring-driven 8-day graphic-meter clock.

In order that the speed may be precisely one revolution per minute, it is essential that the frequency of the power supply should be correct; momentary fluctuations are of no consequence, so long as the average frequency is maintained at a constant value. This is ensured by installing at the power station an accurate clock combined with a synchronous motor in the same case; the hands of the two mechanisms may be mounted concentrically on the same dial, or the clock and motor may act differentially upon a single hand, which by its sense of rotation shows the difference in speed between clock and motor. The attendant has only to note, occasionally, the position of the tell-tale hand, and if the motor is seen to be running in advance of the clock he slightly lowers the speed of the generator, or *vice versa;* it is found easy to keep the average frequency correct to within 15 seconds per day, which would correspond to a precision better than 1/50th of 1 per cent. in the case of an indicating frequency meter.

Apart from the convenience of driving timing mechanisms, the advantages of maintaining correct frequency are daily becoming more important. For the driving of many classes of machinery, notably in textile factories where the output depends upon the maintenance of a minimum speed, but one which cannot be greatly exceeded without impairing the product, everything depends upon the maintenance of a correct motor speed. In paper mills, again, the quality and texture of the product are intimately bound up with the speed of drive. If the system frequency is kept truly constant in the way indicated, the electrical drive gives an exactness of speed which cannot even be approached by any other known method. Again, when sections of a large system have on occasion to be run in parallel with one another, much time can be saved and shocks to the system avoided, if the frequency of all sections is standardised, so that they can be instantly thrown into parallel without a lengthy and often laborious preliminary adjustment of speed.

Given standardised frequency, innumerable uses for timing motors will suggest themselves: graphic and maximum demand meters are examples, but a still larger field of usefulness is in connection with time switches, where the demands on the clock are severe and the question of winding and regulating is a serious one; these troubles entirely disappear if the time switches are driven by synchronous motors. In the United States of America, where the use of this system is rapidly extending, several central stations are encouraging their consumers to use synchronous motors for operating time recorders and multiple clock systems in factories and large institutions, and even for the more humble domestic clock. A consuming device with a load factor of 100 per cent., even at a power factor of 0.4, is not altogether to be despised. Warren synchronous motors have been applied with great success to the construction of time meters for the measurement of short intervals of time down to 1/20th second, in connection with relays, circuit breakers, integrating meters, &c. A spindle is driven from the synchronous motor at a steady speed of one revolution per second; that is to say, on a 50-cycle system the rotor is geared down 50/1. A pointer, which is carried round by friction with this spindle, is normally held stationary by means of a clutch which can be released by a solenoid.

Instrument Transformers.—Voltage transformers differ but little from power transformers, and present few special difficulties to the designer. Current transformers, on the other hand, represent an entirely different problem which affords considerable scope for ingenuity. Although the design has some effect upon minimising both magnetising and iron-loss currents, each depends, ultimately, upon the nature of the material used for the core, so that it is in this direction that the designer must turn. Fortunately, during the last few years several new and promising iron alloys have become available. Fig. 4 shows, for three different materials, the relationship between the flux density expressed in gauss and the magnetising current expressed in ampere-turns per centimetre length of iron path.

Curve I refers to a brand of silicon-steel which is much used in this country for instrument transformers, and is quite suitable for all voltage transformers and for the majority of current transformers, but the silicon-steel to which Curve II refers shows a reduction of about 25 per cent. in magnetising current so that a current transformer constructed with this material would have a phase displacement smaller by 25 per cent. Curve III refers to a nickel-iron alloy ("Mumetal") in which the magnetising current is so much lower that the phase displacement will be less than 18 per cent. of that for the transformer having a core of material I.

The iron-loss characteristics of the three materials are somewhat similar to the magnetising-current characteristics of fig. 4, except that neither of the silicon steels I or II shows any great improvement over the other. The great improvement brought about by proper annealing is clearly seen. Although it is possible to obtain satisfactorily annealed transformer iron in the sheet, it is invariably found that after stamping into rings both the magnetising and iron-loss currents have very markedly increased (the former by perhaps 25 per cent.) so that it is necessary to re-anneal the finished rings.

The design of iron-cored current transformers for radio frequencies cannot be dealt with in any detail. Owing to eddy currents, the depth to which the flux penetrates the iron laminations rarely exceeds an effective depth of ½ mil, so that the permeance of the magnetic circuit depends rather on the number of laminations than on the total thickness of the iron, thus leading to the use of the thinnest possible stampings; for example, 1½ lb. of 12-mil sheet is no more effective than 4 oz. of 2-mil sheet.

In order to keep the iron loss at radio frequencies within reasonable limits, it is essential that the total flux should be small, although the effective flux density may be fairly high.

Owing to the above-mentioned phenomenon the flux density tends to remain constant over a wide range of frequency, the flux penetrating more deeply into the iron at the lower frequencies. For a given core, the ratio variation tends to decrease with increasing frequency. Whilst 20 mils is a convenient thickness of stampings much used for power frequencies, a thickness of 5 mils is to be preferred for radio frequencies. It should be noted that, owing to the leakage inductance of the transformer, the secondary induced voltage increases with the frequency, such increase being relatively greater at low burdens, as evidenced by the ratio falling off less rapidly with increasing frequency than is the case at the heavier burdens. To ensure a uniformly low flux density, it is essential that the entire length of the iron circuit should be covered by the secondary winding and that the fields due to the primary and secondary windings should effectively coalesce; for currents exceed 10 amperes the number of primary turns is few and the leakage flux becomes so great

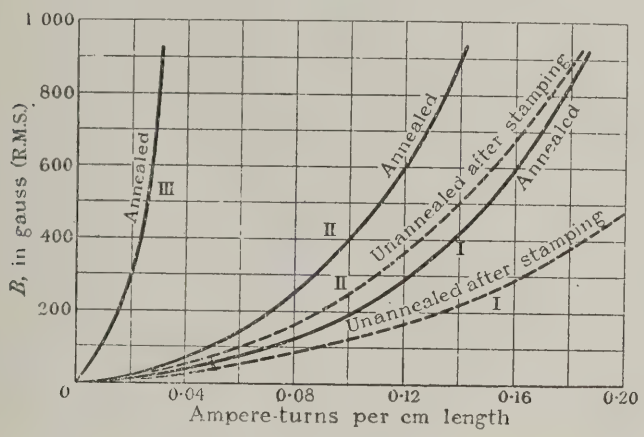


Fig. 4.—Transformer Iron B/H Curves, a.c.

that the iron overheats and the ratio error exceeds the permissible limits. This difficulty can be overcome by completely surrounding the iron core and the secondary winding by a single-turn primary, as shown in fig. 5, which represents a 1,000-ampere current transformer as installed at the Rugby wireless transmitting station. The current enters at A, passes up the central tube B, which threads through the core C with its secondary winding D, and thence returns by way of the outer shell E to the other terminal F.

Some ingenious methods have recently been proposed for lessening the phase displacement in current transformers, but usually at the expense of constancy of ratio. Even with this limitation, such expedients are sometimes useful, particularly for use with wattmeters on loads of very low power factor, since it is usually easier to comply with requirements as to ratio than as to phase.

A preferable solution, in the authors' opinion, lies in the design of a normal current transformer, but provided with a core of nickel-iron (see Curve III in fig. 4). The characteris-

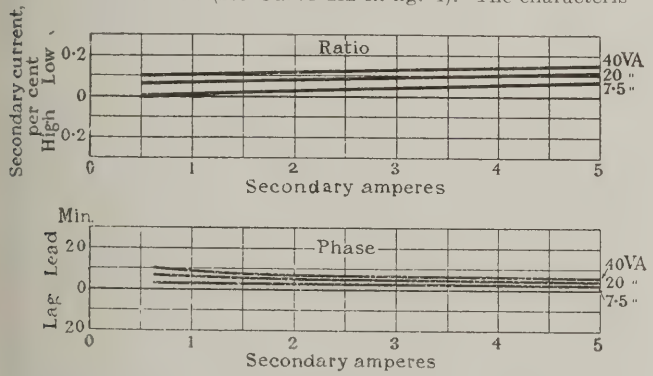


Fig. 6.—Ratio and Phase of "Precision" Current Transformer with Non-inductive Burden.

tics of such a transformer are remarkably good, as will be seen from the ratio and phase curves given in fig. 6 for a transformer wound for 1,200 ampere-turns at rated current. The characteristics may be summarised, for burdens of 7½, 20 and 40 volt-amperes, respectively, at 50 cycles, as in Table I.

TABLE I.

From rated current to 1/5th rated current.			From 1/5th rated current to 1/10th rated current.		
7½ VA	20 VA	40 VA	7½ VA	20 VA	40 VA
Percentage Ratio Variation.					
0.05	0.05	0.05	0.06	0.06	0.06
Phase Displacement in Minutes (Lead).					
3	6	8	4	8	10

Whilst the cost of a nickel-iron current transformer is necessarily very much higher than that of one having a silicon-steel core, yet for precision work, either in current measurements or for use with a wattmeter, the extra cost may be fully justified. For example, the above current transformer used in conjunction with the "Precision" moving-iron ammeter described in an earlier part of this paper will have a combined electrical accuracy of 0.15 per cent. throughout the working range, at any ordinary frequency; or, if used with a wattmeter at a power factor as low as 0.2, the error due to the transformer would not exceed 0.5 per cent. and would probably be less, owing to the fact that a wattmeter forms a somewhat inductive burden.

The difficulties of designing a satisfactory bar-type* current transformer for a small primary current are considerable. It, however, presents advantages from the point of view of insulation, capacity to withstand short-circuits, immunity from damage by surges, as well as cheapness and general convenience in erection. If the primary current is low, there being only one "turn," B must be relatively high and/or the cross-sectional area of the core unduly large, which will lead to a large phase displacement unless a material with a high permeability is used. The nickel-iron alloy of Curve III in fig. 4

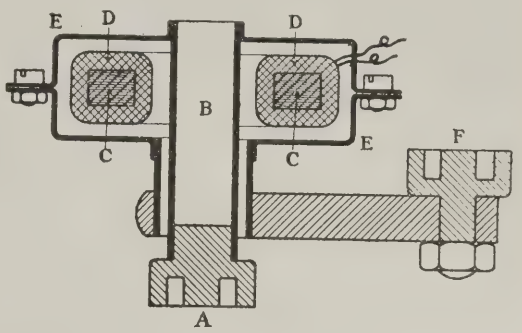


Fig. 5.—Radio-frequency Iron-cored Transformer.

fulfils this condition. A bar-type current transformer for use with an indicating or integrating wattmeter, which may form a secondary burden of from 2 to 5 volt-amperes, entails reasonable accuracy: down to 1/10th rated current the ratio must be correct to within ½ per cent. and the phase displacement must not exceed 90 minutes. In the case of a transformer for use with ammeters and relays, ratio alone need be considered; it will have to be correct to within 1 per cent. down to 1/10th rated current with a burden of 10 volt-amperes. Fig. 7 shows the ratio curve of a bar-type current transformer designed on these lines and having a ratio of only 60/5, with a burden of 10 volt-amperes at 50 cycles: it possesses more than the required accuracy in spite of the excessively low value of the primary current, and the shape is of interest when compared with a more normal curve. If the iron loss varies as B^2, the transformation ratio of the current transformer will be constant at all currents (the curve will be a horizontal straight line). If n in the expression Iron Loss $= kB^n$ is less than 2, as is the case with silicon-steel, the curve will slope downwards: for the nickel-iron core of fig. 7 the ampere-turns are low, so that the flux density at rated current is relatively high and the value of n changes from about 2.2 at low flux densities, resulting in an upward slope of

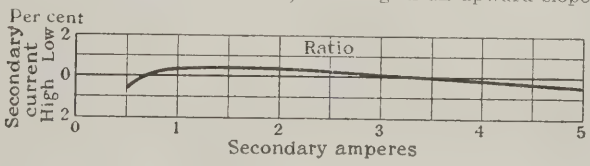


Fig. 7.—Ratio of Bar-type Current Transformer, 60A.

the curve, to 1.8 at high flux densities, resulting in a downward slope. At secondary currents between 1 and 2, the ratio curve is sensibly horizontal, indicating that the value of n is approximately 2.

Instrument Overloads.—Under modern conditions, the overloads to which measuring instruments may be subjected are extremely severe; in fact, fault currents of 20 times the rated carrying capacity must be regarded as quite normal, and of 100 times as by no means uncommon. When it is remembered that the watts dissipated in a meter carrying 32 times its rated current are 1,000 times what they were at rated current (that is, watts become kilowatts) it might be thought that meters would often be "burned out." Experience shows this to be a comparatively rare occurrence, however, and that it is mechanical damage to the moving parts which is most to be feared.

The behaviour of current transformers under short-circuit conditions must therefore be carefully considered with respect to both mechanical and thermal stresses. For example, in current transformers the leading-in conductors of which pass through a single insulator, thus not only saving cost but also improving the insulation, if the distance apart of the two con-

* Variously called "single turn," "straight," "straight through," "bar," "bushing," "stud," "open primary," &c.

ductors is ¾ in. and their length 12 in., the force of repulsion, should the momentary short-circuit amount to 50,000 amperes (r.m.s.) would be over 2½ tons. In this respect a concentric arrangement of the leading-in conductors is much better calculated to withstand the stresses. None of the current transformers tested, with the exception of the bar type, were mechanically capable of withstanding the momentary applica-

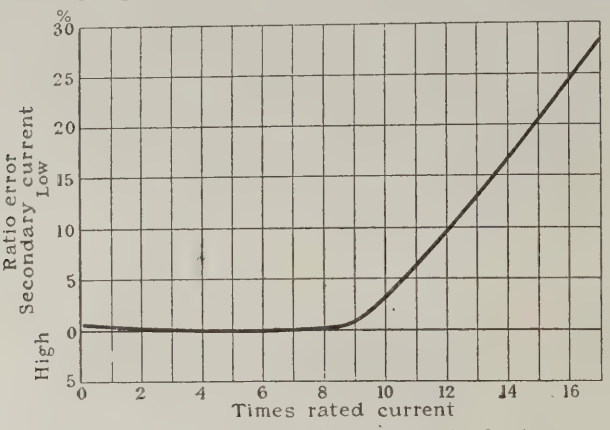


Fig. 8.—Ratio of Current Transformer under Overload.

tion of a current equal to that which they would withstand for ½ sec. from the point of view of overheating alone. All, however, safely withstood 100 times the rated current and may therefore be considered satisfactory.

To obtain data from which the point of break-away from proportionality could be determined, experiments were carried out, and fig. 8 shows the ratio error of a transformer up to 17 times the rated current; up to about nine times the rated current (at which point the secondary output would be 2,400 volt-amperes) the ratio is reasonably constant, but above that point it falls away sharply. Thus, the point of break-away from proportionality depends upon the primary ampere-turns and the dimensions of the core, and is therefore largely under the control of the designer.

A really severe fault must be cleared within a very short

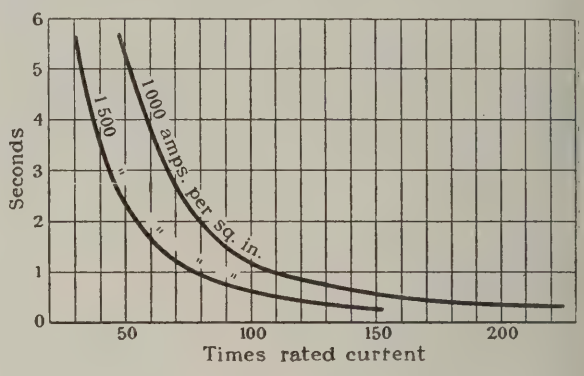


Fig. 9.—Heating of Current Transformer by Heavy Overload.

space of time or any transformer in its path will inevitably be destroyed through over-heating.

Fig. 9 shows the length of time which will elapse before the temperature has risen by 200 deg. C., with various overloads and for current densities of 1,000 and 1,500 amperes per square inch, respectively, at rated current. Air-cooled transformers have been assumed, as oil-insulated or compound-filled transformers are not so satisfactory in this respect.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

A "Pin Jack" Voltmeter.

Whilst the necessity for providing electrical measuring instruments for use in connection with broadcast radio-telephone sets has not hitherto been generally realised, the time seems to be approaching when their important influence on the correct operation of receivers will be accorded due consideration. To ensure the best results, valve makers' values should be adhered to closely, and it is obviously unsound to rely on trial and error methods in the adjustment of three separate voltages: a voltmeter greatly facilitates such control, but it is necessary that it be of a suitable high-resistance pattern that is capable of checking the p.d. under normal working conditions. An instrument marketed by the Weston Electrical Instrument Co., Ltd., specially for radio service,

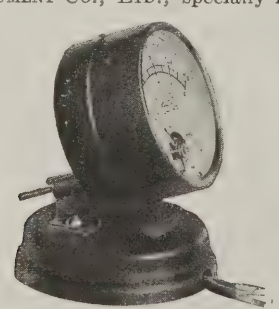


Fig. 1.—Weston High-resistance Voltmeter.

to aid the regulation of filament and plate voltages, for checking batteries, and the location of circuit faults is shown in fig. 1. Each instrument is supplied with a pair of pin jacks for mounting upon the back of the panel of the set by drilling two holes, which need not be exactly spaced because the terminals at the back of the voltmeter are made adjustable so that they can be plugged in with ease; when valve filaments are controlled by separate rheostats, it is advantageous to provide a pair of jacks for each. For checking the high-voltage plate battery, the voltmeter is withdrawn from the panel jacks and plugged into its high-range stand as indicated in fig. 1, the stand being connected to the battery by flexible leads. The instrument has a double scale, the 6-volt range having a resistance of 750 ohms, and the 200-volt range a resistance of 25,000 ohms; thus, the meter requires but 8 mA for full-scale deflection. It should be pointed out that the range shown in the illustration is not now the standard.

"Cosmos" Valves.

One of the most recent of the thermionic valves marketed by Metro-Vick Supplies, Ltd., is the DE.50 dull emitter. It is a good all-round stable type for circuits for which "shortpath" valves are not suitable; if substituted for a bright valve, the filament current will be reduced to about ½. The filament current is 0.09 A at 6 V; the anode voltage is from 30 to 100 V, 3 volts grid bias, and amplification factor 9. The mutual conductance is approximately 0.45 mA per volt, and the anode impedance about 20,000 ohms.

To the "shortpath" range has been added the SP.16/R (red spot) general purpose valve, which is claimed to be specially useful in reflex transformer- or choke-coupled sets. At 2 volts its filament current is 0.09 A; the anode voltage may be from 20 to 120 V, 4.5 volts grid bias, and the mutual conductance (slope of characteristic) is 0.4 mA per volt, the anode impedance being 16,000 ohms.

For incorporation in filament battery eliminators and for h.p. plate accumulator charging purposes the SP.41/U half-wave a.c. rectifier has been designed, with a total emission of more than 0.5 ampere, so that a long life may be expected. It is fitted with a standard 4-pin cap, the anode being connected to the anode pin and the grid pin having no connection. The filament takes 1.25 A, the maximum anode voltage being 250 V r.m.s., and the d.c. output 25 mA. For full-wave rectification the SP.42/U double-anode pattern is available, one anode being connected to the anode pin and the other to the grid pin of the standard cap. The filament takes 2.25 A, the maximum anode voltage being 250 V r.m.s. per anode, and the d.c. output 50 mA. Both these rectifiers are provided with a dull-emitting filament which should be heated through a 4-volt transformer or suitable rheostat.

The bulbs of all the above-mentioned valves are clear, the "getter" on an electrode extension plate apparently not depositing to any extent on the glass.

A Battery Charger.

A radio battery charger which enables electric light users to recharge their accumulators, both those used in the filament and plate circuits, at home from the ordinary lampholder, into which the device is plugged, easily and cleanly at low

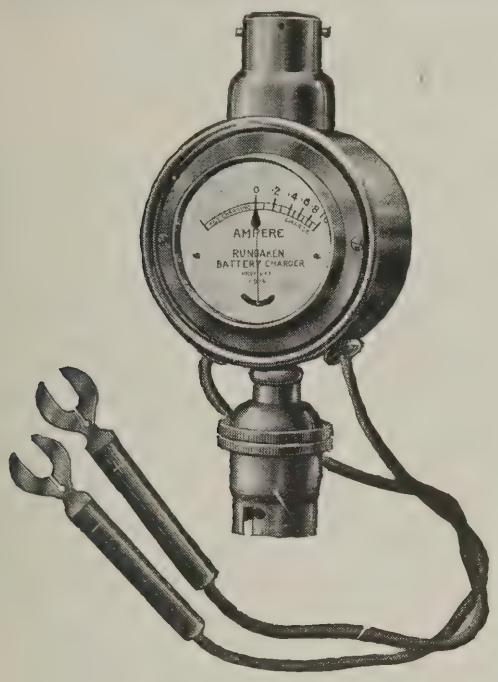


Fig. 2.—The Runbaken Battery Charger.

cost, is shown in fig. 2. The indicator prevents incorrect connection, and also indicates the amount of current passing into the cells. The model illustrated is suitable for use on d.c. mains only; it is marketed by the Runbaken Magneto Co.

The Baty Condenser.

The condenser illustrated in fig. 3 is a product of Mr. Ernest J. Baty. It consists of two aluminium plates, one of which is adjustable by screw, and the spindle tension is also adjustable; there is $\frac{3}{4}$ in. of insulation between the plate supports. It has a scale of 360 deg., and can be used over more

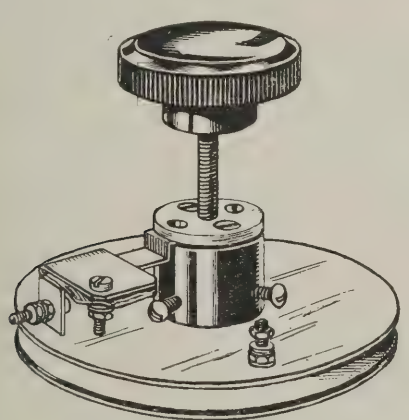


Fig. 3.—The Baty Condenser.

than one turn if desired; its weight is small and range large; it will tune one coil from 250 to 1,200 metres. The condenser alone, or the complete tuned-anode unit (coil, condenser, and grid condenser), are available, the total space occupied in the latter case being only 3 by 1 in., and the grid plate is entirely shielded at all positions.

Diesel Engine Users' Association.

At a meeting on February 4th, the newly-elected president, Mr. Geoffrey Porter, A.M.Inst.C.E., made an interesting statement concerning the growth of the Association during the period which had elapsed since his first term of office as president. The total horse-power of heavy-oil-engines represented by the membership of the Association at the present time was over 200,000 h.p., and was nearly 10 times what it had been in 1916. As recently as 1916 an individual capacity of 80 b.h.p. per cylinder had been usual, whereas at present engines were being installed for marine purposes of 1,250 b.h.p. per cylinder, and in the case of the nine-cylinder engine at Hamburg the power of each cylinder was over 1,600 b.h.p.

The Electromobile Association.

The First Public Meeting.

THE first public "Informal Meeting" of this Association was held at the Royal Society of Arts on Friday last.

The chair was taken by Mr. J. H. C. Brooking, M.I.E.E., who, in opening the meeting, said that it was very appropriate that it should take place on the eightieth birthday of that doyen in electrical science and industry, Edison, a man of wide vision, who foresaw a great future for electromobiles and who had done so much for their advancement. It must be recognised that while electricity had progressed in many ways it had not advanced to anything like the same degree in connection with electromobiles as it had in other directions. He imagined that the chief troubles were, in the first place, the high price of the vehicles, and, in the second place, the difficulties with regard to charging. The Association was arranging competitions, and the awarding of premiums for the best papers read before it during the year.

Mr. J. C. Elvy (secretary of the Association) then read a paper on "The Use of Storage-Battery-Type Electromobiles; in its course he quoted a statement of the President of the Institution of Electrical Engineers to the effect that it was "doubly regrettable that a form of transport which avoided the importation of fuel from abroad and which positively improved the load factor was so neglected in this country." Electromobiles were destined to become the prevailing type for town transport, and charging stations would have to be provided to some extent in anticipation of the coming demand in every town. Nerve specialists and medical experts were agreed as to the evils of present-day road transport. Again, what better agency than electricity could one find for propelling pleasure boats? Bathers at seaside resorts would welcome the absence of oil and fumes. Turning to another class of marine work, the silent action of electric craft would appeal to river and waterway vigilance police patrols. Electromobiles in the form of trucks in warehouses, docks, railways, and factories had already proved an unqualified success. Reverting to town transport, it could not be denied that the electromobile was the ideal for pleasure and business, passengers and goods. It was suitable for practically every class of business—for, amongst others, provision distributors, bakeries, laundries, breweries, chemists, and door-to-door deliveries and collection in streets. The German Post Office had scrapped hundreds of horse vans in favour of electromobiles. As regards price, maintenance, and running costs, they could be regarded as having established their ascendancy over other types of vehicles in the case of town traffic. By means of their more extended use, petrol would be conserved for civil, naval, and military aviation, where its objectionable features were not so pronounced. The reason for the low rate of depreciation in the case of electromobiles was not far to seek when one considered the multiplicity of working parts and the intense vibration of a petrol engine, which resulted in the crystallising of the metal work of the chassis and general deterioration of the whole vehicle. The advantage of electric power for accelerating was evident to anyone observing the progress of a steam train, with all its fussiness, compared with an electrically-propelled train, when both started simultaneously from a station. The medical profession would find the electromobile ideal for ambulance and general visiting work; there would be no delays occasioned by difficulty in starting, or troubles due to frozen radiators and water jackets. Electric taxicabs were successfully used abroad, and they were a commercial possibility in this country; it had been reported that in Berlin another 500 such taxicabs were being placed on the streets. Signs were not lacking that the world was passing from the petrol age to the electrical age in matters of transport.

After the reading of the paper, a long and interesting discussion took place, mainly directed, at the suggestion of the chairman, not to the advantages of electrically-propelled vehicles, but to endeavouring to discover the obstacles in the way of their wider use.

The Electrical Clinometer.

Prof. Henry Briggs gave a lecture and demonstration on "Surveying Boreholes by Electrical Clinometers" to the Scottish Division of the Institute of Mine Surveyors at the close of the annual business meeting held recently in Edinburgh. He alluded to the growing need of very precise means of measuring small deflections of boreholes from the vertical, giving instances of cases in which boring engineers had been required not to exceed a deflection of half an inch per 100 ft. of depth. The fact that the holes were of small diameter made it essential that instruments should be evolved which would descend the hole, the indications being transmitted to the surface of the ground, where the observations were taken. One of the instruments demonstrated was designed for trench warfare purposes, and it enabled the course of a more or less horizontal hole to be ascertained to within about seven minutes of arc.

The Institution of Electrical Engineers.

Annual Dinner and Reunion in London.

THE annual dinner of the Institution of Electrical Engineers was held on February 10th at the Hotel Cecil, London. Applications from members to attend were received in such large numbers that all the tickets were soon disposed of, and none could be issued to non-members, other than the official guests. H.R.H. the Prince of Wales, K.G., was the guest of honour, and Dr. W. H. Eccles, F.R.S., president, occupied the chair; the company numbered 619, only seven ticket holders being absent.

Following the loyal toasts, proposed by the Chairman, the "Institution of Electrical Engineers" was toasted by the Prince of Wales, who remarked that he owed a debt of gratitude to electrical engineers: last year as president of the British Association he had to deliver a very lengthy address, at the end of which Lord Balfour expressed the hope that his year of office would be marked by some striking scientific achievement. Months went by and nothing seemed to happen, and he began to feel that his presidential year was doomed to failure; and then, about a month ago, came the very sudden announcement that, as a result of the labours of electrical experts in this country and in the United States of America, the Atlantic had been finally bridged by wireless telephony, and to-day anybody in Great Britain could (at a price) call anybody in America whenever he cared. He was confident that before next August some of those present would produce triumphs which would be no less epoch-making; when one read of the excitement that was aroused by the opening of the first transatlantic cable, it seemed surprising how calmly everybody had accepted this wonderful achievement of being able to call up the United States of America. In the presidential address to which he had referred, he pointed out that, though the period of preparation by research before science could offer the world some new benefit might be long, yet the scientific machine was always running quietly in the laboratory. They knew, and he knew, as the general public could never know, the amount of hard work and brain-power expended in keeping that machine running, and when it finally produced some striking invention for the use of civilisation, those behind the scenes could appreciate, as no outsider could, the difficulties which had been overcome and the patient skill which had been exercised over a period lasting, perhaps, many years. Individual effort, by itself, would not keep the machine running smoothly, and were it not for the existence of the various scientific and technical institutions, it might even come to a standstill; that emphasised the value of the Institution. It bridged the great gulf between pure science and practical science, and it was up to the great industries to take up and use what electrical engineers invented, and also up to the community to try them out.

The President, Dr. W. H. Eccles, in responding, said that the Institution, which numbered nearly 13,000 members, was very closely in touch with every electrical activity of the country, and the speech of His Royal Highness was a compliment to the present status of the whole profession and recognition of its rising prestige. The growth of the electrical industry in this country, and in the Empire, had been indeed remarkable: in less than a century the capital invested had risen from nothing at all to no less a sum than about one thousand millions sterling. There were men with them that day who could remember the beginning and the time when electrical engineers were of no importance at all. The growth of heavy-current electrical engineering might be measured by the fact that more than seven hundred millions sterling was invested in the electrical equipment of this country. If the economic forces calling to-day for the wider use of electricity in mills and factories were given free play, that capital outlay would probably be doubled within the next twenty years.

For many of them the immediate question was: Could Britain, which was the workshop of the world during the steam age, take a leading place in the expanding electrical age? The question could be answered by glancing at the electrical record of the past year or so. Last year Englishmen laid in the Pacific the longest submarine cable in the world of the most modern type; the Post Office opened its wireless station at Rugby, and "beam" service with Canada had been opened successfully; in design and construction those stations were far in advance of foreign practice. Lastly, a transatlantic telephone service had begun. That was their telegraph record for one year. Next, in respect of electricity supply, several big organisations had installed new plant more efficient than any other in Europe, though not quite up to some of the exceptional plant in America. Statistical returns showed that this country was leading in the electrical export trade of the world, and manufacturers booked orders in 1926 amounting in value to twenty millions sterling. Thus they might claim that their electrical capabilities as a nation were proved.

Dr. S. Z. de Ferranti remarked that "Our Guests" on that occasion were so many, so distinguished, and time was getting so short, that he could not refer to them in the way he would like to do. To Prof. C. Fabry, president of the Société Française des Electriciens, they wished to convey, and asked him in turn to convey them to his Institution, their very best wishes and hope that it would progress and flourish. The Minister of Transport, the Rt. Hon. Wilfred Ashley, had done a great amount of work in connection with the new Electricity Act; owing to legislation in the past, and various other reasons, electrical development had not gone along the lines many of them would have wished: an endeavour was now being made to straighten this out. The technical difficulties did not appear to him to be serious, but there were no doubt great difficulties in reconciling all the divergent interests and getting everybody to work together for the common good. Their principal guest that evening they were more than delighted to have with them; his presence was the recognition of a great industry, and also a personal encouragement to every one to give the best possible electrical service to the country at large.

Lt.-Col. Wilfred Ashley, Minister of Transport, in responding, said that in this country intense loyalty to the Throne was fortified by admiration for the King's eldest son. He was a man who did not shirk hard work and who had travelled to good purpose. The Electricity Act had caused other members of the Government and himself a good deal of trouble last year; there might be some who questioned the wisdom of its provisions, but the answer was provided by the President, who had pointed out that manufacturers in this country exported no less than twenty million pounds worth of goods overseas during the discussion on the Bill: now that it had become an Act, they hoped that amount would be quite doubled. On the chairman and on the members of the Board would depend largely the success or failure of the Act, and he hoped that the selections he had made, after many consultations and deliberations, commended themselves; above all, they would endeavour to carry the several interests with them rather than to compel those interests to come into the scheme against their wish. It now rested with all interested in electricity to sink petty differences and to come together.

Prof. Ch. Fabry (President, Société Française des Electriciens), on rising to respond, said it was a very agreeable duty to express best thanks on behalf of the Société for the invitation accorded to its President. When he crossed the Channel he was impressed by superficial diversities between this country and his own, but after a few minutes' talk with scientific and technical men he was much more impressed by the similarity of their ideals, which was especially true of their two societies. Forty years ago his Society decided to award a medal of renown to a distinguished man for work on pure and applied electricity. The medal was awarded once every three years, and on February 4th, by a unanimous vote, it was awarded for the present year to a man who was not an engineer, but every electrical engineer knew what he owed to Sir Joseph J. Thomson.

During the dinner the British Imperial Orchestra rendered a selection of music. The Prince of Wales subsequently joined in the members' reunion in the Victoria Hall. Those present included Lord Southborough, Lord Rayleigh, Viscount Falmouth, Sir S. Chapman (Secretary, Board of Trade), Mr. A. M. Samuel (Secretary, Department of Overseas Trade), Sir R. T. Glazebrook, Marshal Sir H. M. Trenchard (Chief of Air Staff, Air Ministry), Sir W. H. Bragg, Sir E. Rutherford (President, Royal Society), Sir J. Snell (chairman, Electricity Commission), Sir J. Devonshire, Sir J. Cook (High Commissioner, Australia), Rear-Admiral Sir A. E. M. Chatfield (Controller, Admiralty), Hon. J. S. Smit (High Commissioner, South Africa), Rev. W. F. Norris (Dean of Westminster), Sir W. P. Rylands (President, Iron and Steel Institute), Sir S. Demetriadi (chairman of Council, London Chamber of Commerce), Mr. J. McNeill (High Commissioner, Irish Free State), Mr. E. F. C. Trench (Vice-President, Inst. C.E.), Sir T. H. Holland (Rector, Imperial College of Science), Sir G. E. P. Murray (Secretary, G.P.O.), Col. T. F. Purves (Engineer-in-Chief, G.P.O.), Sir G. Hume (chairman, L.C.C.), Sir Hugo Hirst, Sir F. Heath (secretary, Dept. of Scientific and Industrial Research), Major-Gen. H. F. Thuillier (Director of Fortifications, War Office), Sir J. E. Petavel (Director, N.P.L.), and the presidents of the leading Institutions and Societies.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Electricity Supply Tariffs.

In the articles on the above subject which appeared in your issues of January 28th and February 4th, Prof. W. Cramp hardly does justice to British electricity supply undertakings when he compares their charges with the charges made in Switzerland for similar supplies.

He says that in Basle an engineering works with a load factor of 20 per cent. and a maximum demand of 1,000 kW would pay 0.86d. per unit, and that "most English undertakings would charge at least 1.2d. per unit," although in Darlington the charge for such a supply would be 0.66d. per unit. He also mentions a case of a works requiring four million units per annum, with a load factor of 50 per cent., and gives the price in Basle as 0.68d. per unit, and in this country as 0.91d. per unit, whereas the charge in Darlington, under such conditions, would be 0.42d. per unit. Surely the British prices quoted by Prof. Cramp are not representative.

For household cooking the Swiss charge is said to be 0.768d. per unit, for an off-peak load supply and with a special meter at a rental of 3s. per quarter. The Darlington charge for a cooking supply, assuming that it is not used more in winter than summer, is 0.75d. per unit, without any peak-load period restriction, and with a meter rental of about 1s. 6d. per quarter.

The Swiss charge for domestic lighting is given as 5.3d. per unit during peak-load periods, and 1.92d. per unit during the remainder of the day, the peak load periods amounting to 8 hours per day in winter and 3½ hours per day in summer. In Darlington the lighting charge is 1.5d. per unit for 8 months of the year, *i.e.*, February to October, and one-half the number of units used during this period is supplied at 1.5d. per unit during the darker four months, the remainder of the units used during the darker four months being charged at 3½d. per unit. In addition, there is a service charge of 2s. 6d. per quarter, which includes the rent of one meter. The average cost of domestic lighting (not lighting and cooking or heating) is about 2d. per unit, plus the service charge. The average cost per unit for lighting in Switzerland is not given in the above-mentioned articles, but apparently it will amount to about twice as much as in Darlington.

The standard charge for low-pressure power supply in Darlington is £3 per kW of maximum demand per annum, plus 0.25d. per unit (no coal price or other adjustment), and this is the rate at which the above costs per unit have been calculated. There is also an alternative power rate for small, or low-load-factor, consumers of 1d. per unit for the first 3,000 units per quarter and 0.75d. for the remainder. The heating and cooking rate is similar in form to the lighting rate, but the lower charge is 0.75d. instead of 1.5d. per unit, and the higher charge is 1.25d. instead of 3.5d. per unit.

As electricity is being supplied at the above rates from a comparatively small power station which has been built up by gradual extensions during the last 26 years, and which has no water power, or waste heat, or linking-up arrangement, or even a natural supply of condensing water, and is situated where coal is not as cheap as in many industrial districts, there does not appear to be any good reason why electricity should not be supplied in most towns in this country at lower prices than those given by Prof. Cramp for Switzerland, and without the use of time switches.

The time-switch system of charging has obvious advantages, but it is to be feared that, in this country, the cost of providing and maintaining and attending to the time switches would more than neutralise their advantages, except in special cases.

The seasonal system of charging, referred to above, is, of course, an attempt to obtain most of the advantages of the time-switch system without the cost of additional apparatus. With this system the average charge per unit to consumers whose demand occurs during the winter peak-load period, usually falls as their load factor rises, and when a lighting demand does not occur during the winter peak-load period it is usually from a consumer who uses electricity as much in the lighter as in the darker months and consequently the average charge per unit to such a consumer will be low. Also, the average charge per unit to a cooking consumer who takes a supply regularly all the year round is lower than to a heating consumer who only uses electricity during cold weather.

J. R. P. Lunn,
Engineer and Manager,
CORPORATION ELECTRICITY DEPARTMENT.

Darlington, *February 7th*, 1927.

I notice on page 166 of the ELECTRICAL REVIEW, February 4th, in the very interesting article of Prof. W. Cramp on "Electricity Supply Tariffs" at Basle, Switzerland, that, under the charges for cooking, the householder rents a special meter for recording energy used for cooking purposes at about 1s. per month, *i.e.*, 12s. per year. He has to pay 2.4d. per unit between 6.30 a.m. and 9 a.m., *i.e.*, current used for cooking breakfast; he also has to pay the same price per unit for current used between 4.30 p.m. and 8 p.m., when, even if a full dinner is not cooked, most consumers would cook fish or something light, and during other hours when, in the majority of homes, there is little cooking done because the breadwinner and most members of the family are away from home, he gets current at a little over ¾d. per unit.

Prof. Cramp then asks: "Who would cook by gas if we had such a tariff here?" I think it might safely be said that everybody would. Most supply undertakings, without any restriction whatever as regards hours, are to-day supplying current for cooking and heating purposes at from 1½d. down to 1d. per unit with, in most cases, no meter rent, but it must be borne in mind that British undertakings generally do not charge, as the Swiss appear to be doing, a price of approximately 2½d. per unit for current when, in practice, cooking is usually carried on.

After having made this little criticism, I would like to emphasise how very interested indeed I have been in the article, and I think the thanks of the industry generally are due to Prof. Cramp for having taken the trouble to translate the electricity supply tariff of a typical town of Switzerland and for placing the matter so well before us.

While electricity supply undertakings in both countries are, no doubt, very desirous of improving load factor, the principles on which we are working in this country to attain that end appear to be quite at variance with the Swiss idea.

In Switzerland, apparently in order to induce consumers to improve the load factor of the undertaking, they have many different and sometimes complicated systems of charging, involving a multiplicity of metering equipments. Here I think there is a strong tendency to simplify the methods of charging and reduce the amount of capital outlay on apparatus on consumers' premises.

J. T. H. Legge,
Chief Engineer, SHROPSHIRE, WORCESTERSHIRE AND STAFFORDSHIRE ELECTRIC POWER CO.

Smethwick, *February 8th*, 1927.

I have read with much interest Prof. W. Cramp's article entitled as above, appearing in your issue of the 4th instant, but there is one point which I cannot pass over without comment.

On page 165, he gives particulars of a highly attractive load, from the point of view of a supply undertaking, for which the best terms that could be obtained worked out at 0.91d. per unit, with coal at 12s. 6d. per ton. The author adds: "the corresponding charge in Basle would be, at the most, 0.68d. *No more need be said.*" (The italics are mine.)

The inference is, I take it, that current for such a load is more costly in this country than in Switzerland.

Prof. Cramp has certainly been unfortunate, but if he will offer the same load in Yorkshire, he will have no difficulty in obtaining the required supply from any one of the leading supply authorities, such as Leeds Corporation, Sheffield Corporation, or the Power Company, at a price not exceeding 0.52d. per unit, with coal at 12s. 6d. per ton.

R. Allan S. Thwaites.

Leeds, *February 7th*, 1927.

A Knotty Problem.

As one of the general public of a small town where a supply of electricity has recently become available (at 230 volts, d.c.), I desire to avail myself of the advantages of electricity, and asked three contractors to estimate for the wiring of my business premises (draper and outfitter). My property is rather old, and I should require forty lights installed.

The estimates I received were consistent, but each contractor specified a different wiring system, each claiming that his own was superior. Also two consultants varied in opinion, so how am I, without experience of the technical details and difference of the many systems used, to choose between them and get the best?

Could you, please, give your valued opinion?

As far as I can ascertain, screwed conduit is universally accepted as the superior job; but where do "grip conduit," "C.T.S.," the many lead-covered systems, and "Maconite" stand? In what order should they be placed, electrically, irrespective of costs? If there is nothing to choose between them, why so many? I should be pleased if you would give this letter publicity in your correspondence columns.

Perplexed.

February 10th, 1927.

River Water—or Cooling Towers?

Mr. J. N. Waite refers to fig. 2 in Mr. I. V. Robinson's and my book on "Condensing Plant."* The figure in question gives in curve form approximately comparable values of varying vacua for varying inlet water temperatures. I agree that the curves do not show a great variation from Mr. Waite's figures; but I had in mind, in questioning Mr. Waite's figures, a calculation in which due allowance was made for the respective capital charges, &c., of a riverside installation and a cooling-tower plant. I based my difference of approximately 1 per cent. due to additional circulating-pump power consumption in favour of the river plant on a 10,000-kW unit allowing some 6 per cent. more water for the higher

* "Condensing Plant," by R. J. Kaula and I. V. Robinson. Messrs. Isaac Pitman & Sons, London.

vacuum and 25 feet additional head for the cooling towers, and arrived at an additional power consumption figure of 75 to 80 kW.

However, the main point at issue between us relates to the question of relative turbine efficiencies.

As far as I am aware, the turbine makers' decision to confine their guarantees to one set of terminal conditions—and this applies to the inlet conditions as well as to the exhaust conditions—was based on what appeals to me as very sound reasoning, namely, that the conditions for such a vitally important guarantee should be clear cut and unequivocal. It is open to a prospective purchaser to call for alternative tenders for two units, each designed for its respective vacuum, and he will then be able to determine the practicable thermal gain due to the lower temperature of cooling water in respect of the turbine, and I repeat that he will find the difference to be of the order of 7 to 8 per cent. on full load, and not of 4 per cent. as Mr. Waite suggested. That is to say, the thermodynamic efficiency of the two units will be practically the same. If he bases his comparison as Mr. Waite is doing on one turbine designed for one condition and run under another condition, he will get misleading results. A turbine designed for a back pressure of 1.2-in. Hg is obviously too small to be run efficiently on a back pressure of 0.9 in. Hg, and a turbine designed to work on 0.9 in. Hg is too expensive to be installed for a back pressure of 1.2 in. Hg.

I am of the opinion that Mr. Waite has arrived at a false conclusion to some extent by relying on comparative tests carried out on the same units, but mainly so by relying on tests carried out on turbines that represent conditions of the past rather than those of the present when dealing with a rapidly progressive form of machinery.

R. J. Kaula.

Erdington, *February 7th*, 1927.

Power Supply for Wireless Sets.

In reply to the further letter of "Interested," in your issue of February 11th:—

(1) As to whether I admit the competence of an eminent musician to judge by ear the quality of a set: This depends entirely on circumstances. If any person, musical or otherwise, gave an opinion based simply on listening to a set, I would not accept it for a moment. If several musical people listened to *two* sets, with facilities for instant change-over, I would accept their statement that one was better than the other. If they classed them as equal, I should admit that the difference between them was not more than 33 per cent. in amplitude of any frequency that the loud-speakers in use could reproduce.

(2) On his amended statement, that he is getting reproduction pleasing to himself and professional musical friends with his apparatus, I have no comment to offer, except that one cannot usefully discuss in the ELECTRICAL REVIEW matters of musical taste.

(3) Regarding the makers of his apparatus, I gather from his letters that his set is made by the Western Electric Co. that was—now Standard Telephones and Cables, Ltd.; and that, because my employers have standardised that firm's cone loud-speaker, I am to admit the high quality of his set without proof, on the ground that the Standard Telephones made it. With the best will in the world towards Standard Telephones, I will make no such admission. I believe that the Kone loud-speaker is really good, because I have tested it. I am sure that Standard Telephones *can* make an exceptionally good receiver; but I have not tested any of their receivers, and I do not know how long ago "Interested's" set was designed, nor whether it was designed for first-class loud-speaker work as that is understood to-day. The assurance of some of my acquaintances on the engineering side of that company would go a long way towards convincing me, if "Interested" could obtain them.

(4) I must congratulate "Interested" on a neat touch of humour in his sentence about "museum specimens." None the less, I would advise him to go and listen to that particular specimen—it might be an education in how wireless sets ought to sound.

(5) As to the word "distortionless," unfortunately I have not at hand a copy of my letter of January 7th. Perhaps I used the word loosely to mean "substantially distortionless." I took him up on the point because he claimed his set to be "*absolutely* distortionless," which it certainly is not.

(6) Twice your correspondent refers to me as "laying down the law." This is a misuse of the phrase. I was stating a fact accepted by those who have studied the subject. Does a book on geography "lay down the law" when it states that the world is round?

(7) His final contention is at last a claim which can be tested; that he can, with 0.75-watt d.c. on the anode in his set, get results equal or superior to those obtained with other receivers with 4 watts.

This I can take up. It is self-evidently an absurd contention, but if he persists I am prepared to discuss conditions for a trial, and I should be grateful if you, Sirs, would assist in such discussion. Apart from matters connected with such a test, I do not propose to continue this correspondence.

P. K. Turner.

Blackheath, *February 12th*, 1927.

A Handicap to Electrical Progress.

In view of the wonderful efforts that are being made in England to popularise the uses of electricity, the following facts may be of interest.

A relative of mine, an important salaried official of one of the large insurance companies, moved lately to Leicester. He was fortunate enough to be able to lease a house equipped both for gas and for electricity.

On going to the Gas Department (municipal) to get his cooker connected up, he was asked for £4 deposit. On his protesting, this was reduced to £2, which he paid.

On going upstairs to the Electricity Department and asking to have his house connected up, he was asked for a deposit of £5. No amount of remonstrance reduced this sum, and on his insisting on seeing an official of authority he was informed that the only concession that could be made was the substitution of a guarantee by a responsible ratepayer. As a stranger, this course was not open to him, and in disgust he decided to use gas, which he does.

The house in question is wired for 12 lamps at the outside, so a reasonable quarter's account might be £2 10s. This makes a £5 deposit sound very silly. In fact, as a publicity story, this incident is such a pearl that one can only hope that the Corporation, by these benighted methods, makes up on the gas swings what it loses on the electric roundabouts, and recompenses its gas manager accordingly.

Ivan Fawcett.

Cardiff, *February 11th*, 1927.

The Tricity Restaurant.

To-day I lunched at the Tricity Restaurant, and would like to congratulate the proprietors on the excellent—indeed, magnificent—way in which the place is equipped and run. The carpet, the lighting, the warming, the service, and the cooking are all splendid—*but* is it equally splendid as a piece of propaganda?

It would be if England were chiefly populated by well-off people, instead of by rather badly-off strugglers. I feel sure that if one of these moderately poor citizens were to visit this restaurant he would be confirmed in the still prevalent opinion that electric cooking can only be afforded by the immoderately rich.

I spent 4s. 1d., plus 7d. in tips, for the following:—

About 6 oz. of consommé,
5 oz. of sole (in 2 oz. of sauce),
2 cu. in. of potato chips,
2 small rolls.

This works out at about 5.28 shillings per pound, and I was still hungry, so I bade a reluctant farewell to Lucullus and visited a near-by temple of Bacchus, where bread and cheese provided the necessary calories at a much more modest cost per unit.

Who will start an electric restaurant to demonstrate what can be done at prices which the majority of prospective consumers can afford to pay?

M.I.E.E.

Westminster, *February 11th*, 1927.

[An electric restaurant at popular prices was opened last year in Ludgate Hill by the City of London Electric Lighting Co., Ltd., in connection with its showrooms.—EDS. ELEC. REV.]

Local Exhibitions and the Public.

Your comments on the above subject in your current issue are very timely. It is to be hoped that they will be read and followed by those demonstration engineers who, apparently, cannot conceive of any method of impressing the layman other than attempting to "blind him with science."

Once an interested visitor to an exhibition has had a piece of apparatus demonstrated to him, the only other material consideration, from his point of view, is one of £ s. d. In this connection a very simple indicating device can be used which makes an immediate appeal to the prospective customer. This device consists of an ordinary ammeter, without ampere scale, but scaled to read in "pence-per-hour," thus giving an instant indication of the cost of using any piece of apparatus demonstrated.

The system is equally applicable to a.c. and d.c. supplies as, in the former case, consuming devices taking any appreciable current would be a unity power factor load.

The instrument is not expensive since most manufacturers would be prepared to supply it at the price current for an ordinary ammeter of the same capacity, and there is no doubt that a visible indication of the cost of using any piece of apparatus is not only more convincing than a verbal one, but constitutes another revelation to the visitor of "the wonders of electricity."

Frank Rostron.

Oldham, *February 11th*, 1927.

[The device referred to by our correspondent is certainly effective, and should not be much more costly than an ordinary ammeter. It has already been employed, but its use could be extended with advantage.—EDS. ELEC. REV.]

Legal.

Carlton Main Colliery Co., Ltd.

MR. JUSTICE ROMER, on February 11th, had before him a petition by the Carlton Main Colliery Co., Ltd., Barnsley, Yorks., for sanction to an extension of its objects, one of which was to take powers to conduct a general electricity undertaking.

His LORDSHIP said that in his view the powers asked for were too wide. If the company had the statutory powers which he learned that it was applying for elsewhere, it would be able to go to London and pull up the streets there, provided it got the consent of the local authorities. He did not think that that was what the company wanted, and he would adjourn the petition for evidence to be produced as to the powers being asked for. He suggested that the company should confine those powers to what it really wanted.

The petition was adjourned for 14 days.

British Thomson-Houston Co., Ltd., v. G. Clynes & Co.

MR. JUSTICE ROMER, in the Chancery Division on February 9th, heard a motion by the British Thomson-Houston Co., Ltd., for an injunction restraining Messrs. G. Clynes & Co., Leeds, from infringing its leading-in wire and gasfilled lamp patents.

Evidence was given that the necessary papers were served at the address given as the defendants' address, and that a representative of the plaintiff company bought lamps that were said to be an infringement of the plaintiffs' rights. But an affidavit was also read by a woman named Brown that there was no such company as that of the defendants.

His LORDSHIP, in the absence of any further evidence for the defence, granted an injunction against Clynes & Co.

Electricity Theft Charge Dismissed.

IN the Falkirk Sheriff Court, last week, judgment was given in a case in which a local publican was charged with the theft of electricity from the Falkirk Corporation by altering the index of the meter and preventing it registering the quantity supplied.

Sheriff ROBERTSON said that the Electric Light Order, 1901, under which the charge was brought, presumed the existence of some artifice or device to prevent correct registration by the meter. As the prosecution had not shown that such an artifice or device had been used by the defendant he must find the charge "Not proven."

Compensation for Marconi Company.

IN the High Court, Dublin, last week, Marconi's Wireless Telegraph Co., Ltd., appealed against a reinstatement clause in an award of £4,640 made in its favour by a county court judge. The matter related to the destruction of the appellants' Clifden wireless station in 1922, and the company now stated that it did not propose to continue the station, and would accept £2,000 in lieu of reinstatement. The award was varied by allowing the company an extra £2,050. The Galway County Council, against which the award was made, was given leave to appeal to the Supreme Court.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

13,948. "Replacement type electric fuses." G. P. Dennis. March 1st, 1926. (264,217.)

18,579. "Radio-frequency amplification systems." A. E. White (Thermiodyne Research Laboratories, Inc.). July 21st, 1925. (264,304.)

22,801. "Electric switches." F. B. Cox. September 12th, 1925. (264,552.)

23,115. "Electric telegraphs." H. Pein. September 16th 1925, (264,553.)

23,567. "Automatic switches for use in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). September 21st, 1925. (264,556.)

23,792. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. September 23rd, 1925. (264,557.)

25,853. "Electric switches." J. A. Crabtree. October 16th, 1925. (264,564.)

25,906. "Telephone systems." Standard Telephones and Cables, Ltd., A. M. Searle, J. H. E. Baker, A. H. Cameron, W. R. Moscrip, A. J. Chanter and P. I. Wyndham. October 16th, 1925 (264,565)

26,094 "Composite welding-sticks for electric arc welding." W. J. Mellersh-Jackson (Soudure Autogene Francaise). October 19th, 1925. (264,571.)

26,106. "Aerial systems for use in wireless telegraphy and telephony." C. S. Franklin and E. Green. October 19th, 1925. (264,572.)

26,133. "Thermionic valves." Edison Swan Electric Co., Ltd., and T. W. Price. October 19th, 1925. (264,576.)

26,206. "Electric heating elements." Bastian Meter Co., Ltd., F. J. C. Allen, and A. E. Salisbury. October 20th, 1925. (264,581.)

26,219. "Electrical inductance coils and the manufacture thereof." Coto-Coil Co. August 31st, 1925. (257,564.)

26,335. "Telephone systems." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). October 21st, 1925. (264,593.)

26,362. "Variable condensers." B. Hesketh. October 21st, 1925. (264,595.)

26,379. "Systems of radio broadcast distribution." E. F. Colladay. October 28th, 1924. (242,266.)

26,418. "Variable capacity electrical condenser." F. E. Bancroft. October 22nd, 1925. (264,598.)

26,481. "Electrical measuring instruments." C. Bornmann. January 14th, 1925. (246,104.)

27,113. "Method of making high-resistance units." Dr. S. Loewe. November 6th, 1924. (242,625.)

27,275. "Current-limiting devices." W. J. Davis and T. F. Stent. October 30th, 1925. (264,605.)

27,759. "Secret telegraphic, telautographic, and photo-telegraphic wire or wireless systems." Soc. des Etablissements, E. Belin, and E. Belin. November 4th, 1925. (264,611.)

27,991. "Switching apparatus for telephone systems." Automatic Telephone Manufacturing Co., Ltd., J. Savin, and R. E. Boyd. November 6th, 1925. (264,616.)

28,068. "Electrically-driven pumps." L. S. J. Thompson and Mather and Platt, Ltd. November 7th, 1925. (264,619.)

28,293. "Electric signalling." A. J. King and Metropolitan-Vickers Electrical Co., Ltd. November 10th, 1925. (264,621.)

28,333. "Regulatable shunt motor for alternating-current with rotatable commutating poles." J. Sousedik. November 10th, 1925. (264,622.)

29,450. "Electric telegraph transmitters." G. Miniotti. November 22nd, 1924. (Addition to 189,267.) (243,386.)

30,907. "Anode batteries." J. Lewy. December 6th, 1924. (244,127)

30,908. "Anode batteries composed of pocket-lamp batteries." J. Lewy. December 6th, 1924. (Addition to 244,127.) (244,128.)

31,765. "High-frequency signalling systems." British Thomson-Houston Co., Ltd. January 27th, 1925. (Patent of addition not granted.) (246,808.)

32,214. "Method of increasing the ohmic resistance of pure iron, especially electrolytic iron." Siemens & Halske Akt. Ges. January 9th, 1925. (245,753.)

1926.

2,265. "Attachment means for lamp casings." British Thomson-Houston Co., Ltd., A. P. Young, and A. G. Salisbury. January 26th, 1926. (264,659.)

3,137. "Automatic electric devices influenced by direction of current flow." English Electric Co., Ltd., and A. R. Blandford. February 3rd, 1926. (264,666.)

4,499. "Telegraph and telephone conductors." A. Davidson and E. S. Heurtley. February 17th, 1926. (264,675.)

5,188. "Transformers." Johnson-Williamson Laboratories, Inc. April 11th, 1925. (250,544.)

7,231. "Transformer coils." R. S. Handelmaatschappij, Stokvis & Zonen. February 2nd, 1926. (264,685.)

7,789. "Arc-rupturing devices." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). March 20th, 1926. (264,363.)

7,937. "Alternating-current motors." Himmelwerk Akt. Ges. March 23rd, 1925. (249,565.)

9,086. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 18th, 1925. (250,928.)

9,191. "Correcting devices for use in synchronous telegraphy." Muirhead and Co., Ltd., F. H. Muirhead, E. S. Heurtley, and J. V. Foll. April 7th, 1926. (264,694.)

9,951. "Electric induction furnaces." J. R. de Zubiria. April 29th, 1925. (251,608.)

10,069. "Electric current converting systems." British Thomson-Houston Co., Ltd. April 18th, 1925. (250,965.)

10,529. "General arrangement of electric condensers." M. Sieverts Fabriks Aktiebolag. May 15th, 1925. (252,137.)

11,439. "Electric power transmission systems." British Thomson-Houston Co., Ltd. April 30th, 1925. (251,653.)

11,864. "Electrodes for electric furnaces." Norske Aktieselskab fur Elektrokemisk Industri. May 15th, 1925. (252,153.)

12,273. "Electrically-heated warming-pan." H. Höck and G. Höck. May 12th, 1926. (264,713.)

12,411. "Stopping devices for electric lifts." J. Mair. May 14th, 1926. (264,714.)

13,824. "Electrically-operated hammers and the like." A. Soulier. June 2nd, 1925. (253,110.)

14,066. "Electric discharge devices." British Thomson-Houston Co., Ltd. June 3rd, 1925. (253,126.)

14,363. "Automatic ignition circuit cut-out and lubricating-oil short-supply alarm attachment for automobile engines." E. A. M. Gibson. June 7th, 1926. (264,725.)

14,480. "Loud-speaking telephones." Lissen, Ltd., and R. P. Richardson. June 8th, 1926. (264,726.)

15,431. "Armouring for single-core alternating-current cables." Felten and Guilleaume Carlswerk Akt. Ges. October 10th, 1925. (259,536.)

15,637. "Vibrating diaphragm for sound recording and reproducing apparatus." P. G. H. D'Amour. June 20th, 1925. (253,943.)

16,768. "Headlights for motor vehicles and the like." A. Ringham. July 5th, 1926. (264,391.)

16,977. "Radio receiving systems." Standard Telephones and Cables, Ltd. July 7th, 1926. (264,392.)

17,005. "Multicore high-tension cables." Pirelli & Co. September 2nd, 1925. (257,895.)

18,949. "Acoustic diaphragms." L. Lumiere. August 1st, 1925. (256,252.)

19,033. "Acoustic diaphragms." L. Lumiere. September 28th, 1925. (Addition to 256,252.) (258,842.)

22,540. "Lead cable presses." F. Krupp Grusonwerk. Akt. Ges. October 13th, 1925. (259,934.)

22,647. "Thermionic tubes." British Thomson Houston Co., Ltd. October 8th, 1925. (259,550.)

23,119. "Electric insulators." J. Wilfort. September 20th, 1926. (264,758.)

23,835. "Electric motor combined with a rotary air suction or compressing device." G. O. Lehmann and A. Borsig Ges. September 27th, 1926. (264,422.)

24,405. "Device for rectifying alternating current." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 7th, 1925. (259,565.)

25,744. "Generating systems for high-tension electric currents." G. T. Thurneyssen. October 16th, 1925. (259,986.)

28,543. "Means for the electric ignition of internal-combustion engines." J. Bethenod. November 18th, 1925. (261,738.)

29,339. "Globe fittings for electric lamps." A. Chalmers. November 20th, 1926. (Cognate application 29,593/26.) (264,437.)

29,730. "Electric welding devices." International General Electric Co., Inc. November 24th, 1925. (262,112.)

31,005. "Electrical welding machines." E. G. Budd Manufacturing Co. December 7th, 1925. (262,484.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 9th :—

Tunomophone. No. 472,414. Class 8. Radio-telephonic receiving apparatus. —M. E. Elliott, The Thistles, Kemps Lane, Beccles, Suffolk.

The Fez Cap. No. 473,332. Class 8. Radio telephonic apparatus.—M. Lyon, Sudbourne Hall, Orford, Suffolk.

Virite. No. 476,392. Class 8. Electric cables.—Edison-Swan Cables, Ltd.

Sapian. No. 768,592. Class 13. Sparking plugs, &c.—La Société pour l'Industrie d'Accessoires, Paris. (British representatives: D. Young & Co., 11-12, Southampton Buildings, Chancery Lane, W.C.2.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ARMTHORPE.—Kinema, dance hall and billiard saloon; Garside & Pennington, architects, Pontefract.

AUDENSHAW.—Extensions, Delta Works; Mr. Austin Hopkinson, M.P.

BARNET.—Secondary school, Queen's Road; Herts Education Committee. Elementary school, Potters Road, East Barnet; Herts Education Committee. Elementary school, Underhill; Herts Education Committee.

BRADFORD.—Electrical fittings for botanical laboratory, &c., at Hanson School; education director. Proposed new club premises, with dance hall, &c. (£6,000); secretary, Idle and Thackley Constitutional Club, near Bradford.

BRISTOL.—58 houses at Woodland Way, for Corporation; Gibbs & Davies, Bissicks & Fletcher, and Roe & Gadd. Offices for Customs Department, City Docks; city engineer.

BURY.—Housing scheme (224); J. A. Settle, borough engineer.

CAMBRIDGE.—Schools, Brunswick (£43,096), for the Borough E.C.; J. Honour & Son, Ltd., builders, Tring. School (£13,024); Johnson & Bailey, builders.

CANNOCK.—Housing scheme (40), St. John's and Hunter Roads; Messrs. W. Harrison, Ltd.

CARDIFF.—Dance hall at Cathays, for Mrs. B. V. Sheppard; T. W. Price, architect, 35, Fields Park Road.

CASTLE DOUGLAS.—Electric lighting at the Town Hall; T.C.

CHEDDAR.—Reservoir, &c. (£650,000); Bristol Waterworks Co.

CHESTERFIELD.—Additional 50 houses, Highfield Hall Estate, for the T.C.; Rollinson & Sons, architects, Corporation Street. Conversion of old telephone exchange into municipal offices; Mr. Thomas Smith, Mansfield. Installation of electric lighting, Eyre Street Schools; Corporation architect.

DUMBARTONSHIRE.—New public hall at Duntocher, to cost (£4,500); clerk, Old Kilpatrick Parish Council, Dumbarton.

DUNOON.—Extensions at Hospital, including electric lighting, X-ray apparatus, and new operating theatre; medical superintendent.

EASTBOURNE.—30 houses, Hutment site; borough engineer.

EDINBURGH.—Additions and alterations at St. Anthony's School, Leith, to cost £6,400; master of works, Education Authority.

FARNHAM ROYAL (Bucks).—Factory, Buckingham Avenue, for Slough Estates, Ltd.

FOLKESTONE.—Dancing hall, Dover Road, for Lloyd Forsyth; J. L. S. Dahl, architect.

GLASGOW.—New hall in Bridgeton, for Salvation Army; Officer Commanding, Glasgow.

HARROGATE.—Electric light installation, St. Mark's Church; churchwarden.

HARTLEPOOL.—Housing scheme (42), Howard Street; borough surveyor.

HEMSWORTH.—Additional 500 houses, for the R.D.C.; surveyor.

HOOKERGATE.—Secondary school, Townley Estate, for Durham E.C.; director of education, Durham.

HORFIELD (near Bristol).—108 houses; Messrs. Jennings.

IRISH FREE STATE (Co. Tipperary).—Rebuilding Anner Castle; J. Hearne & Son, builders, Waterford.

(Dublin).—New Gallery, at Science and Art Museum, Kildare Street; T. Cassidy, secretary, Public Works.

IRLAM (Lancs.).—Works extensions, Liverpool Road, for the Hulme Patent Advertising Match Co., Ltd.

KILLAMARSH.—Housing scheme (600), for J. & G. Wells, Ltd., Eckington Colliery.

LETCHWORTH.—Secondary school, Spring Road; Herts Education Committee.

LIFTON (Launceston).—Re-erection of flour mills, for S. Coles.

LINCOLN.—Municipal offices, for the T.C.; borough surveyor. Houses (40), Doddington Road, for Horton & Co.

LIVERPOOL.—Houses (200), for the T.C.; W. H. Davey and Co., builders, Runcorn.

LONDON (Becontree, E.).—Shops on Dagenham section; Mr. J. G. Tilley.

(East Ham, E.).—60 houses, Central Estate, for Corporation; Mr. S. E. Moss.

LONDON—*continued.*

(E.C.).—Post Office buildings, Houndsditch; Postmaster-General.

(St. Pancras, N.W.).—Offices for Weights and Measures Department, Euston Road (£28,000); L.C.C. architect.

(Greenwich, S.E.).—Operating theatre, Woolwich Road Hospital, for the B.G.; William A. Pite, Son & Fairweather, architects, 12, Carteret Street, Queen Anne's Gate, Westminster.

(Lewisham, S.E.).—Large departmental stores on site of Messrs. Strouds, Ltd., premises; Royal Arsenal Co-operative Society, Woolwich, S.E.

(Shooter's Hill, S.E.).—Isolation accommodation, Brook Hospital; Carrington, Thomas & Co., Ltd., Beckenham, for M.A.B.

(Southwark, S.E.).—Shops on Tabard Street Estate, for L.C.C.; Mr. R. J. Rowley, of Tottenham.

(Woolwich, S.E.).—Additional 113 houses, for the T.C.; borough surveyor.

(W.C.).—Theatre on the Meux Brewery site, corner of Oxford Street and Tottenham Court Road; the Casino Theatre, Ltd.

LONGRIGGEND.—Sanatorium extensions, with electrical work, for Lanarkshire C.C.; P. C. Smith, architect, District Offices, Hamilton.

MALTBY.—Secondary schools, for West Riding E.C.; director of education, County Hall, Wakefield.

MARKET HARBOROUGH.—Factory extension, Little Bowden; W. Symington & Co., Ltd.

MINEHEAD.—Secondary school, for Somerset E.C.; A. J. Toomer, county architect, Lloyd's Bank Chambers, Weston-super-Mare.

MISTLEY.—Extensions at Brunswick House Asylum; L.C.C. architect.

NORTON (Stockton-on-Tees).—Kinema, Norton Avenue, for the Norton Cinema Co., Brandon.

NOTTINGHAM.—Elementary school for 1,000 at Lenton Abbey Housing Estate; Education Committee.

OCKENDON.—Mental hospital; West Ham Corporation.

PERRANPORTH (Cornwall).—Hotel on Rean Sands (£25,000); H. L. Wilson, solicitor, Truro.

PLYMOUTH.—Extensions to the South Devon and East Cornwall Hospital (£40,000); general superintendent. Electric wiring, Stonehouse Town Hall; borough engineer. 172 houses, St. Budeaux, for dockyard men; Admiralty. Proposed silo, suction plant and deep water berth; Port Development Committee.

PONTEFRACT.—Houses (500), for the T.C.; builders, J. W. Halliday, Worksop; Hibbert & Sons, Barnsley; T. W. Senior & Sons; F. W. Atkinson, Brigg; and John Stockhard, Cudworth.

PRESTWICH.—Housing scheme (50); M. A. Piercy, architect, Town Hall.

SALISBURY.—Houses (90), for the T.C.; Clarke & Co., builders.

SEAHAM.—Seaham Hall, conversion to sanatorium; Durham C.C.

SHEFFIELD.—Eighteen new schools; Education Committee. Housing scheme (158); W. G. Davies, city architect.

SOUTHPORT.—Housing scheme (56 further houses); borough engineer.

STALYBRIDGE.—100 houses, Harrison Estate; borough engineer.

STEYNING (Sussex).—Houses (56), for the R.D.C.; White and Co., builders, Haywards Heath.

STOCKPORT. — Public washhouses (£7,000), electrically equipped, for the T.C.; borough surveyor.

STOCKTON-ON-TEES.—Municipal buildings, for the T.C.; Lanchester, Lucas & Lodge, architects.

STRETFORD.—70 houses, King's Road and Ravenswood Road; Mr. W. R. Rochelle and Mr. G. A. Russell.

SWINDON (Wilts).—Houses (69), for A. J. Colborne, builder.

TAUNTON.—Maternity home, Canon Street, for the T.C.; Samson & Colthurst, architects, 1, Hammet Street.

THORNE (Doncaster).—Rebuilding works, for the British Moss Litter Co., Ltd.; John Clayton, builder.

TUNSTALL.—Extensions, Alexandra Pottery, Scotia Road; Johnson Bros., Ltd.

UPTON (Yorks).—Additional 262 houses; Housing Corporation of Great Britain, Ltd.

WATFORD.—Extensions, Girls' Grammar School; Herts Education Committee.

WELWYN.—100 houses, Garden City; R.D.C. surveyor.

WINCHESTER.—Housing scheme (42), for the T.C.; city surveyor.

The

Electrical Review

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Contents:

	PAGE
Our Advertising Competition	285
The Growth of the Fair	286
Cheapen Electricity!	286
Ductile Tungsten in the United States	286
Over the Loetschberg on a 4,500-h.p. Locomotive, by Theodore Rich (*illus.*)	287
Sag Calculations for Power Transmission Lines, by William T. Taylor (*illus.*)	290
Standard Performances for Electrical Machinery, by F. T. Chapman (*concluded*)	292
Unemployment Insurance, by Jos. J. H. Stansfield	294
Indian Electrical Notes	295
Parliamentary News	295
Legal	296
Business and Industrial Notes	297
Lighting and Power Notes	300
Tramway and Railway Notes	302
Telegraph and Telephone Notes	302
Radio Notes	303
Contract Information	303
Forthcoming Events	305
Notes	306
Institution Notes	309
Our Personal Column	309
Financial Section—	
New Companies Registered	310
Official Returns of Electrical Companies	311
City Notes	311
Stocks and Shares	313
Our Foreign Electrical Trade	315
The British Industries Fair—II. (*illus.*)	316
The Stability of A.C. Systems, by F. H. Clough (*illus.*)	322
South African Railway Electrification	324
Correspondence—	
A Memorial to Faraday	325
The Earthing of Portable Domestic Appliances	325
Electricity Supply Tariffs	326
A Knotty Problem	326
Kiosk-Type Sub-stations	326
The Salaries of Engineers	326
Extra-High-Pressure Transmission	327
Published Specifications	327
Trade-Mark Applications	327
New Work for Contractors	328

Our Advertising Competition.

ON Thursday last week the judging took place in connection with our second advertising Competition. On this occasion the judges were:—Mr. J. W. Beauchamp, Director and Secretary of E.D.A.; Mr. W. F. T. Pinkney, of the Newcastle-upon-Tyne Electric Supply Co., Ltd.; and Mr. H. T. Young, of Messrs. Troughton & Young, electrical contractors, Knightsbridge.

In this series the subjects of the advertisements were divided into three classes, namely: Class I, generating plant, switchgear, batteries, and heavy machinery in general; Class II, fittings, switches, lamps, heating and cooking apparatus and general accessories; Class III, instruments, meters, telephones, cables and wires, and miscellaneous apparatus. The results were as follows:—

FOR THE BEST SIX FULL PAGES.

CLASS I.—*Prize*, £50. Awarded to The British Thomson-Houston Co., Ltd., Rugby, whose advertisements were prepared by Mr. A. L. M. Ayers, manager of the advertisement department.

CLASS II.—*Prize*, £50. Awarded to The Ormond Engineering Co., Ltd., whose advertisements were prepared by Messrs. Bertram Day & Co., Ltd.

A special award of £25 in this class was made to Messrs. W. T. Henley's Telegraph Works Co., Ltd., for their "ISCO" advertisement.

CLASS III.—*Prize*, £50. Awarded to The Stella Conduit Co., Ltd., whose advertisements were prepared by Messrs. H. P. Pope, Ltd., of Birmingham.

FOR THE BEST SIX HALF PAGES.

As there were not sufficient entries in each of the three classes, they were all judged as one class.

First Prize, £25. Awarded to The Varley Magnet Company, whose advertisements were prepared by Messrs. E. Walter George, Ltd., of High Holborn, London.

A special award of £15 was made to The Midland Electric Manufacturing Co., Ltd., whose advertisements were prepared by Mr. John F. Preston, of Birmingham.

The report of the Judges will appear in our next issue; in the meantime, the Directors of the Electrical Review wish to record their grateful thanks to them for the painstaking efficiency with which they carried out the difficult task of deciding the relative merits of so many excellent entries.

The Growth of the Fair.

Some idea of the remarkable progress that the British Industries Fair has made in the estimation of our manufacturers may be gathered from figures indicating the number of exhibitors in London and Birmingham this year compared with last year's total. At Birmingham the number of exhibits has increased from 400 to 600, while in London the number of firms exhibiting has grown from 600 to 900. The whole of the available space at the White City, London, has been absorbed; it is understood that the number of firms exhibiting would have been larger still but for the limitation of accommodation. At Castle Bromwich, Birmingham, the actual increase in space occupied is larger than the percentage increase in number of exhibitors. There, however, there is practically unlimited site extension accommodation at the disposal of the authorities, and the Birmingham Chamber of Commerce is prepared to add more and more buildings as the popularity of its part of the Fair grows.

It seems certain that the Government Department concerned with the future of the Fair and the Birmingham Chamber will have to consider together this important question of site and space as the Fair reaches the greater place which it seems destined to occupy in relation to our export and Home trade development. Seeing that London has reached its space limit and Birmingham has by no means done so, it might be as well to transfer some of the London trades to Birmingham next year.

Large as the Fair is to-day, the fact remains that approximately 1,500 firms is not an adequate representation considering the vast number of British manufacturing concerns who should be interested in a National Market designed to attract hosts of overseas buyers. The larger the number of firms regularly taking part, the more permanent will be the basis upon which the Fair will be built up; to that end those missing from the present demonstration would assist the authorities in making future plans by intimating their interest at an early date.

Cheapen Electricity!

The price of electrical energy is one of the most important topics of the time—and one of the most difficult to discuss without going deeply into details. No two areas of supply are alike; local conditions and the past history of an undertaking exercise great influence over the position of affairs to-day, and when we meet with anomalies, as we frequently do, it is unsafe to stigmatise them hastily and without examining the relevant facts. In this respect the supply of electricity differs fundamentally from that of gas and similar commodities, which can be produced at one time, stored, and distributed at another time; the load factor and the nature of the load must be taken into account, and the "average revenue obtained per kWh" is only part of the story.

It is true that the Weir Report, signed in May, 1925, pivoted largely upon the average price charged to consumers for all purposes, which was stated to be (in 1923) 2.047d. for statutory undertakings, relating to rather more than half the total electricity consumed in this country; the remainder probably cost much less, and the true average may have been well under 1.5d. The greatest stress was laid on the estimate that by 1940, under the conditions existing when the Report was drawn up, the average price for public supply would probably not be lower than 1.75d., and certainly not less than 1.5d., and the scheme put forward in the Report was expected to reduce the average price in 1940 (or when the consumption reached 500 kWh per head) to "1d. or under."

The Return of Engineering and Financial Statistics issued by the Electricity Commissioners for the years 1924 and 1925 showed that the revenue from sale of energy of all statutory undertakers in 1923-24 was 1.86d. and in 1924-5 1.75d.—a marked reduction in two years. It will be seen that if this high rate of progress could be maintained, by 1931 the goal aimed at by the Weir Committee of 1d. per kWh would be attained without the help of any new Act or Board. Perhaps we shall have the opportunity to witness the event, for it is generally held that the operations of the Central Electricity Board cannot produce much effect in less than five years. The revenue from power units in 1924-5 averaged 1.07d.

We repeat, then, with increased confidence, the claim that we have previously made that, on the whole, electricity is relatively cheap in this country. The same truth is proclaimed from time to time by those who visit other countries where electricity is supposed to be cheap. Nevertheless, we are far from satisfied with the position. The fact remains that the charges for lighting, and for domestic uses, are often higher than they should be. We would urge electricity supply undertakers to take their courage in both hands and offer their domestic consumers really attractive terms. They will be surprised at the result—but they will have no difficulty in balancing their accounts. They are far too cautious, and wait for the demand to reduce the price instead of reducing the price to increase the demand.

Ductile Tungsten in the United States.

It will be observed with interest that, according to a recent decision of a United States Court, the Coolidge patent for the production of tungsten wire ductile in the cold state has been declared invalid, on the ground that the ductility is a natural property of the metal and is not patentable. This decision follows that of the House of Lords two years ago, which was based on similar reasoning. Apparently the legal view was that tungsten wire, if it existed, was inherently ductile, and its production was merely the result of normal progress in the art of the metal-worker.

Apart from commercial considerations, our sympathies are with the inventor of the process which made the drawn-wire lamp practicable and effected a great forward step in the history of the incandescent lamp. The injury is aggravated by the fact that the Edison Medal for 1926 was awarded to Dr. Coolidge in December last for the origination of ductile tungsten and the improvement of the X-ray tube, and he has felt obliged to decline that great honour owing to this adverse decision. Whilst we do not question the propriety of his action in this matter, we feel that the fact is regrettable; the distinction was well earned, and it is unfortunate that the award should be nullified merely on the ground of a legal interpretation of the claims of his letters patent. Dr. Coolidge's electrical confrères are well aware of the real value of his work on the tungsten lamp, which is in no way affected by the Court's decision.

Over the Loetschberg on a 4,500-h.p. Locomotive.

Modern electric railway practice, embodying the use of a new Sécheron locomotive employing 12 motors in 6 units, and a new quill spring drive.

By THEODORE RICH.

THERE is a general impression that all the important railways in Switzerland are owned by the Federal Government, whereas there is a considerable mileage of line still owned and operated by private companies; one of the most active of these is the Bernese Alps Railway, which owns the Loetschberg Railway, as well as one route from Berne to Thun, a line from Berne to Neuchatel, and an important link between Legnau and Moutier on the Délémont-Berne line. The Loetschberg tunnel route differs from the St. Gothard and Mont Cenis routes in that it was designed from the start for electrical operation. From Spietz, where the Loetschberg section begins, to Brigue, not far from the entrance to the Simplon tunnel, the distance is 74.4 km. (46.2 miles); the maximum grade is 1 in 37, with an average of 1 in 57 on the north side and 1 in 48 on the south, the altitude reached being 1,242 metres (3,400 ft.). The minimum curvature is 300 metres, 55 per cent. of the line being on curves. The main tunnel has a length of 14.6 km. (about nine miles).

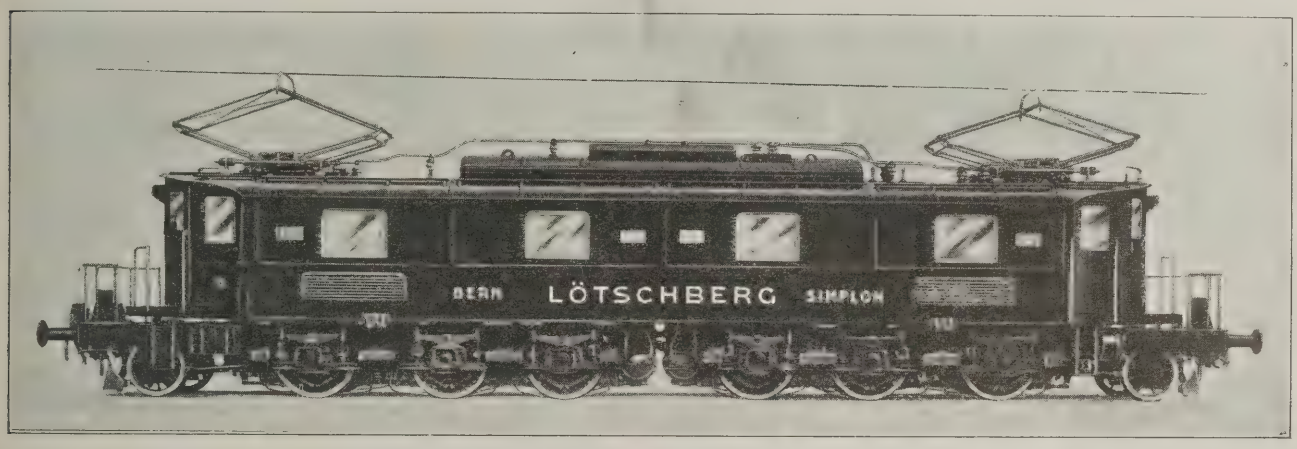


Fig. 1.—A 4,500-h.p. Sécheron Locomotive.

The Sécheron Locomotive.

Until recently the traffic was mainly handled by 2-10-2 locomotives crank-connected to two twin gear-driven dummy shafts, with two single-phase motors of a combined capacity of 2,500 h.p., rated on a 1½-hour basis; these locomotives were designed to haul 300 tons each, three round trips Spietz-Brigue and back in the 24 hours on the standard schedule without overheating. The traffic on the line has been gradually increasing, and instead of using two shorter trains, or one train with two locomotives, it was decided that a material saving in operating costs would come about through the use of a locomotive of a more powerful character; two locomotives were therefore ordered from the Sécheron Company (Société Anonyme des Ateliers de Sécheron) at Geneva, to haul a load of 560 tons up a grade of 1 in 37 at 50 km. (31 miles) per hour. Fig. 1 shows one of the locomotives. It is arranged with six driving axles, and leading and trailing axles, fig. 2.

The total weight is 141.6 metric tons, with an adhesion weight of 114.6 metric tons, or 19 tons per axle The total length over the buffers is 20.26 metres (66 ft. 5 in.), and the diameter of the driving wheels is 1.35 metres (about 52 inches). The gear reduction is 1 to 5.866. There are 12 motors in pairs, fig. 3, each 375 h.p., giving a combined capacity of 4,500 h.p. at 50 km. per hour at the driving axles on a 1-hour rating, or 3,700 h.p. continuously. The motors in each group are arranged permanently in series. The maximum speed is 75 km. (46.6 miles per hour), although the numerous twists and turns on the line will not allow of such a speed being used in practice.

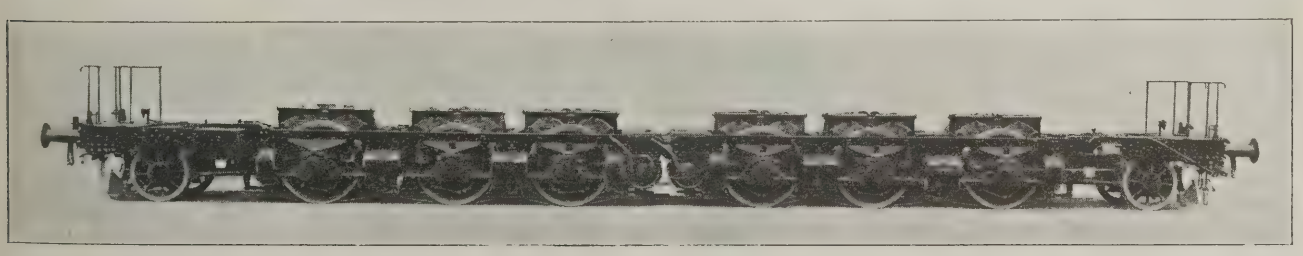


Fig. 2.—The Sécheron Driving Trucks.

Each pair of motors, therefore, has a combined capacity of 750 h.p. Each driving axle has two geared motors driving a quill shaft with a play of 13 mm.,

the movement up and down being allowed for by spiral springs. The Sécheron Company had previously built a number of locomotives for the Swiss Federal Railways with what might be termed tangentially-arranged spiral springs on the Westinghouse system; when it came to the arranging of a similar drive where six axles were concerned, a difficult problem arose in order to get the driving wheels into the space available. A new design was got out and patented by the Sécheron Co. which, instead of driving

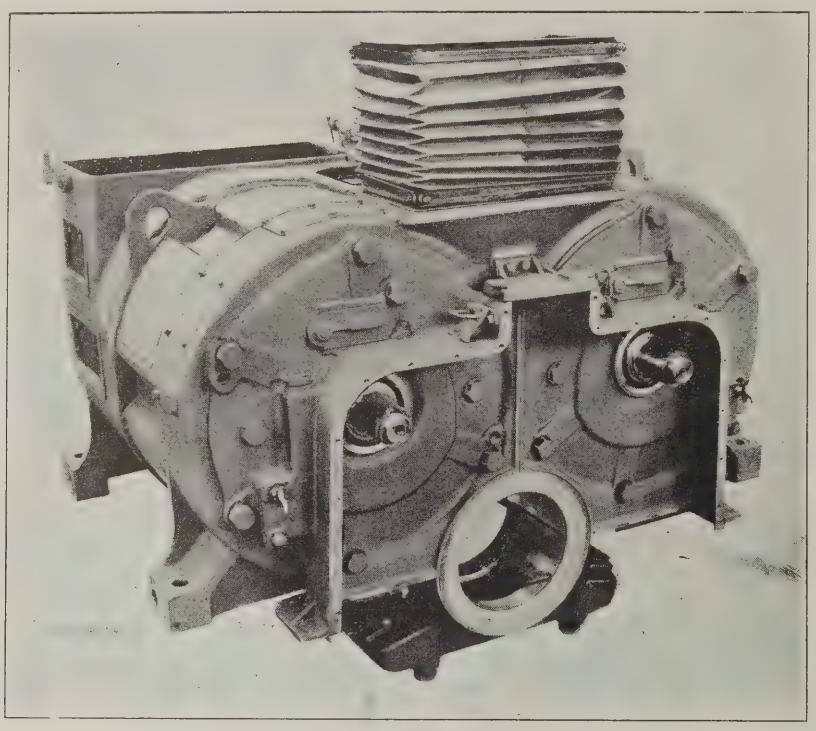


Fig. 3.—Twin-motor Driving Unit, 750 h.p.

on to the spokes with a sort of hand-shaped seat attached to the quill, drives across the spokes on to brackets attached to the inner rim of the wheel, the springs being arranged in pairs. Fig. 4 shows on the right the new type of spring drive as compared with the earlier construction, left. By this means it was possible to use driving wheels of 1,350 mm. (53.2 in.) diameter, thus reducing the unsprung weight by nearly 16 cwt. per axle. The design is such that the number of bolted parts is reduced to a minimum, and the clearance between the quill and axle can be increased. In order to reduce the strain on the springs owing to centrifugal force, they are mounted with an initial stress.

The motors have a series characteristic; they are of the single-phase type operating through a transformer off 15,000 volts at $16\frac{2}{3}$ cycles. Each set of three twin motors is mounted on a steel-plate truck, the trucks being connected by one straight link and one cross link; no haulage strain thus comes on the cab frame. The regulation of the motor is carried out by means of transformer tappings with the aid of pneumatic contactors. With the usual system of pneumatic operation, the air valves are operated by means of solenoids electrically connected to the controller; the Sécheron Co., however, designed a system with some novel features. A cam shaft is run along under the cylinder bases, the cams operating directly on the valve-stalk heads; a slow motion is given to the cam shaft by means of gearing, the shaft running from end to end of the locomotive, so that it can be operated mechanically from either driving position. The contactors are in two banks of 12 each in one long line, one for each group of three driving axles, the sets of cams being, so to speak, in tandem. By this means the wiring of the cab is very greatly simplified; it is claimed that nearly 3,000 metres of contactor circuit is obviated through the mechanical operation of the valves.

By means of an arm on the contactor jaw, the cam shaft is interlocked so that it cannot move further until the contactor has fulfilled its function. By means of an emergency push-button provided at each of the driving platforms, which destroys the equilibrium on both sides of an air-operated piston, the valve-operating cam shaft is shifted sideways so that all the valve tappet heads slip off the cams, thus opening all the contactors simultaneously. The controller is operated by turning a hand wheel which is geared to the cam shaft. Powerful air compressors are fitted to operate the air brakes and pneumatic contactors. In proportion to the power available at the draw-bar, the locomotive, as a single-phase machine, is remarkably light in weight, being only 31.5 kg. (69.3 lb.) per horse power, a figure materially lower than that of most d.c. heavy locomotives; in mountain work it is most important to reduce the dead weight to a minimum relatively to the haulage power. Rheostatic brakes are available.

Power Supply.

The current for the operation of the line is furnished by the Bernische Kraftwerke Company, which owns two power stations in the Kander Valley, at Spietz (64 m. fall) and Kandergrund (300 metres). Energy is purchased on the basis of a pre-war contract at about 3.5 c. per kWh (about .336d.) (although the power company cannot be called upon to supply more than a certain quantity at this figure), whereas in the case of post-war contracts in Switzerland, a price for traction duty of 7 to 8 c. is more usual. The Spietz station furnishes the current for the section Spietz-Fruitigen, 13.54 km. long, and the Kandergrund station for the remaining 60 km. to Brigue, which is divided into two sections; the two stations are operated in parallel. The generators are wound for 15,000-17,000

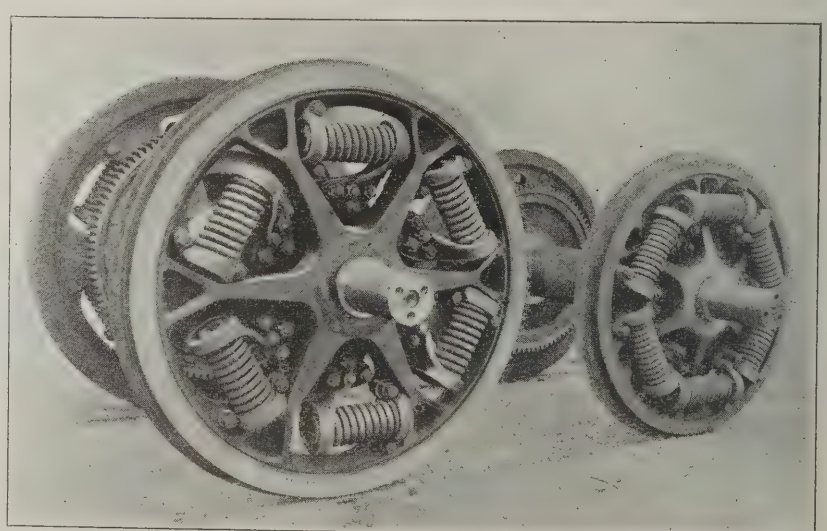


Fig. 4.—Old and New Quill Drives.

volts, $16\frac{2}{3}$ periods, single-phase; they feed the trolley line without any intermediary transformer.

A double feeder, consisting of two bare copper conductors 8 mm. in diameter, runs from end to end of the line. The trolley line is divided up into sections, but linked up at the stations to the feeders by means

of hand-operated oil switches; such operation of these switches as may be required is carried out by the station staff. The contact wires in the goods sidings are fed separately, so that at normal times they can be kept "dead." The maximum circuit breakers at the main feeding points open on to a current-limiting resistance, so that it can be seen whether a short has cleared itself. At each station feeding point a solenoid is placed in the line circuit operating a bell circuit. In the case of a "short," all the solenoids between the fault and the feeding points operate the bell circuits; by finding out which is the furthest bell that has rung, the damaged section can be located.

The trolley wire cross section is 100 sq. mm. along the line, as it acts as an auxiliary feeder; the construction is of the catenary type, with a steel carrier cable of 50 sq. mm. cross section. At these points the supports are of steel lattice work (fig. 5).

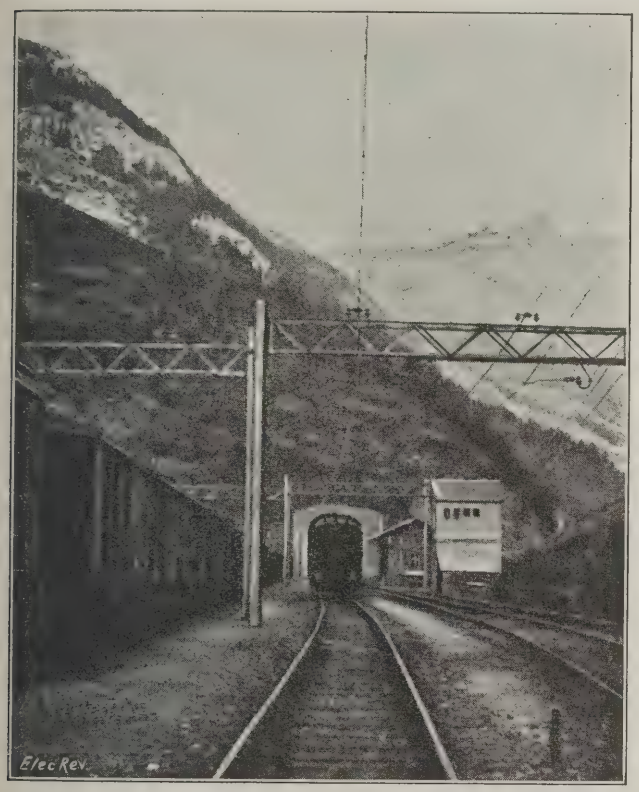


Fig. 5.—Overhead Construction at Goppenstein.

At the stations the trolley wire cross section is 55 sq. mm., the main trolley circuit being bridged round at these points. The trolley supports are of H-section steel with wide flanges, with steel brackets and double insulation; the normal span on the straight is 60 metres. In the main tunnel the supports are 22 metres apart, a copper-clad steel wire acting as the carrier. The trolley wire is placed 4.8 metres (15 ft. 8 in.)) above the rails in the tunnels, 6.7 metres (22 ft. 3 in.) at the stations, and 5.7 to 6.0 metres (18 ft. to 19 ft. 8 in.) on the open line.

A Run Over the Line.

Shortly after the termination of the Basle Conference in September, thanks to the intervention of Mr. Mayfarth, the managing director of the Sécheron Co., of Geneva, and the permission of the managing director of the Bernese Alps Railway, the writer was able to take a run over the line in one of the new locomotives. He went on board shortly before seven in the morning at the railway station of Spietz, which lies about 230 ft. above the lake of Thun; with a goods load behind the locomotive of 505 tons, after the slow start desirable with a long train, speed was rapidly picked up, and on leaving the station yard, up a rise of 1 in 66, it went up to about 40 km. per hour; shortly after leaving, a tunnel nearly a mile long was encountered; later the speed went up to 50 km. The main ammeter showed about 120 amps. with 17,000 volts, or 2,040 kVA. Up to Fruitigen the grades do not exceed 1 in 64. This section of the line was opened in 1902; Fruitigen is well known as the station for Adelboden. From Fruitigen to the northern mouth of the main tunnel there is a continuous grade of 1 in 37. On this section the speed repeatedly went up to 31 miles per hour, decreasing a little where the curves were very frequent. The pressure kept up very well at from 16,000 to 17,000 volts, the current at times being about 240 amps. at the lower of the above voltages, giving 3,840 kVA. The cab is arranged with six ammeters of a sector shape, one for each twin motor group; an ammeter and line voltmeter is arranged at each end, and an integrating wattmeter at one end. As with most locomotives on the Continent, a recording and indicating speed meter is fitted. For operating the contactors, a hand wheel is turned, a pointer showing how the control stands. The locomotives are capable of hauling 550 tons. The number of loaded trucks which can be hauled is limited by the pull allowed on the couplings and draw-gear of the trucks. It was useless, therefore, for the makers to arrange any multiple-unit gear, as, without a further locomotive at the back, one locomotive can take a train of the normal maximum weight.

There were two men on the locomotive; the mate had but little to do during the run; he controlled the two fans which blow air through the traction motors, according to the work to be done placing them in series or in parallel; for a material part of the time he looked out for the signals and called to the driver as he spotted them. The locomotive negotiated the 300-metre curves with great smoothness, without any of that lurching sometimes observable with steam and electric locomotives. The mechanical part of the locomotive was made by Ernesto Breda, of Milan, and the easy running reflected great credit on the makers.

Shortly after entering the tunnel, a white mist was encountered; this sometimes happens under certain atmospheric conditions, although there is no fog at either side in the open. The powerful headlights penetrated the mist very well. Later it was evident that a lot of water was coming through the tunnel walls, almost like rain. At one time after the opening of the line the 15,000-volt trolley line insulators gave a lot of trouble owing to the deposit of dust and salts from the percolating water. This has been got over to a considerable extent. To carry off the water the tunnel is arranged with a hump in the middle. At the southern mouth of the tunnel, fig. 5, the view towards the mountain top is very fine. After a comparatively short distance the line turns to the east, and the Upper Rhone Valley is seen over 1,300 feet below; the line lies on a shelf and slopes down to Brigue at about 1 in 45. During the run down the speed was kept at about 25 miles per hour; the electric brakes were used to a great extent, operating through resistances.

At Brigue a junction is made with the steam-operated section of the Swiss Federal line from Geneva and Lausanne, the lower part of which is operated on the single-phase system, also with $16\frac{2}{3}$ periods. From the station of Brigue onwards through the Simplon tunnel the traffic is worked by means of three-phase locomotives. The single-phase tracks are kept clear of those fitted with 3-phase overhead work, the goods and passenger trains being shunted from one line on to the other with the aid of a steam locomotive. During the recent difficulties in the Rhone Valley when, as a result of an avalanche, the Upper Rhone Valley railway was blocked, the traffic was taken over the Loetschberg *via* Berne.

Certainly there are few better ways of seeing a railway across Swiss mountains than from the cab of an electric locomotive, especially when the "Clerk of the Weather" shows what he can do.

The thanks of the writer are due to the Bernese Alps Railway Co. and to the Sécheron Co., of Geneva, for the above particulars. In the preparation of the notes use has been made of an article by M. L. Thormann, chief constructional electrical engineer.

Sag Calculations for Power Transmission Lines.

A consideration of the requirements for Overhead Conductors under varying working conditions due to changes in temperature, wind pressure, ice covering, &c.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

IT is now generally recognised that the modern construction of power transmission lines requires a more careful determination of the sags and tensions of the conductors. For such work, which nowadays involves much more steel construction and much longer spans than was the practice in the past, it is necessary to so choose the sags as to maintain a safe and economic balance between conditions such as:—

(*a*) The strength of line supports required to resist the conductor-tension, at terminal points and tangents in the line, with moderate or small sags; and

(*b*) The dimensions of line supports required for minimum ground clearance, and for proper separation of the conductors from each other, for large sags.

Without question, the material best suited in the majority of cases to meet these and other requirements for maximum economy is the hard-drawn copper conductor; for most of the bigger lines, cable would be used. In tower line construction the tendency has been to employ longer and longer spans, which practice has resulted in excessive cost of supports and, in many cases, an increased instead of a decreased insulator hazard. Due to this practice, the tendency is to reduce the maximum allowable tension. This condition naturally applies more rigorously to the higher-strength line conductors such as steel, aluminium-steel and copper-steel, than to the *all* aluminium and copper conductors. That is to say, for hard-drawn copper, 50 per cent. of the ultimate tensile strength would more generally be the rule, but, for aluminium-steel, only 40 per cent. or even 30 per cent. of the maximum stress may be used. Thus, from the strength point of view, the use of copper for the main line—excluding certain special spans, which will always employ copper steel (copperweld) where copper is used for the main line conductor—may be ample to meet all requirements.

For hard-drawn solid copper conductors, the above remarks for maximum allowable tension do not apply because the normal maximum tension of the largest size of conductor is no greater than 4,300 lb. It is very important that the *proper* sag of lines be given in each case. Too large a sag is objectionable for the reason that it may require higher line supports to give the necessary ground clearance required by law, or the span length may be reduced, which would in turn require a greater number of line supports, insulators, &c.; also, a larger sag would mean greater spacing of the conductors to prevent them from swinging together. Hence, there may be a disadvantage in the use of, for instance, too high a value for the modulus of elasticity E, where the smaller sizes of stranded conductors are used on fairly long spans. With a small conductor or a conductor of light weight used on a long span, it is often found that the sag just about necessary to keep within the elastic limit when subjected to its maximum loading in winter will produce a very slack line in summer, and, if very wide separation of the conductors is not allowed, they are likely to be blown together. This condition is made still worse where use is made of too high a value of E in the calculation for sag. In the United States, Canada, and other countries it is customary to use a higher value of E for solid than for stranded conductor; the commonly accepted value of E for solid copper (hard drawn) is 16,000,000 lb. per sq. in. As a small conductor is stronger than a large conductor of equivalent sectional area, the tension allowed in stringing should be greater than for the equivalent stranded conductor of large size; with this in mind, there may be reason for rating both solid and stranded conductors for one value of E. In this way the values are better "evened up" than is the case where the mechanical constants are changed by stretching stranded conductor so that W, A, *d*, &c., are different from the recognised values used in the original calculations for sag.

In the calculations for sag, many variables come into play. In the first place, calculations are made on the assumption that the supports are at the same level. We also start out assuming that the supports are absolutely rigid and that the conductors are fixed solidly to their supports, *i.e.*, that supports do not have any flexibility at the top, and that the conductors do not slip through their bindings at the insulators, or that the suspension insulators are not free to swing in the direction of the line, &c. Also, in the design of a line we start out knowing that there is, or that sooner or later there will be: (*a*) variation in weight and area of material from the value assumed in the original calculations; (*b*) uncertain value of tensile strength and/or elastic limit of the material from that assumed; (*c*) uncertain value of coefficient of expansion as well as modulus of elasticity; (*d*) variation of weight along the line due to non-uniformity of ice and/or to density of the ice varying through wide limits from the value originally assumed, &c. As an instance of a small change in the sectional area A, take the two standard sizes 0.025 sq. in. and 0.02545 sq. in. (the difference in area is 0.00045 sq. in.); in a 1,000 ft. span the difference of 0.00045 sq. in. in A will produce a difference of 36 inches in sag for the same temperature and same loading conditions.

For a given material the size of conductor has more of a determining effect upon the possible length of span than any other condition. For line supports at the same and at different levels, there is a proper ratio between the permissible span length, the size of conductor, and the different weather conditions; the most economical span is dependent upon many different and variable conditions—local, mechanical and electrical. Certain of the *actual* local conditions may never conform with the requirements of the Regulations for Overhead Lines. These Regulations intend to provide for safety as regards tension and sag, requiring that:—

(*a*) Maximum tension be taken at a temperature of 22 deg. F. Actually, the maximum tension occurs *at the lowest temperature* with the actual maximum loading; and

(*b*) Maximum sag be taken at a temperature of 22 deg. F. for maximum loading (see footnote Table II), or at maximum summer temperature. Actually, the maximum sag occurs *at the highest temperature at which sleet will form*, in conjunction with ice and wind loads, not the specified values.

Under maximum specified loading conditions the con-

ductor may be stressed to the maximum allowable tension of the material. The conductor is therefore longer under such conditions and the sag greater than an unstressed (or unstretched) conductor. If the temperature increases, the stress will decrease because the expansion of the conductor will cause an increase in sag. At a certain sag, the two tendencies will balance each other. On the other hand, if the maximum load is removed—as would be the case in summer—the decreased stress on the conductor will allow it to contract, thus decreasing the sag, which condition increases the stress, but in this case the sag is made greater due to the increased length or stretch of the conductor. These two tendencies also tend to balance each other. Thus, variations of temperature for any loading produce variations in the length of conductor, and variations of length produce variation in sag. As a conductor tightens up with a decrease in temperature, the resulting increase in stress stretches it, and the stretching keeps the stress below what it would be if there were no stretching. On examination of the tables, these various changes are seen to be evident. For instance, in winter the conductor is stressed to its maximum tension, and the sag under maximum loading conditions is seen to be as great or greater than under any other weather condition, *i.e.*, the conductor is stretched so that it is longer; also, when the maximum load is removed, the decreased stress in the conductor will allow it to contract, thus decreasing the sag, which condition tends to increase the stress; and, when the temperature is increased, the stress in the conductor is further decreased because the expansion in the conductor causes it to sag more; also, with a decreasing temperature, the conductor tightens up and the resulting stress stretches it—this stretch is the best indicator of the ability of the material to resist severe loads; on the other hand, a brittle conductor is a dangerous conductor, and demands a higher factor of safety.

The Regulations specify 24 tons per sq. in. or 53,760 lb. per sq. in. section for solid hard-drawn copper; for cable, a reduction factor should be taken into account. They also specify a factor of safety of 2.0, or an allowable tension of 26,880 lb. The elastic limit of hard-drawn copper is somewhat greater than one-half the ultimate tensile strength, and can be safely taken at 55 per cent. of the ultimate tensile strength. However, the values used in the accompanying tables for the different sizes are those recommended by the Electricity Commissioners* (see Table I). The modulus of elasticity E is specified as 18,000,000 for hard-drawn copper (solid *and* stranded); this value is high for stranded conductor; it is used in the tables for solid conductor. The value of the coefficient of linear expansion α is taken at 0.0000093 per deg. F. Maximum loading P refers to a load (specified by the Electricity Commissioners) of one-half inch radial ice coating and 8.0 lb. wind pressure (right angles to the line) at a temperature of +22 deg. F. (The *constant* for this wind pressure $p=0.0032v^2$; where $v=\sqrt{312.5p}$. In the United States and Canada the generally accepted value for $p=0.0025v^2$; where $v=\sqrt{400p}$).

As it is the practice to consider only *standard* sizes of conductors, and as one kind of material and one size of conductor for each transmission line (circuit) is the general practice, it is sometimes better to make a chart or diagram in terms of one size of conductor, for the use of men in the field. With time, the sizes given in the tables may change, but while the characteristics of the material remain the same, and the loading conditions remain unchanged, it is but a simple matter to plot a chart or graph, so that any size of conductor can be chosen to suit any standard, and any sag value can be determined from the tables for any span length and any change in temperature. The tables† should prove useful both as a means of quickly comparing results with changed loads and also for drawing diagrams or charts to cover any intermediate value of span, temperature and size of conductor, &c. In order that the erection gang obtain accurate values of sag and temperature (or tension, which is obtained by use of the general formula: $P=l^2w/8D$) for any intermediate span length, all that is necessary is for the engineer to mark off the values of sizes in use or to be used on the line, and plot the values on cross-section paper or on

TABLE I.—LOADING ON HARD-DRAWN SOLID COPPER CONDUCTORS UNDER THE ELECTRICITY COMMISSIONERS' RULES.

(*See foot-note Table II.*)

A	d	P	2P	Stress in tons per sq. inch.	w	$w_{11}=w+\cdot62(d+d_1)$	$w_{111}=\frac{3}{8}(d+2d_1)$	$W=\sqrt{w_{11}^2+w_{111}^2}$	Angle of resultant load.	$\cos\phi=\frac{w_{11}}{W}$ $(D_v=D_r\cos\phi)$ *
Nominal area in sq. inch.	Diameter in inch.	Allowable tension in lb.	Ultimate tensile strength in lb.		Dead load per lineal ft. in lb.	Vertical load per lineal ft. in lb.	Horizontal load per lineal ft. in lb.	Resultant load per lineal ft. in lb.		
·01453	0·136	456·0	912	28·0	0·0560	0·451	0·758	0·882	59° 15′	·5113
·01629	0·144	508·0	1,016	27·9	0·0627	0·462	0·763	0·892	58° 50′	·5175
·01697	0·147	528·0	1,056	27·8	0·0642	0·466	0·765	0·896	58° 40′	·5200
·01815	0·152	561·5	1,123	27·6	0·0700	0·474	0·768	0·902	58° 18′	·5255
·02061	0·162	633·0	1,266	27·4	0·0795	0·490	0·775	0·917	57° 40′	·5348
·02164	0·166	662·0	1,324	27·3	0·0834	0·497	0 778	0·923	57° 25′	·5385
·02500	0·178	707·5	1,515	27·1	0·0959	0·516	0·786	0·940	56° 42′	·5490
·02545	0·180	770·0	1,510	27·0	0·0981	0 520	0 787	0·943	56° 35′	·5507
·02688	0·185	810·5	1,621	26·9	0·104	0·528	0 790	0 951	56° 15′	·5556
·02926	0·193	875·0	1,750	26·7	0·113	0·542	0·795	0·952	55° 42′	·5635
·03269	0·204	971·5	1,913	26·5	0·126	0·563	0·803	0·981	55° 0′	·5736
·03631	0·215	1,071·0	2,142	26·3	0·140	0·583	0·810	0·998	54° 15′	·5842
·0500	0·252	1,437·5	2,875	25·7	0·193	0·659	0·835	1 064	51° 44′	·6193
·0750	0·309	2,064·5	4,129	24·6	0·289	0·791	0·873	1·178	47° 50′	·6713
·100	0·357	2,655·0	5,310	23·7	0·386	0·917	0·905	1·288	44° 40′	·7112
·125	0·399	3,215·5	6,431	23·0	0·482	1·040	0·933	1·397	41° 55′	·7441
·150	0·437	3,750·0	7,500	22·3	0·578	1·159	0·957	1·504	39° 35′	·7707
·175	0·472	4,272·5	8,545	21·6	0·675	1·277	0·982	1·610	37° 30′	·7931

NOTE:—*Resultant Loading* = $\sqrt{(\text{dead } load + 0{\cdot}5 \text{ inch ice } load)^2 + (8{\cdot}0 \text{ lb. wind } load)^2}$; where: dead load = w, 0·5 inch ice = d_1, and 8·0 lb. wind pressure = p.

This wind pressure is assumed to correspond with a wind velocity of 50 miles per hour, therefore $p=0{\cdot}0032v^2$ where $v=\sqrt{312{\cdot}5p}$. A very much used value for p is $0{\cdot}0025v^2$, making $v=\sqrt{400p}$. For solid wires the value $0{\cdot}003v^2$ appears to be a good mean; making $v=\sqrt{333p}$.

Quantity of ice per foot of length = $0{\cdot}0218d_1(d+d_1)$, in cubic ft.

Total vertical weight per foot of length = $w+57\times0{\cdot}0218d_1(d+d_1)$, in lb.

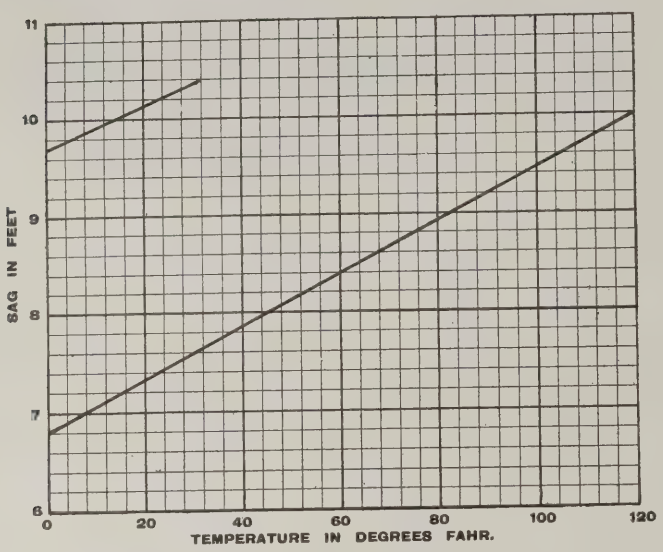
Load due to wind pressure per foot of length on the conductor = $0{\cdot}666(d+2d_1)$, in lb.

* As the resultant load increases, the vertical sag (D_v) decreases because of the greater angle of swing from the vertical plane.

* See also British Engineering Standards Specification, C.A. (E.L.) 6349.

† These tables replace Charts V and VIII for S.W.G. sizes given in the ELECTRICAL REVIEW, October 3rd, 1924.

logarithmic paper. This refers to old, present, or new standard sizes of conductors. For lines using but a few



Sag Chart.—For span=400 ft.; 0.10 sq. in. hard-drawn solid copper; P=2,655.

The upper curve is for conductor loaded with half an inch ice and 8 lb. wind for temperature from 0 deg. F. up to freezing point of +32 deg. F. The lower curve is the "stringing" curve, and shows sags for any temperature between 0 deg. F. and +120 deg. F.

This class of stringing chart is recommended for the erection gang; if desired, other curves may be drawn in for other spans and for corresponding tensions.

In this example, "maximum" sag occurs at +22 deg. F. with load, or at a higher temperature (with load) at which sleet will form (see continuation of upper curve).

Fig. 1.—Transmission Line Stringing Chart.

different spans, it is recommended that a curve be drawn for each span in the manner shown in fig. 1.

The maximum stress conditions in a span are always assumed at the outset, and the first step in designing a transmission span is to look up the allowable value of tension P; this is given in column 3 of Table I. The maximum sag, which may occur either at the maximum temperature *with* or *without* load other than the bare conductor in still air (see fig. 1) is not known, and therefore must be determined. As conductors are never strung under actual maximum loading conditions, it is customary to string them so that, under maximum loading conditions, the stress in them will not exceed the loading specified by the Electricity Commissioners. In this country it is still common practice to use the dynamometer when stringing conductors. A better method is to find the sag for the particular temperature at the time of stringing (bearing in mind that on a sunny day the conductor is at a higher temperature than the air, hence a few degrees must be added to the reading given by the thermometer) and measure the amount of sag required for each span on the adjacent line supports by placing a dab of white paint at the measured levels, or by fixing an adjustable white batten on each adjacent line support at the measured sag level. A line of sight is then taken between these two points, and the conductor is allowed to sag until it coincides with this line of sight. A dynamometer is subjected to very rough handling in the field, and is very seldom tested for accuracy. The *sighting method* should preferably be the one chosen, as it is not only reliable and simple, but it should provide a permanent record on the line supports for present and future reference, and for re-sagging purposes, &c.

(*To be concluded.*)

Standard Performances for Electrical Machinery.

A critical review and some observations on Specifications Nos. 169 and 226, dealing with the working requirements of motors and generators, of the British Engineering Standards Association.

By F. T. CHAPMAN, D.Sc.

(*Concluded from page* 251.)

WE may now examine in detail the two specifications, Nos. 169 and 226, to which we have already referred. They are concerned with large generators and motors rated at more than 2.5 kVA or 2.5 b.h.p. per revolution per minute, excluding, however, alternators of the steam turbine-driven type, which come within the scope of a special specification, No. 225.

No. 169 is a specification for a rating permitting overloads, while No. 226 describes a continuous maximum rating. Both are drawn up in the same form; the main portion of the material is divided into thirteen sections, with the same titles in both cases, and the remainder is arranged in eight appendices. With a small exception in the case of the second, the appendices are identical in both specifications.

The first section describes the scope of the specification. The second and third define certain terms, such as "Rating," "Overload," and "Inherent Regulation," and describe the three types of enclosure which are recognised, *viz.*, "Open," "Duct Ventilated," and "Enclosed Self-Cooled." This is naturally a smaller number of types of enclosure than was recognised in No. 168 in the case of smaller machines. The fourth section defines certain types of machine, such as "Change-Speed Motor," "Variable-Speed Motor," and "Inverse-Speed Motor."

The most important matter in Section V is the specification of the permissible deviation from the sine shape in the e.m.f. wave of an alternator. Since there is no commercial analyser of proved reliability on the market at the present time, the Association has had to rely upon a graphical method of comparing the actual wave form with a sine wave having the same root mean square value. The specified test which the wave form must pass is that, when the two curves are superimposed so as to show the least difference, the maximum deviation between them shall not exceed 5 per cent. of the maximum ordinate in the case of alternators with outputs exceeding 2,500 kVA, nor 10 per

cent. in the case of alternators with outputs below this limit. Where a pronounced ripple of 400 per sec., or over, is present, the deviation of this ripple from a mean curve drawn through it shall not exceed 2½ per cent. of the maximum ordinate. In view of the number and nature of the processes involved in this test, its accuracy cannot be great. The clause is a very necessary one, however, and it is to be hoped that the advent of a satisfactory analyser may make it possible ere long to replace the present cumbrous test by something at once simpler and more accurate.

The next section (VI) relates to rating. The rating of a machine has already been defined in Section II as "the output assigned to it by the maker, together with the associated conditions marked on the rating plate." This is a clear and unambiguous statement, but in Section VI we are told that "the rated load defines a load which can be carried on test under the conditions of the rating and of this specification for an unlimited period without exceeding the limits of temperature rise given in Section VII." Presumably this means that "the rated load *is a* load which can be carried, &c.," and as there will be an infinite number of such loads for any given machine, the "definition" is not of much value. Perhaps the meaning of this statement would be conveyed better by some such sentence as this: "A machine rated in accordance with this specification will give a performance which will not fall short of the standards laid down here when tested in the manner prescribed herein and under the conditions of load, &c., stated on the rating plate."

The remaining sections deal with the tests to be made and the standards of performance which are to be attained, but there is a certain lack of clarity about the way in which they are set out. It would have been better if they had been preceded by a schedule summarising the prescribed tests, which are:—

(*a*) Load test, for the purpose of examining the temperature rise and the commutation.

(*b*) Overload, excess current and excess torque tests.

(*c*) Insulation resistance and high voltage tests.

In connection with (*a*), Section VII sets out fully the methods of measuring temperatures which are demanded and the maximum measurable temperature rise which the specification permits. Embedded temperature detectors are called for in all machines having an axial core-length of one metre or more.

Section VIII deals with momentary overloads under the title "Excess Current and Torque." Here the two specifications differ. According to No. 169, a generator is required to withstand a 50 per cent. increase of current beyond its rating for one minute, and d.c. and a.c. synchronous motors are required to withstand a 50 per cent. increase of torque without injury and without falling out of step, the voltage and frequency remaining constant. Induction motors must be able to withstand, in addition to the last test, an excess torque of 100 per cent. above normal for 15 sec., except where the number of poles is abnormally high. According to No. 226, the 50 per cent. excess current and torque must be applied for 15 sec. only, and induction motors are required to withstand 75 per cent. increase in torque instead of 100 per cent. The clauses relating to prolonged overloads in No. 169 occur in Appendix II, but as they are an essential part of the specification, it would appear that they should come in Section VIII with the other overload conditions.

The standard performance with regard to commutation (Section IX) is necessarily rather vague. The machine is to work "practically sparklessly" with fixed brush position and without injury to the surface of the commutator up to the momentary overload.

No standard of performance is given in the section relating to efficiency and power factor (Section X), but it is hinted that the purchaser should ask for guarantees, and a promise is held out that a standard method of verifying efficiencies may be published in the future.

A minimum insulation resistance of rated volts/(1,000 + rated output in kVA) is to be insisted on before the high-voltage test is applied. The methods of making the test and of measuring the voltage are well and fully described. The test voltage is to be raised and reduced slowly and maintained at its maximum value for one minute. The table of voltages which must be withstood by different parts of machines of different types calls for no comment.

The penultimate section deals with certain details relating to the carrying out of the tests, and the final section sets out the information which must be given on the rating plates of different types of machines. If any addition to the latter is permissible, the manufacturer might be required to state whether the insulation is class A or class B.

The first appendix gives a classification of insulating materials. The second refers to the conditions in respect of cooling air temperature and altitude within which the specification applies, and in the case of No. 169 it sets out the conditions relating to sustained overloads. It is not obvious why these clauses have been put into an appendix, for they would appear to be an essential part of the specifications.

The third appendix contains instructions for making the temperature measurements. This material also is essential to the purposes of the specification, and its proper place would appear to be alongside the other paragraphs relating to temperature. The same observation applies to the precautions to be observed in taking resistance measurements of windings for temperature determination, which form the subject of Appendix IV.

The suggestions to purchasers in respect of information to be sent to manufacturers with orders and inquiries come properly in Appendix V; Appendix VI, when ready, will deal with methods of declaring and verifying efficiencies, and Appendix VII applies to terminal markings. The final appendix relates to high-voltage tests, and contains eleven pages of matter bearing on the measurement of high voltages by means of spark gaps.

Specification No. 225, which was issued at the same time as those we have just discussed, relates to alternators of the type usually driven by steam turbines, and to exciters forming part of such sets. The general arrangement of the specification is similar to that of Nos. 169 and 226, but the sections relating to types of machine and types of enclosure are omitted.

Two ratings are recognised by this specification; one is the defined test rating and the other, which is called the "service rating," is the load "corresponding to the most economical output of the combined set." If required by the purchaser, this shall be stated by the maker and marked on the rating plate. A short-circuit test is not included in the standard test performance.

The specification concludes with the same eight appendices as occur in Nos. 169 and 226.

Although they are susceptible of improvement in form, these three specifications are very useful documents, and they increase the debt which the electrical community owes already to the British Engineering Standards Association.

Electric Cooking and Domestic Economy Teaching.

The London County Council instructed its Education Committee in 1923 to report whether or not at appropriate centres cooking by electricity should be taught. A report has now been prepared. The Elementary Education Sub-Committee states that at four cookery centres experimental electrical installations have been provided. The Sub-Committee proposes to continue the use of the electric cookers which have been installed. Electric cookers as well as gas will be installed in new centres serving districts in which the majority of children come from homes using electricity. In other cases no action will be taken, except where the supply authorities are prepared to furnish and install electrical equipment on exceptionally favourable terms.

Unemployment Insurance.

By JOS. J. H. STANSFIELD.

THE Report of the Blanesburgh Committee on unemployment insurances has just been issued. The Committee was appointed "to consider in the light of experience gained in the working of the unemployment insurance scheme what changes in the scheme, if any, ought to be made."

The report points out that unemployment as we know it is, comparatively speaking, a new phenomenon. Towards the end of the nineteenth century it became more manifest; in the first decade of this century it assumed more serious proportions; and in 1911 it was first made the subject of statutory enactment.

The Committee unanimously submits that the risk of genuine unemployment should be insured against, and that a compulsory scheme should be a permanent feature of social legislation.

It is estimated by the Government Actuary that unavoidable unemployment averages six per cent. over the period of a trade cycle, and whilst it will be generally admitted that there should be a careful examination as to the genuineness of the search for work, the worker who is unemployed through no fault of his own should be protected from the demoralisation that too often follows a period of unemployment.

The recommendation of a non-contributory scheme was not within the reference, but it was agreed that a contributory scheme should comply with certain conditions.

The worker's contribution must be moderate in amount and secure an insurance sufficient in the great majority of cases to save him during inevitable unemployment from recourse to public assistance; the insured contributor should not be tempted to improvidence when in receipt of good pay; the benefits should be less than the general labourer's rate of wages, so that there may be no temptation to prefer benefit to work; the mobility of labour must not be unduly interfered with, and those who would be benefited by a life overseas must not be deterred from emigration. Subject to these conditions, the scheme should be as attractive in its benefits to the insured contributor as, on a strictly actuarial basis, it is possible to make it.

Much has been said and thought about the abuse of the "dole," and it is satisfactory to note that the Committee shows that this has not occurred to anything like the extent which has been commonly supposed, but the suggestions as to contributions and benefits are designed to make abuse more difficult and less attractive.

Space will not permit of the publication at present of the full details of the rates proposed, but it may be generally stated that the rates of benefit and contribution would be smaller than those now in force, and that the contributions of employer, employé and the State would be equal in amount.

At present an employé is entitled to full benefits at 18, when the earning capacity is such as to give unemployment benefit a special attraction, and it is therefore proposed that a new classification should be adopted under which the benefits and contribution of employés aged from 18 to 21 should be below that of the adult.

The new scheme will start with a considerable load of debt. The coal stoppage increased the deficit from 7 to 21 million pounds, and in order to restore solvency a special contribution is suggested of a penny per week from men and young men, and a halfpenny per week from women and other contributors, until the deficit is wiped out. This proposal is calculated to meet with opposition, but it may be a reminder that the heavy disbursements during last year were not taken from an existing or unlimited hoard, but were rather borrowed in advance.

The question of unemployment insurance raises problems which more or less affect the morale of the community as a whole as well as the well-being, peace of mind, and self-respect of many millions of workers.

The Committee states, for reasons given, that public opinion outside the insured classes was and still is to some degree unfavourable to this class of insurance, but whether this view be well-founded or not it is satisfied that any scheme of unemployment benefit in this country will be durable and secure of general acceptance only so far as it is believed to be immune from the social dangers which, in greater or less degree, may lurk in such schemes.

An investigation made in 1913 showed that there was nothing to indicate that unemployment was being provided for by resort to the Poor Law or from any other outside sources, facts which are a notable tribute to the prudence, self-reliance, and self-respect of the insured workers as a whole, whilst under the Act of 1919 benefits were raised without altering the rates of contribution, and at the end of 1920 over £21,200,000 had been accumulated.

It cannot but be hoped by those who are anxious for the common good, that the future course of events will restore the financial solvency of a fund which is designed to provide benefits for all insured persons who can fairly be described as genuinely employed, and that some means may be found to avoid a recurrence of the disastrous circumstances of the past year.

The inquiry was primarily into unemployment insurance, but the Committee was impressed by the consideration that "preoccupation with the task of ascertaining how best unemployment can be insured against" must not weaken the efforts to get rid of unemployment itself, and a number of valuable suggestions are made to this end.

Amongst these may be mentioned a systematic inquiry by every industry into its own unemployment problem and its own supply of labour; a greater mobility of labour; and the helpful guidance of juveniles for their future careers.

The Report is one of 100 pages, and can be obtained from H.M. Stationery Office at the price of one shilling. It is well worth careful perusal, for it contains much that is interesting, informative, and suggestive.

Unemployment during January.

The *Ministry of Labour Gazette* reports that although unemployment in the engineering industry during January remained bad on the whole, there was certainly improvement. There was, however, a setback in the electrical engineering branch, the proportion of unemployed rising from 6.1 to 6.8 per cent. There was an improvement in the electrical wiring and contracting industry, in which the unemployment percentage fell from 8.2 to 8.0. On the other hand, the proportion of unemployed in the electrical cable, wire and lamp manufacturing group rose from 7.1 to 8.3 per cent. The actual numbers of unemployed were as follows:—Electrical engineering, 5,238; wiring and contracting, 1,113; and cable, wire and lamp manufacturing, 7,325.

Indian Electrical Notes.

(From Our Indian Correspondent.)

IT will be remembered that the opening of the electrified Harbour Branch at Bombay was the first step in introducing railway electrification into India. This service, which has since been extended to Bandra, forms only part of the various schemes at present in hand for the electrification of the suburban and main line services in Bombay, which on the Great Indian Peninsula Railway include the electrification of the main and suburban line to Kalyan, of the main lines to Igatpuri and Poona, and on the Bombay, Baroda, and Central India Railway, the electrification of the lines between Church Gate and Borivli. The work on the uncompleted portion of the schemes is being steadily pushed forward, and it is hoped soon to inaugurate an electrified service on the whole of these sections. With the opening of these services Bombay will feel a great benefit, and a better distribution of its great population may be looked for in the near future. The re-examination of the problem of suburban traffic in Calcutta is now approaching completion, and the preparation of a revised electrification scheme is in hand as a result of the decision to proceed with the construction of the Calcutta Chord Railway with a bridge across the Hooghly at Bally. The Madras suburban traffic problem is also being dealt with. Additional tracks are being provided on the suburban section of the South Indian Railway from Madras to Tambaram, and the electrification of this section is under investigation. The feasibility of electrifying other portions of the South Indian Railway is also being discussed, since there is a possibility of a hydro-electric supply being available. In view of the great benefits to be expected in railway working in South India from a hydro-electric supply, the Government of India has associated itself with the local government in the investigation of hydro-electric resources in the Madras Presidency, and the schemes are at present being examined by Messrs. Merz & McLellan, consulting engineers for electrification schemes to the Government of India.

The Chief Inspector of Mines' report for 1925, states that the number of collieries using electric power increased from 99 to 108, the aggregate horse power employed at collieries increasing from 43,502 to 52,336. During the year electrical plant was installed and brought into commission in thirteen additional coal mines. In two gassy coal mines, one in the Raniguńj and one in the Jharia coal field, there was a considerable increase in the horse-power of electric motors installed below ground. The electrification of several important collieries is now in progress.

It is hoped that the preliminary work in connection with the Calcutta station of the Indian Broadcasting Company will be put in hand within a few weeks, so far as the transmitter building is concerned, and that it will be sufficiently advanced by early April to accommodate the first shipment of transmitting machinery. The aerial masts will be 150 ft. high, and the station will be of an ornamental and approved type. About five *cottahs* of land will be covered, while a further area will be utilised for the earthing system. Studios will be located in a carefully chosen vicinity so that interference from outside noises and any possibility of inconveniencing neighbouring residents may be reduced to a minimum. The company's manager is now engaged in examining sites that may prove suitable, and it is possible that Kyd Street or Park Street areas may offer the accommodation desired. The first programme will probably be broadcast in six months' time, but there are many difficulties still to overcome. Engineers from England are already on their way to India. As in other countries, programmes will be under the supervision of special programme boards, on which there will be Indian representatives competent to gauge the tastes of the great Indian population. Upon these boards will devolve the task of arranging programmes of wide appeal, and necessary adjustments as to the balance of the various items, such as lectures, "talks," music, &c., will be recommended by them. So far as Calcutta is concerned, interference from the spark station at Fort William is not anticipated as a serious difficulty. Technically there is little to fear in this respect, because the new station will transmit on a wave-length of 350-400 metres, while the Fort William station utilises a considerably greater wave-length.

X-Ray Martyrs.

According to the *Daily Chronicle* Special Correspondent, X-rays have claimed further victims in France. Sister Glossinde, who for 15 years assisted Dr. Reiss, of Metz, himself a victim of X-rays in 1922, has now died. The first symptoms were revealed after the war, and last year the sister had her right arm amputated.

Dr. Harcourt, chief of the X-ray department of a Marseilles hospital, had the forefinger of his right hand amputated on the 15th inst. He is 60 years of age, and has already undergone six operations. For his X-ray services during the war he was awarded the Legion of Honour.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Trans-Atlantic Telephony.

On February 15th, Sir W. Mitchell-Thomson, the Postmaster-General, informed Mr. Day that the number of telephone calls made on the Trans-Atlantic service since its inauguration was 338, of which 40 per cent. originated in England.

Broadcasting.

On February 15th, Mr. Duckworth asked the Postmaster-General if he would state the attitude of his department towards the new regional broadcasting scheme; and whether there was any hostility to the development of alternative programmes on the part of either Government departments or commercial wireless services.

Sir W. Mitchell-Thomson said that he gave authority to the British Broadcasting Company last year to undertake experiments with the view of ascertaining whether a regional scheme could be adopted without causing interference between one broadcasting station and another, or between broadcasting stations and other wireless stations. The company conducted some experiments and the Corporation was at present arranging to carry out further experiments. The answer to the latter part of the question was in the negative.

Sir W. Mitchell-Thomson informed Mr. Grotrian and Major Ainsworth that his attention had recently been called to a case in which an experimental wireless station had been used for the transmission of concerts. The licensees claimed that those concerts were necessary for the purpose of scientific experiments which they were conducting; but he was not satisfied on that point, and he had asked them to discontinue the concerts until the matter had been considered in the light of certain information which he had requested them to furnish.

Sir W. Mitchell-Thomson informed Mr. G. Peto that he could not consider the reduction of the licence fee for crystal wireless sets to 5s. per annum.

Later, the Postmaster-General stated that the number of persons prosecuted for the use of unlicensed wireless apparatus from the autumn of 1925 to January 31st, 1927, was 583, and the number of convictions 579. The penalties ranged from a fine of 2s. 6d. to £10, in addition to £10 costs.

Beam Wireless Tests.

On February 15th, Mr. Day asked the Postmaster-General if he would state the latest results of the official wireless beam test between Australia and Great Britain.

Sir W. Mitchell-Thomson said that the contractors stated that certain defects developed in the auxiliary apparatus during the recent test, and they were at present engaged in correcting those defects. When that had been done a further test would be arranged.

Agriculture and Electricity.

On February 16th, Sir H. Hope asked whether it was contemplated to nominate any representative of the agricultural industry as adviser to the Electricity Board, so that the benefits of the Electricity Supply Act of 1926 might be secured for that industry?

Colonel W. Ashley said that the manner in which the Electricity Board could best keep itself informed of the special requirements of agriculture in connection with the supply of electricity, was a matter which it would be for the Board itself to determine as occasion arose.

Electrical Surveys.

During the discussion of Supplementary Estimates in Committee of the House on February 17th, on a token vote of £10 for the expenses of the Ministry of Transport, Col. Ashley explained that the vote was necessary to enable him to use certain appropriations in aid to meet an excess of expenditure incurred in connection with the Electricity Act of last year. Before bringing in that measure, the Government considered that it would be well to have independent outside technical advice, in addition to the advice given by the Electricity Commissioners. In the spring of 1925, a Supplementary Estimate for £15,000 was voted by the House, which enabled the Government to use money in the financial year 1925-26 to get that outside technical advice on the Weir Report and on the scheme generally. Not more than £10,500 was actually expended, and so, early last year, a sum of £5,000 was inserted in the Estimates as a re-vote, in order that the work might be carried on. That £5,000 was not sufficient to meet the expenses incurred in the general scheme and in the technical scheme of investigation up to December 15th last, when the Electricity Bill became an Act. On December 15th, any money for those investigations, according to the terms of the Act, became a charge on the fund under the control of the Electricity Commissioners, afterwards to be recovered from the Central Electricity Board. Up to December 15th, the money found by Parliament would be recovered, with 5 per cent. interest, from the Central Electricity Board when it functioned.

Mr. W. Baker (Labour), who moved to reduce the vote by £5, asked for further details.

Mr. G. Balfour (U.) objected to the procedure which the Minister had taken, and contended that the matter should

come before the House at a later stage, so that the House and the country could understand what had been done.

Mr. Harris (L.) asked for the names of the consulting engineers who had advised the Government, and the amount of their fees.

Mr. D. Herbert (U.) said it was wrong for a Government department to incur considerable expenditure on the assumption that a Bill before the House would become an Act of Parliament without alteration. Col. Ashley said that not one penny had been spent without Parliamentary sanction.

Col. Woodcock (U.) complained that money was being wasted on investigations into the Severn barrage scheme.

After further debate, Col. Ashley said that the surveys, general and special, cost in the financial year 1925-26, £10,500. In the current financial year, and up to December 15th, 1926, when the Act came into force, the cost was £19,000, making the total cost up to December 15th, 1926, £29,500. There would probably be a little more expenditure incurred after December 15th, and that would fall on the funds of the Electricity Commissioners, who would recover from the Central Board.

Mr. Hardie (Lab.) complained that the information obtained in the surveys had not been made use of in connection with the Act. Col. Ashley said that the greater part of it had been included, as it had been used in the preparation of the scheme. The other part would be used by the Commissioners when they drew up their schemes for the consideration of the Board when it began to function. All that he had done was to instruct the Electricity Commissioners to prepare a scheme and to place the work of survey in the hands of Messrs. Merz and Kennedy. Those eminent consulting engineers were to engage appropriate staffs to make that general survey of Great Britain, and when that was finished they were to go into much more detail with regard to the areas with which it was proposed to deal first—Central England and the Glasgow and Clyde area. Detailed examination of the two areas was nearly finished, so that the Electricity Commissioners would soon be able to put up one or two schemes for the Board to consider. It would not be for the consulting engineers, nor for the Electricity Commissioners, but for the Board, to decide what areas should be taken next. The scheme for the areas which he had mentioned would be presented to the Board in the next fortnight or so.

The vote was agreed to.

Legal.

Scarborough Electricity Supply Co., Ltd.

Mr. Justice Tomlin, in the Chancery Division on February 17th, heard a summons taken out by the Trust Union, Ltd., trustees for the debenture holders of the Scarborough Electricity Supply Co., Ltd., for a decision as to whether the debentures should be paid off at par or at 105 per cent.

Mr. Cleveland Stephens, for the applicants, said the company, in 1894, purchased the electricity undertaking from the Corporation, but the latter, under the terms of the transaction, re-purchased it in 1926. In 1923 the company issued £60,000 6 per cent. debentures, which were to be redeemed in certain circumstances at 100, 102, or 105.

Mr. Dighton Pollock, for the company, submitted that the debentures should be redeemed at par, but Mr. C. A. Bennett, K.C., for the debenture holders, argued that the redemption price should be 105.

His Lordship said the trust deed contained a clause providing for the repayment of the debentures on a resolution for liquidation of the company, otherwise than for amalgamation or reconstruction, but there was a proviso that if the liquidation was for either of those purposes, the debentures should not be repayable except at 105. That event, however, had not happened, and his conclusion was that the debentures, on the true construction of the deed, should be repaid at par.

Stonebridge Electrical Co. v. Magneta Time Co.

Mr. Justice Tomlin, in the Chancery Division, on February 14th, heard an application by the Stonebridge Electrical Co. to expunge from the register the trade-mark "Magneta" for electrical clocks. The respondents to the application were the Magneta Time Co., Carteret Street, Westminster.

Mr. Bray, for the applicants, said this was a motion by way of answer to an action for alleged infringement of trade mark. There was an affidavit in support of the application raising two grounds of objection to the mark being on the register. The first, which was not before his Lordship now, was that the mark belonged to a Swiss company of that name: and the second was, that the renewal of the mark had been invalidated in those circumstances. In 1908 the mark was registered in the name of the Magneta Time Company, which had offices at Turnham Green, but a receiver of the company's assets was appointed, and he joined in the assignment of the mark and the company's goodwill to a Mr. J. W. Molden. In November, 1917, the company was dissolved. In February, 1918, Mr. Molden assigned the goodwill and mark to the present company, but neither assignment was registered, and the mark, having been put on the register in 1908, the 14 years had elapsed and there had been no proper application for renewal.

Sir Duncan Kerly, K.C., for the respondents, said the assumption that the mark lapsed at the end of 14 years if there was no application for renewal of registration was incorrect. Such a case as this was provided for, and in any event he submitted that a mark remained on the register until it was removed.

His Lordship, in refusing the application, said the claim to expunge was based on a technicality. The error on which that technicality was founded was remedied in 1925, and apart from the technicality the present title to the mark was unimpeachable.

St. Austell Electric Light and Power Co. v. Beavis.

A case which had been before the County Court at four previous sittings was concluded at St. Austell on February 15th. The plaintiffs were the St. Austell Electric Light and Power Co., Ltd., who brought an action against Mr. A. H. Beavis in respect of rent for electric lighting fittings in a house of which he is the tenant, and also against Mr. Alfred Reed, the leaseholder, who claimed that the fittings became his when he bought the house. Mr. Reed further counter-claimed for a declaration that the fittings were his sole and absolute property, the claim of the company not having been brought to his notice when he purchased the property. His Honour Judge Gurdon found for defendants, with costs, with regard to the company's claims against Messrs. Beavis & Reed, and gave judgment for the company, with costs, on the counter-claim, holding that the freeholder had prior claim to the leaseholder.

American Electric Refrigerator Trade Activity.

The General Electric Co., of Schenectady, recently set up a separate department to handle its electric refrigeration business. The two refrigerator manufacturing plants which the company has been operating at Schenectady and Fort Wayne will be continued and expanded as the merchandising programme develops. According to the *Electrical World*, the G. E. electric refrigerator, which has been under development for the past fifteen years, is now being produced in two sizes for domestic use. The company's present plans call for a line of at least eight models of domestic refrigerators, ranging in price from $260 to $600. Some details are given of the merchandising system which will be followed. The new department will market refrigerators through electrical utilities, distributor-dealers and dealers. Distributor-dealers will sell direct to residential customers and also through sub-dealers in the territory allotted to the distributor. Most of the distributorships will be limited to one county or to a territory with a radius of not more than 25 miles. An extensive advertising programme, calling for an expenditure of $1,000,000 in 1927, has been planned, starting May 1st. "This includes a complete advertising service and sales assistance programme for distributors and dealers, consisting of co-operative newspaper advertising, direct-mail campaigns, booklets, publications, window displays and a full complement of dealer helps that will help distributors in localising the national campaign in leading national and trade journal publications."

Sales and Man Power.

Experience indicates that intensive sales efforts produce the best results. A large number of competent salesmen with a small number of prospective customers per salesman permits a degree of customer cultivation which results in maximum sales volume. In many cases, however, conditions are such that this policy must be modified seriously. A utility company may operate in a widespread territory where the income of the customers is limited. Again, competent salesmen are difficult to obtain and to retain unless they are paid a return greater than is warranted by the sales made. Thus the generalised statement on sales and man power is subject to modification in practice, but the principle is sound and should govern the development of sales programmes. The campaign method of sales or the use of specialty salesmen must be judged partly from this standpoint. A large group of refrigerator salesmen, for example, may be needed to sell the quota established for the sales period. It is a problem to get the men, and a still bigger problem arises at the end of the campaign period. A permanent sales staff is desirable, but large groups of specialty men are difficult to hold profitably during unseasonal sales periods or to adapt for selling general appliances. The summer campaigns create a heavy demand for salesmen, but the winter season calls for retrenchments and a slackening of some sales efforts. These points are doubtless kept in mind by utility sales managers in their efforts to stabilise the situation. Any individual plan for a single property must consider the man-power situation carefully and has to operate on the fundamental conception of building a permanent staff of salesmen who sell continuously and intensively.—*Electrical World*, February 5th.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

E.D.A.-E.L.M.A. Campaign.

The official report, dated February 21st, states that local circles were formed at Swindon (chairman: Mr. Nicklen) and South-East London (chairman: Mr. Wilson). Three more demonstration houses were opened at Portsmouth, Bath, and Belfast. From 750 to 1,000 persons are visiting the last-named house daily. An all-electric "house" was to be opened at the Town Hall, Basingstoke, yesterday (Thursday), and free competitions for children and adults are being arranged. Peterborough and Bermondsey have decided to run demonstration houses, while Halifax is to open a further house early next month. In Scotland, a house was to be opened at Aberdeen this week, and another in Glasgow is to be opened by the wife of the Lord Provost on Monday next. In co-operation with the Salford Corporation, the Prestwich Urban District Council was to open a house on February 23rd. Other demonstration houses in prospect are at Blyth, Durham, Sunderland, South Shields, Whitley Bay, Whickham, and Saltburn. Messrs. Ward & Co., of Cardiff, are erecting an all-electric bungalow outside the Cardiff Drill Hall. This will be run concurrently with an Ideal Home Exhibition which is being held in the hall. Exeter reports a daily attendance of 1,500 people at the demonstration house; it is expected that the total will reach 20,000 before the end of the display. Exhibitions are being held at Bradford (first week in March) and Bingley (February 25th to March 12th). The period of the Dumfries exhibition has been altered to March 2nd to 5th. Good results are said to have been obtained from the Falkirk and West Hartlepool exhibitions. The large working model of the prize house has stimulated the demand for competition booklets in the Liverpool and Manchester districts. In the North-East Coast area an impetus has been given by the children's competition.

The latest of the exhibitions of the Shropshire, Worcestershire and Staffordshire Electric Power Co. was held at Halesowen, Worcestershire, and proved very successful. There were a large number of visitors each day, and lectures were given by Mr. J. L. H. Cooper, the campaign officer for the South-Midlands Area, and Mr. C. C. MacLeod, of the company. The exhibition was arranged on the lines of a model home, sections being devoted to the kitchen, dining-room, bedroom, and bathroom, and in each of these demonstrations were carried out, which were watched with a good deal of interest. The Singer Sewing Machine Co. arranged a series of demonstrations of sewing by electricity. Wireless demonstrations were given by the Cable Accessories Co., Ltd., and by Messrs. Shaw Bros., the Halesowen agents for Burndept Wireless, Ltd. In a small industrial section were shown electric welders by Messrs. Holden & Hunt, Ltd., electric tools and soldering irons by Messrs. S. Wolf & Co., Ltd., and an electrically-driven fan forge by Messrs. W. Alldays.

Over 7,000 people visited the all-electric house at Shawlands in one week.

An all-electric house was opened on February 19th by the Luddendenfoot Urban District Council, near Halifax. The local electrical contractors and the Yorkshire Electric Power Co. (which supplies the Council with electricity in bulk) have co-operated in the organisation of the exhibition. The house was wired by the Electrical Distribution of Yorkshire, Ltd. The dwelling is one of the Council's parlour type, with three bedrooms and bathroom.

The Paisley Corporation Electricity Department recently held an exhibition of domestic electrical apparatus with the twofold object of advertising the new temporary showrooms and of furthering the campaign. The complete range of radiators, cookers, water heaters, &c., hired out by the Department was on view, along with the many other domestic appliances which may be purchased or hire-purchased. A good attendance was secured, and all who went were seriously interested in the electrification of their homes. Many hired appliances were booked out and numerous inquiries were received regarding the Corporation's scheme of hired installations. Every visitor to the exhibition was presented with a competition booklet.

Last week the Lady Mayoress of Belfast (Lady Turner) opened a demonstration house in Balmoral Avenue, organised by the Belfast Circle. This is a new villa lent by the builders (Messrs. A. M'Dowell & Co.), furnished by Messrs. Robert Watson & Co., and the electric wiring and fittings have been supplied by local electrical contractors and wholesalers. Presiding at the opening ceremony, Councillor Hyde said that, whilst during the past few years very considerable progress had been made in Belfast in the use of electricity for power, heating, and lighting, there was still much development work to be done.

The fifth Birmingham electric demonstration house, which is situated at Erdington, was opened by Lady Brooks on February 9th. A view of the house accompanies this note. The dwelling is floodlighted at night.



The Erdington Demonstration House.

An electrical exhibition, organised by local contractors along with Mr. W. Johnston, manager of the municipal electricity works, is to be held in St. George's Hall, Dumfries, from March 2nd to 5th. A complete electric kitchen will be on view, and there will also be a model shop window showing correct and incorrect methods of lighting, as well as a small electric laundry.

Aden as an Electrical Market.

Industrie und Handelszeitung (Berlin) reports that Aden is an excellent market for electrical apparatus. At the beginning of last year the town was provided with electricity, and new installations are still being carried out in large numbers. Not only are lamps required, but also fans, refrigerators, and many novelties.

Shop-Window Lighting Enterprise.

The *Huddersfield Examiner* reports that a local firm of bootmakers has installed a novel shop-window lighting system. Anyone who wishes to see the goods in the window when the shop is in darkness has only to press a button situated outside when the lights are switched on and remain on for a minute. The firm is to be commended on its enterprise—an opinion which will be endorsed by all the small boys in the neighbourhood.

The Scottish Lighting Service Bureau.

The first annual report of the Scottish Electric Lighting Service Bureau states that the number of people who attended the lectures at the Bureau was 1,711, while 962 people called for advice. The number who attended other lectures arranged by the Bureau was 882, making a total of 3,555. Free advice has been sought and given, states the report, on a great number of problems in illuminating by electric light in a diversity of directions.

New Belgian Company.

A company has lately been formed at La Louvière with a capital of two million francs and the title La Société Tréfilerie et Câblerie du Centre, to manufacture electric cables of all kinds.

Bermondsey Strike Settled.

The strike of outside employés of the Bermondsey Electricity Department appeared to be settled on February 17th. The Electrical Trades Union decided to accept as a member the man who was the subject of the strike, but at the same time it claimed that all men in the electrical installation department should become members. The matter was to be referred to the Trade Union Congress for its decision, which both the E.T.U. and the Borough Council agreed to abide by. Pending this decision, no men other than members of the E.T.U. were to be employed in the installation department. Later, however, it was reported that the man had refused to join the E.T.U., preferring another union. At the time of going to press the strike continued, but negotiations were proceeding.

A Lamp-Renewal Complaint.

The *Electragist* reports that a contractor-dealer in Hartford (Conn.), U.S.A., has applied for an injunction restraining the Hartford Electric Light Co. from exchanging and renewing lamps for a small fee, alleging that by this means the company has secured a monopoly of the "Mazda" lamp business inthe town, to the detirment of electrical dealers. It is further alleged that the loss of the lamp business has resulted in the loss of other business by the retailers. An agreement between the company and electrical dealers providing that the latter shall receive commission on the sale of appliances is held to be illegal.

Astoria Theatre Lighting.

The electric light fittings, some of which are five and six feet in diameter, installed in the new Astoria Theatre, London, are of excellent design. In collaboration with the electrical contractors, the Berkeley Electrical and Engineering Co., the General Electric Co., Ltd., designed and supplied the large fittings in the auditorium, together with electroliers and basket fittings for the foyer. These are designed on triple circuits for the use of multi-coloured lighting, which is controlled by means of dimmers.

Local Exhibitions.

Ayr.—Ayr merchants and manufacturers are to hold an exhibition in the Pavilion, Ayr, from March 7th to 12th. Among the firms exhibiting will be the Eureka Vacuum Cleaner Co., Messrs. W. G. Dodd, Ltd., electrical and radio engineers, Messrs. Fairbairn, Ltd., radio experts, and Mr. Wm. Ross, electrical and radio engineer.

West Hartlepool.—Mr. J. H. Parker, the electrical engineer of West Hartlepool, says that the local Co-operative Society has just held an exhibition to demonstrate that it is able to provide for the needs of the whole of the population. Included in the exhibit was a bakery section and café; the Borough Electricity Department loaned the Society three large ovens and two hot plates, total 30 kW, besides other electrical appliances. The exhibition ran for 10 days and was crowded out daily. The operation of all the working stalls was entirely electrical; there was no gas used on the premises. The exhibition has now been transferred for 10 days to the neighbouring borough of Hartlepool.

Price Reductions.

Messrs. F. C. Blackwell & Co., Ltd., Great Crosby Works, Liverpool, announce a large reduction in the price of the "Blaco" all-steel continuity fitting, in consequence of increase in demand and production and improved methods of manufacture.

Messrs. A. Reyrolle & Co., Ltd., announce a reduction in the price of their plugs and sockets, due to still further improvements in details of manufacture, and they are able to supply quantities from stock in any required finish.

Callender's at Leipzig.

Among the British companies which will be represented at the Leipzig International Industries Fair (March 6th to 12th) is Callender's Cable & Construction Co., Ltd.

New B.T.-H. Factory.

For the rebuilding of the section of the British Thomson-Houston Co.'s works at Rugby, which was recently destroyed by fire, the company is preparing plans for a factory, to be erected on the site of the old one, which will meet modern needs much more effectively. The old factory was built twenty years ago.

The Floodlighting of Quarries.

At the Barnhill Quarries, near Bristol, a number of G.E.C. standard floodlight projectors have been installed. These are equipped with 1,000-W "Osram" gasfilled projector-type lamps, and night shifts are being worked regularly with excellent yield results. These floodlights, which are portable, are used in conjunction with a number of G.E.C. Wembley lanterns, and electricity is generated by the quarry plant, which includes a G.E.C. alternator. The whole of the cables, fittings, and lamps have been supplied by the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, the installation being carried out by Messrs. Rouch & Penny, electrical contractors, Bristol. Similar lighting has also been installed at the Town Quarries, Weston-super-Mare. In these workings the floodlight projectors are being fixed permanently by Messrs. Crowe & Green, the contractors.

Lamp Syndicate Developments.

It is announced that the Phoebus Company, of Zurich, which is one of the chief representatives of the International Glow Lamp Syndicate, has acquired by purchase the "Meteor" electric lamp works in Vienna, which has been one of the few works outside the scope of the syndicate. Negotiations are also proceeding with other outside firms, as, for instance, Gustav Glanz & Company, with a view to their inclusion in the syndicate.

The Prince Visits Hackney.

The Prince of Wales paid a visit to the Hackney municipal electricity works on February 15th at about 10 p.m. Upon his arrival the Prince was met by Alderman Mrs. Hammer (chairman of the Electricity Committee), Councillor W. J. Stapleton (vice-chairman), and Mr. L. L. Robinson, the borough electrical engineer. His Royal Highness displayed keen interest in the various parts of the works and chatted with the men on duty.

Factories.

Messrs. Leopold Farmer & Sons, of 46, Gresham Street, London, E.C.2, who, as our readers know, have a good deal to do with the letting and sale of factory and other business premises, report a very good demand at the present time for commercial property both in the provinces and in the London area and suburbs. This suggests that business is on the up grade and that further activity may be anticipated. We have received a copy of a paper on "Factories and Something About Them," which was read before the Auctioneers' and Estate Agents' Institute in December last by Mr. Harold L. Farmer.

State Aid for Japanese Engineers.

The Japanese committee for the promotion of home industries, appointed last year, has made a number of recommendations to the Government with regard to machinery manufacture. It recommends that the State should contribute towards the cost of training a body of technicians and mechanics, that State premiums should be paid in respect of well-equipped workshops whose products reach a prescribed standard, and that experimental and model workshops should be planned. It is also suggested that local associations of manufacturers should be formed with a view to improving the methods of production and organisation.

German Holdings in Russia.

It is stated that the shares of the former Russian General Electricity Company are still being dealt in, in the open market in Berlin, the valuation being put at about 4 per cent. In this connection Herr Deutsch, on the occasion of a recent interview, is reported to have been asked whether these shares were of any value. In reply, the director of the A.E.G. said that the shares were worthless, and there was not the slightest prospect that the shareholders would ever receive any return. It could not be thought that the Russian Government, which in general had expropriated capital, would return to that particular company a part of its property.

German Interests in Czecho-Slovakia.

It is reported that the conversion of the partnership company of Siemens & Co., of Prague, into a joint stock company, is to be accompanied by an extension of the interests of the German Siemens concern. The Prague company will receive considerable funds from the Siemens & Halske Company for the purpose of carrying out the conversion. Moreover, an enlargement of the Muglitzer works is contemplated; this works was recently amalgamated with Siemens & Co. It is also stated that the Siemens concern is about to acquire further interests in other Czech electrical undertakings.

Social Events.

The Meter Section of Blackpool Electricity Department held its second annual dinner on February 16th. Mr. E. Donoghue (charge engineer), who presided in the absence of Mr. C. Furness, general manager, spoke of the busy times which would be introduced by new legislation and the commercial development of electricity. Thanks were extended to Mr. Jackson, the organiser.

The second annual dinner of the employés of the Shropshire, Worcestershire and Staffordshire Electric Power Co. was held at Handsworth, Birmingham, last week, and about 250 were present from the company's headquarters and district stations. Mr. T. E. Boothby, the superintendent engineer, presided, and the toast of the company was proposed by an old servant, Mr. W. T. Penny. In response, Mr. J. T. H. Legge recalled the earliest days of the company, and expressed appreciation of the work of all who had assisted in carrying on the company's operations.

Recent Contract.

International Combustion, Ltd., states that its associate, S. A. Foyers Automatiques, Paris, has obtained a contract for a complete "Lopulco" installation to be installed at the Alost plant of the Société Générale de Soie Artificielle "Viscose." This order covers the supply of "Raymond" pulverising equipment, "Lopulco" hollow wall air-cooled combustion chambers with water screens, feeders, piping, burners, and electrical equipment. The normal rating of the boilers is 14,000 kg. per hour, with a peak-load rating of 18,000 kg. per hour.

Unemployment.

There was again a decrease (28,040) in the number of registered unemployed during the week ended February 7th. At that date the total was 1,303,500, as compared with 1,331,540 on January 31st, and 1,164,960 on February 8th, 1926.

The Wareham Electric Supply Co. : Petition for Compulsory Liquidation.

On Tuesday, before Mr. Justice Romer, the petition of Mr. W. E. Weston for the compulsory liquidation of this company was considered. Counsel said that it was a very serious case, a very gross fraud having been perpetrated. As further evidence was necessary, his Lordship adjourned the petition for 14 days for the necessary affidavits to be filed.

Calendars.

The 1927 calendar of Messrs. W. G. BEAUMONT & SON, Priory Works, Bow, E.3, bears monthly slips and a large coloured humorous drawing.

From the DELTA-STAR ELECTRIC Co., Chicago, U.S.A., we have received a 1927 calendar bearing a view of the company's 750,000-V testing laboratory. The company has also sent us one of its "bulletins" dealing with outdoor sub-stations.

Trade Announcements.

MR. C. F. MACKNESS, M.I.E.E., has removed from 37, Norfolk Street, Strand, W.C., to 28, Victoria Street, S.W.1. Telephone No.: Victoria 9355.

MESSRS. GREENWOOD & BATLEY, LTD., of Leeds, have appointed Messrs. Haslam & Stretton, Ltd., of 11, Windsor Place, Cardiff, to represent them in the South Wales district for the sale of their De Laval steam turbines up to 600 h.p., electric generators, a.c. and d.c., electric motors, traction motors, &c.

The business of BRITTAIN'S ELECTRIC MOTOR Co. (formerly Langdon-Davies Motor Co.), has been purchased and will be carried on at Eastdown Works, Dermody Road, Lewisham, S.E.13, by Mr. H. W. Hitching, as heretofore. Mr. Hitching has held the position of general manager for the last 15 years.

New Catalogues and Lists.

MESSRS. HOUGHTON-BUTCHER (GT. BRITAIN), LTD., 88-89, High Holborn, W.C.1.—"Radio News" for February, containing notes on the radio trade, details of new devices, and price lists.

ELECTRICARS, LTD., Landor Street, Birmingham.—An illustrated brochure dealing with storage-battery transport in industry and a pamphlet describing the company's refuse-collecting, &c., vehicles.

THE BRITISH THOMSON-HOUSTON Co., LTD., Rugby.—A reprint of an article from the *Illustrated London News* dealing with successes of cars fitted with "B.T.-H." magnetos.

HIGGS MOTORS, Witton, Birmingham.—February stock list of a.c. and d.c. motors. Priced.

MESSRS. SPENCER (MELKSHAM), LTD., Melksham, Wilts.—An illustrated brochure dealing with the company's machinery for handling materials in bulk.

THE MULLARD WIRELESS SERVICE Co., LTD., Mullard House, Denmark Street, W.C.2.—Four illustrated leaflets giving particulars and characteristic curves of the company's transmitting, modulating and rectifying valves.

MESSRS. E. BROOK, LTD., Empress Works, Huddersfield.—Pamphlet No. 119, containing notes on the company's production methods and illustrations of the works.

MESSRS. E. P. ALLAM & Co., LTD., 107-109, Gray's Inn Road, W.C.1.—A monthly stock list of motors for sale or hire.

MESSRS. SCOTT & HODGSON, LTD., Guide Bridge Iron Works, near Manchester.—A well-illustrated catalogue of the company's products, including a 12,000-i.h.p. mill steam engine, large rope pulleys, spur wheels, steel shears, rolling-mill drives, &c.

THE CAPAC Co., LTD., 11, Willow Avenue, Barnes, S.W.13.—An illustrated booklet describing the "Capac" binaural equipment for testing the internal conditions of machinery.

THE GENERAL ELECTRIC Co., LTD., Magnet House, Kingsway, W.C.1.—Leaflets Nos. 219, 259, and Y4,374, dealing respectively with field regulators, high-speed circuit breakers, and the "D.B. Minor" d.p. switch and fuses. Fully illustrated. Also Pamphlet O.S.4,366, dealing with the "Osram" Pearl" lamp, which is now made in the 100-W size.

SANTON, LTD., Dock Street, Newport, Mon.—An illustrated pamphlet describing the "Santon" electric belt for application to ordinary cylindrical tanks for water-heating purposes. Priced.

THE STANDARD INSULATOR Co., LTD., Winsley House, Wells Street, Oxford Street, W.1.—A brochure and a series of illustrated pamphlets dealing with "Rockbestos" (asbestos covered) wires and cables, for which the company are the sole agents for Europe (excluding Norway and Sweden).

THE NORMAND ELECTRICAL Co., LTD., 3, North Side, Clapham Common, S.W.4.—A leaflet setting forth one hundred and one uses for "Neco" fractional h.p. motors.

MR. A. H. GOWER, 23, Benbow Road, The Grove, Hammersmith, W.6.—A price list of "Ferrowatt" and other lamps and radio valves.

MESSRS. HOLLINGS & GUEST, LTD., Thimble Mill Lane, Birmingham.—A series of illustrated catalogues (priced) of the company's hydraulic presses, industrial stoves, &c.

MR. ALAN WRIGHT, 124, Chancery Lane, W.C.2.—An illustrated pamphlet describing "Hazemeyer" dimmers and regulators for kinemas and theatres. Priced.

Bankruptcy Proceedings.

F. C. SNOOK, 66, High Street, Plumstead, S.E.18, lamp shade manufacturer.—The public examination of this debtor was held recently. The statement of affairs showed liabilities of £898 against assets of £68. The debtor commenced business on his own account in March, 1923, at which time he was experimenting with some electric lighting devices. The business was successful until he became short of working capital. A limited liability company was formed in July, 1926. Debtor said that he was to receive a weekly salary, and he intended to make his creditors an offer. The company had since gone into voluntary liquidation, but he would get substantial compensation under a service agreement. The examination was adjourned.

E. W. KIRK (ACE RADIO MANUFACTURING Co.), wireless apparatus maker, 26, Curzon Street, Derby.—Receiving order made February 9th on debtor's own petition. First meeting held February 24th at the Official Receiver's offices, 4, Castle Place, Nottingham. Public examination, March 22nd, at the Court House, Derby.

E. O. HENSTOCK, electrical engineer, 21, Old Road, Brampton, Chesterfield.—Trustee, Mr. L. A. West, Official Receiver, 4, Castle Place, Nottingham, released February 8th.

C. W. WATSON, electrical and wireless engineer, 33, Rainhall Road, Barnoldswick, Yorks.—Last day for proofs for dividend, March 1st. Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford.

E. D. S. MUNDAY, electrical engineer, 272, Lake Road, Portsmouth.—First and final dividend of 2s. 4¾d. in the £, payable February 28th at the Official Receiver's office, 87, High Street, Portsmouth.

J. REFOY (Varley Radio Co.), dealer in wireless apparatus, 178, Ancona Road, Plumstead, S.E.—Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released February 10th.

Company Liquidations.

RADIO (HOVE), LTD., manufacturers of radio apparatus, Westbourne Place, Hove, Sussex.—A meeting of creditors was held on February 15th at the offices of Messrs. Painter, Mayne & Walker, Cannon Street, E.C., when Mr. A. C. Gillman, the liquidator of the company, presented a statement of affairs which disclosed assets estimated to realise £117. That amount was insufficient to fully discharge the claims of the debenture holders and preferential creditors. There was a deficiency as regarded the debenture holders of £161, and there were no assets available for the unsecured creditors, who were scheduled for £223. The company had created debentures for £200, bearing interest at the rate of 10 per cent. per annum, and £25 was owing in respect of interest. No resolutions were passed, and therefore the voluntary liquidation of the company will be continued with Mr. Gillman as liquidator.

RADIO CABINETS, LTD., Whitehorse Yard, Essex Road, N.1.—A meeting of the creditors was held on February 15th, when it was decided that the voluntary liquidation of the company should be continued with the present liquidator, Mr. Hibbert. An advisory committee was also appointed.

NEUTRON, LTD.—Winding up order made by the High Court on February 15th.

BRITISH WIRELESS SUPPLY Co. (1924), LTD.—Last day for proofs for preferential claims for dividend, March 5th. Liquidator, Mr. H. H. Busfield, 12, Northgate, Bradford.

SOUTHERN COUNTIES ELECTRIC LIGHT AND POWER SUPPLY, LTD.—A petition for the winding up of this company has been presented to the High Court by Messrs. D. Gestetner, Ltd., of Aldwych House, Aldwych, W.C., creditors, and will be heard in London on March 1st.

Dissolution of Partnership.

ALLEN & EDWARDS, electrical and mechanical engineers, 106, Albany Street, N.W.—Mr. G. Allen and Mr. F. R. Edwards have dissolved partnership. Mr. Allen will attend to debts and will continue the business under the style of G. Allen and Co.

Receiver Appointed.

ACCUMULATORS OF WOKING, LTD.—On February 16th Mr. H. Tansley Witt was appointed receiver on behalf of the debenture holders.

United States Exhibitions.

The sixth annual Electric Sign Show was held in the New York Edison Co.'s showroom from February 14th to 19th, and over 200 signs and advertising devices were displayed. Other exhibitions which are being held at the company's showroom are the seventh annual Electric Truck Show (March 14th) and the fifth annual Electric Power Show (February 28th to March 5th).

New Cable Company.

We have received from Messrs. Century Cables, Ltd., of 137, Victoria Street, London, S.W.1, an announcement of the registration of which appears in our "Financial Section" to-day, a pamphlet entitled "The Making of Electric Cables." It contains aerial and exterior views of works which have been purchased at Addlestone, Surrey, for the manufacture of all types of cables, and gives a brief description of the operations of cable manufacture, accompanied by a number of pictures of cable-making machinery.

Book Notices.

In *Electrical Communication* for January an interesting article by Mr. Rollo Appleyard appears, on André Marie Ampère; the life story of the great French mathematician and physicist, who discovered and established on a sound basis the fundamental laws of electro-dynamics, is told in masterly fashion.

To the same issue Mr. J. E. Kingsbury contributes some personal reminiscences of Charles E. Scribner, the inventor of the multiple telephone switchboard and a telephone engineer of the first rank, who introduced the "common-battery" system of working into this country in 1900.

The price of the Post Office Electrical Engineers' *Journal* to annual subscribers has been reduced to 5s. per annum, postage extra; single copies will still be 1s. 6d. each, and this price will appear on the cover. The new price comes into force with the April issue, the size of which will be altered, forming the first part of Volume XX.

"The *Mechanical World* Electrical Pocket Book, 1927." Pp. 400; figs. 133. Manchester: Messrs. Emmott & Co., Ltd. Price 1s. 6d.—This new issue has been revised and brought up to date. New sections have been added, including one on a.c. commutator motors, in which the principles of construction of various types are described and illustrated. Another interesting feature is a chapter on electric lighting and power in villages, in which various systems of supply are considered and many data given.

"Double Helical Gearing." By the technical staff of Messrs. David Brown & Sons (Hudd.), Ltd. Pp. ix+134; fully illustrated. Published by the above company.—This is the second of a series of treatises on the design, manufacture, and application of double helical gearing, with special reference to DBS reducing gears and turbine, haulage and rolling-mill gearing. This well-written and useful book is available to all responsible engineers and executives on receipt of 1s. to cover the cost of distribution.

"Electrical Condensers," by P. R. Coursey. Pp. xxiv+637; 514 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 37s. 6d. net.

"Deafness Explained," by C. M. R. Balbi. Pp. 46; illustrated. London: John Bale, Sons & Danielsson, Ltd. Price 1s. net.

"X-Rays, Past and Present," by V. E. Pullen and W. J. Wiltshire. Pp. 14+229; figs. 43. London: Ernest Benn, Ltd. Price 12s. 6d. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LXV, No. 362. February, 1927. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

Scientific Papers of the U.S.A. Bureau of Standards. No. 539, "Radiometric Measurements on the Carbon Arc and other Light Sources used in Phototherapy." (15 cents.)

"The Purification of Industrial Waters" (107 pp.; 69 figs.). London: The Paterson Engineering Co., Ltd.—Although this deals particularly with the company's own apparatus, it is in the nature of a treatise upon the subject of water purification. A number of methods of treating boiler-feed water, &c., are explained in non-technical terms.

Transactions of the Institution of Engineers, Australia. Vol. V, 1924. Sydney: The Institution.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVI. No. 2. February, 1927. New York: The Institute. Price $1.

Continental Wire Trust.

It is announced that in the course of meetings held last week at Cologne, delegates of the wire-drawing companies of Germany, Belgium, Czecho-Slovakia, and Holland decided to ratify once more the present agreement only so far as concerns the prices to be fixed for each group and their quotas for export. There is no change in the present prices. The provisional agreement came into force on February 15th, and will in the near future be transformed into a definite international agreement to remain in force for several years.—*Reuter* (Brussels).

New Italian Company.

A new company has been formed at Benevento with a capital of 200,000 lire, and the title La Società Elettrica del Vitulanese.

The Economics of the Electrical Industry.

The British Electrical and Allied Manufacturers' Association has prepared a "Monograph on the Electrical Industry" for presentation to a committee preparing matters for the consideration of the International Economic Conference of the League of Nations. This surveys the world production of electrical goods and the markets for them; deals with developments in organisation and technique; and with production costs and selling prices. A mass of useful statistics is tabulated in various forms.

The Norwegian Electrical Market.

In the course of a survey of the Norwegian import markets, the Oslo correspondent of the Federation of British Industries says that British radio material is in good demand, but the United States and Germany are strong competitors. The demand for electrical heating and cooking apparatus is mainly met by Norwegian manufacturers.

New Indian Company.

A company has recently been formed at Aligarh, United Provinces, with a capital of 10,000,000 rupees and the title of the Aligarh Electric Supply Co.

For Sale.

Liverpool Electricity Supply Department invites offers for a number of second-hand d.c. motors. The County of Dublin Commissioners have for disposal two Corliss valve compound steam engines, coupled to two 500-kW alternators, and one Alley & McLellan surface condenser, &c. (See our advertisement columns to-day.)

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Feb. 22nd.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton.	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£9 10s.	...
a	,, Roll ... ... ,,	£9 10s.	...
a	Soda, Chlorate ... ... per lb.	3½d. to 3¾d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	4d.	...
	METALS, &c.		
b	Aluminium, Ingots... ... ... per ton.	£107 to £112	...
b	,, Wire ... ... per lb.	1/6 to 2/-	...
b	,, Sheet ... ... ,,	1/3 to 2/9	...
p	Babbitt's Metal and Anti-friction Metal—		
	Grade I ... ... per ton net.	£271	£4 inc.
	Grade II ... ... ,, ,,	£187	£2 inc.
	Grade III... ... ... ,, ,,	£96	...
c	Brass (rolled metal 2" to 12" basis) per lb.	9⅝d.	...
c	,, Tubes (solid drawn) ... ,,	11⅛d.	¼d. dec.
c	,, Wire, basis ... ... ,,	9⅝d.	¼d. dec.
c	Copper Tubes (solid drawn) ... ,,	1/0½	¼d. dec.
c	,, Bars (best selected) ... per ton.	£86	£2 dec.
c	,, Sheet ... ... ,,	£86	£2 dec.
c	,, Rod ... ... ,,	£86	£2 dec.
d	,, (Electrolytic) Bars ... ,,	£60 10s.	...
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£74 15s.	...
d	,, ,, H.C. Wire per lb.	9d.	...
f	Ebonite Rod ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	8/-	...
h	India-rubber, Para fine ... ... ,,	1/3½	½d. dec.
l	Iron Pig (Cleveland No. 3.) ... per ton.	122/6	...
l	,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g	Lead, English pig ... ... ,,	£29 10s.	30s. inc.
g	Mercury ... ... per bot.	£17 5s. to £17 10s.	...
e	Mica (in original cases) small ... per lb.	3d. to 8/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/ to 20/- & up.	...
p	Phosphor Bronze, plain castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/3	...
p	,, ,, rolled strip & sheet ,,	1/2⅝	...
p	,, ,, wire... ... ... ,,	1/3½	½d. dec.
o	Platinum ... ... per oz.	£23	...
d	Silicium Bronze Wire ... ... per lb.	10¼d.	...
r	Steel, Magnet, in bars ... ... ,,	7¾d.	...
n	Tin, Block (English) ... ... per ton.	£307 to £307 10s.	£3 10s. inc.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co,. Ltd
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Lighting and Power Notes.

Alloa.—Transfer of Undertaking.—The Town Council has given notice of its intention to transfer its electricity undertaking to the Scottish Central Electric Power Co. The transfer is to be made as from January 1st last, and the purchase price is £100,000.

Bedford.—Electricity in Bulk.—For the purpose of affording a bulk supply of electricity to the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co., the Corporation Electricity Committee has recommended the sale to the company of land at Sandy for erection of a sub-station.

Chile.—Hydro-Electric Scheme.—A contract has been concluded between the Santiago Traction and Lighting Co. and the Compañia Chilena for the construction of a hydro-electric plant on the Maipo River, with a minimum capacity of 22,000 kW. The power available from this river is approximately 70,000 kW, which will be barely sufficient for immediate purposes, which include electricity for 25 miles of the Transandine Railway. Other sources will therefore have to be found. The growth of the supply of electricity in Santiago to the State railways and other consumers has been very rapid, sales having increased from 55,000,000 kWh in 1922 to over 120,000,000 kWh in 1926.—*Reuter's Trade Service* (Santiago).

Clitheroe.—Electricity Supply.—The electricity supply for the district is to be formally inaugurated on March 3rd. The h.p. cable is to be extended to Chatburn, where the charges will be 8d. per kWh for lighting and 2d. per kWh for heating, cooking, and power.

Continental.—Switzerland.—The Geneva correspondent of *The Times* reports that the recent completion of the Vernayaz power station of the Swiss Federal Railways—in Canton Valais—brings to an end the construction of the Barberine-Vernayaz hydro-electric plant, the largest in Switzerland. Its aggregate capacity will be over 180,000 h.p. The construction and equipment of the Barberine-Vernayaz plant has cost nearly £1,600,000, and the electricity produced is transformed on the spot and distributed to the railways by several sub-stations. The greater part of the power goes to the electrified lines of Western Switzerland, while a small part is transmitted 80 miles northwards to feed the lines of Northern Switzerland. The plant is also connected with the Amsteg-Ritom plant, on the St. Gothard line, a distance of 100 miles, so that its power can be distributed all over the network of the Swiss railways.

The municipal authorities of Geneva have received Government authority to "export" electricity to industrial works in the Bellegarde district of France. The concession, which is to remain in force until the end of 1930, provides for a maximum export of 2,000 kW, the daily quantity supplied not to exceed 48,000 kWh, and this only during the April-September period.

Andorra.—The Sociedad Electro-Harinera Andoranna is establishing a central power station for the supply of electricity in the Republic.

Germany.—Considerable developments have been made in the electricity supply industry in Germany. The largest electricity supply concern is the Elektrowerke Gesellschaft, of Berlin, whose 110,000-V lines supply the whole of the Central German industrial area. The annual output now amounts to 1,577,000,000 kWh. In 1925 the company extended its power stations to a capacity of 400,000 kW and added several hundred miles to its h.p. network. The Sachsischewerke, controlled by the Free State of Saxony, is connected up to the stations of the Elektrowerke. The Saxon concern has a lignite power station at Hirschfelde, with a capacity of about 100,000 kW, and a second lignite station is under construction near Leipzig. In 1925 the output amounted to 386,000,000 kWh. In addition, a supply of 156,000,000 kWh was taken from the Elektrowerke. The company paid a 10 per cent. dividend on the share capital of £1,000,000. The Rhenisch-Westfalische Elektrizitatswerk, of Essen, increased its output during 1924-25, by 60 per cent., to 1,099,000,000 kWh. The total capacity of the power stations of the company is 475,000 kW, of which 290,000 kW is accounted for by the Goldenbergwerk, near Cologne.

Darlington.—Electricity Supply.—The Rural District Council has given permission to the Corporation to supply electricity within the parishes of Blackwell and Hurworth and Croft, and to the Cleveland and Durham County Electric Power Co. to supply electricity to Brampton, Great Burdon, Haughton, Morton Palms, Neasham, Sadberge, Whessoe, and nine other parishes.

East Grinstead.—Electricity in Bulk.—The Urban District Council has been informed by the borough electrical engineer of Tunbridge Wells that it is hoped that a bulk supply of electricity for the district will be available by next autumn. The scheme will also include Crowborough.

Glasgow.—Hire-Purchase Scheme.—The manager of the electricity undertaking has reported to the Sub-Committee on Propaganda that the Corporation has adopted a ten-year hire-purchase wiring scheme. The sub-committee has recommended that he be authorised to expend a small sum in advertising the scheme.

Progress during January.—During January 106 houses were wired under the Electricity Department scheme, making the total to date 3,236, and there were 251 applications for the hire of domestic appliances, making the total to date 14,279.

Gravesend.—Loan.—The Town Council has applied for sanction to a loan of £12,647 for the installation of a new boiler at the electricity works, which has already been ordered.

Street Lighting.—The lighting in certain streets is to be improved at an estimated cost of £1,150.

Ilford.—Loan.—The Electricity Committee is applying for sanction to the borrowing of £50,000 for mains and services.

India.—Pykara Hydro-Electric Scheme.—The Pykara scheme, which is the largest hydro-electric scheme in the Madras Presidency, was submitted to Messrs. Merz & McLellan for investigation. They have made their report, recommending the Government to begin by first supplying electricity in the area round about Pykara with a view to creating some demand for it, and afterwards to proceed with the electrification of railways which, in their opinion, should be a secondary object. They have also expressed the view that the scheme has been under-estimated, and they have advised the Government to ascertain beforehand what the actual power requirements would be near the source before launching the scheme. The Government has appointed an expert committee, which, it is reported, has been successful in obtaining the support of cotton and other mills in the neighbourhood.—*Reuter's Trade Service* (Bombay).

Inverness.—Purchase of Plant.—On the recommendation of the Electricity Committee, the Town Council has agreed to purchase the Bught hydro-electric plant and acquire the water rights for £850.

Irish Free State.—The Shannon Scheme.—It is understood that the erection of masts in the Dublin to Waterford loop of the Shannon scheme is to be begun immediately. Electricity will be transmitted at 38,000 V from Dublin to Bray, Wicklow, Arklow, Wexford, New Ross, and Waterford. From Waterford the line will pass through Kilkenny to Carlow, Athy, Maryborough, Kildare, and Dublin. The route has been surveyed, and the masts have been placed in readiness for erection.

Lichfield.—Mains Extensions.—The City Council is to carry out mains extensions to various parts of the city, at a cost of £4,550.

London.—St. Marylebone.—The Electricity Committee has received a report from the borough electrical engineer on the future development of the electricity undertaking, in which he states that the five 2,000-kW Parsons turbo-generators installed at Richmond Street station are more or less obsolete, and a considerable saving in working costs, as well as increased generating capacity, would result from the replacement of the whole of this plant. The two 3,500-kW Oerlikon turbo-alternators, although serviceable for some years yet, occupy space which could be used to better advantage. He has recommended the installation of two 20,000-kW turbo-alternators, &c., at an estimated cost of £174,000, in place of two 2,000-kW sets and two 3,500-kW sets. This proposal provides an installed capacity of 74,500 kW, and approximately 50,000 kW of demand capacity. The scheme would be carried out in two stages, and the second stage would include additional boiler and cooling-tower plant, at an estimated cost of £30,500. He also gave figures showing the difference in favour of generation on site with increased bulk supply. The Electricity Committee has recommended that the report be submitted to the Electricity Commissioners and that they be informed that the Council would be prepared to apply for approval to plant extensions and for loan sanctions for the expenditure involved. Sanction has been received to a loan of £29,966 for the acquisition of property in Aybrook and Blandford Streets for electricity purposes.

Hammersmith.—The Electricity Committee has recommended to the Borough Council that a supply of electricity be provided for the Wormholt housing estate of the L.C.C., and that the Council undertake the wiring of the houses to be erected, the total cost of the scheme being £19,083, made up as follows:—Wiring installation of 662 houses, £6,102; h.p. and l.p. mains, £8,517; provision and equipment of sub-stations, £823; services, £3,641.

Islington.—The Finance Committee has recommended that application be made for sanction to a loan of £29,137 for new boiler plant at the electricity works.

Bermondsey.—The Electricity Committee is applying for sanction to loans of £22,000 for mains and services, £5,000 for meters, and £10,000 to cover capital expenditure during the year.

Hackney.—The Electricity Committee has recommended that the increase of 25 per cent., made in certain electricity charges owing to the higher cost of coal, be withdrawn.

Southwark.—The inquiry into the Borough Council's application for sanction to extend its power station was concluded on February 11th. Mr. S. Morse, for the London Power Co. and the County of London Electric Supply Co., Ltd., who were opposing the application as ratepayers, states that his clients had powers to supply in certain parts of the borough, and the fact that the Council had within its area the mains of three companies, each with large generating resources, and able to give the whole supply required by the borough, made the extensions proposed by the Council unnecessary. Evidence was called to show that a bulk supply would be more economical in the interests of the ratepayers than incurring expenditure for the purpose of extending the existing system controlled by the Borough Council. An expert witness pointed out that the acceptance of bulk supply would relieve the Council of certain responsibilities, substantially reduce the expenditure, and would, therefore, be of all-round benefit to Southwark. The Electricity Commissioners will give their decision in due course.

Louth.—Electricity in Bulk.—The Town Council has asked Grimsby Corporation for the lowest terms upon which it would give a supply of electricity in bulk.

Middlesbrough. — Electricity Supply. — The Electricity Commissioners' decision relative to the Corporation's application for sanction to borrow £140,000 for the erection of a new generating station has not yet been received. Meanwhile there has been correspondence between the Corporation and the Cleveland and Durham Power Co., which now provides a bulk supply. The Corporation has informed the company that, while its second offer for a supply is an improvement upon the first, the conditions have not changed, and the result of the Commissioners' inquiry is awaited. The Corporation is still open to negotiate even if sanction to erect its own power station is received.

Milnrow.—Loan.—The Urban District Council has applied for sanction to a loan of £1,830 for extending the electricity supply on the Holt estate and to the Newhey Brick Co.

Northern Ireland.—Portadown (Co. Armagh).—A deputation from the Town Council and consumers, which waited on the managing director of the Portadown Electric Co. with regard to the emergency that has arisen owing to the destruction of the power station by fire, was informed that some days must elapse before the company could give any definite information as to the probable date when a supply would be resumed from the power station. The company, however, would raise no objection to any consumer obtaining a supply of electricity from any source during the time its supply was not available, and no proceedings would be taken against any person or firm who might give a supply. Negotiations have been opened between representatives of the company and a local firm for the use of an engine and premises capable of generating sufficient electricity to supply all consumers. If a satisfactory arrangement can be arrived at, it is anticipated that the company will be in a position to give a supply to consumers within a week or ten days of the conclusion of the negotiations.

Newry (Co. Down).—The Urban District Council is applying to the Electricity Commissioners for Northern Ireland for a Special Order authorising it to supply electricity in the district. The estimated cost of the scheme is £25,000.

Preston.—Electrical Development.—The Town Council is applying for sanction to proceed with the provision of a fourth turbo-generator at the Ribble power station, at a cost of £140,000, thus bringing the total capital outlay on the undertaking to nearly £1,500,000. Electricity is already supplied to Leyland, through the Lancashire Electric Power Co., and next winter Blackpool will receive a supply. There has already been an inquiry respecting a supply for Southport.

Shrewsbury.—Transfer of Undertaking.—The Corporation has sealed an agreement for the transfer of its power station to the West-Midlands Joint Electricity Authority. The agreement provides that the actual completion of the purchase of the generating station will not take place until an adequate supply of electricity is available for the borough from the h.p. mains proposed to be laid down by the Joint Authority.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The Whitchurch and Pangbourne Electric Supply Co., Ltd., to include in its area of electricity supply the parishes of Purley, Sulham and Tidmarsh; the Goring and Streatley Electric Light and Power Co., Ltd., to supply electricity in certain parishes in the rural districts of Goring, Crowmarsh, Bradfield, Wantage and Wallingford; the Chirk Electricity Supply Co., Ltd., to supply parts of the rural districts of Chirk and Oswestry.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Worcestershire and Staffordshire Electric Power Co. to supply electricity in the borough of Ludlow.

Swansea.—Supply for Docks.—The Electricity Committee is to lay a feeder cable, at a cost of £8,000, to give an additional supply of electricity to the docks of the Great Western Railway Co.

Loan.—Application is being made for sanction to a loan of £10,000 for meters.

Tiverton.—Loan.—The Town Council, on February 14th, approved a recommendation of the Lighting Committee that application be made for sanction to borrow £1,650 for an extension of the mains in order to make a complete ring and provide a safety line in case of a mishap to the main feeder.

Truro.—Electricity Supply.—The City Council has been informed by Messrs. Edmundsons Electricity Corporation, Ltd., that a supply of electricity will be available by next winter.

Tynemouth.—Loans.—The Electricity Committee is applying for sanction to loans of £16,000 for cable extensions, £2,000 for a sub-station at Cullercoats, £800 for extensions at Preston sub-station, £1,700 for a sub-station at Dock Road, £6,300 for sub-stations and equipment for supply to Commissioners' Dock, and £1,800 for two transformers.

Tramway and Railway Notes.

Bradford.—New Tramcar Design.—Trials have recently been made with a new type of long, single-deck tramcar, designed by Mr. R. H. Wilkinson, the city tramway manager, and built at the Thornbury depôt workshops. The car is 39 ft. long and capable of a speed of 20 to 30 m.p.h. The exits are in the centre of the car, and the interior furnishing is in polished mahogany, with seats upholstered in red leather. Power operated brakes and doors closed by electric control from the driver's platform form a special feature. The car has seating for 35 passengers.

Continental.—France.—New electric tramways have recently been completed and put into operation between Lille and Marquette (Nord) and between Marseilles and Les Olives (Bouches-du-Rhône).

Germany.—In connection with the work of electrification of the Berlin City railway, which is now in progress, it is announced that the Reich Railway Co. has placed orders for the delivery of aluminium coaches. The coaches will be constructed on behalf of the Metal Bank and Metallurgical Co., which is interested in aluminium rolling mills, in conjunction with wagon construction works.

Darlington.—Railless Cars.—The Rural District Council has granted an application from the Corporation to run railless cars from Park Lane along Geneva Road West subject to any additional cost for road repairs being borne by the Corporation.

India.—Railway Budget.—A *Reuter* message from New Delhi states that the Railway Budget for 1927-28, presented in both the Legislative Assembly and the Council of State on February 17th, provides for an expenditure during the year of 25 crores of rupees, of which 275 lakhs has been set aside for the electrification of the Great Indian Peninsula and Bombay, Baroda and Central railways.

London.—Underground Improvements.—Experiments are now being made at Earl's Court and South Kensington stations (District Railway) with a new type of train-starting device. Suspended from the roof at one end of each platform are a number of rods linked together with a cable. From this cable two wires are suspended, which connect electrically with a bell at the other end of the platform. When it is desired to start the train, the guard touches the two wires simultaneously with the metal handle of his flag. The circuit formed rings the bell which is near the motorman's cab. If these experiments are successful, the device will be introduced at all other stations between Acton and Bow.

Important structural alterations are now being made at Finsbury Park (Piccadilly line) station, to enable the traffic to be handled with greater ease and also to make the station itself more attractive. The present booking offices are to be cleared away and the passimeter system introduced. Several experiments have recently been made in floodlighting, particularly on the new Morden Tube, where the exteriors of the stations are floodlighted and the positions of the stations emphasised still further by means of searchlights placed on the station roofs. A further experiment of this kind is to be made at the reconstructed Finsbury Park station by substituting for the usual rows of subway lights a scheme of floodlights.

Swansea.—Mumbles Railway.—The *South Wales Daily Post* states that there is every possibility of an early move being made in connection with the electrification of the Swansea and Mumbles Railway. The Provisional Order has been obtained, and terms have been arranged with the Swansea Corporation for the supply of the necessary electricity. A conference on the matter with the chairman (Mr. Tegetmeier) and the engineer of the company has been arranged, when it is expected some definite steps will be taken.

Telegraph and Telephone Notes.

France.—Telephone Service.—Work has lately been commenced on the conversion of the Colbert telephone exchange in Marseilles to automatic operation.

It is announced that from February 17th Paris will be able to communicate by telephone with Venice, *via* Milan. A six minutes' conversation in the daytime will cost 60 fr., and an urgent call may be booked at triple rates.

Irish Free State.—Telephone Capital Bill.—In Dail Eireann on February 15th the Minister of Finance moved the second reading of the Telephone Capital Bill, under which it is proposed that £500,000 shall be advanced for the development of the telephone service in the Free State. Mr.

J. J. Walsh, Minister for Posts and Telegraphs, said that development fell under four distinct headings, namely :—

Erection of trunk lines	£26,900
New subscribers' connections and call offices	38,600
Underground cable work	111,180
Automatic telephones	123,000

He reminded the Dail that he was not asking for free utilisation of the taxpayers' money; every penny advanced would be paid back, principal and interest, within a period varying from fifteen to twenty years, and a considerable part of the amount asked for would be used for new buildings. In the year 1922-23 the loss was £46,000, in 1923-24 is was £25,000, and in 1924-25 the loss disappeared altogether. In 1925-26 they introduced substantial reductions in charges, and the loss rose to £35,000. He foresaw its total disappearance in 1927-28. They were installing two automatic exchanges in Dublin—one at Merrion and another in the Castle area; the latter would be opened about the middle of the year, and the other early next year. The Bill was read a second time, and the Committee stage was fixed for February 18th, says the *Irish Times*.

Portugal.—AFTERMATH OF REVOLUTION.—The country is returning to normal following the latest revolutionary movement. It is understood that the damage done to the Anglo-Portuguese Telephone Company's property in Lisbon will cost over 200 contos to repair; the company's loss in Oporto is estimated at 50 contos.—*Reuter* (Lisbon).

The rebel chief telephoned his momentous decision over the telephone system, which had continued working, for the telephone girls, like every one in the danger zone, were obliged to stay where they were when the firing broke out, says *The Times*, which announces that public subscriptions have been opened to reward the telephone girls. The British Ambassador has sent a letter of thanks to Mr. Pope, the manager of the telephone system, for the splendid services rendered. It was stated on February 11th that such messages as came through indicated that all the British staffs at Oporto and Lisbon were safe. The Eastern Telegraph Company's station at Carcavellos (at the northern mouth of the Tagus, near Lisbon) was working normally, and a message came through that the staff at the sub-station in Lisbon was safe.

Marconi's Wireless Telegraph Company stated that it was transmitting and receiving messages as usual between its English and Lisbon stations.

Transatlantic Telephony.—SERVICE EXTENSION.—In reply to a question in the House of Commons, the Postmaster-General, Sir W. Mitchell-Thomson, said that the number of telephone calls on the Anglo-American service from January 7th (the date of inauguration of the service) to the end of that month was 105 from Great Britain and 160 from America.

The service has been extended to other parts of this country outside London, whilst the facilities are being steadily extended in the United States, and now cover 36 of the 48 States in the Union. The area served comprises nearly half the territory of the Republic.

Radio Notes.

Denmark.—LICENCES.—It is stated officially that there are now 106,400 licensed Danish listeners: of that number, 54,743 are crystal users and the balance valve-set users.

Italy.—BROADCASTING CONTROL.—The Department of Overseas Trade learns from a reliable source that a Commission for the control of broadcasting services has been set up in Rome by Royal Decree. In addition to control, the Commission is charged with examining and reporting on the most suitable methods of developing and improving broadcasting from technical, artistic, and educative points of view.

Malaya.—NEW REGULATIONS.—The Malayan Wireless Committee recently submitted recommendations regarding radio regulation, which were accepted by the Government. An exclusive broadcasting licence is to be issued for a period of five years to the grantee, who will be chosen from the group of applicants after the expiration of three months from the date of first publication of the terms of the proposed licence. The broadcasting company must, within one year from the date of issue of the licence, install and operate one or more broadcasting stations with machinery of British manufacture of the latest type; renewals and replacements of operating plant need not be of British manufacture. The company must carry out a regular service, consisting of matter approved by the Postmaster-General. It will have the right to disseminate advertising matter and make charges therefor, but such broadcasting must not exceed more than 10 per cent. of the total daily broadcasting time. The Government will charge $20 annual fee for each receiving licence and pay the broadcasting company $18 of this sum.

Philippine Islands.—NEW RADIO LAW.—The Nieto Radio Bill has become a law. In the past broadcasting in the Philippines has been hampered because the stations had no financial support save that obtained from the sale of receiving apparatus, a portion of which accrued to the broadcasting concern. Under the Nieto law, an equitable situation is created whereby every owner of a set helps to support the programmes which he hears, regardless of whether the merchant from whom he purchased his receiver is carrying on broadcasting or not, says *Commerce Reports*. The installation of the former WJZ transmitter at the transmitting centre at Manila Heights is being expedited and should be heard with reliability throughout the archipelago. At the same time improved studio facilities and an adequate staff are being organised.

Suggested New Station.—NORTH WALES PROPOSITION.—At the Ryle Municipal Council's meeting last week, Mr. J. Jones Williams drew attention to the British Broadcasting Corporation's intention to set up a station in North Wales, and suggested Rhyl as the most suitable position for it. During the war, he said, there was a Government wireless station at Rhyl. The Council decided to ask the B.B.C. to locate its proposed North Wales station at Rhyl.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Aberdeen.—March 4th. Parish Council. Re-wiring the electrical installation of Oldmill Hospital. Specifications from Mr. J. Alexander Bell, city electrical engineer.

Ashford.—March 14th. Electricity Department. Two electrically-driven centrifugal pumps (capacity 30,000 gal. per hour). (See this issue.)

Australia.—MELBOURNE.—April 5th. Postmaster-General's Department. Condensers. (B.X. 3215.)*

March 30th. Victorian Railways. Lightning arresters. (B.X. 3213.)*

April 26th. Telephone switches. (B.X. 3254.)* Instrument cords. (B.X. 3255.)*

BRISBANE.—April 13th. Brisbane City Electric Light Co., Ltd. Transformers. (B.X. 3218.)*

Bedford. — February 28th. Electricity Department. Twelve months' supplies of e.h.p. and l.p. cables and incandescent electric lamps. (February 11th.)

Belgium.—March 9th. Belgian Post and Telegraph authorities, La Salle Madeleine, Brussels. 40 kilometres of silk-covered enamelled wire, 25 kilometres of specially-insulated wire, and 4.6 kilometres of armoured wire cable.

Brecon.—March 16th. Electricity Department. Generating plant and switchgear, battery of accumulators and connections, underground and overhead lines. (See this issue.)

Bridlington. — March 9th. Electricity Department. Stores for 12 months, including lamps, electrical sundries, V.I.R. cables, &c. (See this issue.)

Cheadle and Gatley.—March 1st. Electricity Department. Annual contracts for lamps, meters, and wood covering boards. (February 18th.)

Colwyn Bay.—March 11th. Electricity Department. Twelve months' supply of cables, joint boxes, house service cut-outs, joint compound, sundry stores, house service meters. (See this issue.)

Dublin.—March 2nd. Great Northern Railway (Ireland). Stores for nine months, including electrical fittings, lamps, cable and wire. (February 18th.)

March 2nd. Office of Public Works. Installation of electric lighting at the Custom House, Dublin. Mr. T. Cassidy, secretary.

Dundee.—February 28th. Education Committee. Electrical installation for the new secondary school, Perth Road. Messrs. Thoms & Wilkie, architects, 21, South Tay Street, Dundee.

Durham (Co.).—March 12th. County Council. Electrical work for the Seaham Hall tuberculosis hospital. W. and T. R. Milburn, architects, 19, Fawcett Street, Sunderland.

Edinburgh.—Corporation. Supplies in connection with the maintenance of the Corporation properties, including supplies for the Lighting Department, &c. Form from Town Clerk.

Egypt.—Egyptian State Railways, Telegraphs and Telephones. Chief Inspecting Engineer, Queen's Anne's Chambers, Broadway, Westminster, S.W.1. Telegraph and telephone materials.

Ilford.—March 8th. Electricity Department. Twelve months' supply of house-service boxes, lamps, main cut-outs, meters, and pavement box covers. (See this issue.)

India.—March 22nd. India Store Department. Two 250-kW Diesel-engine alternator sets, with switchgear, transformer, &c. (February 18th.)

Leeds.—March 2nd. Tramways and Transport Committee. Materials, including electrical sundries required during year ended March 31st, 1928. General manager.

London.—Stepney.—March 3rd. Board of Guardians. Electrical fittings for 6 months. Mr. S. McClelland, clerk to the Guardians, Bancroft Road, Mile End, E.1.

Littlehampton.—March 8th. Sussex Electricity Supply Co., Ltd. One 150-kW Diesel engine and generator with auxiliaries, switchgear and cables. (February 18th.).

Oldham.—March 7th. Board of Guardians. Electric lamps and fittings. Mr. Fred. W. Fletcher, clerk.

Rhondda.—March 26th. Electricity Department. Twelve months' supply a.c. ordinary and prepayment meters, mains and house service material. (See this issue.)

Roxburgh.—March 5th. County Education Authority. Electrical work in connection with the reconstruction of and additions to High School, Hawick. Mr. J. A. Carfrae, architect, 3, Queen Street, Edinburgh.

South Africa.—Johannesburg.—March 3rd. South African Railways and Harbours. Overhead line material. (B.X. 3224.)*

March 19th. Municipal Council. Single-phase concentric cable. (B.X. 3236.)*

Cape Town.—March 9th. Electricity Department. Insulated wire. (B.X. 3233.)*

South Elmsall.—March 19th. Electric lighting installation at Westfield Lane Council School. Education Department, County Hall, Wakefield.

Stoke-on-Trent.—March 8th. Electricity Department. De-aerating plant and electrically-driven boiler-feed pumps. (February 18th.)

March 8th. Electricity Department. Twelve months' supply a.c. and d.c. meters, mains and cables. (See this issue.)

Torquay.—March 11th. Electricity Department. Two water-tube boilers with chain-grate stokers, induced draught plant, pipework and economisers. (February 18th.)

March 16th. Electricity Undertaking. One 6,000-kW turbo-alternator, with surface condenser and auxiliary plant. (See this issue.)

Warrington.—March 14th. Electricity Department. Motors and transformers. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bangor.—Corporation.
Wiring 64 houses on the J. & P. wiring system.—Messrs. Owen & Palmer, Bangor.

Bradford.—Electricity Committee. Accepted:—
Water-softening plant at the Valley Road generating station.—Paterson Engineering Co., Ltd.

Chesterfield.—Electricity Committee. Accepted:—
E.h.p. metering switch cubicle.—British Thomson-Houston Co., Ltd.
One steam-driven boiler feed pump.—T. W. Ward, Ltd.
L.p. cables (£312).—Hogan & Wardrop, Ltd.
E.h.p. cables (£372).—Macintosh Cable Co., Ltd.

Clacton.—Urban District Council. Accepted:—
Two 1,125-b.h.p. oil engines (£20,500); two 750-kW alternators (£3,250).—English Electric Co., Ltd.
Rotary convertors and e.h.p. switchgear (£5,250).—Crompton & Co., Ltd.

Clydebank.—Town Council.
Housing scheme.—Supplying and fitting electric radiators (£3 6s. 11d. each).—D. Donald.

Croydon.—Electricity Committee. Recommended:—
Switchgear (£3,145).—Metropolitan-Vickers Electrical Co., Ltd.

Dublin.—Dublin United Tramways Co., Ltd.
Electric lamps, including 8,000 " Osram " vacuum tractior lamps.—General Electric Co., Ltd.

City Commissioners.
Wiring for electric lighting 59 four-roomed houses a Fairbrother's Field (£616).—Electricity Supply De partment.

Controller of Stores, Posts and Telegraphs.
Bell sets.—Siemens Bros. & Co., Ltd.
Coin boxes (telephone).—Hall Telephone & Accessories Ltd.
Insulators.—Doulton & Co., Ltd.
Telephone relays and coils.—Siemens Bros. & Co., Ltd.
Wireless parts.—Marconi's Wireless Telegraph Co., Ltd.
—*Irish Electrician.*

Durham.—Board of Guardians. Accepted:—
Electric lighting installation at the new Cottage Homes (£103).—Mr. R. Wilson.

Evesham.—Town Council. Accepted:—
Installing electric lighting at the baths.—Averill & Son

Glasgow.—Electricity Committee. Recommended:—
Sub-station switchgear (£239).—A. Reyrolle & Co., Ltd. also further sub-station switchgear during the year at the same price per set.
Two preheaters for two boilers at Dalmarnock power station (£5,800).—Howden-Ljungström Preheaters (Land), Ltd.

Libraries Committee.. Recommended:—
Alteration and repair of passenger hoist at Mitchell Library (£210).—Waygood-Otis, Ltd.

Tramways Committee. Accepted:—
Block tin.—P. W. MacLellan, Ltd.
Subway rails.—W. Beardmore & Co., Ltd.

Special Acts Committee. Accepted:—
Electric lighting installation at Eastwood Registration Office.—C. Maguire (Glasgow).

Government Contracts.—The following contracts were placed by various Government Departments during January, 1927:—

Admiralty, Contract and Purchase Department.
Alternators, motors and spares.—Mackie & Co.
Aluminium plating for cables.—British Aluminium Co., Ltd.; G. A. Harvey & Co. (London), Ltd.; Bulpitt and Sons, Ltd.
Aluminium sheets.—British Aluminium Co., Ltd.
Batteries.—Chloride Electrical Storage Co., Ltd.; D.P. Battery Co., Ltd.
Junction boxes.—L. Weekes (Luton), Ltd.; Hawkers, Ltd.
Electric cable.—Anchor Cable Co., Ltd.; General Electric Co., Ltd.; Enfield Cable Works, Ltd.; Siemens Bros. & Co., Ltd.
Mining cable.—Hooper's Telegraph & India Rubber Works Ltd.; Siemens Bros. & Co., Ltd.
Cells.—Premier Accumulator Co. (1921), Ltd.; London Battery & Cable Co., Ltd.
Electric fan spares.—General Electric Co., Ltd.
Fuse holders.—Pinnacle Switchgear, Ltd.
Motor-generator set.—British Thomson-Houston Co., Ltd.
Motor generators.—Newton Bros. (Derby), Ltd.; Laurence Scott & Co., Ltd.
Heterodyne and stabiliser units.—Radio Instruments, Ltd.
Electric light and bell installation and installation of electric light and power.—G. E. Taylor & Co.
Electric lamps.—General Electric Co., Ltd.
3,000-kW turbo-alternator.—C. A. Parsons & Co., Ltd.
W./t. valves.—Mullard Radio Valve Co., Ltd.

War Office.
Aluminium ingot.—British Aluminium Co., Ltd.
Electric cables.—Standard Telephones & Cables, Ltd.
Portable secondary cells.—Tudor Accumulator Co., Ltd.
5-kW frequency changer.—Newton Bros. (Derby), Ltd.
Electric locomotive.—Electromobile, Ltd.
X-ray sets.—" Solus " Electrical Co.
Installation of electric cable system, Smallshot.—Standard Telephones & Cables, Ltd.
Installation of electrical services, officers' quarters, &c.—A. V. Gifkins & Co., Ltd.

Air Ministry.
Wireless towers (various stations).—Milliken Bros., Ltd.
Alternator set (Croydon).—Aster Engineering Co. (1913), Ltd.
Control resistance and voltmeters.—British Radio Corporation, Ltd.

Post Office.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Ericsson Telephones, Ltd.; International Electric Co., Ltd.; Peel-Conner Telephone Works; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.

Wireless apparatus.—General Electric Co., Ltd.; Marconi's Wireless Telegraph Co., Ltd.
Telephone cabinets.—Siemens Bros. & Co., Ltd.
Cable (various).—British Insulated Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; Connolly's (Blackley), Ltd.; W. Geipel, Ltd.; W. T. Glover and Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Pirelli-General Cable Works, Ltd.; Standard Telephones & Cables, Ltd.; Union Cable Co., Ltd.
Loading coils.—General Electric Co., Ltd.
Cords for telephones.—London Electric Wire Co. & Smiths, Ltd.; Phœnix Telephone & Electric Works, Ltd.; Standard Telephones & Cables, Ltd.
Ducts.—J. Place & Sons, Ltd.; Standard Brick & Terra Cotta Co., Ltd.
Electric hand lamps.—Ward & Goldstone, Ltd.
Telegraphic ironwork.—J. H. Allen; Bert, Birks & Co.; Bullers, Ltd.; T. W. Lench, Ltd.; C. Richards and Sons, Ltd.
Cadmium copper wire.—R. Johnson & Nephew, Ltd.
Manufacture, supply, drawing-in and jointing cable.—Godalming-Haslemere: Johnson & Phillips, Ltd. Hull - Grimsby, G.P.O.(S) - Wallington Junction: Standard Telephones & Cables, Ltd. Bristol-Temple Cloud: Pirelli-General Cable Works, Ltd. London—Amersham (London-Chorley Wood section): W. T. Henley's Telegraph Works Co., Ltd.
Manufacture, supply and laying submarine cable.—Portsmouth-Gosport: Pirelli-General Cable Works, Ltd.
Telephone exchange equipment.—Wandsworth, Wimbledon and Epsom Gas Co., Ltd.; Royal Arsenal Co-operative Society, Ltd., (S.E.18); Spillers & Bakers, Ltd. (Cardiff); John Player & Sons (Nottingham); Dorset County Council (Dorchester): Relay Automatic Telephone Co., Ltd. Middlesbrough (Middlesbrough multi-office area), Stockton-on-Tees: General Electric Co., Ltd. Sub-contractors: Chloride Electrical Storage Co., Ltd., for batteries; Crompton and Co., Ltd., for machine plant. Linthorpe (Middlesbrough multi-office area) and Southbank (ditto): General Electric Co., Ltd. Sub-contractors: W. Jones and Co. for ringing machines. Horley (Surrey): General Electric Co., Ltd. Sherwood (Nottingham), Arkwright Street (ditto), and Malvern: Automatic Telephone Mfg. Co., Ltd. Walsall (Walsall multi-exchange area): Ericsson Telephones, Ltd. Sub-contractors: D.P. Battery Co., Ltd., for batteries; Crompton & Co., Ltd., for machine plant. Bloxwich (Walsall multi-exchange area): Ericsson Telephones, Ltd. Sub-contractors: Automatic Telephone Mfg. Co., Ltd., for ringing machine. Bath (Bath multi-office area): Ericsson Telephones, Ltd. Sub-contractors: D.P. Battery Co., Ltd., for batteries; Crompton & Co., Ltd., and General Electric Co., Ltd., for machine plant. Batheaston (ditto): Ericsson Telephones, Ltd. Sub-contractors: Automatic Telephone Mfg. Co., Ltd., for ringing machines. Bermondsey: Standard Telephones & Cables, Ltd. Sub-contractors: Electric Construction Co., Ltd., for charging machines; Crompton & Co., Ltd., for ringing machines; and D.P. Battery Co., Ltd., for batteries.
Telephone repeater station power plant.—Marks Tey: Newton Bros. (Derby), Ltd. Sub-contractors: Pritchett & Gold & E.P.S. Co., Ltd., for batteries; Ruston and Hornsby, Ltd., for engines.
2-wire repeater equipment for Canterbury telephone repeater station.—General Electric Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Cables.—W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.
Fuse mountings.—Telephone Mfg. Co., Ltd.
"Lux" cells.—Chloride Electrical Storage Co., Ltd.
Telephone apparatus.—Ericsson Telephones, Ltd.; Bullers, Ltd.; Peel-Conner Telephone Works.
Train-lighting spares.—Pritchett & Gold & E.P.S. Co., Ltd.; J. Stone & Co., Ltd.
Wire.—F. Smith & Co., Ltd.
X-ray equipment.—Watson & Sons, Ltd.

H.M. OFFICE OF WORKS.

Wiring Adastral House, Kingsway, W.C.—J. G. Briggs and Co.

Hornsey.—CORRECTION.—The names of the contractors for the electric lighting installation at the Council houses, recorded on page 181 of the February 4th issue are Messrs. E. Wight & Co., of Muswell Hill and Finchley (not Wright and Co.).

Liverpool.—Pacific Steam Navigation Co., Ltd.
Twelve months' supply of "Mazda" electric lamps.—British Thomson-Houston Co., Ltd.

London.—LONDON, MIDLAND & SCOTTISH RAILWAY CO.
"Cosmos" vacuum train-lighting lamps.—Metro-Vick Supplies, Ltd.

ADMIRALTY.
Spring contact pieces, rotary switches, and guards for handlamps.—Edison Swan Electric Co., Ltd.

LONDON COUNTY COUNCIL.—Wiring of three blocks of dwellings on the Hornsey Rise estate for electric light:—

A. Shaw	£1,267†
R. Hunt & Co., Ltd. (Accepted.)	**1,375**
Austin & Groves	1,573†
Alpha Mfg. & Electrical Co., Ltd.	1,619
Alex. Hawkins & Sons	1,739
A. Higginbotham & Sons	1,772
C. Mortlock	1,885
D. W. Whymant	1,887
Anderson, Angell & Co.	1,954
Eastern Armature Winding Co.	2,025
Bailey & Incledon, Ltd.	2,159
Smethurst & Co. (London), Ltd.	2,463
Holder & Snider	2,568
E. Wight & Co.	2,816
General Electric Maintenance Co.	3,860

† Tender does not include provision money (£160).

STEPNEY.—Electricity Supply Committee.
3 tons sheet lead (£111).—Locke, Lancaster & Johnson and Sons, Ltd. (Accepted.)
Maximum demand indicators (£7,358).—Reason Mfg. Co., Ltd. (Recommended.)

HACKNEY.—Baths Committee.
Extension of filtration plant at the Central Public Baths, complete with electric motors, switchgear, &c. (£3,745).—Bell Bros. (Manchester), Ltd. (Recommended.)

SOUTHERN RAILWAY. Accepted:—
Six months' supply of electric lamps.—British Thomson-Houston Co., Ltd.; Siemens & English Electric Lamp Co., Ltd.

ISLINGTON.—Lighting Committee. Recommended:—
Steam mechanical soot blowers (£2,650).—Babcock & Wilcox, Ltd.

Works Committee. Recommended:—
Battery for electric vehicle (£182).—Chloride Electrical Storage Co., Ltd.

WESTMINSTER.—Highways Committee. Recommended:—
Dustproof-type electric motor for salvage plant (£96).—Elliston, Evans & Jackson, Ltd.

Macclesfield.—Rural Council. Accepted:—
Installing an electric generating set in connection with the Gawsworth housing scheme (£736).—W. R. Brown.

Newcastle.—Tramways Committee. Accepted:—
200 tons of tram rails and 8 tons of fish plates (£2,191).—Cargo Fleet Iron Co., Ltd.

Rotherham.—Rural Council. Accepted:—
Installing electric lighting in 51 houses at Brampton Bierlow (£260).—Wombwell Electrical Contracting Co.

Southend-on-Sea.—Town Council. Accepted:—
11,000-V, h.p. mains, pilot and control cable for the linking-up of the Leigh, London Road, and Thorpe Bay stations (£28,479).—Pirelli-General Cable Works, Ltd.

Forthcoming Events.

British Industries Fair.—February 21st to March 4th. White City, London, W., and Castle Bromwich Aerodrome, Birmingham.

Institution of Engineering Inspection.—Friday, February 25th. Royal Society of Arts. 7.30 p.m. "The Economic Production of Steam by Electricity." Mr. C. J. Wharton.

Birmingham Electric Club.—Friday, February 25th. Grand Hotel. 7 p.m. "Wireless Telephony." Mr. C. G. A. McDonald.

Institution of Mechanical Engineers.—Friday, February 25th. London. 7 p.m. "Waste Heat Recovery." Major W. Gregson.

Physical Society.—Friday, February 25th. Imperial College of Science, South Kensington, S.W. 5 p.m. Guthrie Lecture, "Atomic Nuclei and their Transformations." Sir Ernest Rutherford, F.R.S.

National Association of Supervising Electricians.—Saturday, February 26th. Holborn Restaurant. 6.30 p.m. Annual dinner.
Tuesday, March 1st. Junior Institution of Engineers. 7.15 p.m. "Electric Lighting and Electrically-worked Apparatus on Railways." Mr. R. T. Smith.

Royal Society of Arts.—Monday, February 28th. "Photo-Elastic Measurements of Stress Distribution." Prof. E. G. Coker, F.R.S.

Electrical Society of Glasgow.—Tuesday, March 1st. 30, Gordon Street. 7.30 p.m. "Reminiscences." Messrs. C. W. Fraser, D. Denholm, W. Bennett, and P. J. Sims.

Röntgen Society.—Tuesday, March 1st. 32, Welbeck Street, W. 8.15 p.m. Ordinary scientific meeting.

Electrical Power Engineers' Association (Midland Division).—Tuesday, March 1st. Chamber of Commerce, Birmingham. 7 p.m. "Super-Tension Cables." Mr. C. Vernier.

(Southern Division).—Friday, March 4th. Institution of Electrical Engineers, London. 7 p.m. "The Installation and Maintenance of e.h.p. Cable." Mr. E. Bowden.

Institution of Heating and Ventilating Engineers.—Wednesday, March 2nd. Caxton Hall, S.W. 7 p.m. Discussion on Dr. Margaret Fishenden's paper, "The Effect of Weather Conditions upon the Heat Requirements of a House."

Edinburgh Electrical Society.—Thursday, March 3rd. Royal Scottish Society of Art. 8 p.m. "Electro-Medical Equipment." Mr. W. Rennie.

Institution of Electrical Engineers.—Thursday, March 3rd. London. 6 p.m. "Illuminating Engineering." Mr. J. W. T. Walsh; and "Problems of Public Lighting by Electricity." Mr. H. T. Harrison.

(North-Eastern Centre).—Monday, February 28th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "Some Recent Advances in a.c. Measuring Instruments." Lt.-Col. K. Edgcumbe and Mr. F. E. J. Ockenden.

(Irish Centre (Dublin)).—Tuesday, March 1st. Mansion House, Dublin. 7.45 p.m. Faraday Lecture, "What is Electricity?" Prof. W. M. Thornton.

(Tees-Side Sub-Centre).—Monday, February 28th. Middlesbrough. 7 p.m. "The Design of City Distribution Systems." Messrs. J. R. Beard and T. G. N. Haldane.

(East-Midland Sub-Centre).—Tuesday, March 1st. University College, Nottingham. 6.45 p.m. "The Design of City Distribution Systems." Messrs. J. R. Beard and T. G. N. Haldane.

(Wireless Section).—Wednesday, March 2nd. London. 6 p.m. "Short-Wave Wireless Telegraphy." Mr. T. L. Eckersley.

(South-Midland Students' Section).—Tuesday, March 1st. 7 p.m. Ordinary meeting.

(North-Western Students' Section). — Saturday, March 5th. Manchester Municipal College of Technology. 7 p.m. Dance.

Junior Institution of Engineers.—Friday, March 4th. 39, Victoria Street, S.W. 7.30 p.m. Informal meeting. "An Evening with the Old Brigade."
Saturday, March 5th. Suffolk Street Galleries. 6.30 p.m. Annual dance.

Notes.

Glasgow Corporation Tramway Supply Account.

A joint meeting of sub-committees of the Glasgow Electricity and Tramways Committees was held recently to consider the price of electricity supplied during the coal dispute. It was recommended that the claim of £1,146 for the extra cost of coal for electricity supplied during June and July be reduced to one-half, and that the account for the other months, amounting to £7,596, be paid in full. The account to be paid by the Tramways Department to the Electricity Department will accordingly be £8,169.

Train Accident Report.

We have received a copy of the official report of the inquiry into the circumstances of an accident which occurred on October 12th last between Charing Cross and Waterloo Junction, on the Southern Railway, when a passenger train from Charing Cross was partially derailed at the facing points of the through crossing from the down through line to the down local lines. The section of the line had recently been equipped throughout with modern all-electric apparatus by the Westinghouse Brake & Saxby Signal Co. The accident was curious in that it was the outcome of the combination of a failure in the locking of the points and a signalman's error in pulling a control lever too soon, resulting in the derailment of the train.

American Drawn Tungsten Patent Held Invalid.

It will be remembered that in 1925 the House of Lords held in the case the British Thomson-Houston Co., Ltd., *v.* British Insulated & Helsby Cables, Ltd., that the British patent owned by the plaintiffs relating to improvements in the treatment of tungsten to facilitate working was invalid. The Lords of Appeal decided that the production of tungsten which was ductile when cold was more the result of advances in the metal-worker's art than of any discovery. The judgment was given in full in our issue of February 13th, 1925 (p. 279).

The parallel United States patent was recently invalidated by a decision of the United States District Court for Delaware. According to an *Electrical World* report, the General Electric Co. (of America) brought an action against the De Forest Radio Co. charging it with contributory infringement of its patent for improvements in tungsten and methods of making tungsten for lamps and other purposes. The plaintiffs also brought suits against the De Forest Co. and the Robelin Piano Co. for infringement of certain product claims of the patent. The acts charged were the manufacture and sale of radio valves having ductile tungsten filaments made by an alleged infringing manufacture of drawn tungsten wire and the re-sale of the valves by the Robelin Piano Co. The defendants contended that the claims made were invalid. The product claims were attacked for want of patentable subject matter, in that they called for a product of nature, that the raw material to which the process was applied and the product resulting from that process were alike, the element tungsten, and that the properties of the product, like those of the original body, were discovered natural, not invented artificial properties. The plaintiffs did not deny that a wire or rod of a prior patent was a coherent mass of tungsten and as such the starting body called for by their patent, but averred that until Dr. W. D. Coolidge, the inventor named in the patent, did his work and accomplished his results it was not known that the prior rod constituted a suitable starting body. The claims in the suit called for tungsten that was pliable or ductile at room temperature, and one problem involved in the trial was to determine whether ductility was a natural or an artificial property of tungsten, whether tungsten ductile cold was a "manufacture" or a product of nature, and whether a single element of nature not patentable before mechanical treatment might be made patentable by subjecting it to mechanical treatment. The Court held that invention involved not only mental conception but manual application, and the discovery of the cold ductility of tungsten was not patentable.

The Batti-Wallahs' Society.

The Batti-Wallahs' annual dinner is to take place at the Hotel Cecil on Tuesday, March 22nd, at 7 p.m., and will be followed by dancing till midnight; it is intended to make this the occasion for celebrating the 21st birthday of the Society. Ladies and gentlemen friends of members will be welcome, and tickets may be obtained from the members of the Council or from the hon. secretary, Mr. M. Whitgift, 7, Coulter Road, Hammersmith, W.6.

On Wednesday last week, at the Hotel Cecil, with the president, Mr. A. W. Blake, in the chair, the Society entertained at luncheon Sir Duncan Watson. After the loyal toast had been honoured, Sir Duncan addressed the members, concisely reviewing the past, present, and future of the electricity supply industry. Referring to the chaotic state of things that obtained 25 years ago, he expressed the views that the incursion of the municipalities into electricity supply had been of immense value, and that full co-operation between private and public enterprise was most important. By reducing the cost of electricity, he said, the Government scheme would increase the demand; the Act was not perfect, but could be amended, and in the meantime it should be given a fair trial. In his view they were on the threshold of the greatest electrical development this country had ever known.

Lecture.

Mr. F. Farrar, A.M.I.E.E., gave a lecture with demonstrations at a meeting of the Walsall Engineering Society last week, on "Some Applications of Electricity." At the conclusion of the lecture the president of the Society, Mr. W. J. Talbot, said that the Talbot-Stead Tube Works, with which he was associated, now employed about 150 electric motors, and their experience had been that electricity was the cheapest medium for power in the long run. They had found that the total cost of energy was only 2 per cent. of the whole. He warned manufacturers, however, not to think that electricity was going to revolutionise everything, or compensate for inefficiency in other directions.

Spinning Electrons and Protons.

Writing to *Nature* of February 12th, Mr. H. S. Allen says: "The remarkable results obtained within the past 15 months by employing the spinning electron in Bohr's atomic model suggest the question whether it may not be necessary to suppose that the proton also is capable of a quantised spin. Although the analytical difficulties in applying the new quantum mechanics to this problem may be considerable, they may not be too great to be overcome by mathematicians. There seem to be several arguments in favour of such a hypothesis. If, as is generally assumed, the proton is the positive electron, it seems natural to suppose that if the negative electron can spin with unit angular momentum the positive electron may do the same. Again, it may be easier to understand the structure of a complex nucleus if the units of which it is composed can act as elementary magnets. Prof. Duane has attempted to explain corpuscular emission from a radioactive nucleus on these lines. Finally, recent experiments on the deflection of protons and alpha particles in collision with an atomic nucleus seem to lend support to the idea of a magnetic field in the vicinity of a nucleus. A spinning electron is one example of a *magneton*. My main object in this letter is to remind readers of *Nature* that a quantised magneton was first described in these columns by Prof. S. B. McLaren, a victim of the war."

E.P.E.A. Dinner.

The third annual dinner of the North-West Midland Section of the Electrical Power Engineers' Association was held at the "Star and Garter" Hotel, Wolverhampton, on February 15th. The chairman was Mr. D. J. Duffy, Wolverhampton, and many distinguished persons were present.

Viscount Ednam, in proposing "The E.P.E.A.," said the Association protected not only its members, but the public also. If other trade unions had behaved in the same way as the E.P.E.A., there would have been no need for the squabble on the subject in the House of Commons. He said that no better principle could be embodied in the rules of any association than that of negotiation under the Whitley system. During a recent visit to America he was impressed by the fact that in Milwaukee they distributed more electricity than in the whole of the City of London. He wanted enough cheap power to run his steelworks and collieries, but he found it was cheaper to generate his own supply. During the general strike he saw some fuel being put into boats from a certain mound, and on inquiry found that the pit had ceased working in 1785; the slack went to a power station, where it was burnt all right. Referring to the Government scheme, he said that if Colonel Moore Brabazon had faith in it, then it must be a good one.

Mr. J. N. Waite, vice-president, in reply, said that for the Association and its members to be prosperous, it was first of all necessary for the industry itself to be in a thriving and prosperous state, as one could not take from an industry that which was not there. He reminded Lord Ednam that the most efficient turbo-generators in the U.S.A. had been made in this country.

Colonel J. F. Lister, C.M.G., proposed "The West Midlands Joint Electricity Authority." He related some of his experiences in a power station in the early days, and referred to the development which was to take place by the interlinking of certain stations. He referred also to the backwardness of this country in the distribution of electricity in rural areas, citing instances on the Continent and in Egypt, where he had come across the most uneducated type of workman operating motors and other gear. He made a plea to all connected with the authorities now being set up in this country to do their best to see that the poles for carrying the h.p. cables in the rural areas would not only be serviceable, but as artistic and pleasing as possible compatible with reasonable cost.

Mr. S. T. Allen, chief engineer and manager of the West Midlands Joint Electricity Authority, replied, and gave a *résumé* of the spadework which had been done in the Midlands during the last six months. He impressed on the members of the Association the great responsibility which was not only on his shoulders, but would be in the very near future on the shoulders of most of the technical staffs represented at the dinner, when the individual stations in the district were taken over by his authority. The total expenditure on the schemes would reach £3,500,000.

Mr. T. A. G. Margary very ably proposed the toast of "The Visitors," to which Mr. G. R. J. Parkinson, vice-chairman of the West Midlands Joint Electricity Authority, responded in a brief but humorous and well-balanced speech.

Electric Locomotives in Switzerland.

The Oerlikon Company is at present building for the Swiss Federal Railways 18 heavy goods locomotives, which differ from those formerly supplied in that they are designed for a larger output. In order to determine the heating of the motor equipments and ascertain their output, one of the motors was provided with thermo-couples and subjected to a series of load tests, the thermo-couples being arranged as near as possible to the conductors of the stator and rotor windings. The results of the tests are given in the following table:—

	Continuous rating			One-hour rating		
	Amps.	kW.	r.p.m.	Amps.	kW.	r.p.m
Data for calculation of motor ...	1,400	435	620	1,600	485	555
Performance on test:						
(*A*) with temperature rise according to the regulations of the Swiss Federal Railways.	1,550	480	560	1,730	530	530
(*B*) with temperature rise according to the American Rules.	1,780	545	520	2,070	610	480

The pressure of all the tests was 360 volts: the tests showed that the motors would even be large enough for the express locomotives recently standardised by the Swiss Federal Railways, as the temperature rise would then be still just within the permissible limit. The speeds of the goods engines at the one-hour and continuous ratings (41 and 40.5 m.p.h., respectively) actually correspond to those provided for in the case of the express locomotives. The highest normal motor speed of 1,030 r.p.m. is, however, only attained at 74.5 m.p.h. by the express locomotive, while it is reached at 40.5 m.p.h. by the goods engines.

Meter Engineers' Technical Association.

The sixth general meeting of this Association was held at the E.L.M.A. Lighting Service Bureau, London, on February 17th, when the chair was taken by Mr. C. H. W. Gerhardi, and a paper was read by Mr. C. W. Pike on "Meter Testing Methods and their Relationship to Output and Accuracy." The discussion was opened by Mr. H. R. Burroughs, who feared that many meter engineers were unable to carry out tests to a great degree of precision. In referring to the sustained accuracy of meters in service, he instanced the case of a large meter recently installed agreeing to within 2 per cent. with the sum of 9 sub-meters which had been on circuit for 20 years.

Mr. S. Hunt did not agree with the suggestion for using a sub-standard meter with a range of shunts; nor with the total abolition of an observer, especially in the case of large meters. His department had no difficulty in testing from 200 to 250 meters per week, the large majority of which he was able to certify as "O.K." Regarding the question of hysteresis, although it had caused considerable inaccuracies in old type meters, he had found no trouble due to this cause in those of recent manufacture.

Mr. W. Casson did not agree that meter engineers should not endeavour to obtain as high a degree of accuracy with integrating sub-standards as with indicating instruments. He suggested that the remedy for inaccuracies due to wave form was to use meters which one knew by experience to be unaffected. He contended that no commutator meter should be used in this country as a sub-standard, as, owing to climatic conditions, its friction would be too uncertain.

Mr. C. B. Green was of the opinion that the "personal error" was practically eliminated when the tester had confidence in himself, and cited the work of the N.P.L. as an example of accuracy obtainable with the use of the stop-watch and potentiometer method of testing.

Mr. R. P. Bossom described the method of testing electrolytic meters by copper voltameters, and stated that these agreed to within ¼ per cent. with the results obtained by potentiometer.

Royal and Whitworth Scholarships.

The Board of Education has recently issued the syllabus for the examination to be held in April and May, 1928, for Royal scholarships and free studentships in science, tenable at the Imperial College of Science and Technology, London, and also the regulations for the award of Whitworth scholarships for mechanical science in 1928. These and full details of the scholarships are obtainable from H.M. stationery office.

Leader Cable for Aircraft.

Fog flying experiments with the leader cable system, as stated in *The Times*, are now in progress at the Royal Aircraft Establishment, Farnborough, and the scheme is now being tried on a large scale in the Woking-Basingstoke area with five miles of cable laid in the form of an oval within the aerodrome. Two sides of the oval are nearly straight, and along one of them is an auxiliary cable giving a signal of a different frequency. This indicates the area around which a landing can be made with the greatest ease. The aircraft is fitted with two search coils in the wings connected with an instrument in the cockpit, which tells the pilot, by means of oscillating lights on vertical scales, whether he is to port or starboard of the cable. The newer instruments have enabled the amperage to be reduced to 50, the horsepower to 3 per mile, and they are sensitive to signals from a height of 1,500 ft. downwards; they are, in fact, so delicate that they respond to a signal of 0.0005 microwatt.

Television.

Dr. E. F. W. Alexanderson, consulting engineer of the General Electric Co. of America and the Radio Corporation of America, who has devoted a great deal of time to telephotography and television, declares that "our work has already proved that the expectation of television is not unreasonable, and it may be accomplished with means that are in our possession at the present day. How long it will take us to attain practical television I do not venture to say." The radio transmission of a single photograph has been accomplished, but television will require the transmission, reception, and reproduction of a single picture in one-sixteenth of a second, and one of the fundamental difficulties is the development of a projector which will enable one to see on a screen the movement of objects miles away. "It is easy enough to design a television system with something like 40,000 picture units per second," states Dr. Alexanderson, "but the images so obtained are so crude that they have no practical value; an operating speed of 300,000 picture units per second will be needed to give pleasing results." The method devised to speed up the process is the use of seven distinct light sources, converging in a cluster which scans the picture, all seven interlacing optically to produce a single good picture. The model projector used by Dr. Alexanderson consists of seven light sources converged by an optical system on to a revolving drum carrying 24 mirrors, which reflect the light cluster on to a screen. The useful illumination is thus increased 49 times, and the speed at which each light beam must travel has been reduced at the rate of 7 to 1; in addition to these advantages each beam needs to move only one-seventh as fast, and therefore needs to give only 43,000 instead of 300,000 independent impressions per second. A modulation speed of 43,000 per second is high in present radio practice, but is within reason, being only 10 times as fast as that used in broadcasting. For the independent control of the seven light spots seven photo-electric cells are located in a cluster at the transmitting machine and control a multiplex radio system with seven channels. A Hammond multiplex system may

be used with seven intermediate carrier waves which are "scrambled" and sent out by a single transmitter, and then "unscrambled" at the receiving station so that each controls one of the seven light beams. Dr. Alexanderson has radio-transmitted pictures by means of both modulated and interrupted signals: with the former system, any broadcasting station can transmit photographs for distances as great as music of good quality can be transmitted by that station; for long-distance transmission the short-wave telegraph system may be used. Reception of pictures by telegraphy is independent of signal strength; thus, if the signal is strong enough to be recorded at all, it gives the same kind of records at maximum as at minimum signal intensity, which makes recording independent of fading. If, furthermore, the signals are stronger than the prevailing static, it is possible to eliminate static effects by introducing a "threshold" value of signal strength in the receiver so that nothing is received unless the signal exceeds this value.

National Union of Scientific Workers.

This union, which was founded in 1918 to promote the cause of science in our national life and to improve the status of the scientific worker, has not succeeded in becoming a fully representative organisation, its membership being a little below 1,000, although there must be some 10,000 persons eligible for membership. An appeal has therefore been issued this week to all qualified scientific workers in this country, inviting an expression of their views on the possibility and desirability of building up a body fully representative of their broader interests. It is signed by a large number of brilliant lights of the scientific and industrial world—including Sir W. H. Bragg, Dr. W. H. Eccles, Sir Richard Gregory, Sir Robert Hadfield, Sir Hugo Hirst, Sir Thomas Holland, Sir Max Muspratt, Sir Charles Parsons, Prof. J. S. Huxley (president), Prof. H. L. Callendar, Dr. Norman R. Campbell, Dr. Ezer Griffiths, Prof. C. F. Jenkin, Prof. E. W. Marchant, Mr. C. C. Paterson, and over 100 other eminent supporters, covering the whole field of science and technology.

The Union is entirely non-political, and has been successful in bringing about improvements in the conditions of service of groups of scientific workers in Government and private employ; if it could speak for a united profession its activities could be extended and its influence could be exercised effectively in the interests of research, training, and other national services, without trespassing on the sphere of any existing organisation. In view of a misconception that exists in some quarters, it is pointed out that the strike is not a possible weapon for scientific workers, and the Union has never imagined the possibility of its employment.

The present rate of subscription is 30s. per annum, but if the membership were considerably increased it should be possible to reduce the subscription to about 10s. The present appeal is not for membership, but for the views of those interested, for the guidance of the Council; readers can obtain particulars from the Secretary, 25, Victoria Street, S.W.1.

Appointments Vacant.

Charge engineer for the Singapore, Straits Settlements, Municipal Electricity Department. Distribution engineer (£456) for the Torquay electricity undertaking. Chief engineer and general manager for the Altrincham Electric Supply, Ltd. Chief clerk (£217) for the Borough of Colne Electricity and Tramway Department. Foreman winder for fans and small motors, for the Rangoon Electric Tramway and Supply Co., Ltd. (See our advertisement pages to-day.)

Mansfield Electricity Investigation.

The concluding stage of the investigations into the affairs of the Mansfield Corporation electricity undertaking, consequent upon the appointment of a special committee of investigation twelve months ago, following certain statements that were made in the Council Chamber, was reached recently when a special meeting of the Council was held to receive the report and findings of the committee.

The statements made with reference to the management of the Electricity Department were to the effect that lengths of cable attached to drums and representing a considerable outlay in money were lying in different parts of the town; that many yards of cable had been laid at great cost, and in some cases were still dead, and in others supplied very few consumers; that mistakes had been made by the engineer in fixing the position in which the cable had been laid, thereby involving extra and unnecessary expense in the connecting up of consumers; that the engineer had not exercised reasonable care in erecting a disconnecting box on the Intake Estate, and that in consequence avoidable expense had been incurred; that the voltage on the Woodhouse section was below that required by the Board of Trade, and the generating plant had been taxed beyond its capacity in an attempt to boost up the pressure; that the cost of electricity in Mansfield compared unfavourably with that obtaining in other towns of a similar size; that for excavation work for cable laying the Corporation had been paying an excessive price; that the establishment of an electricity showroom was bad policy, involving a large expenditure upon which an adequate return was unlikely; that the management of the concern needed investigation, and that the ratepayers were entitled to an explanation of how it had come about that the Corporation was ceasing to generate electricity and taking a bulk supply from the Derby and Notts Power Company.

The conclusions drawn by the Committee were, briefly, that it was satisfied that the undertaking was in a perfectly sound financial position. While it had diffidence in expressing an opinion as to the technical side of the undertaking, the Committee felt that Mansfield was to be congratulated on the fact that during the whole of the time the undertaking had been in existence there had been very few interruptions in the supply to the public. The inference, therefore, was drawn that the plant and cable was of good quality, and that the technical work in the department had been carried out satisfactorily. Further, the figures for generating costs in comparison with the published returns of other stations indicated that the Mansfield electricity works had on the generating side been economically managed. In this connection, having regard to the fact that the Corporation would soon cease to generate, and become in the main a distributing agency, the Committee felt it incumbent to take into consideration how far it might be advisable to review the staffing of the concern with the object of eliminating unnecessary expenditure. The Committee was satisfied that there was not the slightest cause to doubt the personal honour and integrity of the chairman and members of the Electricity Committee, or of the engineer and his staff. Much information had been required by the Committee, which had thrown additional work on the electrical engineer's staff, particularly the chief clerk, and it was recommended that he should be granted an honorarium of £10.

The Mayor of Mansfield, in moving the adoption of the report, said: "Our investigations have covered a period of ten years. We are satisfied, and confirmed in the view we held before the inquiry began, that there is not the slightest cause nor ground for questioning the personal honour and integrity of the present chairman, nor of any of his predecessors, nor of the members of the Electricity Committee during that or any other period, nor of the engineer or his staff. It is well to remember that all the decisions, all the acts of the Committee, are those of the Council, for the Council has confirmed the decisions and recommendations of the Committee." The motion was carried, only one member voting against it.

Accumulator Makers' Association.

The annual dinner of the Accumulator Makers' Association was held at the Savoy Hotel, London, on February 21st, when Mr. B. M. Drake presided over a large company. Our report of the speeches is unavoidably held over until next week.

The French Electrification Programme.

According to Mr. Raymond de Nys, in *Foreign Trade*, France, after the war, began the execution of a vast programme of exploitation of her immense hydraulic resources, and increased the consumption of electricity from 7,738 million kWh in 1923 to 10,000 million kWh in 1925. It was hoped that the electrification of the country districts would proceed rapidly and that several important railway systems would be able to substitute electric for steam traction. The P.L.M. completed promised work on the Culoz-Modane line, the Midi system equipped the Bordeaux-Bayonne line and introduced electric traction on its Toulouse-Pau line, and the Orléans electrified its Paris-Orléans section; but this was all, except a few short-distance lines in the suburbs of Paris.

The hydro-electric plant of Eguzon, in the Department of the Indre, was put in operation recently, and now furnishes energy to the Paris region. The new station of Mativie, on the Cère, tributary of the Dordogne, is expected to begin operations in a short time. There remains, however, in the south-east an entire network on which work has been practically stopped. In the Massif Central numerous stations were being constructed to produce 32,000 kW. On the Truyère, at Brommat, a hydro-electric plant was under construction for producing 56,000 kW. On these enterprises millions have been spent—40,000,000 fr., it is said, for the Brommat plant alone. To-day a collection of simple wooden huts with a few watchmen constitutes all that remains of the former activity. In Brittany, at Guerledan on the Blavet and at Aber-Wrac'h, two installations were being built to furnish 3,900 kW, but this work has been discontinued. All these projects have been stopped because of lack of funds. The construction of a generating station and the equipment of a waterfall involves a heavy initial capital investment. The first sites to be developed were, naturally, those which offered the greatest facilities, and the further the programme of French electrification is developed the more difficult becomes its execution. To-day's cost estimates of developing new water-power are 20 to 30 times higher than those of before the war. Accordingly, in hydro-electric enterprises long periods are required for amortisations.

Long-term money, which cost 5 per cent. before the war, now costs from 13 to 14 per cent., even with enterprises of gilt-edged credit. As the construction costs must be multiplied by 6 or 7, it is easy to see what the charges are which are now burdening the hydro-electric industry. As a result, the amount of invested capital has decreased in recent years. In spite of this, the consumption *per capita* has increased from 150 kWh in 1922 to 197 in 1923, 230 in 1924, and 250 in 1925. The consumption in Germany is said to be only 160 kWh *per capita*, in Italy 185, in Sweden 350, and in Switzerland 780. Only a decisive and rapid monetary reform, it has been asserted, as a prelude to a concrete financial programme, can restore a normal circulation of capital and ameliorate the present situation in French national finance and economics.

Service Notes.

The Air Ministry announces that increases in the Pilots' Section of the Air Force Reserve of Officers are necessary, and a large number of openings present themselves now to young men to be trained as pilots "*ab initio*." At least 50 candidates will be taken by the Air Ministry if the necessary number of the right type are forthcoming. Applicants must be of good education and physique, but need not have had any previous flying experience. They must be over 18 and under 25 years of age. Application forms and further details can be obtained from the Secretary (S.7 Reserves), Air Ministry, Adastral House, Kingsway, London, W.C.2.

Electrical Association for Women.

The first annual meeting of the Manchester District Branch of the Association was to be held on Tuesday last at the Town Hall, Manchester, and to be followed by a lecture on how the American housewife saves labour in the home, given by Mrs. Christine Frederick, of the Applecroft Experiment Station, U.S.A.

At a special meeting on February 15th, at the King's College for Women, Mrs. Frederick lectured on "How the American Housewife Solves Her Household Difficulties," and showed how important a part electricity played in the domestic field in America. She attributed the extensive use of power in the homes of that country to the attitude which the housewife took up in connection with housework. It was to her a profession; 98 per cent. of the American women did the whole of their housework.

On February 18th, Mrs. Frederick also addressed a meeting, at the Lighting Service Bureau, London, when she reviewed the past and present methods of doing housework employed by the American housewife.

Institution Notes.

Institution of Electrical Engineers.

At the ordinary meeting on Thursday, March 3rd, at 6 p.m., papers will be read on "Illuminating Engineering," by Mr. J. W. T. Walsh, M.A., M.Sc., and "The Problems of Public Lighting by Electricity," by Lieut.-Commander H. T. Harrison, R.N.V.R. This meeting will be preceded at 5.30 p.m. by a demonstration in the Common Room, by Mr. Ll. B. Atkinson, of an electro-pneumatic lamp. The lamp, in which hydrogen gas is generated, was patented in 1807, and the one to be demonstrated is believed to be the only example known. It is ignited by a spark from an electrophorus.

Institution of Chemical Engineers.

Examinations for the associate membership of this Institution will be held in June and July next. Particulars may be obtained from the hon. registrar, Mr. C. S. Garland, Abbey House, London, S.W.1.

Institution of Mechanical Engineers.

The annual report of the Council of the above Institution for the year 1926 shows a total membership at December 31st of that year of 10,117, as compared with 9,805 for the previous year. The total expenditure for the year was £33,419, leaving a balance of £443.

Institute of Metals.

The annual general meeting will be held at the Institution of Mechanical Engineers, Westminster, on Wednesday and Thursday, March 9th and 10th. On March 9th the annual dinner will be held at the Trocadero Restaurant, and will be followed by a dance. The annual autumn meeting will be held in Derby from September 6th to 9th.

The Röntgen Society.

According to the *British Medical Journal*, at a special general meeting of the Röntgen Society on January 11th it was agreed to amalgamate the society with the British Institute of Radiology. Negotiations between the two bodies had been proceeding for two years. The title of the new organisation will be "The British Institute of Radiology incorporated with the Röntgen Society." There will be no alteration in the character of the work, objects, and constitution of the society in consequence of the amalgamation.

At a further meeting of the Society on January 25th, the resolution for amalgamation was unanimously confirmed. The British Institute of Radiology will now submit a similar resolution to its members at two statutory meetings.

The Physical Society.

At the annual general meeting on February 11th, Prof. O. W. Richardson was in the chair, when the reports of the Council and of the hon. treasurer were read and adopted and officers and members of Council were elected for the year 1927-28. The president presented the Duddell Medal for 1927 to Mr. F. Twyman, F.R.S., for meritorious work on scientific instruments and materials. Messrs. Adam Hilger, Ltd., to whom Mr. Twyman has for many years been both managing and technical director, enjoys, deservedly, a reputation for the production of optical instruments employed in physical research which is not second to that of any other firm. The presidential address was delivered by Prof. O. W. Richardson, F.R.S., who took as his subject "The Present State of Atomic Physics."

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

We recently reported that Dr. W. D. COOLIDGE had been awarded the Edison Medal by the American Institute of Electrical Engineers in recognition of his invention of ductile tungsten. Dr. Coolidge has now informed the Institute that he cannot accept the honour in view of the recent decision of a United States court that his ductile-tungsten patent is invalid. The decision referred to is reported in our "Notes" columns to-day.

Agricultural and General Engineers, Ltd., has appointed Sir CHARLES E. LOW, formerly secretary to the Commerce and Industry Department of the Government of India, to take charge of the Indian interests of the group.

Inspector SWINDLEHURST, of the St. Helens Tramway staff, who is retiring after 27 years' service, has been presented by his colleagues with a wallet of Treasury notes, and his wife with a lady's bag. Mr. Swindlehurst has been associated with tramway work for 47 years; he was previously at Liverpool.

Mr. J. A. FORDE, manager and engineer of the Isle of Thanet Electric Supply Co., Ltd., has been presented by the staff with a silver tea-service and tray on the completion of 25 years' service with the undertaking. The presentation was made at the employés' annual dinner by Mr. T. A. Chell, chief assistant.

Mr. HAROLD DICKINSON, city electrical engineer, Liverpool, is taking three weeks' rest in the South of France, owing to ill-health.

Mr. T. M. KIRKBY, who for many years was associated with the Metropolitan-Vickers Electrical Co., Ltd., has joined the staff of the Macintosh Cable Co., Ltd., as assistant sales manager, with headquarters at Derby.

The Edinburgh Salaries and Wages Committee, by six votes to five, recently disapproved of a recommendation from the Tramway Committee that the salary of Mr. STUART PILCHER, tramway manager, should be increased from £1,500 to £1,700 by annual increments of £100.

It is recommended that the salary of Mr. EDWIN SEDDON, electrical engineer and manager to the Edinburgh Corporation, shall be increased from £1,200 to £1,300.

General FERRIE, a leading French wireless authority, recently paid a short visit to this country. A luncheon, at which Sir John Reith, director-general of the B.B.C., presided, was given in his honour last week.

MR. I. MACKINNON, the recently-appointed manager of the Glasgow Corporation Tramways, recommends a re-arrangement of the staff and states that the scale fixed for the chief electrical engineer, civil engineer, constructional engineer, and mechanical engineer is from £600 to £800 per annum.

The Glasgow Corporation Tramways Committee recommends the appointment of Mr. JAMES N. WILSON, now secretary and treasurer, as deputy general manager at a salary of £1,000 a year.

The Newark-on-Trent Corporation has passed a resolution thanking Mr. R. W. WILLIS for the very able manner in which he has carried out his duties, and expressing the pleasure that the Council has experienced in working with him during the installation of electricity supply in the borough.

The Portsmouth City Council has adopted the A.M.E.E. minimum salary scale as the basis of the future remuneration of its chief electrical engineer, Mr. B. HANDLEY.

The *Financial Times* states that Mr. A. SPYER has been appointed general manager of Babcock & Wilcox, Ltd., and Mr. C. S. DAVY assistant general manager.

The address of Mr. W. A. GILLOTT is now 28, Wood Street, Deansgate, Manchester.

Obituary.—DR. J. R. ERSKINE-MURRAY.—Dr. James Robert Erskine-Murray, whose death was briefly recorded in our last issue, was born at Edinburgh in 1868. He was educated at Glasgow University, where he studied under Lord Kelvin for six years. A period as a research student at Trinity College, Cambridge, followed, and later engagements included the post of Assistant Professor of Physics and Electrical Engineering at the Heriot-Watt College, Edinburgh, which he held from 1896-1898; in the latter year he became chief experimental assistant to Mr. Marconi. From 1900 to 1904 he was Lecturer in Physics and Electrical Engineering at University College, Nottingham. After this he spent two years at the George Coats Technical College at Paisley as Lecturer in Electrical Engineering, and a few years later (from 1907-1911) he lectured on Radio-telegraphy at the Northern Polytechnic Institute. He became a partner in the firm of Clark, Forde, Taylor and Erskine-Murray, the well-known telegraph consulting engineers, in 1913, but he left them in the year 1918 in connection with war activities. He did much design and experimental wireless work for the Royal Air Force between 1918 and 1922,

and in the latter year he was promoted to major. His appointment as Experimental Engineer at H.M. Signal School, R.N. Barracks, Portsmouth, followed. He held this position until his death, which occurred at Portsmouth on February 12th, after a very short illness. Dr. Erskine Murray wrote a number of books on wireless telegraph matters, and his demonstration shortly after the war, before the Institution of Electrical Engineers in London, of wireless telephonic communication with an aeroplane in flight, will be remembered by many of our readers. He was a Fellow of the Royal Society of Edinburgh, past-president of the Wireless Society of London, and a Fellow of the Institute of Radio Engineers and of the Institute of Physics. The funeral took place at Edinburgh on Friday.

Sir Frederick Green.—We regret to record the death, which occurred on Friday last, in his 82nd year, of Sir Frederick Green, a founder of the Orient Line and a director of the United River Plate Telephone Co., Ltd., and many other companies.

Mr. A. Berkeley.—Mr. A. Berkeley, wholesale electrical supplier, of 111, Granville Street, Birmingham, passed away on February 15th. The business is for the present being continued by his executors under the management of Mr. Gamble, who has been with Mr. Berkeley for many years.

Mr. W. Auld.—The death occurred on February 12th of Mr. William Auld, head of the firm of William Auld & Sons, electrical engineers, of Ayr. He served on the Town Council for 10 years.

Mr. J. W. Colclough.—Mr. James William Colclough, who had been employed in the electrical department of Messrs. Howard & Bullough, textile machinists, Accrington, for 30 years, passed away recently, aged 63 years.

Mr. W. H. Blurton.—The death occurred on February 9th of Mr. W. H. Blurton, who was electrician to the Highley Mining Co.

Mr. G. H. Alderton.—Mr. George Herbert Alderton, carrying on electrical business at 31, Portland Street, Brighton, recently died at the age of 69 years.

Mr. J. Smith.—Mr. J. Smith, rolling stock superintendent in the Sheffield Tramways Department for the past 22 years, died last week, aged 66 years.

Mr. H. U. Wellington.—The death occurred on February 13th, at the age of 43 years, of Mr. Harry Upson Wellington, electrician at the Duke of York's School, Dover.

Will.—The late Mr. Frederick Leverton Harris, a director of the Metropolitan Electric Supply Co., Ltd., left £257,223 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Vacuum Power, Ltd.—Private company. Registered February 12th. Capital, £6,000 in £1 shares. Objects:—To acquire and test an invention in respect of which provisional letters patent for the United Kingdom and the Isle of Man have been granted to C. Scott-Snell and E. Scott-Snell, dated November 11th, 1926, and numbered 28,432, and to carry on the business of mechanical, electrical and experimental engineers, makers of models, &c. The first directors are:—C. Scott-Snell, 47, Linden Gardens, Bayswater, W.2; E. Scott-Snell, 47, Linden Gardens, Bayswater, W.2; J. E. Gibson, c/o Messrs. Price, Waterhouse & Co., Valparaiso, Chile; R. E. Heard, 18, Pembridge Villas, Bayswater, W.11. Qualification, 500 shares. Solicitors: H. M. Meyler & Co., 8, Churton Street, Westminster, S.W.

Mouldings and Insulators, Ltd.—Private company. Registered February 11th. Capital, £1,000 in £1 shares. Objects:—To acquire the business carried on at St. Peter's Court, Lee, S.E.12, as General Mouldings and Insulators, to adopt an agreement with H. F. Shand, J. R. F. Shand, E. A. Leyman and A. H. Norman, to carry on the business as manufacturers of moulded products and other apparatus required in connection with the distribution, supply, generation, and employment of electricity, electrical engineers, &c. The subscribers (each with one share) are:—L. S. Woolf, 37, Walbrook, E.C.4, solicitor; W. H. Burns, 19a, Coleman Street, E.C.2, chartered accountant. Solicitors: B. A. Woolf and Co., 37, Walbrook, E.C.4. Registered office: 19a, Coleman Street, E.C.2.

M. A. Halle & Co., Ltd.—Private company. Registered February 11th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers, importers, exporters, and shippers of, and dealers in electrical, magnetic and galvanic apparatus, machinery and accessories, &c. The subscribers (each with one share) are:—M. A. Halle, 26, Brunswick Square, W.C.1, merchant; J. I. Stephens, 353, Grange Road, Upper Norwood, S.E.19, merchant. Qualification, 5 shares. Solicitors: Bulcraig & Davies, Amberley House, Norfolk Street, Strand, W.C.2.

The Ship Carbon Co. of Great Britain, Ltd.—Registered as a private company on February 14th with a nominal capital of £130,000 in £1 shares (65,000 8 per cent. cumulative preference and 65,000 ordinary). Objects:—To adopt an agreement between Schiff & Co. A.G., of the first part, the Anglo-Oriental and General Investment Trust, Ltd., of the second part, and Charles H. Champion & Co., Ltd., of the third part, and to carry on the business of manufacturers of, and dealers in carbon, and all substances and materials containing or capable of producing carbon, chemists, mine owners, electrical and mechanical engineers, manufacturers of, and dealers in mechanical apparatus, lamps, batteries, dynamos, accumulators and appliances, rubber, cork, leather, vulcanite, mica, celluloid and like substances, &c. The subscribers (each with one ordinary share) are:—F. W. Eve, 101, Salisbury House, London Wall, E.C.2, cashier; L. Hillman, 101, Salisbury House, London Wall, E.C.2 clerk. Qualification, 100 ordinary shares. Solicitors: Mawbie & Barrie, 101, Salisbury House, London Wall, E.C.2. Registered office: Anglorient House, 31-33, Bishopsgate, E.C.2.

Premier Products (1927), Ltd.—Private company. Registered February 10th. Capital, £500 in £1 shares. To carry on the business of agents for mechanical, electrical, lighting, heating, hydraulic, pneumatic, ventilating, telephone, telegraph, wireless and consulting engineers, &c. The first directors are:—H. Burrows, 14, Green Street, Ardwick, Manchester, master packer and merchant; G. H. Elliott, 22, Hemingway, Blackpool, accountant. Qualification, 50 shares. Secretary: G. H. Elliott.

Southern Industries, Ltd.—Private company. Registered February 14th. Capital, £7,000 in £1 shares. To carry on the business of electrical, motor and mechanical engineers, manufacturers of and dealers in machinery of all kinds, iron founders, tool makers, brass founders, metal workers, &c. The subscribers (each with one share) are:—W. B. Enever, Broad Street House, E.C.2, articled clerk; A. Wood, Broad Street House, E.C.2, articled clerk. The first directors are W. G. Ball (chairman and life director), W. C. Taylor, F. Cressall, and I. J. Harvey. Qualification, 100 shares. Solicitors: C. R. Enever & Co., Broad Street House, Old Broad Street, E.C.2.

Amalgamated Brake and Signal Co., Ltd.—Private company. Registered February 17th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers, exporters and users of and dealers in brake and signal appliances, electrical, mechanical, hydraulic and general engineers and contractors, manufacturers of and dealers in electrical, magnetic and galvanic apparatus, &c. The subscribers (each with one share) are: E. Rudland and V. Summers, 2, Bond Court, Walbrook, E.C.4, clerks. The first directors are to be appointed by the subscribers. Solicitors: Linklaters & Paines, 2, Bond Court, Walbrook, E.C.4.

Indian and Colonial Supply Association, Ltd.—Private company. Registered February 14th. Capital, £3,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electric lamps, torches, batteries, and other similar articles, optical lanterns and slides, photographic apparatus, kinematographs and films, electrical, optical, radio and scientific apparatus, mechanical, electrical and steam toys, &c. The first directors are:—J. Conoley, "Mona," The Leas, Westcliff-on-Sea, wholesale warehouseman; A. E. Cotton, 47, Swains Lane, Highgate, N.6, wholesale optician; L. Conoley, "Mona," The Leas, "Westcliff-on-Sea, traveller. Remuneration as fixed by the company. Solicitors: G. S. Warmington and Edmonds, 14-15, Coleman Street, E.C.2. Registered office: 83-86, Farringdon Street, E.C.

Century Cables, Ltd.—Public company. Registered February 17th. Nominal capital, £100,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers and traders in wires, cables and all other articles in the electrical and allied trade, and to adopt an agreement with Sir Edward Nicholl and Sir Herbert Blain for the acquisition of a freehold factory at Addlestone, Surrey. The minimum cash subscription is 7 shares. The subscribers (each with one share) are:—W. S. King, 8, Wallace Gardens, Canonbury, N.1, clerk; and six other clerks. The first directors (to number not fewer than two nor more than nine) are to be appointed by the subscribers. Qualification, 500 shares. Remuneration, £250 each per annum (chairman, £500) and 5 per cent. of the profits after 10 per cent. dividend is paid, divided between them. Secretary: G. Smith. Solicitors: Elvy, Robb & Co., 19, Bedford Row, W.C. Registered office: 137, Victoria Street, S.W.1.

Official Returns of Electrical Companies.

Anglo-Portuguese Telephone Co., Ltd.—Trust deed dated February 1st, 1927, to secure £300,000 debenture stock and premium of 2 per cent. charged on the company's rights and interests under the concession by agreements dated April 15th and June 21st, 1901, and the buildings, works, lands, and other immovable property, telephones, plant, machinery, fixtures, lines, and other chattels now or at any time to be appropriated to or used by the company in connection with the working of its system of telephones and lines under the concession and the company's other assets, present and future, including uncalled capital. Trustees: H. Allen, 31, Budge Row, E.C.; and Second Consolidated Trust, Ltd., Dashwood House, Old Broad Street, E.C.

Telephone Manufacturing Co., Ltd.—Satisfaction in full on January 5th, 1927, of land charge, mortgage and charge, and land charge, all dated August 19th, 1924, securing all moneys due or to become due from company to the Midland Bank, Ltd., respectively.

Gilfillan Brothers, Ltd.—C. E. Smedley, of Bush Lane House, Bush Lane, Cannon Street, E.C., was appointed receiver and manager on February 7th, 1927, under powers contained in debenture dated October 15th, 1926.

Joseph Tabbush & Co., Ltd.—Particulars filed of £2,500 debentures authorised January 15th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Barnes Bros. (Radiex), Ltd.—A. H. Ballard, C.A., of 6, Fen Court, E.C., was appointed receiver on February 4th, 1927, under powers contained in mortgage dated December 14th, 1926.

Siemens Bros. & Co., Ltd.—Satisfaction to the extent of £30,500 on January 1st, 1927, of debenture stock dated January 15th, 1918, securing £1,330,000.

Jones, Burton & Co., Ltd.—Satisfaction in full on January 31st, 1927, of mortgage or charge dated May 11th, 1921, securing £5,000.

Ajax Production Engineers, Ltd.—A. G. White, of 14, Old Jewry Chambers, E.C.2, ceased to act as receiver or manager on February 8th, 1927.

Claremont, Johnson & Co., Ltd.—W. J. Hodge, of 26 and 27, Union Bank Chambers, Hatton Garden, E.C.1, was appointed receiver and manager on February 9th, 1927, under powers contained in debentures dated October 22nd, 1926.

Evalasio Distributing Agency, Ltd.—Particulars filed of £1,000 debentures authorised February 8th, 1927, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £850.

City Notes.

Metropolitan Railway Co.

Lord Aberconway (chairman) presided at the annual meeting on February 17th, and in presenting the report and accounts (*vide* our last issue, p. 268), said that the general strike, with the resultant loss of traffic and extra expenses; the coal dispute, which cut down the coal traffic and involved the purchase of high-priced foreign coal; and the loss of the Exhibition traffic, represented a total loss of £300,000 to the company—equivalent to a 4 per cent. dividend on the ordinary stock. After dealing with the accounts and the developments proceeded with during the year, the chairman referred to the continued growth of competition from motor traffic. He characterised this form of traffic as a subsidised business, it being free from the burdens which the railway companies had to bear. He considered that the proportion of road construction and maintenance costs borne by motor traffic was inadequate; in effect, the railway companies, as ratepayers, were aiding their competitors. The character of the company's business was gradually changing. The long-distance traffic was increasing, but not at so fast a rate as that at which the short-distance traffic was being taken from them. The company was being assisted considerably by the operations of the Metropolitan Railway Country Estates, Ltd., which was opening up new districts. The report and accounts were adopted.

The "Underground" Group.

In our last issue we recorded the final dividend announcements of the companies forming this group. We have now received their reports for 1926 which were to be presented at the annual meetings yesterday (Thursday). These reports are summarised below:—

London Electric Railway Co.—The traffic receipts rose by £64,344 to £1,978,527, while the expenditure increased by £35,354 to £1,167,168, leaving net receipts of £811,359—an increase of £28,990. The addition of miscellaneous receipts and the balance brought forward gives an available sum of £1,103,789, as against £1,045,331. Interest, rentals, &c., absorb £504,849; £45,000 is transferred to reserve for contingencies and renewals; and after meeting preference and consolidated ordinary dividends, £100,515 is carried forward. The capital expenditure was £1,212,702, the principal item being the Charing Cross-Kennington extension (£974,622). Reference is made in this, as well as the other, reports to the adverse effects of the coal stoppage upon revenue and working expenses. The Bill promoted by the company and the Metropolitan District Railway Co. received the Royal Assent in August last. The Charing Cross-Kennington extension was opened for traffic in September, but the reconstruction of the Piccadilly Circus station was delayed by the mining dispute. The passimeter system was installed at several stations. The board has decided to renew the bodies of the company's original rolling stock. The death of Mr. Z. E. Knapp is recorded, and it is stated that Sir Ernest Clark, K.C.B., was appointed to the vacancy on the board thus created.

City and South London Railway Co.—This company's traffic receipts rose by £113,619 to £652,929, and the expenditure by £87,579 to £353,212; the net receipts thus increased from £273,677 to £299,717. The addition of miscellaneous receipts gives a total of £362,249 as net income, and to this is added £25,037 brought forward, making £387,286. After deducting interest, rentals, and other fixed charges; transferring £25,000 to reserve; and meeting the preference and consolidated ordinary dividends, there remains £29,327, which is carried forward. The expenditure on capital account was £1,015,114 (net), the largest item being £2,973,871 for the extension from Clapham Common to Morden; this extension was opened for traffic in September, and the results have exceeded expectations. The remodelling of, and the installation of escalators at, the Oval and Clapham North stations have been completed. The report mentions the death of Lord Stuart of Wortley (deputy chairman) and Mr. Z. E. Knapp.

Central London Railway Co.—The traffic receipts at £553,793 showed an increase of £42,447, and the expenditure at £365,469 a rise of £25,219. The net receipts thus rose from £171,096 to £188,324. Miscellaneous receipts amounted to £85,638, and the addition of these and the balance brought forward gives an available amount of £354,970, an increase of £9,128. Rentals, interest, and other fixed charges absorb £102,523; £40,000 is put to reserve; and after paying dividends a balance of £70,847 is carried forward. Only £47,174 was spent on capital account during the year, mainly upon the installation of escalators. Work commenced upon the improvement of the rolling stock, and steps have been taken to increase the speed of operation. The reconstruction of the Bond Street station is nearly accomplished, and escalators at this station and Tottenham Court Road are now in service. Lord Newton has been appointed to the board.

Metropolitan District Railway Co.—The traffic revenue for 1926 was £1,640,665, and the expenditure £1,122,047, showing increases of £5,887 and £19,962, respectively. The net receipts were therefore lower by £14,075, the figure being £518,618. The addition of miscellaneous receipts and the balance brought forward gives an available sum of £767,345. After meeting interest, rentals, &c., transferring £45,000 to reserve, and paying dividends, a balance of £41,501 is carried forward. The capital expenditure amounted to £93,020, plant and machinery at the Acton and Ealing Common works accounting for £62,022. Among the improvements carried out during the year were the re-arrangement of signalling on the main line and the installation of the passimeter system at several stations. The extension of the Acton works is almost com-

pleted. This will enable the company to repair and maintain the rolling stock of the associated companies as well as its own stock. Arrangements are being made for the erection of a modern office block near St. James's Park station for the accommodation of the staff of the company and its associates.

Summary of Results.—We reproduce below a comparative statement of the four companies, which, with the London General Omnibus Co., Ltd., participate in the "Common Fund":—

	1926. £	Increase+ Decrease− £
Traffic receipts	4,825,914	+226,297
Expenditure	3,007,896	+168,114
Net receipts	1,818.018	+ 58,183
Miscellaneous receipts (net) ...	537,699	+ 33,447
Net income	2,355,717	+ 91,630
Deduct Interest, rentals and other fixed charges	1,222,620	+116,399
Appropriation to reserve for contingencies and renewals ...	155,000	—
Dividends on guaranteed and preference stocks	389,477	—
Balance	588,620	− 24,769
Add balance from last year's accounts	257,673	+ 9,286
Total amount available for dividends on ordinary stocks and shares and for other purposes	846,293	− 15,483
Dividends on ordinary stocks and shares (average rate 3.54 per cent.)	604,103	—
Balance carried forward	242,190	− 15,483

Traffic Figures.—With the exception of the City and South London Railway, the traffic again decreased. The figures for the four companies were as follows:—

	1926.	Decrease.
Passengers carried—		
Ordinary	210,470,208	7,444,288
Workmen	50,580,564	836,422
Seasons	48,727,502	642,856
Total	309,778,274	8,923,566
Number of car-miles run	65,398,129	38,584

Yorkshire Electric Power Co.

The annual meeting was held at Leeds last week. Mr. A. G. Lupton (chairman), who presided, said that at great cost the company had been able to maintain the supply to its consumers throughout the period of the coal dispute. Although some of the coal imported was of a very inferior quality, much of it was excellent for steam raising. The agreements with many consumers embodied a coal clause, and if the company were to insist upon the enforcement of these the consumers would be called upon to pay considerably increased amounts, although a substantial amount would be returnable in July next if the price of coal remained normal. The company had decided, at some loss to itself, to assume a lower price for the past half year than the actual price. He felt that the consumers would appreciate this arrangement. During the year the demand for bulk supplies of electricity had increased, and the company was now supplying over 39,000 consumers directly and indirectly. The amount spent on capital account was larger than in any previous year, owing mainly to the construction of the Ferrybridge station and the laying of further 33,000-V transmission mains. The completion of the Ferrybridge station had been delayed, but on January 8th the first of the large turbo sets was put into service and was now running on load. The whole station would soon be in commission. The issue of £773,000 6 per cent. cumulative preference shares was very successful, and again added to the number of shareholders in the company, which now totalled 5,389. The company was asking for Parliamentary powers to borrow up to one-half (instead of one-third) of the issued capital. It was advantageous to raise money in this way, and he thought that the company would be able to offer a lower rate of interest than 5½ per cent. when the next issue of debentures was made. The existing debentures would have to be repaid first, however. The dividend of 8 per cent. had become a standard for the company, and it was paid after placing £60,000 to reserve and £25,000 to the plant renewal fund. The report and accounts were adopted.

Electrical Distribution of Yorkshire, Ltd.

The net profit for 1926 was £46,768, as compared with £31,099 in the preceding year. To this is added £14,114 brought forward, making £60,882. It is proposed to transfer £10,000 to reserve (making £47,000), and to pay a final dividend of 4½ per cent. on the ordinary shares (making 9 per cent. for the year), leaving £15,837 to be carried forward. The report says that there was a notable increase in the sale of electricity for street lighting and for new housing estates supplied through prepayment meters. There has been a large increase in the number of consumers in all districts, and the developments have enabled the company to reduce its charges in spite of the difficulties engendered by the coal dispute. During the year new Orders were obtained for the supply of electricity in the following districts: Baildon, Dodworth and Thurlstone, Queensbury, Ryburn Valley, South Yorkshire (extension), and Wetherby. The company now has an area of over 960 sq. miles with a population of 668,000. It is proposed to issue 300,000 ordinary shares forthwith at the price of 25s. per share, and these will be allotted to present shareholders in the proportion of three new shares to each five held. Meeting: March 1st.

Power Securities Corporation, Ltd.

In moving the adoption of the report at the annual meeting last week, Mr. G. Balfour, M.P. (chairman) referred to the death of Sir James Kemnal, an original director of the corporation and a director of Balfour, Beatty and Co., Ltd. He said that during the year the corporation had successfully handled the finance of a number of electrical and other undertakings at home and abroad, and Balfour, Beatty & Co. and the South American business were developing a number of contracts. The Lochaber water-power contracts were making progress. The Grampians development would have been commenced last year but for uncertainty regarding the effects of legislation. It is anticipated that progress will be made with the scheme during the current year. He (the chairman) had taken a somewhat prominent part in the proceedings relating to the Electricity (Supply) Act. Although he disliked the principle of the Act, they would do their best to make it a success now that it was upon the Statute Book. The company's investments were valued at £1,104,592, and 46 per cent. of this was represented by investments in electricity supply and allied undertakings. A further 22½ per cent. represented their holding in Balfour, Beatty & Co. Loans and participations totalled £139,142, as against £72,010. Approximately £64,000 was on account of the holding in the Hydro-Electric Development Co. and in two electricity supply undertakings purchased in connection with the Grampians scheme. The balance was their holding in a Spanish electrical company of which Balfour, Beatty & Co. were acting as engineers and managers. The Corporation's development might call for the issue of some of the authorised capital; at present only half of the £2,000,000 had been issued. The report and accounts were adopted.

Northampton Electric Light and Power Co., Ltd.

The report for 1926 records continued progress, in spite of the coal stoppage, the energy sold having increased from 14,278,101 to 18,471,276 kWh. In April last the capital was increased to £500,000, and the premiums received (£22,187) has been credited to the reserve. A further amount of £86,000 5 per cent. debenture stock was also issued. From the year's revenue £24,785 has been allocated to depreciation, £5,000 written off debenture discount and expenses, £4,813 transferred to reserve, and £1,000 to the employés' benefit fund. It is proposed to pay a final dividend of 5 per cent. on the ordinary shares, making 9 per cent. for the year, as for 1925, and £8,077 is to be carried forward. The report records the death of Mr. T. A. Dickson and the resignation of Mr. E. M. Browne, and the filling of their places on the board by Messrs. L. H. Church and F. Kilby.

Torquay Tramways Co., Ltd.

The report for 1926 records a profit of £29,241, and after providing for debenture interest and sinking fund there remains a balance of £22,641, to which is added £1,703 brought forward, making £24,344. Of this, £5,000 is transferred to reserve, income tax provision absorbs £4,200, and £111 is allowed for depreciation. It is proposed to pay a final dividend of 4 per cent. and a bonus of 1 per cent. (both free of tax) on the ordinary shares, making 9 per cent., tax free, for the year, and leaving £1,533 to be carried forward. The number of passengers carried, the car-mileage, and the revenue all showed increases, although the cost of energy was £2,000 higher on account of the coal dispute. The company's associate, the Devon General Omnibus and Touring Co., Ltd., has paid its preference dividend, and carries forward £1,802.

Mersey Railway Co.

The report for the year ended December 31st last records receipts of £217,480, and expenses of £147,536, leaving a balance of £69,944. To this are added £10,405, miscellaneous receipts, a balance of £2,325 brought forward, and £10,000 from special reserve, making £92,674. Interest, rentals, and other fixed charges absorb £65,928, £6,000 is transferred to depreciation and renewal funds, and it is proposed to pay the full dividend on the 3 per cent. perpetual preference stock, leaving £1,274 to be carried forward. The board recommends the appointment of Mr. C. A. Jones as a director. The meeting was to be held yesterday (Thursday).

Smithfield Markets Electric Supply Co., Ltd.

The net profit for the past year, after providing for debenture interest and redemption and depreciation, was £6,729. To this is added £2,394 brought forward, making £9,123. It is proposed to pay a final dividend at the rate of 5 per cent. (1s. per share), making 8 per cent. for the year. After transferring £2,000 to reserve, a balance of £2,323 is carried for-

ward. Further progress was made during the year, and the revenue was well maintained. Sir Herbert Leon, Bart., the chairman, died during the year, and his place as chairman has been taken by Sir George Leon, Bt. The vacancy on the board has been filled by the appointment of Mr. G. M. Powell, the manager and secretary, as director. Mr. A. W. Wilson has been appointed trustee for the debenture holders. The meeting was to be held on Wednesday last.

French Companies.

The *Câblerie Phoceenne*, Marseilles, has declared a dividend of 30 fr. per share for 1924-25.

The *Société des Lampes Gramme* reports net profits of 473,000 fr. for 1925-26. After placing 348,000 fr. to depreciation, the balance has been carried forward.

The *Société Centrale pour l'Industrie Electrique* reports net profits of 4,573,000 fr. for 1926; the dividend is 45 fr. per share, as against 40 fr. in 1925.

The *Compagnie Générale Parisienne de Tramways* records net profits of 3,231,000 fr. for 1926. It is proposed to maintain the dividends paid for 1925 of 16 fr. per priority share, 13.5d. fr. per ordinary share, and 3.50 fr. per deferred share.

County of London Electric Supply Co., Ltd.

The ordinary share capital as increased by the recent bonus issue is to receive a final dividend of 5 per cent.; the interim dividend on the original capital was also 5 per cent. For 1925 a total of 15 per cent. was paid.

At general meetings held on February 17th the holders of the company's first and second debenture stock approved the conversion of their holdings into Government 4 per cent. consolidated loan at the rates of £115 per cent. for the first debenture stock and £112 10s. per cent. for the second debenture stock.

German Company.

The *Electricity Company* (late *Schuckert*), Nuremberg, reports receipts from installations, undertakings and securities amounting to 4,779,000 marks, as compared with 2,844,000 marks in 1924-25. After meeting general expenses, taxes, depreciation, &c., the accounts show net profits of 3,616,000 marks, as against 1,979,000 marks in the previous year It is proposed to increase the rate of dividend from 4 per cent. to 7 per cent.

Swedish Company.

The directors of the *Allmanna Svenska Elektriska Aktiebolaget* report that after providing for depreciation and taxes, the net profits for 1926 were 3,938,000 kr., which compares with 3.011.000 kr. in the previons year. It is proposed to pay a dividend of 5 per cent., as against 4 per cent. in 1925. The stock of orders on hand is satisfactory, and the company's position is said to be strong.

Rushden and District Electric Supply Co., Ltd.

From the revenue for 1926, £2,240 is allocated to reserve, £140 to the writing off of debenture expenses, and £500 is transferred to reserve. A final ordinary dividend of 4½ per cent. is recommended, making 8 per cent. for the year (as in 1925), leaving £1,021 to be carried forward. Mr. R. E. Lamb has been appointed to the vacancy on the board caused by the death of Mr. T. A. Dickson. The amount of energy sold rose from 1,131,691 to 1,300,823 kWh.

Wellington Electric Supply Co., Ltd.

The report for 1926 shows that after allocating £3,000 to depreciation there is a balance of £4,728. After meeting debenture charges, &c., and crediting the balance brought forward, there remains £5,396. From this £1,000 is put to reserve and a dividend of 5 per cent. is paid, leaving £2,146 to be carried forward. There was an increase in the amount of energy sold.

Marconi's Wireless Telegraph Co., Ltd.

In spite of a recommendation from its sub-committee, the Shareholders' Committee has refused to accept in advance the recommendations of the Advisory Committee (consisting of Sir Hugo Hirst, Bart., Lord Ashfield, Lord Buckland, and Mr. F. A. Szarvasy). The latter committee has therefore notified the company that it cannot accede to the company's request that it should act as an advisory committee.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

Auckland Electric Power Board.—£250,000 5 per cent. water power conversion and general extension purposes debentures.

County of London Electric Supply.—1,773,334 ordinary shares of £1 each, fully paid, Nos. 1,330,001 to 1,500,000 and 5,000,001 to 6,603,334.

South London Electric Supply Corporation.—234,000 ordinary shares of £1 each, fully paid, Nos. 310,001 to 544,000.

Companies to be Struck off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Caergwrle and District Electricity Supply Co., Ltd.
Standard Electric Welding Co., Ltd.

Mather & Platt, Ltd.

The directors have declared a final dividend of 5 per cent. (making 10 per cent. for the year), together with a bonus of 5 per cent., both free of tax. £164,458 is carried forward. The dividend and bonus for 1925 were the same.

South London Electric Supply Corporation, Ltd.

The directors recommend a final dividend of £5 17s. 6d. per cent. on the ordinary shares; an interim distribution of 5 per cent. was made on the capital then existing. Last year's total dividend was 15 per cent., but since then the capital has been increased by a bonus share issue.

Chas. Clifford & Sons, Ltd.

Out of a reduced net profit of £10,833 (plus £41,305) brought forward it is proposed to pay a final ordinary dividend at the rate of 10 per cent. for the six months and a bonus of 5 per cent., both free of tax.

Scottish Power Co., Ltd.

The profit for the past year was £62,281 gross and £47,083 net. A dividend of 8 per cent. has been declared on the ordinary shares, £8,000 is transferred to reserve, and £2,718 carried forward.

Crossley Bros., Ltd.

The net profit for 1926 was £50,095, plus £51,221 brought forward. After paying the balance of the preference dividend £73,079 is carried forward. The ordinary shares last received a dividend in 1920 (3 per cent.).

Midland Counties Electric Supply Co., Ltd.

The directors recommend a dividend of 6 per cent. on 1,250,000 ordinary shares, and at the rate of 6 per cent. upon instalments paid on 250,000 ordinary shares.

South Metropolitan Electric Light and Power Co., Ltd.

A final dividend of 6 per cent. is recommended upon the increased ordinary capital. The interim dividend was 5 per cent. Last year's total dividend on the smaller capital was 15 per cent.

Aberdeen Suburban Tramways Co., Ltd.

There was a loss of £1,189 during the half-year ended January 31st last. This is deducted from the balance of £2,426 brought forward, leaving £1,237.

Shawinigan Water and Power Co.

A dividend of 50 cents per share has been declared on the common shares of no-par value for the quarter ending March 31st.

Clyde Valley Electrical Power Co.

It is proposed to pay a final dividend of 5 per cent. on the ordinary shares, making 8 per cent. for the year, as for 1925.

O. C. Hawkes, Ltd.

A final dividend at the rate of 14 per cent. is recommended on the ordinary shares, making 10 per cent. for the year.

Australian Company.

The Australian Wireless Co., Ltd., is increasing its capital to £200,000 by the issue of 175,000 shares of £1 each.

Bruce Peebles & Co., Ltd.

The directors recommend a dividend of 10 per cent. on the ordinary shares for the year ended December 31st last.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets are less buoyant than they have been of late. The China uncertainty and a fear of money becoming dearer instead of easier; disclosure of a rather ragged speculative account in the oil market; a continuance of the new issues which follow too closely upon each other's heels—these are some of the causes that impose a check upon the exuberance hitherto shown this year. People are disposed to hold their hands. The new 4 per cent. consolidated stock, quoted at 15s. premium a month ago, is soberly priced at 3s. 9d. discount, and gives the lead to many other investment securities.

The Underground Electric Railways group is very firm, the £1 shares rising 1s. to 15s. Dividends in the combination were given here last week (ELECTRICAL REVIEW, p. 269), and it may be of use to mention the proportions in which the receipts of the pool are divided, these being at the same rates as the 1925 distributions. The District draws 12 per cent. from the pool, or "common fund," as it is called. The London General Omnibus takes 25 per cent., the London Electric Railway 41 per cent., Central London 16, and City and South London 6 per cent. By the report of the

London General Omnibus Company, it will be noticed that 1,249,000,000 passengers were carried last year, an increase of 13 millions. Total receipts came to £8,683,607; expenses took £8,323,915. Included in the latter amount is £352,000 for depreciation. The company worked at the narrow margin of 4 per cent., its ratio of expenditure to receipts being 96 per cent., a rise of nearly 1 per cent., as compared with the 1925 proportion.

Districts are 1 higher at 59, and Metropolitan consolidated shows ½ loss on the week. A jump of 3 points in London United Tramways 4 per cent. debenture has lifted the price to 49¼. A little business developed in the preference shares, and the price strengthened to 4s. 9d. London and Suburban Traction preference remain at 6s. 6d. The ordinary shares occasionally change hands at 1s. and thereabouts.

The Electrical Distribution of Yorkshire Company, whose shares stand at 29s. 6d., will hold its meeting on March 1st, when proposals are to be submitted authorising the issue of 300,000 new ordinary at 25s. Three new shares are to be offered in respect of every 5 old shares now held. There will be, of course, a premium in the market on the new, when these are issued. The company is paying 9 per cent. for 1926. Northampton Electric repeats its previously-paid 9 per cent., the company's net profit of £44,150 being £250 up, on the year. The Smithfield Markets Electric Supply net profit is down on the year, but the dividend is maintained at 8 per cent. on the ordinary shares. The coal strike and increased taxation are given as reasons for the smaller profit.

Clyde Valley ordinary are 1s. higher at 29s. 6d. The company's final dividend of 5 per cent. makes 8 per cent. for the year, the same as before. Folkestone Electrics at 39s. 6d. show an improvement.

Westminster Electric ordinary weakened to 25s., to which price St. James' have advanced. It becomes increasingly apparent that 25s. is about the level to which London electricity supply shares will approximate with closeness until something happens to remove the list from its "groovy" character. At this price, the eventual 7 per cent. dividends likely to be paid by the companies, on their ordinary shares, will give a yield of £5 12s. on the money, although for the half-decade to the end of 1931, the returns are fairly sure to be higher. The former income is not bad for a thoroughly sound industrial investment, but, at the same time, it is not large enough to tempt new buyers unless there is a low Bank Rate ruling. Charing Cross have hardened to 25s. 6d., as the company has an extra five years tenure under its existing conditions of dividend payment. County of London shares are a trifle lower at 28s.

No change beyond a rise to 8⅜ has to be recorded in the market for cable and telephone issues. The manufacturing shares remain inanimate. Siemens shed a few pence to 29s. 6d. Telephone Manufacturing continue to be a dull market at 7s. 6d.

Marconis pursued what has now become almost a weekly habit, rising to 16s. and then reverting to 15s. Proprietors will feel disappointed at the turn which events have taken, leading to the refusal of the Advisory Committee to act. The Advisory Committee laid it down as a "cardinal principle" that any recommendation they should make would be supported by the Marconi Board and by the Shareholders' Committee. The latter has declined to accept this, and affairs are, for the time being, at a deadlock.

The issued share capital of the Marconi Company is £3,250,000 in ordinary shares of £1 each—some of which were offered to shareholders at £3 per share—and £250,000 in 7 per cent. cumulative participating preference shares. There is also outstanding an amount of £1,354,000 in 6½ per cent. convertible 10-year first debenture stock. The preference shares stand at 22s., and the debenture stock is quoted at 95 middle. In view of the unquestioned importance of the undertaking, the commanding position that it occupies in the sphere of wireless, its far-reaching ramifications, and its scope for immense extension, there is something lamentably pathetic in the present position. The sub-committee is now engaged upon a report containing recommendations designed to secure the success to which, as it maintains, the company is entitled, and which, it significantly adds, would long since have been attained with efficient administration.

Mexican affairs continue to hold out a reasonable hope of pacification in the country, and a steady return to business prosperity. On these grounds favourable attention is paid to the shares and bonds of the utility companies. Gains of 2 points have lifted Mexican Light and Power common shares to 42, and the company's first mortgage bonds to 70½. It is confidently affirmed by people in close touch with the country that the long-expected scheme is nearly ready for dealing with the question of interest arrears on the Mexican Light and Power preferred shares. Other foreign traction and lighting descriptions are quiet, Brazilian Tractions being a dollar lower, at 121. The troubles in China are not affecting this department to any marked extent, apart from the indirect influence that they exert over investment prices as a whole.

Rubber shares begin to exhibit signs of vitality, and there is a vague idea that the market may derive advantage from the check administered to the previous excitement in oil shares. The engineering group is quiet, with daily price movements narrow and irregular. In the metal market the price of copper has rallied from the price recently reached, the lowest touched for years past.

Share List of Electrical Companies.

	Nom.	Dividend. 1924.	Dividend. 1925.	Price Feb. 21 1927.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	60/9	—	4 12 0
Brompton Ordinary	£1	10	10	25/-	—	5 12 0
Charing Cross Ordinary	£1	15	15	25/6	+6d	5 9 10
do. do. 4½ Pref.	£1	4½	4½	17/-xd	—	5 6 0
Chelsea	£1	12	12	25/-	—	5 12 0
City of London	£1	15	15	2 1/16	—	... ...
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Clyde Valley	£1	8	8	29/6	+1/-	5 8 4
County of London	£1	15	15	28/-	—6d	... ...
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	£1	7	8	26/3	—	6 2 0
do. 7% Pref.	£1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	£1	10	10	30/6	—	6 11 2
Kensington Ordinary	£1	15	15	24/6	—	5 14 8
Lancs. Light and Power	£1	7½	7½	24/-	—	6 2 5
London Electric	£1	10	10	24/-	—	5 17 8
do. do. 6% Pref.	£5	6	6	5 7/16	—	5 10 4
Metropolitan	£1	11	11	26/-	—	5 7 8
do. 4½% Pref.	£1	4½	4½	17/-	—	5 2 10
Midland Counties	£1	5½	6	21/-	—	5 14 8
Newcastle-on-Tyne Ordinary	£1	7	7	21/3	—	6 11 0
do. 5% Pref.	£1	5	5	17/6	—	5 14 8
do. 7% Pref.	£1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	£10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	£1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	£5	17½	17½	25/-	+1/-	5 12 0
South London	£1	15	15	24/6	—	6 8 0
South Metropolitan Pref.	£1	7	7	1¼	—	6 8 0
Urban Ordinary	£1	4	7	24/6	—	5 14 8
do. 6 % Pref.	£1	6	6	20/6	—	5 17 1
Westminster Ordinary	£1	15	15	25/-	+6d	5 12 0
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	£1	8	8	29/6	+6d	5 8 4
Home Rails.						
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	£	5	5	64	—½	4 13 9
do. District	£	8½	8½	59½	+1	5 18 8
Underground Electric	£1	Nil	Nil	15/-	+1/-	2 0 0
do. do. Income	Bonds	6	6	104	—	*5 15 5
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	100	—	6 0 0
do. Def.	£	1½	1½	24	—	6 5 0
Automatic Telephone	£1	8	10	2 1/16	—	8 14 3
Chili Telephone	£5	5	6	6½	—	4 12 4
Cuba Sub. Ord.	£10	5	5	7	—	7 5 6
Eastern Extension	£10	10	10	17⅝	—	*5 13 4
Eastern Tel. Ord.	Stock	10	10	172½	—	*5 16 0
Globe Tel. and T. Ord.	£10	10	10	18¾	—	*5 6 8
do. do. Pref.	£10	6	6	11	—	5 9 1
Great Northern Tel.	£10	22	20	26⅜	—	7 10 0
Indo-European	£25	8½	10	46½	—	*5 7 6
Marconi	£1	10	Nil	15/-	—	... ...
Marconi-Marine	£1	10	7½	1¼	—	6 13 4
Oriental Telephone Ord.	£1	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	£5	8	8	8⅜	+1/16	*4 15 7
Western Telegraph	£10	10	10	17	—	*5 17 8
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	3	—	9 13 6
do. do. 2nd Pref.	£5	6	6	3	—	10 0 0
do. do. 5% Deb.	Stock	5	5	71½	—	7 0 0
British Electric Traction Ord.	£	7	8	145½	—	5 10 0
do. do. 6% Pref.	£	6	6	109	—	5 10 1
Brazil Traction	£60	4	5	121	—1	4 19 4
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	+1	5 11 9
do. do. Preferred	£	96/-	136/9	123½	—3	*4 0 0
do. do. Deferred	£	129/5	8	160½	—2	*4 18 6
do. do. Deb.	£	4¼	4¼	81½	—	5 4 4
London & Sub. Trac. 5% Pref.	£1	2½	Nil	6/6	—	Nil
London United Tram. Deb.	Stock	4	4	49½	+4	8 1 8
Mexico Trams, 5% Bonds	—	5	5	67	—	7 8 2
Mexican Light Common	£60	Nil	Nil	42	+2	Nil
do. Pref.	£60	Nil	Nil	92½	—	Nil
do. 1st Bonds	—	5	5	70½	+2	7 1 10
Yorkshire (West Riding)	£1	5	—	10/-	+1/3	... ...
Manufacturing Companies.						
Babcock & Wilcox	£1	12	13	52/6	—	4 19 1
British Aluminium Ord.	£1	5	10	46/3	—	4 6 7
British Elec. Transformer Pref.	£1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	£1	15	15	70/-	—	4 5 9
Brush Ord.	£1	10	10	28/3	—	7 1 7
Callenders	£1	15	15	3½	—	4 5 9
do. 6½% Pref.	£1	6½	6½	23/9	—	5 9 5
Crompton Ord.	£1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	84	—	5 19 1
Electric Construction	£1	10	10	31/3	—	6 8 0
Enfield Cable Pref.	£1	7½	7½	11¼	—	6 6 4
English Electric	£1	5	Nil	15/-	—	... ...
do. do. Pref.	£1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	£1	6½	6½	23/6	—	5 10 8
do. Ord.	£1	5	7½	31/6	—	4 15 8
Henley	£1	16	20	4½	—	4 9 0
do. 4½% Pref.	£5	4½	4½	4¼	—	5 6 0
India-Rubber	£1	5	5	1	—	*5 0 0
Johnson & Phillips	£1	10	17½	2 1/16	—	5 19 1
Met.-Vickers Ord.	£1	8	8	28/3	—	5 13 3
do. Pref.	£2	8	8	2 5/16	—	6 18 4
Siemens Ord.	£1	7½	7½	29/6	-6d	5 1 8
Telegraph Construction	£2	20	10	29⅜	—	*4 0 8

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during January, 1927.

FOLLOWING upon last year's excellent showing, the new year opened well for the electrical export trade, auguring a period of record prosperity. It must be admitted that the increase of exports in January as compared with December was due to the rise in shipments of submarine telegraph and telephone cable, but this only accounted for about a half of the increase in the comparison with January, 1926. In placing the January list against that of the previous month, it will be seen that decreases predominated, the greatest being a fall of £51,818 in exports of telegraph and telephone instruments and apparatus, while the non-submarine cable sections showed declines. In the machinery class, however, there were satisfactory increases—£45,000 in the case of unenumerated machinery and £50,539 in railway and tramway motors. Comparing the figures with those of January last year, the increases are seen to be greater in number. Apart from the increase in submarine cables already referred to, the machinery section was responsible for the rise in the total, the aggregate increase in the three items being £139,753. The only decrease of consequence was the fall of £15,032 in the value of exported telegraph and telephone wires and cables (not submarine).

Only one of the import items was higher than in December, *viz.*, insulated wires and cables, which rose by £4,375. The result was a decrease of £62,769 in the total, over half of which was due to lower values in respect of batteries and accumulators and unenumerated electrical machinery. As compared with January, 1926, however, there was a fairly general increase in imports and, strangely enough, the principal rises occurred in the cases of unenumerated electrical machinery and batteries and accumulators. The principal decreases were in telegraph and telephone wires and cable (not submarine) and unenumerated goods and apparatus.

The comparatively unimportant re-export section dwindled still further; the increases and decreases were balanced in number, but the former were much greater in magnitude. The decrease in comparison with January, 1926, was not so great.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Jan., 1927.	Inc. or dec. as compared with Dec., 1926.	Inc. or dec. as compared with Jan., 1926.	Electrical imports for Jan., 1927.	Inc. or dec. as compared with Dec., 1926.	Inc. or dec. as compared with Jan., 1926.	Electrical re-exports for Jan., 1927.	Inc. or dec. as compared with Dec., 1926.	Inc. or dec. as compared with Jan., 1926.
Electrical goods and apparatus (unenumerated)	£187,475	— £2 555	+ £19,664	£115,242	— £7,424	— £10.132	£5 967	—£3,965	—£1,013
Insulated wires and cables ...	274.575	— 21,033	+ 6 015	60,888	+ 4,370	+ 13,195	1,707	+ 1,238	+ 1,470
Glow lamps	43,097	— 3.616	+ 716	35 931	— 5,925	— 8.675	947	— 218	— 1,314
Arc lamps and parts	1,449	+ 724	— 738	1,966	— 1,817	+ 1,636	12	+ 6	+ 10
Batteries and accumulators ...	88,381	— 16.146	+ 2,575	47.099	— 20 079	+ 22,543	360	— 2,040	— 914
Meters and instruments ...	31,709	+ 4,175	+ 9,409	22,098	— 3,810	+ 1,703	598	+ 436	— 130
Carbons	1,039	— 1,995	— 1,460	6,817	— 4,674	+ 2,549	54	+ 37	— 52
Electrical Machinery—									
Electrical machinery (unenumerated)	304,856	+ 45,300	+ 80,538	130,144	— 15,646	+ 45,946	6,589	— 1,109	+ 825
Railway and tramway motors	99,827	+ 50,539	+ 54,422	—	—	—	—	—	—
Other motors and generators ..	208,640	+ 5,793	+ 4,793	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	4,355	— 3.032	— 574	567	— 233	+ 310	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	53,558	— 20,244	— 15,032	9,727	— 2,144	— 24,937	40	+ 32	+ 23
Submarine telegraph and telephone cable...	203,486	+ 189,769	+ 189,163	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	207,811	— 51,818	— 2,559	47,621	— 5,347	— 3,232	2,480	— 4,650	— 1,958
Totals	£1,710,258	+£175,861	+£346,932	£478,100	—£62,769	+ £40,9.6	£18,754	—£10,233	—£3,053

Brazil's Electrical Imports.

Official statistics in some detail have just been issued relating to the foreign trade of Brazil in 1925. The values of Brazilian imports of electrical goods in that year, compared with 1924, are given below, together with a note of any increase or decrease. Particulars regarding the countries of origin of this material are not available:—

	1924. £ (thous.).	1925. £ (thous.).	Inc. or dec. £ (thous.).
Insulated electric copper wire	115	75	— 40
Electric cables	125	125	—
Insulators	66	62	— 4
Machinery for electricity and electric light ...	865	965	+100
Electric light carbons ...	30	14	— 16
Dynamos and generators	129	197	+ 68
Electric lamps	139	187	+ 48
Motors	274	306	+ 32
Transformers	172	145	— 27

Siamese Electrical Imports.

Although the value of electrical goods and apparatus imported into Siam rose from £74,852 in 1924-25 to £76,964 in 1925-26, Great Britain's share declined from £26,000 to £22,400. This country is still, however, the largest exporter to Siam of this class of goods. In 1925-26 the values of goods supplied by our largest competitors were as follows:—Germany, £10,811; Japan, £9,556; United States, £9,411; and Belgium, £8,000 (approx.). The last country's share was almost three times as large as in the previous year. This information is contained in a recent report on Siamese conditions prepared for the Department of Overseas Trade by Mr. J. F. Johns, Consul-General at Bangkok. (Stationery Office, 1s. 6d. net.)

Polish Foreign Electrical Trade.

According to the *Board of Trade Journal*, the imports of "apparatus, conductors and other electrotechnical materials" into Poland during December last were valued at 2,712,000 gold zloty (£108,000), while the value of Poland's exports of the same class of materials was 16,000 gold zloty (£640).

The British Industries Fair.—II.

Functions and Exhibits at London and Birmingham.

THE Fair is now open, and there is great activity both in London and in Birmingham. Last Friday the preliminary Press view took place at Birmingham, and one was very favourably impressed with the extensions and improvements that have been made. Mr. T. R. Martin, the chairman of the Management Committee, in addressing representatives of the trade and newspaper Press, said that the Castle Bromwich show was the largest and most comprehensive collection of British goods ever marshalled together. He acknowledged the efforts of the Press, of the exhibitors, and of the officials who had helped to carry the Fair to a successful issue. It was a means for furthering British trading everywhere, and manufacturers could help materially by giving early notice to the organisers that they would exhibit again next year. In 1928 they would be able to bring to this country an influx of foreign buyers such as this country had never experienced if manufacturers would make known their intentions. He urged British firms to link up definitely with the Fair, forming an integral part of it by means of composite displays of particular industries. Mr. Martin said that Birmingham now possessed the finest permanent Fair buildings in the country, with unlimited scope for future extensions. If British goods were to be sold, they must be seen, and if all British manufacturers took part in the Fair, the buyers would feel compelled to come and see. The Birmingham exhibits this year number 600, as compared with approximately 400 last year. We pass on to the trade Mr. Martin's assurance that any buyer will be welcomed at Birmingham whether he has received the official invitation or not. Entrance can be obtained on presentation of his trade card or other satisfactory trade credentials.

On Monday evening, at the Mansion House, the Prince of Wales was present at a banquet given by the Government to mark the opening of the Fair. Sir Philip Cunliffe-Lister, President of the Board of Trade, presided. The large and distinguished company present included our Colonial High Commissioners, many foreign Ministers and Ambassadors, and men of eminence in various departments of trade activity at Home. The Prince delivered a lengthy, well-thought-out speech regarding British industry and trade, and some of the essentials for future success. The situation was very promising, and we were looking forward with a more cheerful spirit after all that we had passed through in 1926. He dwelt upon the qualities of enterprise and enthusiasm as the most necessary at the present time; the importance of foreign travel, collective action in industries, standardisation, better salesmanship, the freer use of foreign languages, the willingness to acknowledge that there was something new to learn every day, and other points making for efficiency. We must adopt as our policy: "Adopt, Adapt, Improve."

On Tuesday the Prince visited the Fair at Birmingham. To-day, Friday, is the first of the Electrical Days there. Others are as mentioned in the programme published here last week.

We continue below our description of the principal exhibits. In London, 900 firms are exhibiting this year, as compared with 600 a year ago. The number would have been larger but for the limited accommodation available.

The Fair remains open until March 4th.

THE BIRMINGHAM SECTION.

Macintosh Cable Co., Ltd.

The exhibit of this company includes a wide range of products, from a patent system of wiring to examples of the latest types of e.h.p. cable. An interesting feature of the display is the demonstration of various tests upon the cable-insulating and sheathing compound "Maconite." Lengths of cable thus insulated are shown immersed in various acids, alkalies, &c., with the current passing through them. The object of this feature is to demonstrate the suitability of "Maconite" cables for use under such difficult conditions as are found in chemical works, on board ship, in railway tunnels, and in collieries. Of particular interest to mining engineers are the specimens of the new Macintosh trailing cable. The salient features of the new cable are:—Each "Maconite" insulated core is separately wrapped in tinned copper strand, giving flexibility and easy access in case of damage. Being continually earthed, the wrappings prevent short circuiting of the phases; and the main earth core is completely protected from damage, being central between the phase cores. The cable is made in two forms, one for use with any type of gear and one for use with the Williams-Rowley earthing system and its gate-end switch. By means of a specimen of this type of switch (made by Switchgear & Cowans, Ltd.) the Williams-Rowley system is demonstrated. The special cable has an insulated pilot conductor carrying a low-voltage current, energised by a transformer. The circuit is made through the earth core and energises the special trip device of the gate-end switch in the event of a faulty earth. Samples of "H"-type super-tension cable for working pressures of 33,000 volts and over are exhibited. (This type of cable was described in our issue of December 17th, 1926.) The essential principle is the wrapping of each of the three cores with metalised paper, which is maintained at earth potential by contact with the other cores and with the lead sheath. Tangential stresses are thus eliminated. Wired showboards display the latest developments of the Macintosh wiring system and its accessories. The system of wiring by lead-covered "Maconite" is also shown in this way. A range of boxes and accessories made for town services, &c., is included in the exhibit.

Chloride Electrical Storage Co., Ltd.

Upon this stand appears a full range of batteries suitable for every application. A selection of different types of "Chloride" batteries for house lighting is displayed, comprising both the open type and the new fully-charged, sealed-in type, which is adopted by the chief lighting-set manufacturers in this country. The batteries on exhibition include specially-designed types for radio work, including the latest developments in h.t. batteries, exemplified by the "WH type" 24-V units in multi-compartment glass boxes, and the "WJ-type" 20-V units assembled in wood crates. The usual range of batteries in celluloid boxes, together with "DTG" and "DFG" cells in glass boxes, are also on view. Higher-capacity batteries are available for inspection, and types for marine wireless installations and lifeboat sets, together with others designed for emergency lighting and gyro compass operation on board ships are represented. Other exhibits include Exide-Ironclad batteries for traction purposes; special cells for miners' handlamps and portable batteries; and specimens of the "Lux" battery, specially designed for train lighting.

Park Royal Engineering Co., Ltd.

This is a comprehensive exhibit of modern switchgear and instruments ranging from an 11,000-V heavy rupturing capacity oil switch, and a 6,000-A air circuit breaker, down to a 2½-in. ammeter. A large capacity oil switch exhibited is one of a number recently made for the Bolton Corporation. Its massive appearance, it being built up on heavy iron framing, gives no suggestion of the ease and smoothness with which it is operated. The operating handle for replacement is of the "loose handle" type and has a throw of 180 deg. in a downward direction (to close the switch) and by means of a double toggle mechanism shows the position "On" or "Off" A prominent feature of the switch is the arrange-

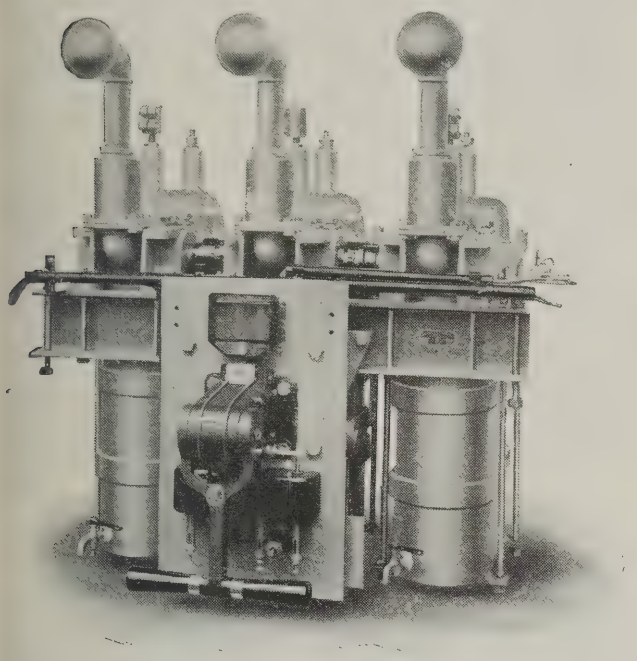


Fig. 7.—A Large Park Royal Oil Switch.

ment of ample vent pipes, a necessity for switches of large breaking capacity. The gear is illustrated in fig. 7. A draw-out cubicle is exhibited. The whole of the operating mechanism can be withdrawn for attention when required, the contacts in the fixed portion being automatically covered up and rendered fool-proof. The oil switch is on similar lines to the one described above, but of proportionate size for the cubicle. Another type of oil switch of this company's design is one for wall mounting, for use in sub-stations, or for industrial purposes. It is fitted with the usual automatic features, and may be either single-, 2-, or 3-phase, for pressures up to 2,000 V. Air circuit breakers are represented by a 6,000-A, single-pole, overload type, direct operation. This, again, combines ease of operation with massive construction. An example is also shown of an electrically-operated circuit breaker where necessity or convenience requires the breaker to be re-set from a distance. Besides these types for exceptional use, examples are shown of the switchboard type of breaker, the special features of which are a definite catch so that vibration will not open the breaker, hand tripping by means of a key, and the usual qualities of ample construction and observance of B.E.S.A. standard specifications. Hand switches and self-aligning fuses are also to these specifications. The company produced instruments before it commenced making switchgear, and the latest development in this direction is the introduction of a patented method of protecting the pivots by the provision of small springs which, whilst inert in normal operation of the instrument, come into play if the instrument is subjected to shock. The adoption of this device therefore transforms what was hitherto a delicate and easily damaged instrument into a robust and serviceable unit. This device is applicable to both miniature instruments and large ones, and the company has a large range varying from a number of small models suitable for portable use, motor cars, &c., up to large illuminated dial instruments suitable for central station switchboards.

Electricars, Ltd.

The principal exhibit of this company is a 30-cwt. low-loading vehicle developed to meet the demand for one possessing a very low loading line and capable of manœuvring in narrow streets and entrances presenting difficulties to a machine of ordinary dimensions. The wheelbase is 7 ft. long, and the vehicle has a turning radius of 13 ft. Wheels of 20-in. diameter permit of a chassis height of only 27 in., so that the loading line can be anything from this figure upwards according to the type of body fitted. A single motor of very robust design drives an overhead worm axle, and a drum controller gives three speeds forward and reverse. All the control gear is mounted on the dashboard within the cab, and is thus very accessible for inspection and adjustment. A battery of 160-Ah capacity gives a road speed of 8 m.p.h. fully loaded on the level and a range of 20 to 25 miles per charge according to the class of road surface. Other exhibits include a 2-ton elevating platform truck which has been designed for use in connection with stillages whereby these are conveniently loaded as required and when ready for movement are packed up by the truck and deposited again wherever necessary. A 2-ton general purpose platform truck, which has a platform of 3 ft. 4 in. wide by 6 ft. long, but for carrying light and bulky articles it can be extended to 8 ft. 9in. by fixing the end gate in a horizontal position in the holes provided for it in the end bumper plate. The standard battery consists of 24 Edison cells of 225-Ah capacity, and this is sufficient for a full day's hard work without the need of a boosting charge. This latter can, however, be given under exceptional circumstances, thus enabling the truck to carry on for still longer periods.

George Ellison.

Conspicuous among the exhibits upon this stand are a new design of fireproof circuit breaker for use in mines, a new cable-way plug and socket connecting point for trailing cables, and an 11,000-V cubicle. The plug and socket equipment is especially designed for use in factories, mines, docks, &c., where a plug connection for portable tools and machines is a great convenience. Its cases are heavy gun-metal castings, turned, screwed and finished in steel bronze. The fixed contact case is provided with a flange for bolting to a flat surface or over the cable entrance of a totally-enclosed circuit breaker, and a screwed cap fits over the fixed contacts when the connector is not in use. A rubber packing ring firmly held on the fixed contact face makes the coupling, or the fixture covered by its cap, proof against dust or weather. A secure grip of the trailing cable is obtained by means of a screwed gun-metal conical clamp and wood bush. The terminal blocks are recessed to receive the cable strands under a clamp and are specially shaped to assist the cable grip without a strain on the binding screws. The special features claimed for it are: (1) the contacts are self-cleaning, self-aligning, spring type, offering no resistance to the effort of inserting the plug, but making forcible union between plug and socket; (2) the terminals are effective clamps for the cable strands, ensuring a good electrical and mechanical joint; (3) the trailing cable is securely gripped by a screw clamp. The plug connector box, illustrated in fig. 8, was designed for installation in an armoured cable run under a jetty, a small hole being provided for inserting the trailing cable plug. It is also suitable for use in connection with cables laid underground. The flame-proof circuit-breaker shown is designed for use in mines, and is made to withstand rough usage. It can be produced with two, three, or four poles, to carry currents up to 150 A. Four automatic releases can be fitted, including no-voltage and overload releases with or without time lag. The gear is effectively

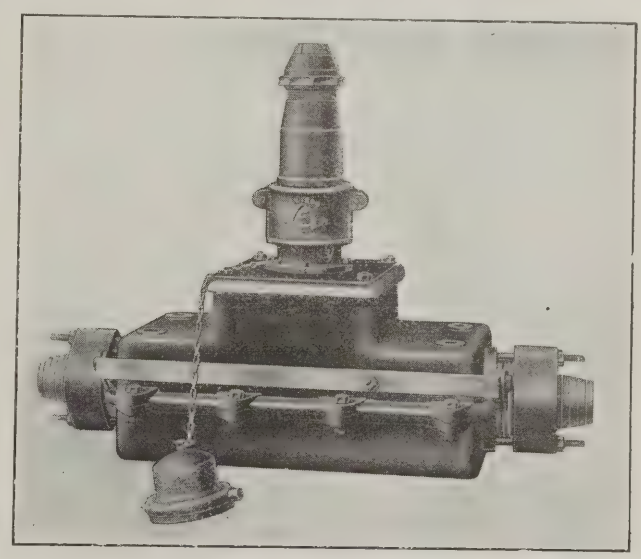


Fig. 8.—A Cable Plug and Socket Box.

interlocked to prevent improper operation or interference. The 11,000-V cubicle shown is a steel construction, access to the gear being gained through hinged doors, which are fitted with padlocks. A unit may contain one or two sets of busbars, pole-operated isolating switches, a hand-operated oil circuit breaker, current and potential transformers, instruments, meters, signal lamps, and interlock contactors. A number of units may be erected together with continuous busbars, to form a switchboard. The breaking capacity is 150,000 kVA at 11,000 V, 3-phase, on a symmetrical short circuit. Other exhibits of this firm are sub-station switchgear, circuit breakers, "Tufnol" (a synthetic-resin insulating material), and a time-lag device for circuit breakers. The last allows the passing of the momentary rush of current upon starting.

W. Canning & Co., Ltd.

A working exhibit of a fully-automatic electro-plating apparatus is exhibited by this old-established company. This not only embodies practically every latest improvement in electro-plating practice, but enables work to be successfully produced without any manual labour beyond hooking the articles on at one end, and taking them off when finished at the other. As the work to be plated has to pass successively through all the preparatory cleaning and swilling vats before going into the depositing vat, and finally through swilling and dipping out apparatus after deposition, careful and accurate design has been very necessary. As will be seen from fig. 9, the various vats are placed in line, one behind the other, in their proper order. Two conveyor chains are arranged to move slowly over this line of vats, supported at intervals by idler pulleys mounted on shafts carried by steel standards on each side of the line of vats. The chains are driven at a slow speed by reduction gear from an electric motor mounted on a steel framework over the rear end of the apparatus. Steel standards are erected at intervals each side of the line of vats, each pair of which carry bearings for a shaft fitted with two chain wheels. This shaft runs just under the line of the conveyor chain and each chain wheel has a chain drive to a similar chain wheel vertically above it, which is mounted on a fixed pin carried by the steel standard. The conveyor chain track and each vertical chain is fitted with a pick-up attachment which lifts the bar out of one pair of holders on the conveyor chain and drops it into the next pair. The transporting gears are operated by a long shaft running down one side of the apparatus, which drives a worm gear on each of the steel standards connected by a chain drive to the lift gear shaft.

Although this description may seem elaborate, in reality the apparatus is exceedingly simple. The details have been carefully thought out so as to eliminate wear and breakdown. Along the length of the plating vat, just outside the track of the conveyor chain, are two angle sections of brass at such a height that the cathode suspender bars slide on them whilst they pass over the vat. These angles are connected to the plating dynamo and form the electrical connection through the suspender bar and suspending hooks to the cathode. The top of the angle bar is broken up into small inclined planes with a step down again at their finish so that the suspender bar gets a jerk every time it drops over the end of one of these planes during its travel. This forms a cathode gas-disturbing device and shakes the gas bubbles from the work being plated. The solution is heated by electrical elements, and an alternative heating system is exhibited for heating by steam coils. A combined agitating and filtration apparatus is fitted by which the solution is continually filtered free from suspended matter and kept in constant movement. The apparatus is operated by a 6-V, 250-A motor-generator for the plating vat, and a 6-V, 150-A motor-generator for the cleaning vat, which is of the electric cleaner type, and a 3-h.p. motor drives the pump for the agitation and filtration apparatus. The apparatus shown is 50 ft. long by just over 4 ft. wide. On the stand the company also exhibits a range of its dynamos, including a 6-V, 1,000-A machine for belt drive, a 2-h.p. motor polisher, and various patterns of polishing lathes for belt driving. Various types of grinding machinery, a small "Minik" plating apparatus, and various other plating accessories are shown.

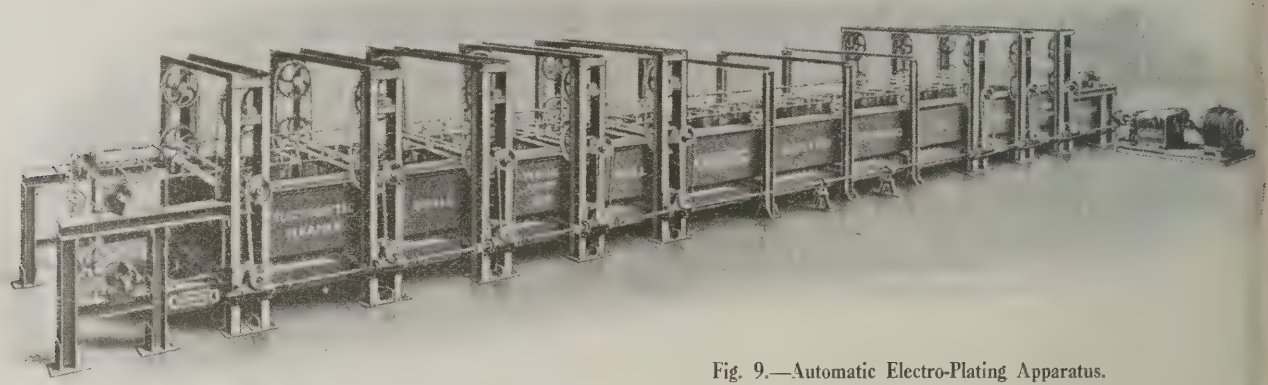


Fig. 9.—Automatic Electro-Plating Apparatus.

Electroflo Meters Co., Ltd.

The stand of this company is in the Steam Power Section, and the exhibit comprises electrically-operated fluid flow meters for the measurement of steam, water, air, oil, and gas. Two additional panels are also located in the section, one on the stand carrying the Lancashire and water-tube boilers, and the other on that carrying the turbo-generator. The first panel is the "Electroflo" standard boiler-control panel, comprising a 15-in. diameter circular dial type boiler load indicator, having 2-in. high numerals and clearly visible pointer, two draught indicators, and one pressure indicator, all circular in shape and 12 in. in diameter, so that they are clearly visible from considerable distances. The draught indicators are calibrated in 0.01 in. w.g., and have a 320 deg. scale. The importance of clear visibility of the reading instruments has been considered, and the dials are either 12 in, or 15 in. in diameter. The boiler control panel is completed with the addition of a 9-in. scale CO_2 indicator. The panel on the turbo-generator exhibit comprises two meters, one measuring the main steam supply to the turbo, and the other the condensate discharge. These meters include an indicator, a recorder, and a 5-dial continuous integrator. The panel is completed with a multi-point distance temperature indicator, complete with totally enclosed multi-point rotary switch. The exhibits on the main stand also comprise distance temperature indicators of the thermo-couple and electrical resistance type, and a multi-point continuous electric temperature recorder. The features of these instruments include straight charts, approximately 7 in. wide, and individual operating systems. The "Duplex" continuous electric temperature recorder has two entirely separate operating systems, so that any two chart records can be used simultaneously. The whole of the actuating mechanism is mounted on a bracket swinging 180 deg. out of the instrument casing. A model of the "Electroflo" meter in section demonstrating its principle of operation is exhibited.

Crossley Bros., Ltd.

This exhibit includes two "Crossley" standard types of crude oil engines representing the horizontal 4-stroke and also the vertical 2-stroke. In addition, a 1½-kW lighting set is shown; all engines can be seen in operation. The horizontal oil engine is of the cold starting type developing 32 b.h.p. as a working load, and using as fuel the cheapest grades of residual (crude) oil, in addition to standard grades of Diesel and gas oils. The fuel oil is supplied on the solid injection principle, the fuel pump being of the vertical type with double suction and delivery valves, and is operated from a cam on the sideshaft. The governor regulates the exact quantity of fuel oil admitted each power stroke by means of a control valve, and ensures that the fuel always enters the cylinder when the heat of compression is at its maximum. The Crossley vertical 2-stroke oil engine has a capacity of 14 b.h.p. working load. This engine also uses residual (crude) oil, Diesel oil, or gas oil. A special feature on the engine consists of a separate air scavenging system obtained from a low pressure air pump driven from the crankshaft. Forced lubrication is fitted throughout to all bearings and main moving parts. The Crossley lighting set consists of a 1½-kW, 50/70-V, belt-driven dynamo, coupled to a 3-b.h.p. engine, the whole being mounted on a substantial underbase. A separate wall mounted type switchboard is included. The engine is of the horizontal totally-enclosed type, with a continuous system of automatic lubrication, whereby the set will operate all day without attention, the fuel used being paraffin.

W. & T. Avery, Ltd.

This company is displaying a very comprehensive display of types of weighing machines, counting machines, testing machines, and so on. Readers will no doubt find their interest chiefly engaged here on the machines for testing specimens representative of a bulk of material and for carrying out hardness tests. Other noticeable machines will be those that count as well as weigh to a fine degree of accuracy.

Birmingham Corporation Electric Supply Department.

The principal exhibit of this department is a complete mercury-arc rectifier sub-station of 460-kW capacity, including two 138-kW booster rectifier equipments, as used in outlying areas to convert 5,000-V, 25-cycle a.c. (three-phase) to d.c. at 220 and 440 V for distribution. Another type of sub-station is an example of the equipment installed in large consumers' premises. It consists of three 100-kW transformers for reducing the pressure of the three-phase, 25-cycle supply from 5,000 to 230/415 V. In conjunction with Automatic & Electric Furnaces, Ltd., the department is showing a number of electric furnaces ranging in size from 7.2 to 21 kW, for a number of purposes and industries, including tool-hardening, carburising, annealing, enamelling, &c. Another section of the stand is devoted to welding plant, and three types are shown, *viz.*, a 3-kW butt welder, an 8-kW spot welder, and a 15-kW flash welder. In addition to these there is a large collection of all kinds of industrial appliances, including an automatic coil winder, an electromagnetic separator, a magnetic pulley, a

foundry riddle, portable electric tools, "Ozonair" air-purifying apparatus, "Morganite" factory-type heating units, &c. A wide range of domestic appliances is also shown; this includes a 4-kW coffee boiler, fires, irons, kettles, &c.

Wingrove & Rogers, Ltd.

Among the exhibits of this company is its newest product, the "Super Giant" sprung truck of the battery propelled type. This is designed to give efficient service under the roughest conditions. The drive is from the motor by means of a cardan shaft, through a worm and worm wheels, on to a differential of the fully floating type; the differential is fitted with roller bearings, all shaft ends being splined. The truck is rated at 5,000 lb., and is mounted on semi-elliptic springs, the battery being additionally sprung by means of eight helical springs suspending from the main frame. In this manner the battery is completely protected against bumps or jars. The truck is fitted with a specially designed controller, which is arranged to give three speeds in either direction and is electrically interlocked with the brakes, this rendering the truck fool-proof. Amongst the other exhibits are the "Midget Whippet" elevating truck and the company's No. 2 size locomotive. The principal feature of the elevating truck is the very handy manner in which it can be manœuvred, its turning radius being only 3 ft. to the centre of the truck, and it will turn out of a gangway 4 ft. wide into one of similar width. It is fitted with hand-operated elevating gear. The No. 2 locomotive has a hauling capacity of 10 tons. It has a cast-iron frame, the motor being situated under the driver's platform. The drive is of the spur gear type on to all four driving wheels, and efficient braking is provided upon all four wheels.

Credenda Conduits Co., Ltd.

On this stand, which is among the larger ones, is a very complete range of "Creda" electric heating and cooking apparatus produced at the company's new works at Oldbury,

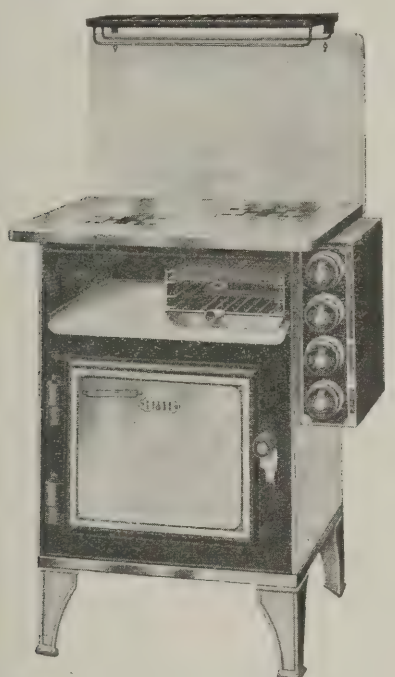


Fig. 10.—A New "Creda" Cooker.

which were described in our issue of January 14th. Six different types of cookers are shown, from the "Bijou" model suitable for two people, up to a large range capable of cooking for 18 persons. The latest model is the "C.35," illustrated in fig. 10. This has a total loading of 6,300 W, made up as follows:—Oven, 1,800 W; two boiling plates (7 in. square), 1,500 W each; and grill, 1,500 W. The control apparatus is conveniently mounted at the side, and includes rotary snap switches. This cooker is designed for catering for from four to seven persons. In addition to the cookers, the company displays a large number of fires, irons, kettles, wash boilers, and other domestic appliances. One section of the stand is devoted to conduit and conduit fittings. Daily demonstrations of electric cooking are given.

W. H. Allen, Sons & Co., Ltd.

The principal item of interest upon this stand is a 250-kW geared turbo-generator set designed for back pressure. The turbine is of the impulse type, running at 6,000 r.p.m., driving a shunt-wound 110-V dynamo through double helical reduction gearing at a speed of 650 r.p.m. The set is constructed for a steam pressure of 210 lb. per sq. in., 590 deg. F. total temperature, exhausting against a back pressure of 20 lb. per sq. in. With the set are samples of turbine blading and a complete wheel. Another generating set shown comprises a two-crank compound enclosed force-lubrication engine direct coupled to a 100-kW d.c. dynamo, running at 500 r.p.m., mounted on a combined baseplate. This engine is designed for operation on a steam pressure of from 125 to 200 lb. per sq. in. exhausting against a back pressure of from 0 to 5 lb. gauge or 105-200 lb. per sq. in. dry saturated, exhausting with condenser. These two sets are suitable for works requiring steam for processes as well as electrical power. The company's oil engines are represented by a 50-b.h.p. heavy fuel oil engine designed to give its output at 375 r.p.m. It is of the vertical, two-cylinder type. A model of a 35,000-sq. ft. condenser is shown; the company has since produced condensers with a surface of 45,000 sq. ft. The pump gear exhibited includes a belt-driven "Conqueror" centrifugal pump with an output varying from 250 to 800 gal. per min. against heads of from 10 to 50 ft., the speed ranging from 640 to 1,140 r.p.m.; a model bore-hole pump; and a high-lift pump impeller and guide ring. A collection of photographs of the company's products completes the exhibit.

Rapid Magnetting Machine Co., Ltd.

This exhibit consists of electric lifting magnet equipment and magnetic separators. Three different types of the latter are shown, all of which are obtainable in different sizes. The windings in each type consist of solid metal formers insulated with fireproof material, impregnated with non-hygroscopic insulation varnish, and wound with fireprooof insulated high-conductivity copper wire or strip. These formers fit into suitable recesses in the machined castings, and in all cases renewable lifting poles having recesses for protecting the bolts are fitted. Finally, intervening spaces between the coil units and the shells are filled with insulating compound which facilitates radiation and increases the insulation resistance to earth. The mechanical construction is robust in design, and the connection boxes are fitted with spring cable protectors, the glands being watertight. Amongst the electro-magnetic separators, the "B.B." type claims attention. It consists of a framework, suspended from which is an highly-intense magnetic separator trough. A series of magnet bars stretches across the trough at right angles to the direction of flow of the material being treated; the trough, suspended on machine brackets and pins, is jig shaken by means of machined totally-enclosed dust-proof pattern ball bearing eccentrics at about 250 oscillations per minute.

Paterson Engineering Co., Ltd.

In the Model Boiler House this company shows a lime-soda water-softening plant for the treatment of boiler feed supply, having a capacity of 1,500 gal. per hour. The plant is in operation under working conditions, and is fitted with osilameter measuring and chemical supply gear, wood fibre strainers, and sludge settling arrangements. There is also displayed a model of the by-pass type osilameter measuring and chemical supply gear for the addition of lime and soda ash as installed in connection with large water-softening plants of 5,000 to 100,000 gal. per hour capacity. An interesting exhibit is the "Basex" base-exchange water softener for producing a water of zero hardness. The "Basex" softening material used in this plant possesses the characteristics of a natural base-exchange material, and is a natural earth product suitably treated to enhance its sensitivity and stability. Upon its stand next to the Boiler House the company exhibits a pressure filter as installed for the purification of sedimentary waters for boiler feed supply and manufacturing purposes. This is exactly similar to the filters used for the purification of drinking water supplies at Bradford. Another exhibit is the Paterson "Chloronome," for the continuous sterilisation of drinking water supplies.

Bulpitt & Sons, Ltd.

This company is again showing its range of electric cooking utensils. These are constructed on the immersion heater principle, which, besides giving rapid boiling, permits instant replacement. A wide range of articles is exhibited, extending to coffee percolators, kettles, egg steamers, irons, double saucepans, and steam cookers, and all the items exhibited can also be made in aluminium. A novel form of safety device is arranged to throw off the connector when overheating occurs, and this device gives a rapid break, besides furnishing visible evidence of having operated. A recent improvement is the disposal of the spare safety capsule in a recess in the handle of the kettle. On this stand is also to be seen a range of d.c. and a.c. motors, sold under the trade name of "B.K.B." Messrs. Bulpitt form part of the B.K.B. combination, and make part of the range at their Birmingham works. There is a "B.K.B." motor for driving many classes of machines, their range extending from 0.01 to 7.5 h.p. Exhibited on the stand are models of the a.c. patterns, but in addition to the ordinary 2- and 3-phase induction type, the company exhibits its repulsion induction motor and split-phase induction motor, both for single-phase. Another exhibit is a range of d.c. battery chargers, two sizes of which are intended for home use for re-charging radio and automobile accumulators.

Sturge & Baker, Ltd.

As usual, this Birmingham company shows a full range of its "Red Rose" electric fires and small heating apparatus. These are made in five sizes, and they can all be used for toasting, boiling, frying, &c., as well as for general heating. They can be wound for any of the ordinary voltages, a.c. or d.c., and the heat rays can be directed in any direction by tilting the copper reflector. Another interesting exhibit is the "Vesper" electric fire screen. This is in appearance

an attractively-designed screen for the ordinary coal fire-grate, and can be used as such during the warmer months, when a fire is not required. It contains in the centre, however, an electric fire which can be covered by a shield when not in use. It is made in various styles and sizes, including antique copper and oxydised silver finishes. Messrs. Sturge and Baker also show their spring reels and balls for coiling up slack flex and cable.

Westminster Tool and Electric Co., Ltd.

This company shows standard sizes of electric portable drills ranging in capacity from ¼-in. to 2-in. holes in mild steel, the No. 2a pattern, which is shown, representing a reduction of 22 lb. in weight as compared with ordinary drills of the same capacity, of 11 in. in overall length, and an increase of 3½ in. in length of feed. All the drills are "universal" wound, *i.e.*, they can be used on either direct- or single-phase alternating-current circuits. Two features of the small centre grinder, which are shown, are the special micrometer adjustment of the shaft and the careful balancing of the armature. The portable blowers exhibited are of value in keeping motor windings clean and for similar purposes. Several interesting examples of magnetic and other drilling stands are shown in use. Commutators of various sizes are also on view, as are samples of meter, solenoid, and switch-control coils. In conjunction with the Flexible Shaft Manufacturing Co., the Westminster Company shows long flexible shafts applied to its tools.

Electric Fires, Ltd.

Exhibited on this stand is a range of "Heatrae" electric fires, which are designed as an imitation of the old-fashioned blazing coal fire. Included in the range is the "Columbine," which is suitable for fitting in the standard coal fireplace. Samples of "Heatrae" portable electric fires are also shown, some of which embody the "Heatrae" plug-in type fire bar. These fire bars are backed by reflectors, which project the heat forward and downward as required. Practical demonstrations of the fires are given. Other "Heatrae" apparatus exhibited includes electric water heaters, low-temperature air warmers, low-temperature air tubes, water urns and glue kettles, immersion heaters, towel rails, hot plates, griller-boilers, breakfast cookers, glossing or treeing irons for the boot and shoe trade, and the "Heatrae" housewife cooker, which is designed with a view to convenience and safety for export.

Beatty Bros., Ltd.

This company exhibits its two principal products, the "Beatty" and the "White Cap" electric washers, the former being a new model. It can be worked from either a.c. or d.c. mains, the power being derived from a ½-h.p. motor situated at the base of the machine. The agitator—the revolving wheel in the tub itself—turns 106 times a minute, and this is claimed to be faster than any other make on the market. The driving gears are mounted in a solid iron bed plate, are double cut, with wide faces, and run in oil. A wringer that can be electrically operated is attached; this can be removed when desired. The "White Cap" is built along much the same lines, except that the base and general framework are of wood instead of metal, and that the agitator is situated in the top of the tub and not the bottom.

Davidson & Co., Ltd.

In connection with the model boiler-house plant in the Steam Power Section, this company is showing one of its patent flue dust collectors, which remove from the flue gases not only the particles of grit, but dust so fine that it will pass through a 200-mesh screen. On an adjacent stand the company is showing a working model of this collector, as well as a representative selection of "Sirocco" fans, one of the fans being completely dismantled, affording the visitor an opportunity of inspecting it in detail. A small collector for dealing with industrial dust in a factory is also shown in operation. This collector is not only suitable for catching wood refuse and dust from grinders, but on account of its high collecting efficiency is also extensively employed for retrieving valuable dust produced in manufacturing processes.

Hollings & Guest, Ltd.

This company is exhibiting some of its hydraulic and other machinery, &c. Of interest is the vertical four-column press with steam-heated platen, specially designed for the manufacture of insulating materials. This is fitted with two hot plates, made of cast iron, in which the steam-heating coil is cast solid in the plate, making it practically impossible for a fracture to occur at any steam pressure. The top plate is firmly fixed to the press head, and the bottom plate is attached to the press table. The table is suitably insulated from the bottom hot plate, so as to prevent the hydraulic packing from being damaged. Other exhibits include hydraulic valves and fittings, hand-bundling presses, a light metal-bundling press, and a selection of "Ellmar" moulded pressings.

Birkbys, Ltd.

"Elo" synthetic resin products are shown by this company, comprising mouldings, moulding powders, insulating varnish and resin. "Elo" is suitable for electrical work, scientific instruments, and also for mechanical applications. It does not soften in heat, retains its shape and form under all normal conditions, is unaffected by damp, and can be moulded to very fine limits of accuracy. Metal inserts can be firmly moulded into position during manufacture if required, and within certain broad limits it can be drilled and tapped. It has a specific gravity of 1.33 to 2.0, a dielectric strength of 30,000 to 40,000 volts a.c. for ⅛ in. thickness, and a tensile strength of from 4,000 to 5,000 lb. per square inch.

Santon, Ltd.

The usual range of "Santon" electric geysers and switching plugs is shown. A three-phase geyser dealing with a loading of 12/15 kW is actually demonstrated. Another exhibit is the "Santon" heater belt. This is a flexible aluminium belt with an asbestos-lined cover, 1½ in. wide of varying lengths, which can be slipped around any existing hot-water tank and connected to the bathroom heating plug. It provides a simple means of supplying hot water, and cuts out the necessity for installing expensive storage systems. It is supplied with three loadings, viz , 500, 750, and 1,000 W.

Shropshire, &c., Power Co.

The Shropshire, Worcestershire & Staffordshire Electric Power Co. is represented by an Information Bureau which is designed upon pleasing lines. It is exhibiting a fine relief map for the area served, on which are clearly indicated main transmission and distribution lines. Another feature of interest is a collection of photographic enlargements which display to the manufacturer at a glance the advantages of the company's area in respect of transport by rail, canal, and river, and direct communication with the Bristol Channel.

Damard Lacquer Co., Ltd.

This company, which specialises in bakelite and lacquer products, is exhibiting chiefly "Formite" bakelite synthetic resin for the manufacture of insulating and other varnishes and enamels, and also mixtures for producing such articles as moulded radio components, fancy articles and the like. Other exhibits include insulating varnish, adhesive cement, ornamental "C" material, specimens of finished articles from the above materials, and specimens of metal work coated with various lacquers.

Ebonestos Insulators, Ltd.

The principal exhibit on this stand is a number of bakelite mouldings and "E.I.L." lampholders. Of interest, too, are the h. and l.p. line insulators for power transmission, telegraph and telephone lines. A noticeable feature of the stand is the erection of three sections of telegraph poles above the top of the stand, showing the actual application of "E.I.L." insulators.

W. & C. Pantin.

This exhibit is of interest chiefly to the principals of large manufacturing works and shipping houses. It consists of a vertical swing tray elevator for raising boxes, a gravity roller conveyor for carrying them, and a patent inclined belt lowering apparatus for lowering them. The vertical swing tray elevator is fitted with a patent automatic loading device for raising the boxes automatically from the gravity roller conveyor at the bottom.

Antrobus & Co.

This firm exhibits electric lighting fittings, including 3-light electroliers, pendants, bowls, wood and metal table standards, wall brackets and hall lanterns, amongst which is an entirely new design of pendant in which the band, chain and ceiling plate are made of polished Jacobean oak; a silk shade is fitted.

The "Petosign" Co.

This company is displaying an advertisement projecting machine for shop windows, showrooms, and exhibitions. This machine projects lantern slides, which change every five seconds, on to a ground glass screen embodied in the construction of the machine.

Richard Johnson, Clapham & Morris, Ltd.

In addition to various types of copper wire, this company is showing miners' safety lamps, wire lattice for road reinforcement, woven wire, wirework of various patterns, and two types of reinforcement.

J. B. Stone & Co., Ltd.

This company is exhibiting two of its "nibbling" machines for nibbling steel plate up to 5/16 in. thick. Both are entirely new and improved models, embodying many new features.

Earle, Bourne & Co., Ltd.

This company shows cold rolled brass and copper in strips and sheets, solid drawn and brazed brass and copper tubes, locomotive and condenser tubes, and a wide selection of sections and angles.

A. Morton, Ltd.

A comprehensive range of small capstan, automatic, and turned parts for the electrical and allied trades is shown by this company, which specialises in making parts to customers' requirements.

E. H. Millington & Co., Ltd.

Electrical shop signs for both inside and outside lighting are displayed on this stand.

THE LONDON SECTION.

S. G. Brown, Ltd.

There can be only one gyro compass exhibited at the Fair, because the "Brown" is the sole British representative in this specialised branch of engineering skill. Its sea performance is proved by the fact that the owners of the new *Ile de France*, 40,000 tons, the largest vessel constructed since pre-war days, have given preference to it. The workmanship throughout is of high quality. The electro-megaphone is a loud-speaker telephone for ships, railways, workshops, mines, and other places where noise is a disturbing element. The transmitted voice can be heard 100 ft. from the receiver, and the outfit is of robust and simple construction, no valves being used. To meet the needs of those who desire to purchase a broadcast radio-telephone receiver complete, the firm is showing for the first time the "Ideal" set, which includes everything that is required, together with a 21-in. loud-speaker. The set is suitable for use with an indoor aerial within a radius of six miles from a local station and 15 miles from Daventry. In addition, the new "Sphinx" loud-speaker is being placed on the market for the first time, and the company's usual range of speakers, headphones, crystal amplifiers, gramophone attachments, &c., is too well-known to require further comment.

Vulco Dry Battery Co., Ltd.

Amongst the high-voltage batteries for wireless purposes displayed are a "treble-capacity" type and also grid-bias cells. Batteries for general use are made in three grades, designed for heavy, medium, and light work; they are all made in a London factory.

Beard & Fitch, Ltd.

In this display of radio components special attention is directed to the "Success Super III" receiver, which incorporates an oxydised-silver metal panel and cabinet to match of handsome appearance. It is a 3-valve set with single-filament control and tunable between 40 and 2,500 metres, the S.L.F. condensers having a 100 to 1 ratio slow motion. Specimens of gearing are also on view.

London Radio Manufacturing Co., Ltd.

The company specialises in the design and construction of sound-reproducing instruments, and is demonstrating "Orphean" loud-speakers. Those on view include the standard model for ordinary home entertainment purposes and the De Luxe model with moulded bakelite base: both of these models are horn-type instruments. Gramophone attachments are also on view, and the "Oriel" cabinet speaker for use in the drawing or music room.

Ogilvy & Co.

The company manufactures microscopes, optical projection instruments, and medical and dental illuminating apparatus. For microscopical illumination a special "Opalite" lamp bulb of the half-watt type is available: made of a mixture of glass which presents an exceedingly fine opal surface, the filament is entirely obscured and the rays diffused, so that when the surface of the bulb is sharply focused in the plane of the object no structure or granular matter is observable in the field of view. An axial illuminator is also available.

British Electrical Sales Organisation.

"Beco" hornless loud-speakers are to be seen on this stand in various metal finishes and wood cabinets. One pattern has the unusual form of a rose bowl, and it is declared that filling the bowl with water and flowers does not impair the function of the device as a speaker.

British General Manufacturing Co., Ltd.

Broadcast radio apparatus known as "Britimax" includes 2- and 3-valve receivers built into cabinets of pleasing design, with compartments for storing batteries, and all wires are hidden from view. The sets are transformer-coupled and constructed for a wave-hand of from 250 to 2,000 metres, without the need for changing coils, by the incorporation of an aerial-tuning unit, which consists of a straight-wound 10-tapped inductance with stud-switch fitted in order to select the required wave-length. The reaction coil is mounted in one end of the unit, which is designed to work in conjunction with a .0005μF condenser in parallel; to change from the local station to Daventry all one needs to do is to turn the top knob to the required stud and finally tune on the condenser.

Brilliant Sign Co., Ltd.

Illuminated signs in a great variety of styles are made by this company, electric flashing devices and time switches being a speciality; also recessed faced metal letters now so largely used for changing signs. The "Internalite" day and night sign has a design, lettering, &c., etched on polished plate glass in colour, and the illumination, provided by tubular electric lamps in the framework, is transmitted through the substance of the glass; single side signs are transparent, and do not obscure the background.

Formo Co.

This firm's wireless products are too well known to need any introduction; they are well made, the shrouded l.f. transformer being wound with 12,500 turns of wire on a Stalloy laminated core. The choke-capacity coupler has an iron core wire wound and incorporated with resistance and capacity elements, the whole being very compact. Screened coils, low-loss couplers, and heterodyne oscillators are also on view, and the straight-line frequency condenser shown has a 16 to 1 dial reduction gear enclosed in a bakelite cover which is provided with a window and fine hair line for accurate adjustment; cone bearings are used which wear concentrically, thus tending to preserve alignment.

Portable Utilities Co., Ltd.

The "Eureka" radio products shown on this stand include coils, aerial couplers, h.f. and l.f. transformers, chokes incorporating grid-leak and condenser, and ortho-cyclic condensers, each degree on the dial covering exactly 10 kilocycles, it is claimed. The large l.f. transformer is claimed to be hermetically enclosed in a coppered steel case and proof against atmospheric influence. The h.f. model is formed of two ebonite tubes, the inner one carrying the primary winding, and on the outer ribbed tube is wound the secondary coil with ample air spacing.

Electro-Magnetic Blanket Co., Ltd.

As its name implies, this company is showing electrically-heated blankets and pads for local application. The latter have a heavy copper coil at their centre, while the "Radiocoil" blanket is constructed by winding 12 strands of copper wire round a cord which is sewn in two parallel rows in two sections down the whole length of the blanket.

Artistic Shade Co.

This stand illustrates the progress that has been made during the last few years in interior lighting. The company claims to be one of the originators of the new decorative lighting movement, and is showing about 200 of its latest models. Every shade, and every part of the shade (shape, design, colour, trimming) is said to be designed by an artist, and buyers will find every type from which to choose, from the simplest to the most elaborate. Architects in particular will be interested in a series of hand-painted designs for schemes of decorative lighting carried out by this firm in various parts of the country.

Tungstone Accumulator Co., Ltd.

In addition to a full range of lighting and starting models for motor-cars, lorries, and public-service vehicles, 3 (actual) ampere-hour high-voltage wireless batteries at voltages of from 24 to 96 are exhibited. "Caxton" wireless cabinets also form part of the exhibit.

Mr. Harold Ashton.

On this stand spreaders are to be seen for constructing cage aerials. They are made of galvanised metal, circular in shape, 18 in. diameter, with nine spokes carrying nine china insulator bobbins; two spreaders are fixed on one pole any distance apart, according to the length of aerial required, and the aerial wire is wound on the insulators, between the spreaders, starting on the top spreader and finishing on the bottom spreader, the lead-in wire being taken from the last insulator on the bottom spreader. Any kind of wire may be used and any type of pole, which the spreaders are made to fit, the fixing clips in the centre of the spreader being adjustable. The Ashton aerial is also made in a portable form, similar to an umbrella when closed.

Halcyon Wireless Supply Co., Ltd.

The company specialises entirely in portable receivers, and three-, four-, and five-valve receivers are exhibited in both oak and mahogany cabinets. The five-valve receivers are guaranteed to give loud-speaker reception anywhere in England without external connections. Although a "straight" circuit, the makers are prepared to guarantee loud-speaker reception in London of the London, Daventry, Paris and Berlin stations. In addition, the Company is showing for the first time a new seven-valve portable super-heterodyne set in an exceedingly compact form, and all valves and batteries, as well as an "Amplion" loud-speaker, are enclosed in the cabinet.

R. F. Graham & Co.

The "Norbex" wireless accessories shown include crystal detectors, eight types of valve socket, plugs, &c., made of brass and nickel plated.

J. J. Eastick & Sons.

This exhibit of a large variety of radio accessories includes many patterns of plugs and sockets, connectors, adaptors, &c. Interchangeability is a standard feature, and freedom from error is guarded against by the selection of six distinct colours for the insulating sleeves of the plugs with corresponding indicating rings on the sockets.

The Stability of A.C. Systems.

Synchronous machines can be made sufficiently stable for all usual power supply purposes; the power limit and voltage regulation of transmission circuits depend principally on their series reactance.

By F. H. CLOUGH, C.B.E., M.I.E.E.

(*Abstract of Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE stability of a system may be defined as its ability to respond to the power demands for which it was designed, and it is very closely associated with voltage regulation. When power is transmitted over long distances, stability needs very careful investigation. Although transmission and distribution circuits in this country are usually sufficiently stable, being comparatively short, we are probably nearer to the instability point on large synchronous machines than is generally realised. To show more clearly what is meant, assume that a sub-station or distribution point is fed over a line containing considerable reactance; the power factor of the load at the sub-station is assumed to be 0.8, and the reactance in the feeder 100 per cent., *i.e.*, the reactance is equal to the impedance of the load under full-load conditions. In order to give normal voltage at the sub-station at full load, the voltage at the supply point must be 79 per cent. higher than at the sub-station: if the voltage at the supply point remains constant at 179, and if the load is varied in magnitude, but always with a power factor of 0.8, then the sub-station voltage will vary according to the curve ABC (fig. 1), where the voltage is given in relation to the current flowing. By plotting the product of current and voltage corresponding to it, a power curve DBC is obtained which attains maximum value at normal full-load conditions. The power factor at the sending end would be 0.446, and a machine of 179 kVA would be required to give 100 kVA at the sub-station. On the assumption of normal voltage at the sub-station at full load, the voltage at the sending end will depend on the power factor of the load; for unity power factor 141 volts would be necessary, and for 0.8 leading power factor 89 volts. In all cases, however, the maximum power limit would have the same value, and would occur at full load; fig. 2 gives the curves for unity, and fig. 3 for 0.8 leading p.f. If the load at the sub-station consists of induction motors, such a system would be unstable—for if the motors are called upon to supply additional load, they will respond by taking more current, so that the voltage will rapidly fall off and the motors will come to a standstill. If synchronous motors were installed, the system would be equally unstable if the power factor remained at the original value, but synchronous motors can be made to supply leading current to change the power factor, and the power limit can be raised. Instability does not necessarily occur at the point of maximum power; generally, the natural limit for power stability of a circuit is reached when the external reactance is about 100 per cent.; or, in the case of a transmission line, maximum power will be transmitted when the impedance of the load is approximately equal to the reactance of the line.

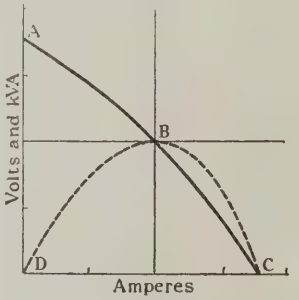


Fig. 1.

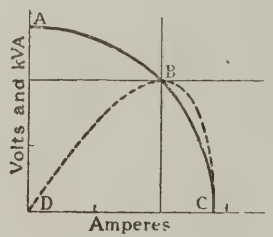


Fig. 2.

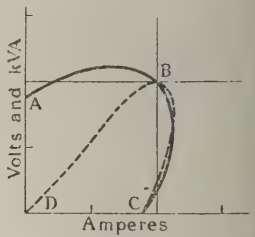


Fig. 3.

When the reactance of a line is high, a large amount of reactive kVA is required to send the current over it: if this is supplied by the generators at the sending end these machines will be unduly large and will operate at low power factor, and the voltage at the sending end will be very high. It is preferable to subdivide the total reactive kVA, placing some at the receiving end in the form of synchronous condensers, as by so doing the power factor of the line can be raised, the voltage at the sending end reduced, and the voltage at the receiving end held approximately constant. The stability of the machines can be used also to raise the stability of the system. In certain cases synchronous condensers are connected to intermediate points along the line; this makes a long line equivalent to several short ones in series. The presence of considerable capacity currents in high-voltage lines helps to improve the power factor and reduce the amount of reactive kVA supplied by the synchronous machines.

In the present state of the art, where large powers have to be transmitted over long distances, it would seem desirable to split up the line into a series of shorter lines, or else to generate and transmit at low frequency and convert to normal frequency by means of motor-generators at the receiving end. With low frequency the reactance could be made low enough to give the necessary stability, and as the voltage could be varied for varying loads the maximum use could be made of the capacity current to give unity power factor and reduce the size of the synchronous machines.

Artificial stability is not necessarily inferior to natural stability—the terms are only used in a distinguishing sense. Cases of instability, where alternators are supplying an induction-motor load, have occurred, and sometimes such cases are rather difficult to understand, because the motors will trip off the circuit due to the voltage falling, and, as soon as they have tripped off, the voltage will again be restored. In an alternator the excitation corresponds to the voltage at the source of supply, and the synchronous reactance to the reactance of a feeder. This "feeder" is highly inductive, but both ends are near together, so that a regulator can be connected to the receiving end (the machine terminals) to control the voltages at the source of supply (the exciter). By this means artificial stability can be obtained. In fig. 4 the curves of an alternator controlled by a regulator are also shown.

If a machine operating at normal voltage is suddenly short-circuited, the current momentarily rises to a value several times normal, and at the same time the exciting current rises to a high value by induction. An explanation would be that there is a hypothetical internal voltage in the machine, which is proportional to the increased excitation, and that the current is equal to this voltage divided by the total synchronous impedance of the machine. This increase in excitation occurs partly in the exciting winding and partly as currents in the heavy damping windings and solid metal parts of the rotor. This phenomenon means that such a machine has two limits of stability, one for gradually applied loads which gives a low value of stability, and the other, a much higher limit, which occurs when the load is suddenly applied, for instance, when the machine is short-circuited. Under actual service conditions the stability will fall somewhere between these two limits.

The turbo-alternator should have two automatic governors, one operated by change of speed to control the power of the turbine, and the other operated by change in voltage to control the excitation of the alternator: the former controls the energy component of the current, and the latter the inductive component; both should operate so that the alternator is able to deliver both load and wattless currents up to any demands within the limit of the capacity of the machine. The mechanical rotating parts of a turbo-alternator set have a considerable amount of momentum, or stored energy, usually amounting to about 6 or 10 kW-seconds per kW of rating of the set. This corresponds to a mechanical time-constant of about 3 to 5 seconds, which means that during any period when the load is changing, mechanical energy may be borrowed from the rotating masses to make up any excess or deficit in the supply of steam energy, and as the time-constant is reasonably long there is considerable time available for the governor to act and the steam supply to be adjusted to the new conditions. In an alternator similar conditions exist, as there is in the rotor a considerable amount of magnetic energy which will supply excitation whilst the voltage regulator is adjusting

the exciter to the new conditions of load. The stored magnetic energy has a value of about 4 or 5 kW-seconds per kW of exciter rating, or time-constant of 2 to 2½ seconds.

During normal operation the armature reaction of the stator tends to suppress the flux, and the exciting current tends to maintain it. If there is a sudden increase in the load, additional currents are induced in the exciting windings and also in the damping windings of the rotor: they flow in opposition to the stator currents and tend to oppose any change of flux during the changing period. The increase in magnetic energy associated with any increase in rotor current is taken from the mechanical energy of the rotating masses.

The rate at which the flux ultimately changes depends on the losses caused by currents flowing in the rotor copper. Due to the large amount of copper in the rotor, these losses are low, and current can be sustained for an appreciable period by the magnetic energy of the rotor. The magnetism of the field acts as a link in the conversion from mechanical to electrical energy, and the stored magnetic energy acts as a reservoir for maintaining excitation during changes of load.

The design of regulator and exciter should be such that the excitation can be corrected to the new value required during the time available: usually most suitable is the vibrating type, which intermittently short-circuits a portion of the field rheostat of the exciter, so that it responds very quickly to changes of voltage. The exciter must also be made to respond quickly to the control of the regulator; this means that the field spools must be made with low time-constants, and that it is preferable to use a separate source of power for exciting the field spools of the exciter, preferably a small auxiliary machine with a highly saturated magnetic circuit incorporated in the same frame with the main exciter.

The use of a separate source of supply for the exciter fields is highly desirable for another reason, as by this means instability of the exciter is avoided. In large machines main field rheostats are undesirable for several reasons, and therefore the exciter must work over a wide range of voltage. If made self-exciting, its voltage is liable to be indefinite, and the exciter to become unstable at low voltages; this difficulty is removed by using a separate source of excitation.

Suitably designed alternators can be made sufficiently stable, so that they can be regarded as fixed points when considering the primary voltage distribution of a system. The capability of transmission lines and feeders of supplying power to, and maintaining voltage at, distant points of a system has also been touched on. The transformer sub-stations fed from the primary system can be considered as fixed voltage points for the voltage distribution of the lower-power, lower-voltage secondary feeders; and similarly for the tertiary and quaternary systems if used. In the primary system the generator reactance limits the maximum fault current, and in the subsidiary system the reactance of the step-down transformers fulfils a similar duty. Any additional reactance in the feeders reduces their value as conveyors of power and should be kept as low as possible.

The maximum fault current in a circuit should have some reasonable relation to the normal current carried. This means that a small feeder should not be connected to a high-power bus-bar, and a main trunk feeder should not be tapped to give a small power supply. The main primary trunk feeders should be used only to convey large blocks of power, and, in order to give maximum reliability and reduce the cost of high-power switchgear, they should be few in number and have a minimum number of tappings. Present practice indicates a limit for the fault current in any part of a large system to that corresponding to about 500,000 kVA. In a large system it may not be possible to get down to this value without using so much reactance that the voltage regulation is too poor, or the system tends to become unstable. In such cases the system should be split into groups which, however, will be connected together by means of the lines containing considerable reactance.

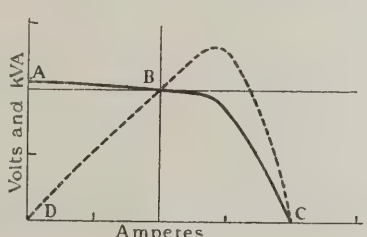


Fig. 4.

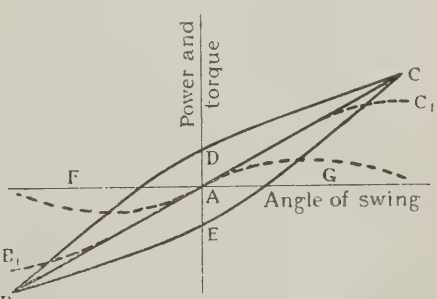


Fig. 5.

A tie line between power stations is usually put in with a definite intention of supplying power in one direction. If the reactive kVA of the line and load is supplied by the generators at the sending end, then their voltage must be raised to deal with the line drop. If, however, synchronous condensers are installed at the receiving end of sufficient capacity to supply the reactive kVA of the load and part of the line, there will be very little line drop. In the latter case voltage control at the receiving end can be effected by adjusting the capacity current of the synchronous condensers, provided that the voltage at the sending end is kept high enough to give stability.

In certain cases it may be necessary to transfer power in either direction over a tie line. If there is sufficient reactive capacity at both ends, then the direction and amount of the energy flow can be controlled by adjusting the governors of the prime movers, and the proper voltage can be controlled by adjusting the excitation of the synchronous machines. In practice there will usually be more synchronous machinery available at one end than at the other, and consequently it may be necessary to use taps on the transformers to get the right adjustment of power flow and voltage. It will probably be a convenience if tap-changing can be done under load.

To illustrate these conditions, assume a 75-mile, 50,000-kVA, 132,000-volt line: at 50 cycles the line reactance would be about 30 per cent. If no synchronous condensers were used the generators at the sending end would have to be rated at approximately 60,000 kVA at 0.67 power factor, and the voltage-drop over the line and transformers would be about 25 per cent. If synchronous condensers were installed, their rating would be about 40,000 kVA, but the generators would be only about 40,000 kVA and could operate at approximately unity power factor. The synchronous-condenser arrangement is more costly than the other, as a total plant capacity of 80,000 kVA in two machines is needed, instead of 60,000 kVA in one: there is, however, a saving in the size of transformers.

The power limit of the line will depend primarily upon the total reactance, which should preferably not exceed about 50 per cent.; but actually rather more stable conditions will exist if synchronous condensers are installed. Voltage control at the supply point by means of synchronous condensers is more conveniently and satisfactorily carried out than by changing the voltage at the sending end, or altering transformer taps, which would be necessary if no synchronous condensers were installed. Synchronous condensers can provide reactive kVA where it is wanted near the load, and consequently lagging currents need not be transmitted over inductive lines, and the voltage regulation of the system is better. When power is supplied over an inductive line there is a considerable phase angle between the voltage vectors at the two ends. Synchronous machines carrying load have also an internal phase displacement between their mechanical and voltage vectors. If machines at both ends of a line are operating as generators, the difference in their mechanical displacement will be approximately equal to the phase difference due to the load on the line. If the machine at the receiving end is a synchronous condenser, the mechanical displacement will be that of the generator and line, whereas if the receiving end machine is running as a motor, the total displacement will be due to the generator, line, and motor. If there is a change in load of either machines or line the displacements will change also; when the load changes suddenly, mechanical and electrical oscillations may occur.

When a synchronous machine is oscillating, the power flow and torque may be assumed to be proportional to the amplitude of swing, as shown by the line BAC in fig. 5. For large angles there will be a tendency for the power to droop, as shown by the line B_1AC_1, but, depending on the frequency of oscillation and the time-constant of the rotor, supplementary exciting currents will be induced which will prevent this droop. A damping winding on the rotor will produce a torque displacement curve BDCEB, and the oscillations will be quickly quenched. If two, or a group, of machines forming two systems are coupled by means of a small tie line, the torque will fall off for larger amplitudes of displacement, on account of the limited power that can flow over the line, and the relationship will be as shown by curve FAG. Such a tie line would be too small to hold the systems in synchronism when a bad load fluctuation occurred, although it might be sufficient to hold them in synchronism during normal steady service. A larger tie line would hold the systems in synchronism, but would allow too much current to pass if a fault occurred. A solution might be to connect portions only of the two systems together. In some cases where it is not economically feasible to build a sufficiently large tie line, the systems may be allowed to break apart (each carrying its own load) at a suitable point where the least disturbance to the power supply will occur.

Discussion in London.

Mr. C. H. MERZ opened the discussion by remarking that the paper was particularly opportune, as the legislature now seemed to have reached a state of stability. He hoped the system which would result from recent legislation would not be so complicated as some people seemed to think it would, although the paper was not very hopeful in that direction. Future development would result in an entirely new picture, and the author had directed attention to matters which would have to be guarded against. Fortunately, in general, the difficulties were got over as the system grew, although others might then be introduced by short-circuit currents, so that

a careful balance between the various factors was needed. Not only had the designed power to be considered, but also that which the system would have to carry momentarily under fault conditions, the latter not being so easy to provide for without running risks in other directions. Separate excitation of the main machines would not fit in with the policy (which was the right one) of subdividing generating units in a station. Regarding the author's reference to the cost of high-power switchgear, in this country it would invariably be necessary to lead the power out of a generating station at two, at least, or more voltages: therefore, the practice of connecting the transformers directly to the generators would lead to undesirable double transformation in series. It was that aspect which had led the Americans to do their switching at the generator voltage, in spite of the difficulties introduced thereby. He hoped that the design of synchronous condensers would be given immediate consideration, not left till such apparatus was called for; abroad the use of such plant had resulted in considerable savings being made. One of the most valuable features of the paper was that it urged engineers to look ahead.

Mr. A. R. Everest agreed that the paper was timely, for the new conditions that would arise in the near future would raise to prominence features which had not been conspicuous in the past, and might involve the adoption of measures that had not been considered necessary hitherto. It had apparently been realised some years ago that the time constant of generators could not be lengthened much beyond the present figure, and so the subject resolved itself into the use of automatic regulators.

Mr. W. E. Highfield thought that, good as the paper was, the author had chosen a somewhat confusing method of presenting his arguments. The problem centred round the employment of very long e.h.p. lines, and, when suggesting methods of compensation, the author must have held his breath a long time before advocating a reduction of frequency. The lower frequencies should be avoided, and although they were adopting the idea in Canada, they did not contemplate frequency-changing. High-voltage lines that supplied cotton mills had given trouble recently, and it was very difficult to explain to the millowner the reasons therefor; he gauged continuity of supply by his old steam reciprocating plant, which very seldom broke down, and electrical engineers must live up to the same standard. It was of interest to note that the lines concerned had been rectified, not by compensation, but by placing them underground in single-core cables.

Major A. M. Taylor pointed out that trouble was not confined to long lines, short ones being also involved if the power carried were large enough. The author looked at the subject from the alternator designer's point of view; his diagrams were not good, they did not show what was taking place from moment to moment, and were not a patch on the circle diagram, to explain which the speaker used several lantern slides. In America they had had considerable experience of the difficulties outlined in the paper, and it was significant that there the use of synchronous condensers was favoured in preference to regulation from the alternator end of the line.

Generating at a lower frequency and raising the frequency at the receiving end of the line in order to reduce the reactance of the line, when it was a long one, met with the speaker's approval; in fact, he had publicly suggested it, but it was not the only way, and it was not realised that raising the voltage was the best way to cure the reactance trouble; he believed very firmly that instead of the old rule of 1,000 volts per mile the voltage of even short transmission lines, if the power were considerable, could with advantage be doubled or even trebled: doubling the voltage reduced the reactance effect four-fold, and also greatly reduced the cost per kW transmitted by an overhead line.

Mr. H. W. Taylor outlined the advantages of separately exciting the main generator's exciter. The characteristic of an alternator controlled by a regulator as shown in fig. 4 was desirable, but only attainable if the exciter responded very quickly: it would do so if its time constant was low, and therefore when separately excited. The small exciter must not be considered as a fractional horse-power machine; it must be designed for much more than it would be called upon to perform, and in the case of the plant with the design of which he was associated the small machine was made in the same shop and under similar conditions as the large one.

Mr. A. Wright endorsed what had been said about the circle diagram, and explained that the American 220,000-volt lines had been perfectly stable up to 250 miles in length, and would carry much more power than the normal in case of emergency. When the length was increased to 400 miles, however, very different conditions obtained.

Mr. F. H. Clough, in reply, explained that he did not advocate two frequency conversions: in the case of water wheels low-speed generators were usual, and a low frequency would therefore be convenient and involve conversion at the receiving end only. With synchronous condensers located along a very long line he could visualise the current distribution being somewhat like a corkscrew: the machines at either end would be mechanically displaced by perhaps half a revolution; it was owing to the phase difference between the voltage vectors at the two ends of an inductive line that he suggested frequency changing. The 400-mile American line mentioned failed because the phase angle was so large, whereas in the case of a 250-mile line the voltage had been chosen so high as to keep the reactance of the line low, and it was therefore stable. Synchronous condensers were preferable from the operating point of view, and their use would not be more expensive than providing all the reactive kVA in the main generators.

South African Railway Electrification.

Some instructive operating data relative to the 175 route miles of converted main line in Natal between Glencoe and Pietermaritzburg.

ONE of the most important developments in railway operation in South Africa took place during June, 1926, at which date the work of converting 175 route miles of the Natal main line from steam to electric traction had reached the stage of permitting the introduction of a full electric service between Glencoe and Pietermaritzburg. In that connection the following extracts from the report of the general manager of the State Railways and Harbours Board for the year ended March 31st, 1926, are of considerable interest. He refers, of course, to the 95 electric locomotives supplied by the Metropolitan-Vickers Electrical Co., Ltd., for operation on the line in question:—

"It is as yet too early to give the actual economic advantages, expressed in money, of electric traction, as compared with steam, or to comment thereon extensively, but it is possible to give actual results in respect of some of the features of the two methods of transportation during the period the scheme has been in process of completion. The electric locomotive has been quick to demonstrate its superiority in two directions, particularly higher speeds on grades and increased availability for traffic purposes. Whereas the electric locomotives are, under normal conditions, available during approximately 90 per cent. of the twenty-four hours, the steam locomotives on the same section were ordinarily available for not more than 50 per cent. of the time. The greater continuous capacity of the electric locomotive has enabled heavier individual trains to be handled at higher speeds than was practicable with the steam locomotive. An analysis of the operating speeds on the electrified section shows, for example, that one of the passenger trains which formerly required 8 hours 17 minutes for the 175-mile run, is now handled in 7 hours 47 minutes, an acceleration in schedule speed of 30 minutes. In the reverse direction an acceleration of 37 minutes has been obtained.

"A typical goods train schedule shows a decrease of 6 hours and 15 minutes under electric traction. The schedule for a steam locomotive to haul the heaviest trains between Glencoe and Pietermaritzburg was 16 hours 30 minutes with the following loads:—

From Glencoe to Ladysmith	1,000 tons.
From Ladysmith to Mooi River	820 tons.
From Mooi River to Pietermaritzburg ...	850 tons.

"Three electric units manipulated by one driver and an assistant now convey 1,500 tons throughout the distance in 10 hours 15 minutes. The load for the journey in the reverse direction (from Pietermaritzburg to Glencoe) with one steam locomotive was 385 tons, the schedule time allowance being 14 hours; with three electric units 800 tons are hauled to a schedule time allowance of 10 hours. These accelerations have had the effect of considerably speeding up the transit of traffic on the Natal main line. The average transit for coal trains between Glencoe and Booth Junction under steam conditions was 34 hours 15 minutes; the journey is now performed in approximately 25 hours 9 minutes. In the reverse direction the transit time for 'empties' to the collieries has been reduced by 9 hours 26 minutes.

"Under steam conditions the factors which contributed principally to the lengthier transit were: low speeds up gradients; remarshalling of trains at Ladysmith, Mooi River, and Pietermaritzburg owing to the varying load restrictions over the different sections, and time occupied at frequent intervals for watering locomotives and attending thereto on the journey. A 1,500-ton train is conveyed the entire route between Glencoe and Pietermaritzburg by electric traction without being disturbed; the average speed up the gradient between Estcourt and Mooi River, where there is a ruling grade of 1 in 65, is 21 miles per hour, compared with eight miles per hour under steam; the electric locomotives require little or no attention en route.

"The electric units are averaging 7,000 miles per month, as against the steam locomotive's 2,700, and some of the units have already done 75,000 miles without heavy overhaul. Steam locomotives had frequently to be withdrawn from service for heavy repairs after having accomplished from 25,000 to 30,000 miles, although there are instances of such locomotives having given better performances. The heaviest tonnage moved south of Ladysmith under steam on any one day was 25,351 tons, and this was not accomplished without a considerable strain on the resources; in fact, the movement of such tonnage under steam conditions could not be maintained daily for any length of time.

"During the financial year ended March 31st, 1926, when a partial electric service was in operation, the average daily tonnage moved south of Ladysmith was 19,343, and the highest tonnage moved south on any one day totalled 27,466. The most recent records disclose that during July, 1926, when a full electric service was in operation, traffic (including passenger traffic) moved south of Ladysmith averaged 25,438 tons daily; the highest tonnage on any one day during the same period aggregated 27,104. The capacity of the line under electrification has up to now been governed by the number of electric locomotives available: from the experience gained to date, there is no reason why, with additional equipment, the existing line should not handle up to 40,000 tons a day, or more.

"Each electric unit has a one-hour rating of 20,000 lb. The largest steam locomotive displaced exerted a tractive effort, at 75 per cent. boiler pressure, of 48,375 lb., as compared with the 60,000 lb. of three electric units; the increased effort of the latter is steady in character, which makes it the more effective. It has been argued that a modern steam locomotive will haul 1,500 tons, whereas three electric units are required to haul an equivalent tonnage: this is correct, but, in the case of the steam locomotive, an important factor to be considered when making comparisons is the grade over which loads are hauled. It is true that a steam locomotive of the articulated type conveyed a load of over 1,500 tons between Pietermaritzburg and Cato Ridge, but this was on a grade of 1 in 100, and over a section where the electric units do not work. Three electric units are hauling 1,500 tons between Estcourt and Mooi River over a grade of 1 in 65; one particular steam locomotive conveyed 1,011 tons over the same section, but the electric units haul 1,500 tons in 68 minutes less time than it took the steam locomotive with 1,011 tons. For a steam engine to haul 1,500 tons up a grade of 1 in 65, it would require to be, approximately, of 75,000 lb. tractive effort, and even then the speed would probably be limited to 10 miles per hour, whereas three electric units convey 1,500 tons with ease at speeds averaging from 20 to 23 miles an hour.

"The steam locomotives used on the section now electrified were the most powerful on these railways. For handling the normal traffic before electrification, 130 steam locomotives were required. The motive power equipment for electric operation, which, incidentally, is being called upon to handle a greater tonnage than steam, includes seventy-eight 3,000-volt direct-current units designed for both passenger and goods work."

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

A Memorial to Faraday.

Will you kindly permit me to invite the interest of your readers in the following:—

The progress of electrical science and industry in the past century is founded largely upon the results of the labours of the illustrious natural philosopher, Michael Faraday, whose experimental researches and discoveries opened wider the power-houses of nature and pointed the way to the utilisation of the forces stored therein, as evidenced by the present universal application of them, particularly electricity, in the service of mankind, and who, in the words of Sir Oliver Lodge, initiated a whole new profession—Electrical Engineering—while Sir Richard Gregory, in a recent presidential address, declared that "every dynamo in the world owes its origin to Faraday." In his lifetime he was described as "our great electrician."

Michael Faraday, to whom the world thus owes so large a debt of gratitude, was born in Southwark, the son of a blacksmith, whose forge stood near the well-known local landmark, the "Elephant and Castle."

To commemorate this great pioneer worker, who in the world of science holds a place almost equivalent to that of Shakespeare in the world of literature, the Southwark Borough Council desires to form a special collection of standard and current literature on electrical and allied sciences in the Central Reference Library of the borough, which is situated close to the spot where the forge stood.

It is suggested that the memorial shall include also a bust of Faraday.

The use of the library is not limited to local residents, but, like the benefits of Faraday's discoveries, is open to all. Moreover, it is centrally and conveniently situated near the junction of all the main thoroughfares of populous South London converging upon the principal London bridges; and it is well used—there was an issue of over 100,000 volumes last year.

It is purposed to create a Faraday Memorial Library Fund, the income from which would be expended in the acquisition of the best new books year by year, and so keep the memorial collection always abreast of developments in, and practical applications of, the sciences for which Faraday did so much.

The Council would welcome the co-operation of electricians and scientists generally, many of whom, it is believed, would be glad to know of this opportunity to assist, if only in a small measure, in establishing in Faraday's native borough a memorial that will be worthy, permanent, and increasingly useful in character.

The year 1927 has been described as the "Dawn of Britain's Electrical Age," and the time would thus seem appropriate to pay tribute to the memory of the man who made the "Electrical Age" possible.

The project has the interest and generous support of, among others, the Royal Society, the Royal Institution, Messrs. Benn Brothers, the British Electrical and Allied Manufacturers' Association, the Eastern Telegraph Co., the Western Union Telegraph Co., the British Thomson-Houston Co., the General Electric Co., Provincial Tramways Co., Ltd., Messrs. J. Dewrance & Co., Ltd., the County of London Electric Supply Co., the City of London Electric Light Co., the Edison Swan Electric Co., Messrs. W. H. Willcox & Co., and a number of private individuals.

I shall be happy to acknowledge any contributions which may be sent to the Town Hall, Walworth Road, S.E.17.

H. Hewitts,
Mayor.

Southwark, *February 15th*, 1927.

The Earthing of Portable Domestic Appliances.

I wish to support the views of Mr. R. H. Rawll, as expressed in his article on the earthing of portable domestic appliances. In my house I have provided all-electric equipment, including water heating, although one coal fire is in fairly constant use in the kitchen. All the plugs are three-pin, and each earth-pin socket is connected to earth *via* the lead covering of the wires and the water pipe. All the appliances, with the exception of table lamps and the vacuum cleaner (this was supplied with a long piece of 2-core flex which I have not yet changed to 3-core), are earthed. With the exception of two Berry fires and a wash boiler, no provision was made on any of the apparatus for earthing. The earthing of stationary apparatus presents no difficulty, but portable apparatus, such as saucepans with plug and socket connections, and perhaps three heat control by a combination of three pins and three sockets, present difficulties when earthing is desired. Manufacturers only supply these with earthing connections if specially ordered. I have never tried specially ordering, as I should probably have to wait about eight weeks and pay extra. My method is to attach an earth connection myself, and here another difficulty arises. The insulation of the slip-on sockets is so weak mechanically that it is difficult to work, and if it be broken I invariably find that the replacement (worth 4d. at the most), must be specially ordered. I don't know whether the B.E.S.A. specification calls for earthing these appliances, but as there is nothing to prevent their use near a water tap the I.E.E. wiring rules do call for earthing.

Some supply authorities are deserving of blame in connection with this matter. There are one or two with very stringent regulations of their own who have showrooms containing all kinds of gadgets without any provision for earthing. They also put their service cables and meters over concrete floors, and do not earth them or box them so that there is no risk of anyone touching them.

There have been many fatal shocks from hand lamps—hence the regulations. Must history repeat itself, or shall we be wise in time?

A.M.I.E.E.

[The fatalities in connection with hand lamps have not occurred in private houses.—Eds. Elec. Rev.]

The article by Mr. R. H. Rawll under the above heading in your issue of February 11th raises several points of considerable interest and importance.

Personally, I am inclined to agree with Mr. Rawll in principle, but the solution is not as simple as he would have us believe.

Assuming that one agrees that all appliances should be earthed because they may be used in rooms where earthing is regarded as essential, it necessarily follows that manufacturers must discontinue their present practice of supplying small domestic appliances, such as kettles, irons, &c., taking, say, 500 watts or less, with adaptors and twin flex.

To guard against the danger which Mr. Rawll suggests, they should be fitted always with 3-core flex and a 3-pin plug.

Admittedly the cost of a 3-pin earthing plug and socket is not very serious, but although it acts as a safeguard against accidental contact with "live" apparatus it does not entirely meet cases such as occur in sculleries, bathrooms, &c., where the switch also is a potential source of danger. Here either the switch should be entirely insulated or the dolly earthed. The ideal arrangement is a 15-ampere combined interlocking 3-pin earthing switch-plug. I have for a long time been trying to find such an article which, while being capable of breaking 3 kW at 230 volts, is sold at a reasonable price and is not such an ugly and clumsy-looking piece of apparatus as to be vetoed for use in a lady's drawing-room.

All switches on heating circuits must be capable of breaking the circuit of a 3-kW fire "full on," as people are not always careful to operate the switches on the fire first.

The potential market for such an article is so great that the manufacturers would be well advised to get busy on the problem—by no means an easy one.

Incidentally, if it is to be generally accepted that all portable apparatus must be earthed, since their use may not be restricted to rooms where they may be deemed safe, even 5-ampere plugs should be 3-pin and all flex connected to such appliances 3-core.

By the way, does Mr. Rawll propose to wire all plug points, when C.T.S. is used, with 3-core cable?

So much for this side of the picture. The other side is this: Are we not making too much fuss about the whole business?

How many fatal accidents from unearthed apparatus have been recorded in, say, the last ten years?

Which is likely to have the greater deterrent effect on the more general use of electrical apparatus, an ever-increasing cost of installation, or the remote risk of a fatality, or of some such unpleasant experience as an individual who shaves in the bathroom and gets more than he has asked for from his sponge?

I express no opinion, but invite your readers to give theirs.

The Midland Electric Power Installation Co.
H. Joseph, *Proprietor.*

Wolverhampton, *February 15th*, 1927.

[The opinion which we hold, and have repeatedly expressed, is that endeavours to secure 100 per cent. safety are misguided, and doomed to failure. An installation may be wired and equipped in faultless style, complying with the most stringent "rules," but how long will it remain perfect? When flexibles are renewed, as they must be, what likelihood is there that three-core flexibles will be used? What assurance is there that the earthing connections, leads, or bonds will never be severed—without the slightest indication of the fact? Above all, what need is there for absolute safety, when no such burden is imposed upon gas, oil lamps, candles, matches, coal and coke fires, windows, staircases, and other potential sources of danger in private houses? Statistics should govern the question; there have been probably more deaths through noxious gases entering houses from short-circuits on electric mains in the street than from electric shocks received inside private houses in this country. Only in such places as bathrooms are special precautions essential.

The imposition of irksome and superfluous restrictions and regulations on the public is a characteristic national fetish.—Eds. Elec. Rev.]

Electricity Supply Tariffs.

In his comments upon my recent articles, Mr. Lunn quotes the Darlington tariffs against those of Basle, and concludes that my figures are not representative. Let me assure Mr. Lunn that a glance at the published data of the electrical undertakings in the U.K. will be sufficient to convince him that the figures which are not representative are those of Darlington. And this is true even when they are compared with the tariffs of much larger stations. In this comparison I need not take advantage of the high figures of 1926 which were affected by the recent coal strike. I will confine myself to 1925. Then, as against £3 and 0.25d. for power in Darlington, I find that the price in Liverpool was £6 and 0.4d. Or, on comparing towns more like Darlington and Basle in size—for we must pay attention to the size and character of the undertaking—let me ask Mr. Lunn if he can point to any town of 70,000 inhabitants in which the prices are as low as his?

Again, as regards cooking and heating, the Darlington figure is almost unique. A comparison of all the undertakings of reasonable size in the U.K. shows that the average price per kelvin for this purpose is about 1.5d., as against 0.75d. in Darlington.

How Mr. Lunn has achieved the figure of 0.56d. as the cost per unit sold on a load factor of 26.36 per cent. I cannot explain, but he asks a very pertinent question in connection therewith. "Why," he asks, "should electricity not be supplied in most towns in this country at prices lower than those in Switzerland?" Ah! Why, indeed! That, also, I cannot explain!

But, relatively to my main contention, these are side issues. It has been stated before the I.E.E. that the second 25 per cent. of load factor can be delivered at a quarter the price of the first. If, therefore, Mr. Lunn could increase his l.f. from 26.36 per cent. to the Basle figure of 74 per cent., he could reduce his prices much further and establish a record. Now the domestic load is usually considered to be the worst for this purpose, and yet it is by encouraging this very load in the proper manner that 74 per cent. has been achieved. And the chief instruments have been tariffs B (8) and (9), the deferred payment agreement A (2), and simple but reliable time switches. Mr. Lunn's seasonal system is undoubtedly a step in the right direction, but it will only improve the seasonal load factor. It is the diurnal load factor that needs attention.

There is much force in Mr. Legge's contention as to cooking during peak hours. But it is also true that in many small Swiss households the chief meal is taken at mid-day, and much can be done by the intelligent use of long-hour electric apparatus embodying the "hay-box" principle.

Mr. Thwaites points out that in certain English towns the prices for large amounts of power are lower than in Basle. So they ought to be. But is it quite fair to compare great industrial centres of half-a-million inhabitants with Basle and its population of 145,000?

The University, Birmingham. **William Cramp.**
February 20th, 1927.

A Knotty Problem.

Referring to "A Knotty Problem" in the "Correspondence" columns of your issue of the 18th inst., it is difficult to advise on this matter without adding to the perplexities of "Perplexed."

The principal claims of the screwed-conduit system to superiority over other systems are complete protection of the conductors from mechanical injury, and immunity from fire. These claims can, however, only be substantiated if the system is complete with ironclad switches and fuseboards, and totally enclosed lighting units. These conditions are costly, the whole installation is somewhat inflexible, and does not lend itself well to extensions and alterations, and, in my opinion, is not suitable or necessary for the premises and requirements under consideration.

Grip conduit will give the required degree of protection, and is easier to install; the ordinary standard type of fittings can be employed, and it is consequently cheaper than the screwed job.

Other systems of wiring mentioned, *viz.*, metal-sheathed, C.T.S., and Maconite, are approved by the Institution of Electrical Engineers, and may be adopted with confidence, provided that the I.E.E. "Regulations for the Electrical Equipment of Buildings" are observed.

The majority of installation contractors specialise each in one particular system of wiring, and carry a stock of the particular material required; therefore it is only natural to assume that they will specify, and boost, that system.

A more important point than the choice of system is the question of workmanship, and my advice to "Perplexed" is to put the matter in the hands of a reliable and reputable contractor, and to cease from troubling himself.

Epsom, *February 19th*, 1927. **H. H. Atkinson.**

Kiosk-Type Sub-stations.

Is it not high time that manufacturers of kiosk-type sub-stations realised that it is even more important in an outdoor kiosk than in an indoor cubicle to protect live conductors against accidental contact?

It is common practice in cubicle work to provide separate doors for the isolating switch and oil switch compartments, yet in the kiosk described in your issue of February 11th (page 231), which purports to represent the latest practice, a single door is provided, and the writer claims that "the design has been considerably simplified" by providing only one interlocked door.

This interlocking, however, does not prevent the switch attendant from coming into accidental contact with the live isolating switch blades when he is inspecting the oil-switch contacts, &c., the risk of which is far greater when one is slipping about on wet grass in inclement weather and with imperfect lighting.

An interior door to the isolating-switch compartment, even if it were only expanded metal, would guard against this danger.

P. M. W.

Waltham Cross, *February 18th*, 1927.

The Salaries of Engineers.

There exist, to my knowledge, two organisations whose functions are partly to safeguard the status of the technically-trained electrical engineer. I refer to the Chartered Institution of Electrical Engineers, and to the National Union of Scientific Workers. The former exists only in the interests of electrical engineers; the latter exists, professedly, in the interests of all technically trained men, including electrical engineers. These bodies are unlike, in that the former is well known, whilst the latter is but little known, in spite of its 8½ years of existence. They are alike, however, in their

persistent neglect to tackle the most urgent problem of the electrical engineer—that of starvation salaries. Since they refuse to perform this portion of their functions, it becomes necessary for the private individual to do what he can to forward the interests of the technical man. Hence this letter.

I see that a world-famous firm with London offices advertised a post in your last issue. The *essential* requirements (my italics) are: "(1) A thorough knowledge of the French language. (2) A sound general education and technical training. (3) Practical training and experience in the manufacture, erection, and running of heavy electrical plant; (4) Commercial experience in the preparation of tenders and correspondence. (5) Outside commercial experience."

The munificent salary offered for this highly trained man is £350 per annum. The probability is that some poor blighter, in desperate straits, will sell his services for this salary. Comment is unnecessary, but I cry shame on any employer who so disgraces himself, and on the bodies who profess to safeguard our interests, and fail to make the slightest attempt to do so.

February 18th, 1927. **Another Poor Blighter.**

Extra-High-Pressure Transmission.

The letter by Mr. W. Fennell in your issue of February 11th raises the important question: Which is the more reliable, an overhead line or an underground supply? He then proceeds to take up the case for the overhead, at the same time giving the impression that the author of the article in question takes the opposite view.

Mr. Fennell shows the important distinction between the frequency of failure and the length of stoppage, and reasonably associates the former with overhead lines, and the latter with cables. His humorous reference to sending a window-cleaning gang out on an overhead line may be more to the point than is intended, for, much as the wise and bold policy of replacing insulators in a bad position has to recommend it, this policy will, in many cases, only postpone the date at which the porcelain cleaning gang will be necessary.

To have to clean insulators is not unusual even in power stations. Outside, the rain will not always do this duty, especially under the sheds of the insulators. Fortunately, cleaning is not often required, but where pin insulators are used in bad situations for voltages of 33,000 V and above, it is certainly most desirable yet difficult to carry it out.

A further difficulty not altogether solved is the quick location of a faulty insulator; and where overhead lines are very long and take short cuts over difficult country, patrol is not easy, and repairs may take a considerable time to effect.

There are certain inherent weaknesses in overhead lines which cannot be overlooked, especially where large bulk supplies are concerned, and where real continuity is essential. For such continuity a duplicate supply is necessary, and not merely an alternative supply as suggested.

Overhead lines have to work under adverse conditions such as are outlined in an article in your issue of December 3rd last. It is hoped that by pointing out and promoting discussion on the weaknesses of overhead lines, the necessity for really sound and reliable cables for super-pressures will be made more generally evident, for both overhead lines and cables for these pressures are necessary, and the development of the former has not kept pace with the latter.

With regard to Mr. Fennell's reference to G.P.O. trunk lines, he has apparently been unwittingly assisting in providing revenue for the financing of extensive underground developments for some years, and the responsible authorities would no doubt inform him of their activities if requested.

London, *February 15th*, 1927. **A. T. Scott.**

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

18,950. "Method and arrangement for directional transmission and reception by means of electric waves." W. Hannemann. August 4th, 1924. (237,906.)

19,368. "High-speed vertical-shaft electric motors." Soie de Chatillon Soc. Anon. Italiana and M. Biroli. July 30th, 1925. (264,617.)

19,473. "Panel mountings for electrical apparatus." A. H. Grebe. December 5th, 1924. (244,046.)

21,189. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). August 24th, 1925. (264,680.)

23,723. "Means for regulating the terminal voltage of a generator." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). September 23rd, 1925. (264,891.)

26,132. "Inductance coils for use in radio apparatus." Igranic Electric Co., Ltd., P. W. Willans, and L. E. Curran. October 19th, 1925. (Cognate application 2,186/26.) (264,897.)

26,326. "Mounting electric inductance coils." C. F. Halsall. October 21st, 1925. (264,901.)

26,336. "Telephone systems." Standard Telephones and Cables, Ltd., and A. H. Cameron. October 21st, 1925. (264,902.)

26,395. "High-frequency alternator." F. Newton. October 21st, 1925. (264,903.)

26,477. "Telephone systems." Standard Telephones and Cables, Ltd., A. J. Chanter, G. C. Hartley, and W. R. Moscrip. October 22nd, 1925. (264,905.)

26,487. "Electric transmitters for use in automatic telegraphy." Creed and Co., Ltd., F. G. Creed, and R. D. Salmon. October 22nd, 1925. (264,906.)

26,488. "Telegraphic transmitting and tape-perforating apparatus." Creed and Co., Ltd., F. G. Creed, and R. D. Salmon. October 22nd, 1925. (264,907.)

26,592. "Wireless direction-finding apparatus." G. Du Bourg de Bozas. April 3rd, 1925. (Addition to 235,898.) (250,170.)

26,595. "Thermionic valve amplifying arrangements." M. Graham, A. Graham (legal representative of E. A. Graham, deceased), and L. H. Paddle. October 23rd, 1925. (264,910.)

26,671. "Apparatus for filtering and rectifying electric currents." Dubilier Condenser Co. (1925), Ltd. October 24th, 1924. (241,946.)

26,777. "Control of dynamo-electric machines." British Thomson-Houston Co., Ltd., and H. W. C. Liddiard. October 26th, 1925. (264,912.)

26,779. "Electric lamp holder and connections therefor." British Thomson-Houston Co., Ltd., and H. C. Wheat. October 26th, 1925. (264,913.)

27,005. "Electric furnaces." Siemens-Schuckertwerke Ges. December 15th, 1924. (244,426.)

27,027. "Electrical connections." R. S. Macrae. October 28th, 1925. (264,924.)

27,031. "Detachable adjusting handles or levers for variable electric condensers and other apparatus." J. J. Rowe. October 28th, 1925. (264,925.)

27,047. "Telegraphy and telephony of the kind employing high-frequency oscillations." A. C. L. Turpain and Soc. des Etablissements Gaumont. October 28th, 1925. (Addition to 241,237.) (264,926.)

27,077. "Telephone systems." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). October 28th, 1925. (264,927.)

27,078. "Signal-transmission systems, and more particularly picture-transmission systems." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). October 28th, 1925. (264,928.)

27,197. "Prepayment arrangements for automatic telephone systems." Siemens Bros. & Co., Ltd., and A. E. Caswell. October 29th, 1925. (264,932.)

27,286. "Wireless transmitters." J. K. Im Thurn, G. Shearing, and C. Matthews. October 30th, 1925. (264,935.)

27,415. "Protective devices particularly for use in telephone systems." Standard Telephones and Cables, Ltd., B. B. Grace, and H. J. Gowring. October 31st, 1925. (264,941.)

27,986. "Electrical time-lag devices." British Thomson-Houston Co., Ltd. (General Electric Co.). November 6th, 1925. (264,949.)

28,316. "Devices for interrupting an electric current." W. J. Tennant (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). November 10th, 1925. (264,954.)

28,675. "Mechanical rectifiers for alternating current." Siemens-Schuckertwerke Ges. December 12th, 1924. (244,438.)

28,967. "Electric motor convertor sub-stations." T. W. Ross, C. Ryder, and Metropolitan-Vickers Electrical Co., Ltd. November 17th, 1925. (264,961.)

29,826. "Electric storage batteries or accumulators." Edison Swan Electric Co., Ltd., and G. E. Webster. November 25th, 1925. (264,970.)

30,495. "Process and apparatus for therapeutic treatment." T. R. N. Gerdes. December 2nd, 1925. (264,976.)

30,880. "Insulated supports for electric cables and the like." Siemens-Schuckertwerke Ges. December 10th, 1924. (244,457.)

30,963. "Automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and C. C. Puckette. December 8th, 1925. (264,979.)

31,739. "Electric switches." Brookhirst Switchgear, Ltd., and J. A. Hirst. December 16th, 1925. (264,986.)

1926.

168. "Electric stoves." J. E. Raworth (McClary Manufacturing Co., Inc.). January 4th, 1926. (264,991.)

449. "Multiple-filament electric incandescent lamps, vacuum tubes, and the like." C. Cristesco. January 6th, 1926. (Convention date not granted.) (245,777.)

1,425. "Electric storage batteries or electric accumulators." Fuller's United Electric Works, Ltd., and S. C. Whaite. January 18th, 1926. (265,000.)

3,555. "Automatic electric switching systems." British Thomson-Houston Co., Ltd. February 6th, 1925. (247,222.)

3,958. "Installations for repeating indications of movement at a distance." Evershed & Vignoles, Ltd., and C. Midworth. February 11th, 1926. (265,012.)

5,237. "Wireless receiving apparatus." C. H. C. Cansdale. February 24th, 1926. (265,017.)

5,941. "Tuned amplifying circuits for wireless receiving apparatus and the like." Lovejoy Development Corporation. June 4th, 1925. (253,072.)

8,749. "Automatic quick-acting circuit-breaking device." P. J. Branchu. April 8th, 1925. (250,570.)

9,355. "Electric illuminated advertising device." H. K. T. Lindquist and C. V. Madsen. April 9th, 1926. (265,038.)

9,442. "Uniformly-loaded signalling conductors for the transmission of currents of acoustic frequencies." Felten & Guilleaume Carlswerke Akt. Ges. June 8th, 1925. (253,078.)

9,615. "Electric traction system for agricultural implements." F. Remy. April 12th, 1926. (265,040.)

10,070. "Systems for converting electric currents." British Thomson-Houston Co., Ltd. April 18th, 1925. (250,966.)

12,140. "High-frequency electric signalling systems." British Thomson-Houston Co., Ltd. May 11th, 1925. (252,027.)

12,286. "Method and apparatus for removing hydrogen from the surface of metal objects to be coated by electrolysis." L. J. J. Van der Hoorn. May 12th, 1926. (265,047.)

12,821. "Variable electric condensers." International General Electric Co., Inc. May 22nd, 1925. (252,376.)

16,081. "Sound recording or reproducing devices." Standard Telephones and Cables, Ltd. May 29th, 1925. (Divided application on 23,665/25.) (254,333.)

16,083. "Horns for acoustical instruments." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). September 22nd, 1925. (Divided application on 23,664/25.) (265,060.)

17,556. "Hollow electric cables." Siemens-Schuckertwerke Ges. April 29th, 1926. (Addition to 254,308.) (265,066.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 16th:—

Tropex. No. 476,330. Class 4. Raw or partly-prepared vegetable, animal and mineral substances used in manufactures.—Chloride Electrical Storage Co., Ltd.

Mecvent. No. 476,789. Class 6. Electrical fans and blowers.—P. M. Millns, trading as the Millns Electrical Co., 17, Whitefriars Street, E.C.4.

E.S. (lettering and design). No. 474,990. Class 8. Electrical measuring instruments, switchboards, cables, current limiters, accumulators, radio-telephonic receiving apparatus, and parts therefor.—Edison Swan Electric Co., Ltd.

Nora. No. 476,192. Class 8. Apparatus for radio-telephony.—Aronwerke Elektricitats Gesellschaft, Charlottenburg. (British representative: Henry Fairbrother, 30-32, Ludgate Hill, E.C.4.)

Hegra (lettering and design). No. 476,581. Class 8. Apparatus for use in radio-telegraphy and telephony.—B. Becker, trading as George Becker, 203-205, Edgware Road, W.2.

Allhall. No. 476,591. Class 8. Loud speakers.—L. Kremner, 49a, Shudehill, Manchester.

Junoscale. No. 476,903. Class 8. Electrical measuring instruments.—Johnson & Phillips, Ltd.

Asbestulon. No. 476,275. Class 50. Insulating substances (electrical).—Thomas de la Rue & Co., Ltd.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AIREDALE (Yorks).—Kinema, for A. Whitaker, The Square.

ALTRINCHAM.—Extensions, County Girls' School; Cheshire Education Committee.

AYRSHIRE.—Central fire station at Kilmarnock; burgh surveyor, Kilmarnock. Alterations to Alloway Public Hall (heating installation by radiators); Sir Robert Lorimer, architect.

BAWTRY.—Housing scheme (80), for Doncaster R.D.C.; Walker & Thompson, architects, Carbon Chambers, 7, Hall Gate, Doncaster.

BECKENHAM.—Roman Catholic church; J. B. L. Tolhurst, architect.

BEDFORDSHIRE.—Ouse improvement scheme (legislation necessary) (£2,750,000); Board of Agriculture.

BIRKENHEAD.—Kinema, Borough Road; H. A. Thomas, Liverpool.

BOSTON.—Additional 70 houses, for the R.D.C.; surveyor.

BOURNEMOUTH.—Additions, Donegal Works, Hamkinson Road; H. C. Skerratt, Ltd. Pavilion, Woodland Avenue, for Corporation; J. Scott.

BURFORD (Oxon).—Cotswold Gateway Hotel (with electrical work and heating), for H. G. Powell, Kidlington; J. R. Wilkins, architect, Oxford.

BURTON-ON-TRENT.—Additional 300 houses, for the T.C.; borough surveyor.

CANTERBURY.—Re-erection of premises, High Street, for H. J. Goulden, Ltd. (several thousand pounds).

CARDIFF.—Conversion of Green Dragon premises for tram dept. offices; city architect.

CHATHAM.—Hospital extensions (£39,000), for Medway B.G.; C. W. W. Thompson, architect, Rochester; F. E. Wallis, builder, Maidstone.

CONGLETON.—Housing scheme (108), for the T.C.; borough surveyor.

CROYDON.—Super kinema, Main Road; Pavilions, Ltd., 505, Oxford Street, London, W. Hotel. Aerodrome (£50,000), for Barclay, Perkins & Co., Ltd.; E. P. Pullan, secretary.

DONCASTER.—Reinstatement, after fire (several thousands pounds damage) of clothing store and casual ward at Doncaster Workhouse; clerk, Board of Guardians.

DUMFRIES.—Extensions, with electrical work (£2,450), for the Dumfries-shire Unionist Association, Loreburn Street; secretary.

EARLESTOWN (Lancs.).—Additional 152 houses, for the U.D.C.; surveyor.

EDINBURGH.—Working men's hostel; city architect.

FIFESHIRE.—Golf cleek factory at Anstruther; c/o burgh surveyor.

GLASGOW.—Public hall in East End; city engineer. 306 houses and 10 shops at Ruchill, for Corporation; city architect. Extensions, including Central Hall (£35,000) for School of Art; John Keppie & Henderson, architects. Improvements, Queen's Theatre, Watson Street; B. Fruitin.

GUILDFORD.—Flats (60), Aldershot Road, for the T.C.; J. W. Hipwood, borough engineer, Tuns Gate.

HALESOWEN.—Electric light installation, Congregational Hall; H. Jones, secretary, 53, Stourbridge Road. Super-kinema (£12,000), for S. Bray; T. Stanley Beach, architect; Messrs. Tate, builders, Cradley.

HEADINGTON.—Housing scheme (436); W. Page Webb, architect, 23, High Street, New Headington, Oxford.

HEREFORD.—Tile factory, Barr's Court; city surveyor.

HEYWOOD.—Housing scheme (100), for T.C.; G. A. Russell and Sons, builders.

HUDDERSFIELD.—Extensions to Greenhead High School and Almondbury Grammar School, for the Borough E.C.; borough architect. Hospital block at Crosland Moor Institution; clerk to Board of Guardians.

KIRKINTILLOCH.—School clinic (£6,000); clerk, Education Authority, Dumbarton.

LITTLEWORTH (Stafford).—St. John's Church; Sir Charles A. Nicholson, architect, London.

LONDON (Becontree, E.).—Hall, Dagenham Avenue; Salvation Army.

LONDON—*continued.*

(East Ham, E.).—Alterations, Coliseum Cinema, Green Street; Scriven & Huxtable.

(Ilford, E.).—Re-erection of portion of factory, Farnham Road, Seven Kings, for the Metropolitan Wire Spring Mattress Co. Extensions, Highways Depôt; borough engineer.

(St. John's Wood, N.W.).—Flats, Circus Road and Grove End Road; Central London Building Co.

(Downham, S.E.).—Additional schools (£41,790), for the London E.C.; Holland & Hannen & Cubitts, Ltd., builders.

(Kennington, S.E.).—Enlargement Beaufoy Institute (£12,000); L.C.C. architect.

(Battersea, S.W.).—Enlargement, Lavender Hill Pavilion; Pavilions, Ltd.

(Clapham, S.W.).—Five blocks of flats, Albion Road; C. Miskin & Son.

(Hammersmith, S.W.).—Central school near Western Avenue; L.C.C. architect.

(Marble Arch, W.).—Enlargement, Marble Arch Pavilion; F. T. Verney, architect, Pavilions, Ltd.

(W.).—Shops, flats, restaurant, &c., adjoining Baker Street Underground Station; Metropolitan Railway Co.

MAIDENHEAD.—Kinema and dance hall, Bridge Street; Maidenhead Picture Theatre, Ltd.

MAIDSTONE (Leeds).—Alterations, with lighting and heating (£100,000), Leeds Castle, for Mr. Wilson-Filmer.

MEXBOROUGH.—Dance hall, shops, and billiard hall, next Palace Kinema; Mexborough Electric Theatre, Ltd.

MIDDLESBROUGH.—Dock and river improvement scheme, for the Tees Commissioners. School clinic, Woodlands Road (£5,500); director of education.

MORLEY.—48 houses, Bradford Road; borough engineer.

NEWPORT (Isle of Wight).—Corn exchange, &c., for the T.C. (£5,000); borough surveyor.

NORTHAMPTON.—Factory extension, Overstone Road; Mounts Factory Co.

PORTSMOUTH.—Workshops for the blind, Portsdown Hill; borough engineer.

RICHMOND (Surrey).—Houses (35), for the T.C.; Streek and Co., Ltd., builders, Tranquil Vale, Blackheath, S.E.

RIPON.—Housing scheme (38); city engineer.

SALE (Cheshire).—Re-erection of factory, for I. & E. Nelson, hosiery manufacturers (several thousand pounds).

SEDGLEY.—Electricity generating station, Redhall Road; Lower Gornal Picture Palace Co.

SOLIHULL.—Extensions, Grammar School; governors.

STIRLINGSHIRE.—New classrooms, laboratory, and gymnasium at Balfron School; clerk, Stirlingshire Education Authority, Stirling. Advanced subjects school at Stirling (£48,000). Additions to five primary schools (£72,545); clerk, Education Authority, Stirling.

STOCKTON-ON-TEES.—Cinema, Norton Avenue, Norton, for Norton Cinema Co., Brandon. Re-housing scheme, Mount Pleasant (£56,000); borough engineer.

STRETFORD.—Alterations, workshops, Empress Street; Empress Coppersmiths & Engineers, Ltd.

SWANSEA (Landore).—Roman Catholic church, Dinas Street; Rev. Father Harrington.

TAIN.—Hall for Parish Church (electric lighting and heating); A. Maitland & Sons, architects.

WALTON-ON-THAMES.—70 houses for U.D.C.; G. B. Carvill.

WARWICK.—Office accommodation, Militia Barracks; Warwickshire C.C.

WEAVERHAM.—School extensions (£4,300), for Cheshire E.C.; F. A. Brown, county architect, Newgate Street, Chester.

WESTON-SUPER-MARE. — Business premises, Meadow Street, for E. J. Steel, draper (several thousand pounds).

WEYMOUTH.—84 houses, Down Close, for Corporation; James Drewitt & Son, Bournemouth.

WHITCHURCH (Salop).—Housing scheme (60), for the U.D.C.; surveyor.

YEOVIL.—Housing scheme (296), for the T.C.; Eadie Towers and Co., Wolverhampton.

The

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For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

Contents:

	PAGE
The Electrical Industry	329
The Last Month of the Campaign	330
Dr. S. Z. de Ferranti, F.R.S.	330
Ultra-Violet Rays	330
Agricultural Electrical Machinery, by R. Borlase Matthews (*illus.*)	331
What is it to Drive?, by Robert Marsden	333
Sag Calculations for Power Transmission Lines, by William T. Taylor (*continued*)	334
The Centenary of Volta, by T. B. Fowler	336
The Factor's Catalogue, by A. J. Smith	337
The Accumulator Makers' Association	339
Legal	339
Parliamentary News	340
The National Association of Supervising Electricians	340
Reviews	341
Business and Industrial Notes	343
Lighting and Power Notes	346
Tramway and Railway Notes	348
Telegraph and Telephone Notes	348
Radio Notes	349
Contract Information	350
Forthcoming Events	351
Notes	352
Institution Notes	354
Our Personal Column	354
Financial Section—	
New Companies Registered	355
Official Returns of Electrical Companies	355
City Notes	356
Stocks and Shares	357
The British Industries Fair—III. (*illus.*)	359
Assisted Wiring Schemes	365
The Canadian Market	366
Electrical Wholesalers' Federation	368
Correspondence—	
Electric Power on the Farm	368
Power Supply for Wireless Sets	369
Electricity Supply Tariffs	369
Kiosk-Type Sub-stations	369
The Earthing of Portable Domestic Appliances	369
The Salaries of Engineers	369
River Water—or Cooling Towers?	370
Extra-High-Pressure Cable Discharges	370
A Handicap to Electrical Progress	370
A Metering Problem	370
"Do it with Electricity"	370
Published Specifications	371
Trade-Mark Applications	371
New Work for Contractors	372

The Electrical Industry.

AS was briefly mentioned in our last issue, a "Monograph on the Electrical Industry" has been prepared by the B.E.A.M.A. for the information of Committee "B" of the World Economic Conference Preparatory Committee. In a foreword Mr. D. N. Dunlop intimates that a study of international developments in the electrical industry, both technical and economic, would possess great importance—if it could be carried out with accuracy—at the present time "when the whole industry is in a state of flux, preparatory to embarking on a period of rapid expansion." In this Monograph, therefore, the B.E.A.M.A. has prepared a partial survey assembling all available relevant data, and it has carried out an international census bearing on the production of electrical goods, the world market, actual and potential, for such products, and the distribution of production costs and prices.

The estimates differ materially, at times, from those made in the German Monograph submitted to the same Committee by the Zentralverband der Deutschen Elektrotechnischen Industrie, and it is felt, therefore, that the British survey and the German document should be read in conjunction. It is pointed out that in the expression of general principles there is fairly close agreement between the two surveys, but there is natural confusion in comparing foreign trade statistics where the official interpretations of classifications of trade returns vary.

The document reviews the developments that have taken place in organisation and technique of the electrical industry in different countries. Beyond certain lamp production arrangements, international agreement on a large scale does not exist in the electrical industry; though the leading American and German firms have come into contact again for

exchange of research data and manufacturing experience, "no international control either over production or price has yet been attempted." This statement reached us just as reports were appearing in the newspaper Press to the effect that a big combine of German and American electrical concerns was under discussion. The various sections of the B.E.A.M.A. Monograph contain much statistical and other information respecting the world production of electrical goods, the development of electrical export trade, and the consumption of electrical goods in different countries in 1925 per head of population. There is a section on the world market for electrical goods, in which the production of electricity in various countries is tabulated and comments are made upon the place and measure of development of electrical power in industry and transport. The statistics foretell a prospect of great expansion of the electrical industry due to the uses of electrical power in these directions; notes on the distribution of production costs, and on the significance of prices, form the closing sections.

The valuable information here brought together hardly lends itself to brief review. The whole document requires to be read with care by all who are deeply concerned with questions of vital interest to the industry if they aspire to be up to date in their knowledge of affairs, tendencies, and prospects.

The Last Month of the Campaign.

As we have just entered the month of March, we take the liberty of reminding our readers that the E.D.A.-E.L.M.A. Better Home Lighting Campaign is nearing its end so far as the actual competition is concerned. The Perforated Ballot Sheet has to be removed from the booklet 1002 and posted to the E.D.A. offices, 15, Savoy Street, Strand, London, W.C.2, on or before March 31st. It is not yet time to attempt a review of the great work that has been and is being accomplished, though the temptation is strong upon us to say congratulatory things regarding those who have really seriously co-operated. We prefer to direct everybody's attention to the much that remains to be done and to the great opportunity that presents itself of making this last month the best of all. Weekly progress reports to which we have given publicity tell a story of the many thousands who have been interested in the electrification of the home during the past five months through the various electric houses that have been co-operatively prepared for their inspection. Though the story is necessarily incomplete, anybody can see that a wonderful propaganda work for the industry has been done, and that its good effect will never end. Yet we are wondering how the map on page 10 of the E.D.A. publication 1000 will look when we have been enabled to fill it in with colour varying from brilliant red to the palest nondescript hue indicating the campaign temperature of the different areas. There is time in the next three or four weeks to change the story that will be told by such a map if it be published.

Dr. S. Z. de Ferranti, F.R.S.

It was with great pleasure that we learnt that the President and Council of the Royal Society at their recent meeting decided to recommend for election into the Society Dr. S. Z. de Ferranti. Of all the distinctions that the world of science has to offer, there is none more coveted, more jealously guarded, or more difficult to acquire, than the Fellowship of the Royal Society of Great Britain, which excels all academic degrees in dignity and status, and is in itself a guarantee that, in the proud formula of the Legion of Honour, the man who bears it has deserved well of his country. It is awarded not on the strength of any written or oral examination, but on the sterner and more searching test of public opinion as moulded by assured knowledge of achievement of the highest order—sometimes a single epoch-making discovery, sometimes the fruit of the work of a lifetime.

It is under the latter category that Dr. Ferranti may perhaps be classified. Like Edison, whose eightieth birthday we recorded a few weeks ago, he entered the electricity supply industry at a time when it was a conception rather than a reality; in those days the great pioneers invented new devices as the need arose, and thought nothing of the feat—but whereas Edison adopted the direct-current system, Ferranti followed the a.c. path, taught the world to transmit electricity at high pressure from outside a city to transformers connected in parallel, and thus laid the foundations of the great business of a.c. generation, transmission, and distribution which is transforming the conditions of human existence throughout the world. Ferranti, with dauntless courage and inexhaustible resource, designed his own generators of unprecedented dimensions, his own cables for unheard-of pressures, his own transformers and switchgear—and inspired in his colleagues and pupils a personal devotion which to-day bears witness to the charm of manner and the sterling worth of a great leader.

Had the nation followed Ferranti it would have led the world in electrical engineering. The least we can do is to recognise that he indicated clearly the right way to go, and that the Electricity Act of 1926 is a belated attempt to regain that path and carry out the policy that he initiated. We are sure, therefore, that all electrical engineers will join us in congratulating him on his Fellowship, and in the hope that the example set by Science will be followed by the State.

Ultra-Violet Rays.

We notice that, in accordance with professional advice, the London County Council's Control Committee has refused to sanction the use of ultra-violet rays at a massage establishment without medical supervision, on the ground that the treatment has potential dangers. The medical profession possesses one of the strongest of all trade unions, the only stronger one, perhaps, being the law, and we feel no surprise at the action which has been taken in this matter. Where the danger is real and inherent, as in the case of X-rays, we entirely agree with the view that the amateur should be warned off the ground, for his own sake and that of his family, but ultra-violet radiation is on a different footing.

The fact is that medical men for some time past have been preaching the merits of ultra-violet rays, whether natural or artificial; if the former cannot be obtained, the latter afford the only alternative, and a brisk demand is springing up for the means of producing them, which is in course of being met by numerous manufacturers. That the medical profession should seek to retain control of this valuable curative agency is perfectly natural; but it is not likely to be successful in that aim. Just as, for instance, aspirin has passed from professional hands into general use, so will ultra-violet radiation become a household commonplace. It is not without significance that it is to be found in the Ideal Home Exhibition which was opened on Tuesday.

However, it is only in houses equipped for electric lighting that this will be possible, and as not more than one home in five is so equipped, the field is limited. The successful practice of electrical treatment will arouse the interest of the residents in gas-lighted houses, who must perforce go to their medical attendants if they wish to obtain such treatment for themselves—and thus the movement, which is gathering way, will benefit the medical profession in the long run, besides benefiting the user.

Agricultural Electrical Machinery.

A comparative review of the exhibits at the 1927 Paris Agricultural Exhibition with those of previous years, and machines employed in other countries, depicting some items of special interest to engineers at home.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

NEARLY 1,000 electric motors were either shown or utilised for driving the machines on view at the above exhibition. This is indicative of the rapidly growing appreciation of the electric-motor drive in connection with agricultural work on the Continent. Of course, the oil engine has not yet been entirely displaced, as there are still regions where public electricity supply is not available, and quite a number of such engines were exhibited; but naturally they were not employed to demonstrate the driving of machinery when a more up-to-date method was available. Incidentally, it may be remarked that there is a distinct trend in the design of small petrol and paraffin oil engines towards a very neat and clean external appearance. Amongst the neater type of engine was one of British make—the Lister. Where such engines were employed for driving dynamos, direct coupling was adopted almost without exception.



Fig. 1.—Law ½-h.p. Portable Motor.

A feature of the exhibition was a special display of portable electric agricultural motors shown driving various forms of farm machines. This special exhibit was arranged by the Union des Syndicats de l'Electricité. Some detailed notes concerning this exhibit will be given a little later on.

This was the sixth French exhibition devoted entirely to agricultural machinery without the inclusion of any livestock whatsoever. In England the general feature of agricultural shows is the livestock, while the machinery exhibits seem to be a sort of "Cinderella," only admitted by the authorities because they can ill afford to dispense with the income that is provided by the rents of the spaces occupied. At the Paris exhibition there were 623 exhibitors, a 25-per cent. increase over the figure of last year. The stands taken occupied 50,000 square yards. There were no German exhibitors, but it is proposed to admit them next year. British manufacturers were well represented, and included Ruston & Hornsby; Ransomes, Sims and Jefferies; Clayton; Austin & Fordson Tractors; Bamfords, Ltd.; Harrison McGregor; Listers; Tudor Batteries, and others.

A very noteworthy feature of the exhibition was the strict classification of all the exhibits. This is very valuable from the purchaser's point of view, as it enables him to make direct comparisons; also from the maker's aspect, as it ensures that his exhibit will not be overlooked, as might be the case where exhibits are arranged by the makers instead of being classified with



Fig. 2.—Law Motor Driving Grindstone.

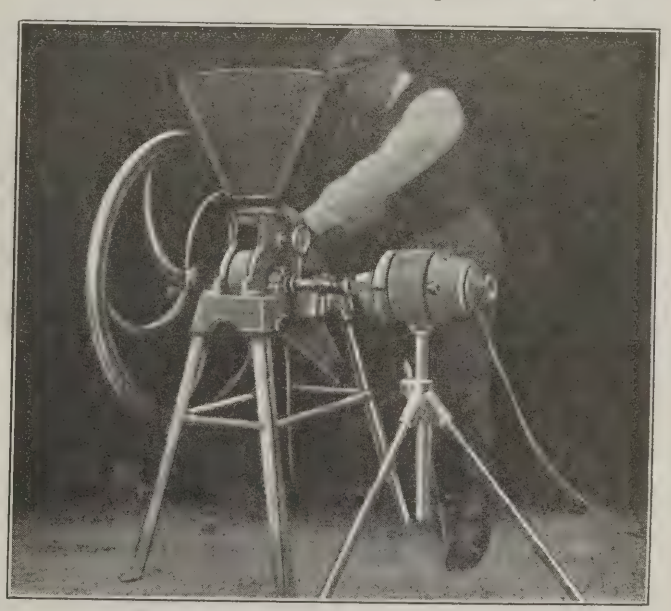


Fig. 3.—Law Motor Coupled to Oats Crusher.

the whole of the entries. The arrangement is the outcome of the experience of the general manager, Mr. Villard, who has made a point of visiting all the important British and Continental agricultural shows for the past 25 years.

Apart from the agricultural electric motor exhibit, the most interesting feature of the show was the huge combined reaping and threshing machines shown in operation by several American manufacturers; they were driven by electric motors, though in many

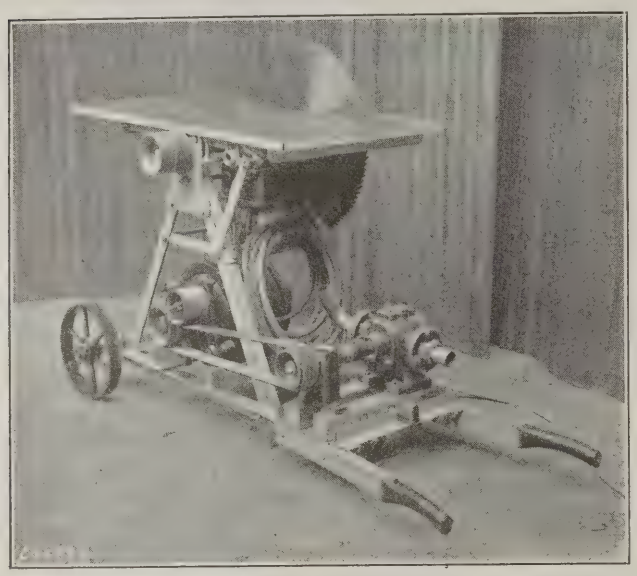


Fig. 4.— A "Fleno" Motor Outfit for driving a Saw and a Pump.

cases they would undoubtedly be operated by oil engines. These big machines are intended more particularly for use in the North of Africa and in parts of America where the grain is ripe and dry when cut, and also where straw is of little value and is discarded with the chaff on the field, to be ploughed in later on. The width of cut of such a machine is up to 15 ft., and it has a capacity of 25-30 acres per day while threshing out 125-150 quintals (440-530 bushels) of wheat. These machines are constructed entirely of metal, including the threshing portion.

tion. In addition to the public display at the exhibition, tests were carried out to demonstrate the portability of each complete motor-driven unit. The next stage will be the technical trials of the Paris Laboratoire Centrale d'Electricité, where the usual efficiency, temperature-rise, insulation, and other records will be made. Upon completion of this part of the work, the motors will be taken to an agricultural college, and on the farm they will be again tested under working conditions. The main points to which the judges will give consideration are: (1) The speed with which the equipment can be put into operation; (2) the brake h.p. available on the shaft of the driven machine; (3) safety in use for the farm labourers and the machines to be driven; (4) facility for transport; (5) facility for the substitution of the motor; (6) robustness; and (7) price. The motors are specified to be of the single- or 3-phase type in three sizes, which French experience has indicated as being most suitable for farm purposes, viz., 1.5, 3, and 5 h.p. The output is measured at the motor shaft as the basis of a one-hour rating. The competition is limited to French manufacturers, and the motors have to conform to the French National Standardisation Regulations. They are required to be delivered complete, ready for use, together with a standard length of flexible cable. The standard speed specified was 1,500 r.p.m. when running on no load, but speeds of 3,000 and 750 r.p.m. were permitted as alternatives. It was further specified that through reduction gears, speeds of 1,500, 300, 150, and 50 r.p.m. (with a tolerance of 10 per cent. less) were to be available on the shafts of the machines to be driven. The direction of rotation of the latter machines was specified to be clockwise.

The judges selected were representative of the Government departments concerned, the electrical industry, the rural electrification authorities, the agricultural machine builders, and agricultural bodies. The above particulars have been given in detail, as this is probably the first case of national competitive tests for agricultural electric motors.

Twelve manufacturers sent in about eighteen entries, the most novel of which was a motor of the Electromoteur Co., which had a similar appearance to a lathe headstock without back gearing, the armature being, of

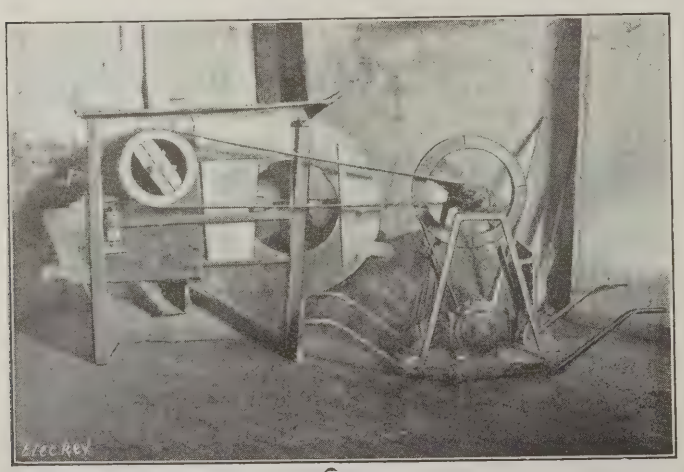


Fig. 5.—"Touchard" Gearing driving a Winnowing Machine.

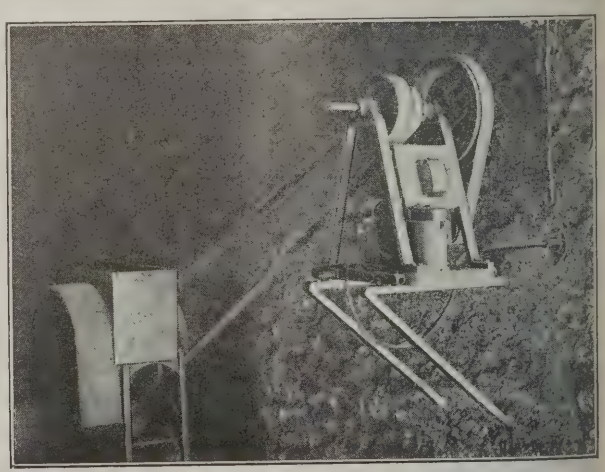


Fig. 6.—"Touchard" Gearing bracketed for Root-cutter Drive.

A novelty was a Fordson tractor, mounted on wheeled stilts. The object of this is to allow for the cultivation of high crops set out in line, such as sugar-cane, cotton and grape vines; the clearance under the body of the machine is nearly 4ft.

Turning now to the agricultural electric-motor display, it may be mentioned that this section will be repeated next year on a very much larger scale. Owing to limited time, only 12 manufacturers sent in entries. The object of the tests that are to be carried out is rather of a standardising nature than competitive, as no awards are to be made; it is to reassure the farmer that he can safely purchase any electric agricultural motor that has passed the tests of the Associa-

course, stationary, while the field, which was formed like five stepped pulleys, rotated.

The Société d'Electro-Motoculture de Carcassonne has always advocated the use of a single motor for all purposes on the farm. The motor it supplies is cylindrical in shape, without feet, but it is fitted with two convenient handles, and on to the frame of every machine that is to be driven, a special semi-circular bed is fitted to take the motor. In addition to the ingenious friction drive which this firm showed last year (Electrical Review, April 9th, 1926, p. 569), it has now introduced a special intermediary speed-reduction gear for use after the preliminary friction-drive speed reduction. This consists of two gear wheels,

the smaller of which is connected directly to a V-groove pulley; the machine itself is then driven off this pulley by means of a leather link belt. The writer has made some independent tests of this friction drive and found that the slip is excessive on large ratios of speed reduction; evidently the makers have come to the same conclusion—hence their adoption of this intermediate speed-reduction gear.

The "Law" portable ½-h.p. motor, which is mounted on a tubular tripod stand, fig. 1, is arranged for direct connection to barn machinery. A double reduction gear is incorporated within the motor frame. The motor starter and speed controller is incorporated in the end frame of the machine, and consists of a simple circular handle, which has merely to be turned to put the motor in operation, to change the speed and to reverse it. The tripod stand is of fixed rigid construction, but it is provided with a central vertical adjustable tubular support for the motor, so that the latter can be aligned to the machine to be driven. During last year 1,680 of these special agricultural-type motors were sold. Figs. 2, 3, and 4 show some applications for agricultural motors, and figs. 5 and 6 show the "Touchard" portable reduction gearing, which can be used with any standard motor.

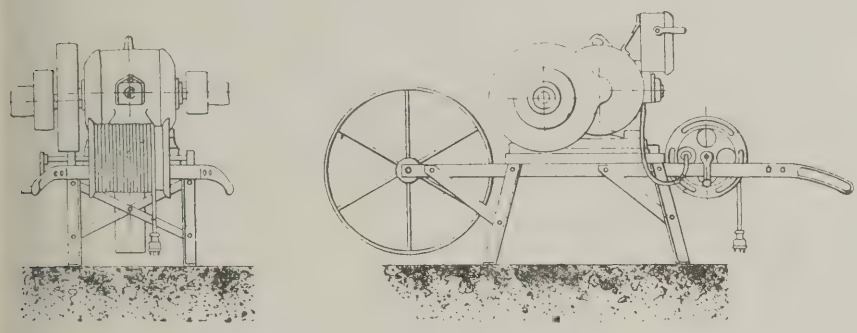


Fig. 7.—The "Patay" Reduction-geared Motor.

The "Patay" portable farm motor, fig. 7, was shown provided with a toothed reduction gear. The single-barrow wheel is so arranged as to be well clear of the ground when the motor is in use. The general design of the chassis of this set is typical of those of many French makes. Belt drive, with jockey pulleys, is the usual speed-reduction device.

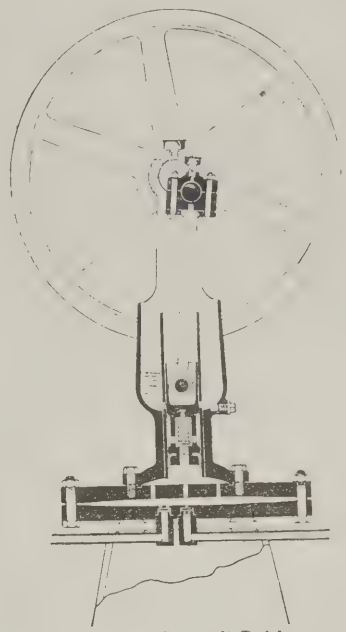


Fig. 8.—The "Corblin" Refrigerator.

Among the refrigerating machines was the "Corblin" diaphragm type, fig. 8. Several minor improvements have been made since last year. It is obvious that the use of a diaphragm entirely overcomes leakage of the substance (in this case ammonia), which is employed as a refrigerant. The "Corblin" machine is now made in domestic sizes.

(To be continued.)

What is it to Drive?

Some guiding suggestions for the user when choosing the motor and method of drive to be employed.

By ROBERT MARSDEN, M.M.A.E.

IT is useless to attempt to supply a motor unless you are in possession of the following information:—

1. The type and make of machine to be driven.
2. The load at starting.
3. The drive required.
4. Speed variation—if any.

If such information is not in your possession, it is always advisable to visit the prospective buyer, unless it is a question of long distance or export.

Knowing what machine is to be driven will undoubtedly smooth away most of the difficulties, but do not spoil the job by cutting the horse-power. You cannot expect the best life out of a motor which is compelled to run continually at its full output. Naturally, machine makers—out to sell their products—cut the horse-power to a minimum, leaving no safety margin. The best plan is to take the published horse-power and add about 20 per cent. to be sure of meeting all requirements. By doing this you will also allow for the "stiffness" inseparable from a new machine.

In the case of a direct-current supply, it can generally be assumed that a compound interpole motor will meet the essential requirements, as this type of motor will give a very high starting torque, and reasonable speed variation without commutation troubles, and deal with sudden changes of load in an excellent manner. Even if the starting is easy and no speed variation is required, should there be any danger of an erratic load, put in a compound interpole motor and be on the safe side.

In alternating-current work, however, a supply company has much more to say in your choice of a motor on account of starting conditions; therefore, if any doubt exists, see the company's representatives before making a decision. If no speed variation is wanted, you will do well to consider the new designs of high-torque squirrel-cage motors now on the market which, with approximately three times full-load current, will develop 200 per cent. of their running torque when starting. There is a wide field of possibilities open to this class of motor. These motors are now used for driving nearly every class of machinery which, prior

to their advent, had to have the slip-ring type. Another point in their favour is their cost, which is little more, if any, than that of the ordinary squirrel-cage type. All over the country to-day they are in use driving textile machinery, conveyors, cranes, hoists, pumps, &c., and they offer the finest driving facilities procurable.

Speed variation on an a.c. supply, with the exception of the a.c. commutator motor, is not so efficient as on a d.c. supply, but many very satisfactory equipments are in use, giving 50 per cent. variable reduction in motor speed by using resistance in the rotor of a slip-ring motor. It should be remembered that this 50 per cent. reduction corresponds to a 100 per cent. speed variation on the driven machine.

In cases where the saving of floor space has to be considered, if you cannot directly couple your motor, perhaps one of the best drives is by the jockey-pulley. By this means, an efficient drive can be obtained with even four-foot centres. There is this advantage with a belt: if it should break, it can be immediately replaced or repaired. An alternative method is by gear-driving, but unless it is very carefully designed and fitted, your motor pinion will require continual replacement. Under all circumstances, the motor base must be mechanically fastened to the frame of the machine being driven, otherwise "creeping" will take place with disastrous results. There are times, however, when, owing to structural details, it is not possible to introduce a gear. The chain drive is then clearly indicated.

Another important point for consideration is the neighbourhood and atmosphere in which the motor has to work. In chemical works, for instance, it is by far the best to have a totally enclosed machine, despite the extra cost involved, if there is any likelihood of dangerous gases attacking the insulation. When the motor has to work in the open, it is essential to specify "weatherproof," not merely "totally enclosed." Where inflammable or dangerous gases are liable to accumulate, *never take a risk*, it is much too vital a point to disregard—demand a flame-proof and explosion-proof motor.

In conclusion, it is well to remember that there exists no driving proposition which cannot be successfully accomplished electrically, provided the right motor is installed.

Sag Calculations for Power Transmission Lines.

A consideration of the requirements for Overhead Conductors under varying working conditions due to changes in temperature, wind pressure, ice covering, &c.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

(*Continued from page* 292.)

The values from which different charts may be plotted are given in the accompanying tables. That is to say, with reference to Table V only, we may:

(1) Plot curves for each size of conductor and for the more generally used stringing temperatures, in terms of span length and sag. In this way the values of sag for *any* span length are found.

(2) Plot curves for one size of conductor and for

TABLE II.—Sag in Plane of Resultant, corresponding to the Loading on Bare Hard-Drawn Copper (Solid) Conductors under the Electricity Commissioners' Rules.

Formula: $D = \frac{l^2 W}{8 P}$.

Length of span in feet = l.	*Total maximum allowable tension in conductor in lb. = P.															
	456	508	561·5	633	662	757·5	810·5	875	971·5	1,071	1,437·5	2,064·5	2,655	3,215·5	3,750	4,272·5
	*Total resultant weight per foot of conductor in lb. = W.															
	·882	·892	·902	·917	·923	·940	·951	·962	·981	·998	1·064	1·178	1·288	1·397	1·504	1·610
	†Weight per foot of bare conductor, in lb. = w.															
	·056	·0627	·0699	·0795	·0834	·0959	·104	·113	·126	·140	·193	·289	·386	·482	·578	·675
	†Sectional area of conductor in sq. inch = A.															
	·01453	·01629	·01815	·02061	·02164	·025	·02688	·02926	·03269	·03631	·05	·075	·10	·125	·15	·175
100	2·418	2·195	2·008	1·812	1·743	1·551	1·466	1·374	1·262	1·115	·925	·713	·606	·543	·501	·477
150	5·4 9	4·938	4·518	4 074	3·921	3·490	3·300	3·090	2·840	2·508	2·08.	1·6 5	1 364	1 222	1·128	1·073
200	9·6 0	8·7 99	8·032	7 243	6·971	6·204	5 866	5·497	5·049	4·459	3·701	2 853	2·425	2·172	2·005	1·907
250	15·0 9	13 737	12·550	11·317	10·892	9·694	9·166	8 587	7·889	6·967	5·78·	4·458	3·7 8·	3·394	3·133	2·980
300	21·756	19·7 52	18 072	16·296	15·684	13·960	13·200	12 360	11 360	10·032	8·328	6 420	5·456	4·8·8	4·512	4·292
350	29·613	26·887	24·598	22·182	21·349	19·005	17·968	16·822	15 462	13·656	11 334	8·737	7·4 8	6·652	6·141	5·841
400	38·6 80	35·196	32·128	28 972	27·884	24·816	23 464	21 988	20·196	17 8·6	14·804	11·412	9·700	8·688	8·020	7·628
450	48·9 51	44 442	40·662	36·666	35·289	31·410	29·700	27·810	25·560	22·572	18·738	14·445	12·276	10·998	10·152	9·657
500	60·435	54·872	50·200	45·270	43·570	38·779	36·667	34·332	31·555	27·870	23·130	17·831	15·160	13·577	12·553	11·922
550	73 1·6	66·395	60·742	54·777	52·720	46·923	44·367	41·542	38 181	33·723	27·987	21·575	8·341	16·428	15·165	14·426
600	87·024	79·008	72·288	65·184	62·736	55·840	52·800	49·440	45·440	40·128	33·3·2	25·680	21 824	19 552	18·048	17·168
650	102·133	93·745	84 838	76·501	73·628	65·534	61·966	58·027	53·329	47·095	39 095	30·138	25·613	22·946	21·181	20·148
700	110·452	107·548	98·392	88·728	85·396	76·020	71·872	67·288	61·848	54·624	45 336	34·948	29·712	26·608	24·564	23·364
750	135·981	123·643	112·950	101·853	98 028	87·246	82·494	77·383	71·01	62·703	52·047	40·122	34·101	30·516	28·197	26·820
800	155 920	140·784	128 512	115·888	111·536	99·264	93·856	87·952	80 784	71·344	59·216	45·648	38·800	34·752	32·080	30·512
850	174·161	158·829	145 078	130 825	125 912	112·062	105 958	99·371	91·197	80·5·9	66·851	51·534	43·801	39·234	36·217	34·448
900	195·804	177·68	162·648	146·664	141·156	125·640	118·800	111·240	102·240	90·288	74·952	57·780	49· 04	43 992	40 608	38·628
950	218·173	198 333	181·222	163·417	157·280	139·982	132·358	24·091	113·917	100 603	83 507	64·374	54·713	49 010	45·241	42·932
1,000	241·749	219·488	200·800	181·082	174·282	155·115	146·667	137·43	126·222	111·480	92·521	71·324	60·640	54·307	50·133	47·688

*That the factor of safety shall be based on the breaking load, and shall be calculated on the assumption that the line conductors are at a temperature of 22° F., and have a covering of ice to a radial thickness of half an inch, and that they are simultaneously subjected to a wind of 50 miles per hour at right angles to the line, this wind to be taken as exerting a pressure equivalent to 8 lb. per sq. ft calculated on the whole of the projected area of the ice-covered lines.

†British Standard Specification values.

TABLE III.—ACTUAL LENGTH OF CONDUCTOR AT DATUM TEMPERATURE WITH MAXIMUM LOADING.

Formula : $L = l + 8D^2/3l$.

A/l.	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1,000
·01453	100·156	150·525	201·25	252·44	304·21	356·57	409·98	464·20	519·47	575·92	633·67	692·80	753·50	815·72	879·70	945·68	1013·64	1063·65	1155·85
·01629	100·128	150·381	200·90	251·77	303·05	354·84	407·23	460·29	514·12	568·76	624·37	681·04	738·69	797·18	857·76	919·30	982·32	1046·76	1128·37
·01815	100·108	150·363	200·86	251·68	302·91	354·61	406·88	459·90	513·44	567·89	623·24	679·53	736·89	795·38	855·04	916·12	978·43	1042·24	1107·52
·02061	100·087	150·295	200·70	251·37	302·36	353·36	405·59	457·97	510·93	564·54	618·89	674·03	729·98	786·86	844·76	903·72	963·78	1024·97	1087·44
·02164	100·081	150·274	200·65	251·27	302·19	353·48	405·19	457·40	510·14	563·51	617·53	672·28	727·84	784·22	841·58	899·84	959·18	1019·59	1081·18
·025	100·064	150·217	200·51	251·00	301·73	352·75	404·11	456·85	508·03	560·69	613·88	667·64	722·06	777·11	832·92	889·48	946·86	1005·08	1064·22
·02688	100·057	150·193	200·46	250·88	301·55	352·45	403·66	455·22	507·15	559·52	612·37	665·71	719·62	774·14	829·29	885·13	941·73	999·08	1057·22
·02926	100·056	150·170	200·40	250·79	301·36	352·16	403·23	454·59	506·30	558·38	610·88	663·84	717·29	771·27	825·80	880·94	936·76	993·21	1050·42
·03269	100·043	150·143	200·34	250·66	301·15	351·82	402·72	453·87	505·56	557·41	609·62	661·88	714·58	767·93	821·76	876·12	931·00	986·46	1042·50
·03631	100·034	150·115	200·27	250·53	300·92	351·46	402·18	453·10	504·26	555·68	607·37	659·937	711·68	764·37	817·34	870·93	924·45	979·22	1039·08
·05	100·023	150·077	200·18	250·36	300·62	350·98	401·46	452·08	502·87	553·80	604·93	656·27	707·85	759·63	811·69	864·03	916·64	969·59	1022·82
·075	100·013	150·046	200·11	250·21	300·37	350·68	400·87	451·24	501·69	552·26	602·93	653·73	704·65	755·72	806·94	858·33	909·89	961·62	1013·54
·10	100·010	150·033	200·98	250·15	300·27	350·42	400·63	450·89	501·23	551·63	602·12	652·70	703·37	754·14	805·03	856·03	907·16	958·44	1009·83
·125	100·008	150·027	200·06	250·12	300·21	350·34	400·50	450·72	500·98	551·31	601·70	652·16	702·70	753·32	804·03	854·53	905·74	956·75	1007·87
·150	100·007	150·023	200·05	250·11	300·18	350·29	400·43	450·61	500·84	551·12	601·45	651·84	702·30	752·93	803·43	854·12	904·88	955·75	1006·70
·175	100·006	150·020	200·05	250·09	300·16	350·26	400·39	450·55	500·76	551·01	601·31	651·66	702·08	752·56	803·10	853·72	904·42	955·19	1006·06

TABLE IV.—LENGTH OF UNSTRESSED CONDUCTOR AT DATUM TEMPERATURE (*zero stress*).

Formula : $L_0 = \dfrac{L}{1 + P/AE}$ (where E = 18,000,000).

A/l.	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1,000
·01453	99·981	150·267	200·90	252·00	303·68	355·95	409·21	463·41	518·57	574·91	632·57	697·59	752·19	814·38	878·15	944·04	1011·88	1081·76	1153·84
·01629	99·956	150·122	200·55	251·34	302·53	354·33	406·53	459·51	513·24	567·75	623·30	679·87	737·42	795·81	856·28	917·72	980·63	1044·96	1126·33
·01815	99·937	150·105	200·50	251·25	302·39	354·00	406·18	459·11	512·56	566·92	622·30	678·87	735·33	794·02	853·58	914·55	976·75	1040·46	1105·63
·02061	99·916	150·038	200·35	250·94	301·84	352·65	404·90	457·09	510·06	563·57	617·83	672·88	728·73	785·51	843·32	902·18	962·13	1023·22	1085·58
·02164	99·911	150·019	200·30	250·84	301·68	352·88	404·50	456·62	509·27	562·55	616·48	671·14	726·60	782·89	840·13	898·31	957·45	1017·86	1079·34
·025	99·896	149·965	200·17	250·58	301·22	352·16	403·43	455·68	507·17	559·75	612·85	666·52	720·85	775·80	831·52	887·99	944·27	1003·40	1062·43
·02688	99·890	149·942	200·12	250·46	301·05	351·86	402·99	454·47	506·30	558·58	611·35	664·60	718·42	772·85	827·91	883·65	941·15	997·41	1055·45
·02926	99·883	149·920	200·06	250·37	300·86	351·57	402·56	453·83	505·50	558·45	609·86	662·73	716·09	769·98	823·42	879·47	935·20	991·55	1048·66
·03169	99·877	149·893	200·00	250·24	300·65	351·24	402·05	453·12	504·72	556·48	608·60	660·78	713·40	766·65	820·39	875·66	929·45	984·82	1040·77
·03631	99·869	149·867	199·94	250·12	300·43	350·88	402·52	452·35	503·43	554·76	606·37	658·28	710·51	763·11	815·99	869·48	922·92	977·60	1033·37
·05	99·863	149·837	199·86	249·96	299·94	350·42	400·82	451·36	502·07	552·91	603·96	655·22	706·80	758·41	810·39	862·65	915·20	968·04	1020·58
·075	99·861	149·818	199·80	249·83	299·91	350·15	400·26	450·55	500·93	551·42	602·01	652·74	703·58	753·57	805·71	857·02	908·51	960·16	1012·01
·10	99·863	149·812	199·79	249·78	299·83	349·91	400·04	450·23	500·49	550·82	601·24	651·74	702·34	753·03	803·85	854·77	905·83	957·03	1008·36
·125	99·864	149·811	199·77	249·76	299·77	349·83	399·92	450·07	500·26	550·52	600·84	651·22	701·69	752·24	802·87	853·30	904·44	955·37	1006·43
·150	99·869	149·814	199·77	249·76	299·76	349·81	399·88	449·99	500·15	550·36	600·62	650·94	701·33	751·89	802·32	852·94	903·63	954·43	1005·32
·175	99·872	142·818	199·78	249·75	299·76	349·79	399·85	449·94	500·09	550·28	600·50	650·79	701·15	751·55	802·02	852·58	903·21	953·91	1004·72

different temperature and loading values, in terms of span length and sag. In this way the values of sags for any span and for different temperatures are found.

(3) Plot curves for the size of conductor and one or more spans, in terms of sag and a full range of temperatures. As most lines often keep to one size of conductor and to one or two lengths of span, a curve of this nature should be found very useful (see fig. 1, p. 292).

(4) Plot sag curves for the spans used and for different temperatures, in terms of *all* sizes of conductor and sag values.

(5) Plot sag and tension curves for each size of conductor in terms of different loadings and different temperatures for different spans. In this way any intermediate value of sag and tension is found. (The tension values are obtained from the general formula: $P_1 = l^2 w / 8D'$ or $P_t = l^2 w / 8Dt$ where D' and D_t are the sag values given in Table V.)

Sags for the most severe weather conditions, which conditions are specified by the British Electricity Commissioners, are given in Table II for different sizes of conductor A, different spans l, and different tensions P. In the use of the parabolic equation, which is used herein, it is fortunate that, at the outset, the factors P, l and w are well established, so that the resulting sag D and the corresponding length L of conductor for spans up to about 800 ft. can be relied upon for accuracy.

The actual (or original) length of conductor, *i.e.*, the length of the parabolic curve, under the same conditions governing Table II, have been calculated for different sizes of conductor A, different spans l, and different sags D; these are given in Table III.

The most economical span-range for hard-drawn copper is under 850 ft.; therefore, up to this range, the values of L and L_0 given in Tables III and IV are almost as accurate as they would be if calculated from the catenary equation.* The values of L and D may also be plotted on one chart in terms of P for the different sizes, and the desired sag values for different temperatures and loading obtained just the same as with the "Thomas" chart. Or, if desired, we may divide the tabulated values for L, D and P by the respective spans l, and prepare a chart on the basis of a 1-ft. span for a 1-lb. per ft. length of conductor, which would serve for any material, size, weight, loading and span; or we may use the formulæ: $P = (1/8)\ (l^2 w / D) =$ (tension for unit span); and $L = l + (8/3)\ (D^2/l) =$ (length for unit span), which amounts to the same thing. We would thus have P, D and L values for unit span for any conductor material, weight, size, &c. These values, if plotted on logarithmic paper in terms of P for L and D, will give a straight line for L and a straight line for D values.

The next step in the calculations for sag is to determine the unstressed length of conductor in the span. In Table IV it is seen that if all the stress were removed from the conductor, the span would show, in a great many cases, a less length than the actual span length. For different sizes of conductor, different spans and different lengths L, values for the unstressed length L_0 at zero temperature (or datum) have been calculated; these values are given in Table IV.

Under the above-mentioned conditions the effect of temperature is not taken into account. If now we assume the temperature to rise t°F., then the length of the conductor—still without stress—would increase with the increase in temperature. For the different sizes A of conductor, different spans l, different temperatures t°F., and different lengths L_0, the values of L have been calculated.

* See Electrical Review, September 11th, 1925, giving sag calculations using the catenary equation.

(To be continued.)

The Centenary of Volta.

His Career and Important Inventions.

By T. B. FOWLER.

THE centenary of Alessandro Volta, whose name has been applied to the volt, the practical unit of electromotive force, occurs to-morrow. The event happily coincides with a period of rapid electrical development, which in this country is marked by the scheme for reorganising the whole of our electricity supply.

When he died, on March 5th, 1827, Volta had gone far towards solving phenomena which had mystified men for over two thousand years. Thales, one of the seven sages of Greece, was the first to discover the electrical properties of amber, as early as 640 B.C. Centuries passed before any notable advance in knowledge was achieved. Then William Gilbert, Queen Elizabeth's physician, found that other materials besides amber were capable of electrification by friction. A succession of developments paved the way for Volta's great discoveries. Galvani, in 1791, revealed some of the wonders of electricity and performed pioneer service of the utmost value; but poverty and disease prevented him from following up his discoveries, and it was left to Volta to elaborate the theory of current electricity along purely physical lines.

Volta, who came of an aristocratic family, was born at Como on February 18th, 1745. It was a time of upheaval in Europe, and Maria Theresa, of Austria, was prosecuting an ambitious war of conquest in Italy.

Invention of the Electrophorus.

Through the troubled and difficult years that followed the invasion, Volta's education proceeded to good purpose. His special aptitude for electrical discovery was manifested as early as 1769, when, a young man of twenty-four, he addressed a Latin dissertation to Beccaria, entitled "De Vi Attractiva Ignis Electrici," which is historically significant for the fact that it announced his earliest invention—the electrophorus.

In its essential simplicity it struck the keynote of the mental processes which Volta brought to bear in wresting from Nature the truth respecting her most secret operations. All that it consisted of was two circular metallic plates, between which was a round disk of resin, which was excited by being struck a number of times with either a silk kerchief or pieces of dry, warm fur or flannel.

In 1774 Volta was appointed to a professorship of physics in the gymnasium of his native town. Five years later, when a chair of physics was founded at Pavia, he became its first occupant. Journeys to Switzerland, France, Germany, Holland, and England enabled him to compare notes with some of the most advanced scientific thinkers of the day.

About 1782 he announced two more important discoveries. The first consisted of what he described as

an electrical condenser, an adaptation of the electrophorus by the substitution of a plate of marble or varnished wood for the disk of resin; the second disclosure was the existence of negative electricity in the vapour of water, the smoke of burning coals, and the gas produced by dissolving iron in weak sulphuric acid.

But the achievement which, above all others, entitles him to rank among the greatest scientific discoverers, was his demonstration of the development of electricity in metallic bodies, and the production of the "pile" which perpetuates his name. Here, again, the scientist presented a device capable of comprehension by those least versed in technicalities. His pile was constructed of an equal number of zinc and copper disks, alternating with circular plates of cloth, paper, or pasteboard soaked in dilute acid or salt water.

Demonstration Before Napoleon.

Thus Volta, in the words of Dr. Dickerson, gave to the world a new manifestation of electricity, presenting it in a form in which "this subtle agent is far more manageable than in the form of static electricity. By the use of galvanic batteries a current of low tension, but of enormously greater power, can be maintained with little difficulty, whereas static electricity is like lightning and readily leaps and escapes on the surfaces on which it is confined."

The discovery of the electric current appears to have been made a year or so after Volta's marriage, which took place in 1794, but it was not announced until March 20th, 1800, when Volta communicated the facts in a letter to Sir Joseph Banks, who conveyed the news to the Royal Society. Volta had been awarded the Copley Medal in 1791, and further distinctions were conferred upon him in 1801, when he demonstrated his theories and conclusions before the members of the National French Institute.

Among those who attended the lectures was the First Consul, Napoleon, who was quick to perceive the importance of Volta's discoveries. On his initiative a gold medal was struck in Volta's honour. Napoleon added a gift of 6,000 francs and the Cross of the Legion of Honour. Volta was elevated to the dignity of a senatorship of the kingdom of Lombardy, and in 1815 the Emperor of Austria appointed him to the directorate of the Philosophical Faculty of Padua.

Napoleon had been specially impressed by Volta's experiments in the electrochemical decomposition of water, and it is an interesting fact that, as an outcome of the physicist's visit to Paris, a commission, which included such eminent scientists as Laplace, Coulomb, Halle, Fourcroy, Brisson, Sabathier, and Biot, was appointed to repeat his experiments on a large scale.

Volta was as industrious as he was ingenious, and his active career was marked by an almost unbroken succession of discoveries. Apart from those already indicated, his gifts to science included a device for testing the amount of oxygen in the air; he was responsible for much useful exploratory work as regards heat and gases; and he is credited with being the first to entertain the idea of an electric telegraph.

In support of this claim, Sir Francis Ronalds refers, in a letter, to an autograph manuscript wherein Volta states that he does not doubt the possibility of exploding his "electrical pistol" at Milan through wires supported by posts whenever he discharges a powerful Leyden jar at Como.

Knowledge for the Sake of Knowledge.

Volta combined with acute intelligence and clear insight, lofty ideas and transparent sincerity, the rarest personal modesty. He is described by those who knew him as being entirely free alike from ambition, thirst for wealth, or jealousy. He pursued knowledge for the sake of knowledge alone.

Scattered throughout the letters and memoirs which he accumulated was a wealth of informative detail respecting his researches, but he shrank from publicity, and it never occurred to him to embody the material in book form.

It needed Faraday's discovery of the induction of electric currents, and the creation of currents by the motion of conductors in magnetic fields, to open up the era of modern electrotechnics, but Faraday himself generously and ungrudgingly acknowledged the debt of obligation which science owed to Volta for the removal of what he described as "doubtful knowledge."

"Such knowledge," he declared, "is the early morning light of every advancing science, and is essential to its development, but the man who is engaged in dispelling that which is deceptive in it, and revealing more clearly that which is true, is as useful in his place, and as necessary to the general progress of science, as he who first broke through the intellectual darkness and opened a path into knowledge before unknown."

Volta spent his last years in retirement at Como, and there, amidst the friends and scenes he loved best of all, a great, simple-minded and affectionate man, and an earnest student to the last, he passed away at the advanced age of eighty-two.

The Factor's Catalogue.

Some aspects of a field of publicity work which is little exploited.

By A. J. SMITH.

THE majority of manufacturers appreciate to a greater or less degree the important *rôle* of the catalogue in sales promotion work, but in many cases it is not so fully appreciated that the publication of the maker's own lists does not exhaust the possibilities for effective publicity in this line, for there still remains the large number of catalogues issued by wholesalers, factors, or export merchants in which are embodied details of various manufacturers' productions, many of which have a circulation as wide as that enjoyed by the makers' own sales literature. It is seldom indeed, that the edition of any catalogue is less than four or five thousand copies, while the amount of care used in its distribution is usually precisely in proportion to its cost. Broadly speaking, space in a factor's catalogue of any kind is only a shade inferior in value to the maker's own lists and in estimating its value it is interesting to note that in certain trades, notably in the radio industry, there are one or two wholesalers' catalogues which are frequently preserved and used by buyers in preference to the lists of the actual makers,

on account of the better arrangement and classification, as well as the more varied range of information which they contain. The important point in connection with all such extraneous publicity is that if an article is once included in a factor's catalogue of any kind, orders are bound to follow sooner or later. It might be thought therefore that there would be very considerable competition on the part of makers generally to secure representation in such a work, but this is by no means the case. Far from being bombarded with offers from makers to collaborate in every conceivable way in the preparation of his sales literature, the average factor or merchant in any line has to extract details piecemeal by dint of much hard work from apparently indifferent or hard-pressed makers. Copies of the latter's standard sales literature are usually obtainable without much trouble, but if special information or additional details are required, it is quite a different matter. On the question of the loan of blocks or electros, it is surprising how many are the manufacturers who consider that they should be paid for these, and if a block should ever be required of a special size, or without the maker's name or trade-mark appearing, there are yet greater difficulties, and the maker's "take it or leave it" attitude becomes still more pronounced. There are in fact cases where makers have declared that they would not dream of allowing an illustration to be published of any product of theirs which did not bear their name! In the compilation of an export catalogue, it is often possible to waste weeks if not months in the endeavour to obtain a list of standard sizes and prices from some maker whose motto is "Prices and Particulars upon Application." Fortunately, however, it is usually possible to find a competing maker who is a little more complaisant or farsighted as to the ultimate possibilities, and who consequently gets his own productions listed, while the other is left to point to the coal strike, the unsettled state of export markets, or some equally plausible reason as an explanation of lack of business. In such a trade as radio, for instance, one may come across instances of important wholesalers' catalogues being held up for a couple of months at the critical time of the commencement of the winter season owing to the failure of manufacturers to supply details of their new models in good time.

Although practice differs from trade to trade, there are one or two general considerations which require to be borne in mind by the manufacturer who wishes to obtain adequate representation in a wide range of different factors' and wholesalers' catalogues. In many trades where the merchant's position is not very clearly defined, it is practically an essential condition that the block used must not show the maker's name or trade-mark. If the factor's position is at all ambiguous, it is obviously not good policy for him to show who are the actual makers of the goods listed. The provision of plain blocks, or the offer to provide them upon request will often be a considerable "pull" in securing representation in any pages of this kind, as will also the offer to provide blocks of a size to suit the pages for which they are to be used.

In the majority of lines listed, the average factor naturally prefers an illustration showing a conventional type of article which may fairly be held to represent general practice, in preference to illustrating something of special or unconventional design, which in case of business can only be obtained from one source. Obviously it is very desirable that a factor should have alternative sources of supply in case of unexpected increases of price, or inability to obtain reasonable delivery, and it is considerations of this nature which usually render necessary a great amount of sub-editing of the manufacturer's descriptive matter and the deletion of many selling points which may distinguish a particular article from others of its class, so that the resulting description is in such general terms that it may apply equally well to several different makes. But in spite of all sub-editing due to such considerations, the maker whose article is illustrated and whose description is adopted retains a decided advantage when it comes to filling orders which may have resulted from a distribution of the catalogue.

The time or trouble which may be necessary to get one's products listed in merchants' catalogues is well-spent, though the value of the work is apt to be disregarded as the securing of an order is not the *immediate* result; but though the primary result is propaganda space only, the writer has never yet encountered a case of the listing of goods in factors' catalogues which did not result in orders sooner or later. In fact in certain lines of engineering goods, where patterns are standardised and designs change but little from year to year, the useful effect of an appearance in a substantial catalogue is enormous, and the writer has traced business coming along regularly for periods of fifteen years and over as a consequence of a particularly well-compiled catalogue of this description.

The essentials which require to be borne in mind by the maker who desires his products to be widely listed by merchants and wholesalers are generally:—(1) He must be prepared to supply blocks without any name appearing; (2) they must be of a suitable size for the publication for which they are intended; (3) the descriptive matter should be drawn up to follow the general plan of the catalogue for which it is intended, and of the exact length to fill the space which can be alloted without sub-editing; and (4) the particulars require to be drawn up with the same care and the same promptitude as would be used in the case of the maker's own lists. There are few factors who would not appreciate attention upon these lines. In fact, it only requires some little experience of the results which can follow a more progressive policy with regard to this type of propaganda to show that there exists here a field for indirect salesmanship which though comparatively little cultivated, is yet capable of bringing in remunerative results spread over long periods.

Supervisory Traffic Control for Hudson Tunnel.

An electrical protective system, based on the supervisory control system developed for railway and power stations and modified to meet the particular local conditions, will ensure safety in the Holland vehicular tunnel between New York and New Jersey, U.S.A. An order totalling half a million dollars for the necessary equipment has been awarded by Messrs. Fischback and Moore, electrical contractors, to the Westinghouse Electric and Manufacturing Co. Three kinds of traffic signals will direct motorists using the tunnel: green for "go ahead"; red for "stop," and a special "stop-engine" signal. These lights will be spaced 240 ft. apart; traffic officers every 480 ft. will patrol the tunnel, and for each there will be a traffic-light control station and a telephone. A board located in the administration building in New York and carrying 926 pilot lamps will inform a central operator of everything going on within the tunnel, and will enable him to stop traffic at any desired point, and he only can reset the signals. The pilot-light board in the control room will show, in addition to the position of the traffic lights, definite signals indicating the state and speed of every piece of ventilating apparatus and the conditions of every circuit serving the tunnel. If anything fails, a bell will ring, and a bright light will indicate the location and character of the trouble. When everything is in good order, the pilot lights will burn dimly, so that a bright light will instantly attract attention. The 84 ventilating fans will be on six independent circuits. Normally the power supply will be divided between New York and New Jersey, but any piece of apparatus can be supplied from any source the operator desires, and all switchgear is to be interlocked. The tunnel will be illuminated by lamps spaced every 20 ft., except at the entrances, where they are spaced every 10 ft. to help in counteracting daylight. The tunnel will be opened to traffic early in the summer of 1927.

The Accumulator Makers' Association.

Third Annual Dinner in London.

THE annual dinner of the Accumulator Makers' Association was held at the Savoy Hotel in London on February 21st, Mr. B. M. Drake presiding over a company numbering about 200.

The loyal toast having been honoured, "The Accumulator Makers' Association" was toasted by Mr. J. S. Highfield, who remarked that the public's impression that the function of associations was price arrangement was quite wrong; they enabled resources to be pooled, so that business could be built up securely, and were not "trusts," as they kept up competition. They had a right to the profit they made, otherwise they would have no resources wherewith to back up progress, and, moreover, profit was a standard whereby efficiency could be gauged.

Mr. B. M. Drake, in reply, claimed that the Association had benefited all concerned. The industry was now in a flourishing condition and able to hold its own at home and in foreign markets, too, in spite of the fact that protection did not exist in this country as it did abroad. Last year the value of exports reached £871,000, whereas imports were only valued at £53, which figures showed that they were not abusing their position, or overcharging for their goods. He welcomed the publicity which the electrical industry had obtained during the passage of the Electricity (Supply) Bill through Parliament, as it could not fail to benefit all branches, including that of accumulator manufacture. Some doubt had been expressed as to the effect on the accumulator trade of the spread of alternating current, but, in spite of the undoubted fact that many had held back their orders last year owing to uncertainty as to the final form the Bill might take, it was satisfactory to be able to record that the output of accumulators had actually increased during that period. When electric light was introduced timid shareholders hastened to sell their gas shares, but the very utility of an appliance invited the appearance of a competing alternative, and two good alternatives always benefited each other. Only a small proportion of the population was at present using electric light and power, and the extension which was expected to follow the widespread network of mains would so popularise electricity that many who were not within reach of them would consider themselves behind the times if they did not purchase private plant, of which an accumulator formed an essential part in order to obtain security, steadiness, and economical working of the engine. In a.c. generating stations there was a growing market for emergency batteries to light the buildings when a breakdown occurred, in which respect they were following the lead of America, where large emergency batteries had proved their utility. The serious losses which would occur in works if the electricity supply failed would justify the use of accumulators as an insurance against breakdown, and in hospital operating theatres and for other vital services accumulators might well be made compulsory. He looked with confidence to the future of the accumulator industry.

Mr. D. P. Dunne, in proposing "The Electrical Industry and the Guests," referred to the talk heard on every hand of a coming revival of trade; the best augury was the fact that the people were looking for it, they expected it. In addition, the Electricity (Supply) Act, designed to stimulate the public, had been passed with progressive notions for fostering the use of electricity. However, the industry did not consist solely of the generating stations, and they must not depend too much on the Act alone, for an Act that was not put into operation properly became destructive. Development would, therefore, depend upon the efforts that were put forward from within the industry itself, but they still had to contend with competition from abroad, and the greater their own efforts were the greater would competition be.

Sir Duncan Watson, in responding, intimated that the Central Electricity Board and the Electricity Commissioners would welcome suggestions for improving load factor, because doubling the l.f. would halve the cost. He considered it pertinent to remind the assembly that four years ago the all-electric house was a dream; to-day it was a practical reality, and it had come to stay, and if they progressed on those lines this would be a happier and more prosperous country in future than it had been in the past. No better chairman of the Board than the one chosen could have been found to solve a very tangled scheme; the Board's composition and the manner in which it had been received indicated that the Government meant business. The electrical Press, which had always been independent, had not been afraid to say what it thought and to give credit where it was due. He hoped the industry would close up its ranks and render that assistance to the Board which it so much needed.

Mr. J. W. Beauchamp also replied to the toast, pointing out how representative of the electrical industry was that night's gathering.

In addition to the much appreciated songs of Miss Edith Furmedge and Mr. Thorpe Bates, accompanied by Mr. G. H. Ison, the band of the Royal Regiment of Artillery rendered a programme of music which added to the enjoyment of the evening.

Legal.

Wareham Electric Supply Co., Ltd.

Allegations of Fraud.

In the Companies' Winding-up Court, on February 22nd, Mr. Justice Romer had before him, as briefly mentioned in our "Business Notices" last week, the petition of Mr. W. E. Weston, of Spring Grove Road, Hounslow, a shareholder, for an order for the compulsory winding-up of the above company.

Mr. C. A. Bennett, K.C., who appeared for the company, said the petition was by a gentleman who, in one part of his petition, said he was a fully-paid shareholder, and in another that he had repudiated the allotment of the shares to him. The petition was one of the longest he had ever seen—it contained 68 paragraphs—and throughout it made charges of fraud against those concerned in the management of the company. He was going to ask his Lordship to say that the statutory affidavit should not be regarded as sufficient, but that the allegations should be properly verified by another affidavit.

His Lordship: Where is the fraud alleged in the petition?

Mr. Bennett: It is alleged throughout.

His Lordship: I see in one paragraph it says "the said shares were created in fraud of," &c.

Mr. Bennett said in another paragraph it was stated that there was "deliberately withheld from your petitioner all such material facts and information in order to mislead and deceive your petitioner and others who might be induced to apply for shares or debentures in response to the said prospectus."

His Lordship: Is the company in voluntary liquidation?

Mr. Bennett said the petition in one place alleged that it was, and in another that an order was made in the Dorsetshire County Court staying the voluntary liquidation. The conclusion seemed to be that the company was still in voluntary liquidation. It was impossible, he thought, from the petition to understand what the petitioner's real case was against the company.

Mr. R. J. Willis, for the petitioner, said this was a serious case, and the facts were somewhat unusual. According to the petition there was very gross fraud by those concerned with the company.

His Lordship: You had better file proper evidence in a detailed affidavit. Is the company still carrying on business?

Mr. Willis said that only in the last day or two one of the directors of the company had sent out a circular to the shareholders of this and four other companies suggesting that some trust should be formed.

Mr. Galbraith, K.C., said he appeared for the liquidator, whose duties were supposed to have come to an end in 1923, when the voluntary winding-up was stayed. What he wanted to know was whether he was still liquidator or what had happened.

Mr. Willis: I say the company is still in voluntary liquidation, but it may not think so.

His Lordship adjourned the petition for 14 days for the filing of further evidence, and said that in the meantime the company would deal with the assets only at its peril.

Montreal Tramways and Power Co., Ltd.

Mr. Justice Romer, in the Chancery Division on February 22nd, sanctioned a scheme of arrangement of the finances of this company.

Mr. Linden, for the company, said it was entirely controlled by a board in Canada, and most of the shareholders were there. The scheme was in reality a reconstruction. The company was registered here and the scheme provided for shares of a Canadian company, called the Montreal Tramways Co., to be issued to the liquidator of the present company, and for the Canadian company to take over its liabilities and pay for the winding up. The scheme also provided for a reduction of capital, as according to the laws of Quebec it was liable for taxation on the amount of its actual capital and at the same time to taxation here

British Thomson-Houston Co., Ltd., v. Mullard Radio Valve Co., Ltd.

A motion by the British Thomson-Houston Co., Ltd., against the Mullard Radio Valve Co., Ltd., was mentioned to Mr. Justice Tomlin in the Chancery Division, on February 25th.

Mr. Whitehead, K.C., for the plaintiff company, said the motion was for an injunction to restrain the alleged infringement by the defendant company of certain patents. It had been adjourned until that day to enable the defendant company to answer his affidavit, and it was a term of the adjournment that the defendant company would let his clients have the affidavits in answer by February 23rd. The defendant company was unable to let him have two of those affidavits until February 24th, and those affidavits he (Counsel) wished to

answer. But there were certain negotiations proceeding between the parties, and he hoped that if his Lordship would allow the motion to stand over for 14 days it might be possible to dispose of the whole matter without its coming into Court.

Mr. R. Moritz, K.C., for the defendant company, said, without prejudice to the position which he took up that the motion was wholly misconceived and ought never to have been brought, he had no objection to the adjournment asked for.

His Lordship granted a further adjournment, and said that Mr. Moritz's statement would not interfere with anything which he might say on behalf of the defendant company when the motion came on again.

Birmingham District Power and Traction Co.

Corporation Profits Tax Appeal.

In the Court of Appeal on February 23rd the appeal of the Birmingham District Power and Traction Co. from a decision in favour of the Income Tax Commissioners, given in the King's Bench Division by Mr. Justice Rowlatt, was allowed. The company claimed that its profits and those of three omnibus companies which it owned should be assessed for corporation profits tax together. In this case two years' exemption could be claimed under the Act as the company was a public utility company, while it lost £1,500 in exemptions (£500 for each subsidiary).

Costs of Opposition to Dublin Electricity Bills.

In the High Court, Dublin, recently, the Dublin Corporation and the Liffey Syndicate, Ltd., applied for liberty to plead in defence of an action brought against them by Col. R. C. Cane that a Parliamentary Committee which awarded costs to Col. Cane in respect of his opposition to electricity supply Bills promoted by the defendants was acting *ultra vires* and was not lawfully constituted. The judges held that the application of the Liffey Syndicate, Ltd., should be refused, but they gave the Corporation liberty to plead, as the preamble of its Bill was proved, although the Bill was subsequently withdrawn.

An Unlicensed Transmitter.

On February 18th, Eustace Dennes, electrician, Chorlton-cum-Hardy, was charged with working a radio transmitting station without a licence. It was stated that the defendant had used another's call sign; he admitted working the station. A fine of £10 was imposed.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Electricity Board.

On February 22nd, Mr. Montagu asked the Minister of Transport whether members of the Electricity Board, apart from the chairman, could hold other lucrative posts or retain separate commercial interests.

Colonel Ashley said that the answer was in the affirmative. None of the members of the Central Electricity Board, other than the Chairman, was required by his appointment to devote the whole of his time to the performance of his duties as a member of the Board. Under Section 1 (4) of the Electricity (Supply) Act, 1926, however, a member of the Board, if interested in any company with which the Board had, or proposed to make, any contract must disclose to the Board the fact and nature of his interest, and might take no part in any deliberation or decision of the Board relating to such contract.

Broadcasting.

On February 22nd, the Prime Minister informed Captain Fraser that he could not give an opportunity for a debate on the question of the broadcasting of the proceedings of the House of Commons. He also was not prepared to set up a Select Committee, as he was unaware of any change of opinion on the question of broadcasting Parliamentary debates

Mr. Day asked the Postmaster-General if he could state the number of licensed wireless listeners in Great Britain on the last convenient date, together with the comparative figures for Germany, Sweden, Denmark, Hungary, Switzerland, and the United States.

Sir W. Mitchell-Thomson said that the latest available figures which were properly comparable were those for December 1st, 1926, *viz.*:—

Great Britain and Northern Ireland	2,130,000
Germany	1,337,122
Sweden	238,000
Denmark	114,492
Hungary	53,070
Switzerland	51,750

There was no licensing system in the United States, and no official statistics of the number of wireless receiving stations were available.

The North Metropolitan Bill.

The Times states that the Bill to raise £2,250,000 new share and loan capital which has been introduced into the House of Lords by the North Metropolitan Electric Power Supply Company will proceed as an unopposed measure through that House.

The National Association of Supervising Electricians.

Annual Dinner.

On Saturday last the annual dinner of the N.A.S.E. was held at the Holborn Restaurant, the president, Mr. A. M. Sillar, M.Inst.C.E., occupying the chair.

After the loyal toast, Mr. W. E. Highfield, M.I.E.E., proposed "The Guests," ascribing the success of the Association largely to those who came to its banquets and meetings. Mr. F. Palmer, President Inst.C.E., who responded, expressed the cordial goodwill of the Institution towards the Association. Mr. W. W. Lackie, C.B.E., Electricity Commissioner, also responded, and undertook to prove that all the guests were "supervising electricians." He warmly commended the work of the Association in connection with the I.E.E. Wiring Rules, pointing out that no body of men could know better what wiring rules should be.

Sir R. Burton Chadwick, M.P., proposed "The Association," which he described as a body representing trade unionism at its best. The campaign in favour of industrial peace that was in progress dealt with the dominant factor in our national life: since the Armistice we had lost more money and time than all other industrial countries together. Unless the people of this country realised the complete interdependence of capital and labour the outlook would be black. The Association exercised an immense influence in favour of sane trade-union leadership; next year it would dine under a new title.

Mr. Sillar, responding, said the term "electrician" was honoured in the early days, but in 1889 the Society of Telegraph Engineers and Electricians became the Institution of Electrical Engineers; the Association was adopting the title "Association of Supervising Electrical Engineers," which was more in accordance with the duties performed by its members.

Mr. Alan Kirk, A.M.I.E.E., chairman of the N.A.S.E., also responding, said that membership of the Association was now recognised as a hall-mark of professional efficiency; as a non-political trade union with the highest ideals, it provided numerous benefits for its members. Last year it experienced a most trying time, but came through without a wry word, thanks to the leadership of Mr. E. North and the loyal support of the Board and the members, and to the guidance of the general secretary, Mr. A. Brammer. Their position in the industry was now recognised; a suggestion that an abridged version of the I.E.E. Rules should be prepared had been referred to the Association and the E.C.A. in collaboration. The name of the Association would be changed on April 1st, and the scope of membership would be enlarged to include the commercial electrical engineers. He proposed the health of the first Board of Control, of 1914, and Mr. Stiling responded, describing the early struggles out of which the Association came into being.

Mr. E. North, M.J.Inst.E., proposed "The Industry," for which, he said, the prospects were now bright, provided that every man did his best; they needed initiative, economy, and efficiency—and less preaching.

Col. R. K. Morcom, C.B.E., chairman of the B.E.A.M.A., responded, forecasting victories for the close association of science and practice, and deprecating the too-common tendency to depreciate our national achievements, a result of the mixed thinking which pervaded politics and fed on statistics and catchwords If all did their best to make good the losses of war and the losses of peace, the future of the industry would be a rosy one.

Mr. J. S. Highfield, M.I.E.E., after expressing the desire of the past-presidents (who were all present except Mr. A. P. Trotter) to help and advise the Association at all times, proposed the health of the general secretary, which received musical honours. Mr. Brammer, in acknowledgment, attributed the success of the Association to the loyal support of the presidents and past-presidents, backed up by the yeoman service of the Boards of Control, and said the Association was now composed of men who had the right to call themselves supervising electrical engineers.

The speeches were interspersed with music and song, and the evening was thoroughly enjoyed.

Reviews.

Condensing Plant. By R. J. Kaula and I. V. Robinson. Pp. xiii+400; figs. 245. London: Sir Isaac Pitman and Sons, Ltd. Price, 30s. net.

While the reciprocating steam engine held the field, condenser design remained more or less stagnant, for this form of prime mover could not effectively utilise a higher vacuum than about 26 in. Hg. This degree of vacuum was easily obtained. With the advent of the steam turbine it became apparent that this new prime mover could effectively utilise much higher vacuum. The realisation of the thermal gain to be achieved by exhausting to a higher vacuum caused attention to be directed to the design of condensing plants. Numerous workers attacked the various problems concerned, but the results of their work, when published at all, were more or less in the form of studies of individual factors affecting condensation, and were scattered among papers to technical institutions, and in the various technical journals. It is only recently that any attempt has been made to collect the scattered data, co-ordinate the same in the light of modern experience, and present the result as a co-ordinated whole affecting condenser design and operation.

From being a cast-iron box stuffed full of tubes, located in any odd place, the condenser has risen in importance, until now it ranks with the boilers and turbines. Power plant sites are largely determined by the facilities offered for condensing purposes.

The authors have set out to treat the subject from the standpoint of the user as well as that of the designer and student. This standpoint is a commendable one, for the number of users is greater than that of designers, and also probably their need is greater. It may be said at the outset, that the volume under review is a notable contribution to the literature on condensing plant, and affords all who are interested an opportunity of becoming acquainted with the essentials of design and operation, and with the latest developments in condenser-plant practice, for the most recent improvements are included and given adequate notice.

After a brief summary of the various types of condensing plant, the effect of vacuum on turbine economy is discussed. The fact that there is an optimum value for vacuum, for given circumstances, is brought out. The authors do not mention that the thermal gain realised depends to a large extent upon the design of the exhaust stages of the turbine, and further that the actual gain at turbine full load rapidly falls away from that theoretically possible after about 28.5 in. Hg vacuum has been reached. Until the advent of bleeding for feed heating, the optimum thermal efficiency at full load was reached with about 28.9 in. Hg vacuum, even for turbines having a double-flow low-pressure cylinder. At higher vacuum the loss of heat from the condensate outbalanced the gain in steam consumption, for the actual gain in steam consumption below this degree of vacuum is very slight indeed. The advent of bleeding extended the optimum value. Chapter 3 gives in detail the calculations necessary for estimating the quantity of circulating water, and gives values commonly used in modern practice.

Eight chapters are then devoted to surface condensers, starting with the principles of design, following on with an exhaustive examination of the various factors influencing design and operation, and finishing with detailed illustrated descriptions of typical designs of leading makers in this country and abroad. An examination of the various tube plate diagrams of modern designs, shows that designers have all realised the vital importance of presenting the maximum possible cooling surface at the entrance to the condenser, with adequate tube spacing at this point, in conjunction with an entrance of adequate size and shape to render available the maximum amount of cooling surface at the entrance. The reviewer remembers a case years ago, where putting an augmentor steam jet in series with the piston air pump, increased the vacuum at the bottom of the condenser by about 0.5 in. Hg, but the vacuum at the top of the condenser remained practically the same as it was before the jet was on! This was one of the first condensers made for high vacuum (29.1 in. Hg), and the effect of steam friction through the tubes had been overlooked when the tube pitch was settled. Happily such things are no more.

Corrosion, erosion, and tube cleaning are next covered, then come chapters devoted to evaporative condensers, jet condensers of the high and low level type, and ejector jet condensers. The various ordinary and special forms of each type are described, and the relative advantages and disadvantages of each type adequately discussed. It appears to the reviewer that these chapters would have been better placed at the start of the volume.

Eight chapters are then devoted to air pumps. It may be truly said that air-pump performance dominates condenser performance, for a good condenser performance cannot be achieved without a good air-pump performance. Much useless ingenuity has been expended in trying to do with condenser design what can only be done by air pumps. With the advent of high vacuum the limitations of the reciprocating type of pump became apparent. Various expedients were tried to overcome these limitations, the most successful probably being the steam jet augmentor of Sir Charles Parsons. As a matter of fact, a good piston pump with a steam jet augmentor in series will give as good air-pump performance as any modern form of air pump. The limitations of the piston pump led to the development of rotary hydraulic pumps, which proved good from the vacuum production view, but took more power than the piston pump. Then came the development of the steam jet extractor type, the practical advantages of which greatly outweigh any theoretical disadvantage, such as degradation of high-grade heat in an auxiliary, and to-day it is established—and in the reviewer's opinion quite rightly so—as the best form of air pump. The authors' treatment of the various types of air pumps is comprehensive, thorough and unbiased, and will be of great value to operating engineers. The authors devote the necessary attention to adequate provision of air cooling. There is a typographical error on page 231, where fig. 109 is referred to in the text instead of fig. 112.

The book concludes with useful chapters on testing, de-aerating, and closed feed systems. The treatment throughout is thorough, sound, and unbiased. The volume is an attractive one from every point of view—save one—and that is the price. This appears to be on the high side, which is to be regretted, as it may restrict the field of a good book.

J. N. Waite.

Engineering Factory Supplies. By W. J. Hiscox. Pp. viii+176; 49 diagrams. London: Sir Isaac Pitman & Sons, Ltd. Price, 5s. net.

"The subject matter of this work is the purchase, receipt, storage, and distribution of factory supplies." To most people engaged in industry, this is not a thrilling subject. It follows that if it is to make an appeal it should first of all be readable. But this book suffers, as do so many technical text books, from the lack of an attractive style.

Everybody who is engaged directly or indirectly upon the transformation of raw materials into finished goods in all the multitude of factories throughout the land, should have a sound knowledge of the methods and means of handling the material. It appears to be the author's object to produce a standard text-book that everybody concerned can read. Surely, if it were easily read, it would attract very many searchers for knowledge and guidance. Perhaps, it is too much to expect that those who have the experience should also have the faculty of clear expression. The author certainly has the experience. Now, if the would-be author of the technical text-book, who does not possess the power of expression, would but collaborate with one who is able to write with an attractive style, both the reader and the author himself would benefit vastly. Thus, we must begin this review by exhorting those who have a desire to study this subject to struggle on, neglecting some of the details and shutting their eyes to some of the phraseology which is not helpful, so that they may pick out just those points that matter.

There is a great deal that does matter in the book. The trials and troubles of pilfered stock, late delivery, inefficient production, and lack of fluid capital, can more often than not be traced to the slack methods adopted in so many factories to deal with material supplies. Either there is lack of co-ordination between production, purchasing, storage, and distribution, or the storage of material is looked upon as a very minor function of the business, or, again, there is a distinct absence of that control of stock which is so essential to efficient production.

If one could assess the time lost, the penalties incurred, the deterioration of stock, and the loss of profit due to overstocking in terms of money, the country would be appalled at the waste thus accounted for. One of the prime causes of bankruptcy is undoubtedly overstocking. It is time such a cause were made a criminal offence. It is so unfair to the up-to-date manufacturer, after exercising due control over his own stocks, to have to write off huge sums annually for bad debts, when these debts become cancelled owing to the slack methods of his customers.

In order to avoid overstocking, it is necessary to set very fine limits for the maximum stock to be carried of each line kept in store. The trouble of late delivery is often caused through inattention to minimum stock levels, but of equal, if not greater importance, is the setting of the maximum levels. Even where they have been set, they usually have a large factor of safety, and that factor of safety is the means of tying up big sums of money, which, particularly in these times of financial stringency, are needed as much as liquid capital. Without maximum stock levels, scientifically based, the stocks which do actually grow up are those which are rarely or never used, and which in time, owing to changed demand, never will be used. When this happens, and it is happening in very many factories, wholesale scrapping, or sales at ridiculous prices take place. It depends upon the magnitude of this overstocking in any one factory whether it results merely in a diminution of profits or whether insolvency follows in its wake.

Mr. Hiscox tells us, if not all, a great deal about minimum levels, but he is sadly reticent concerning the maxima. At least half the problem of instituting thoroughly useful stock records centres around the calculation of really sound maximum stock levels.

Then, again, the days of the old card index, whether it be for stock or any other records, are passing. A manager, for instance, has not the time to look through hundreds of hidden cards to find out what he wants to know. He needs a visible record which *tells* him the position at a glance. If he is to

be interested in the stock, as it is most important he should be, the stores organiser must provide him with a picture of the stock rather than a stodgy book about it. The manager must be provided with something that will tell him in an instant what is right and what is wrong. There are several types of visible stock records on the market. Certainly they are more expensive than card indexes, but the ratio of useful service to investment cost is the important, and should be the deciding, factor.

We have not been greatly helped by the index to this work. It has failed to show us where to look for just those points we find most interesting, points that are included in the text. This lack of sufficient indexing is another fault of so many technical books.

There are 41 diagrams. We have seen better forms, but it is, we realise, difficult to include forms that will apply generally, and these can only be regarded as specimens of what might be used. Some of the methods advocated do not appear to be the least expensive compatible with economical working, and that is the acid test of any system. The author neglects to mention the advantages to be gained from the use of certain modern office machines which do facilitate clerical labour.

In introducing any system into a factory, there is always the tendency to over-elaborate the methods employed. It is so easy to get just a little more information than is actually required by the extension of a form, or the introduction of a further record. But it must be remembered that the larger the form or the number of records, the greater is the amount of clerical labour required to deal with them. The test to be applied is whether the purpose served or the added control acquired by such extensions of the system will fully compensate for the extra time needed in factory and office in handling the extra information. It is not enough to say, "This information can easily be obtained, if it is wanted." It is necessary also to show that the service given corresponds with the effort made. An authoritative text book should demonstrate the relative time required and utility gained by each step advocated or suggested.

The following are the main points dealt with by Mr. Hiscox:—The necessity for efficient handling of material; what to stock and who decides; the buyer, his duties, and his relation to other executives; purchasing for stock and for special requirements; receiving, checking, inspecting, and distributing supplies; circulating information regarding stores; the location and layout of storage space; the kinds of stores required and how each is sectionalised; the status of the storekeeper; methods of storing; transport of supplies; records and accounts; errors, and dealing with empties.

The subjects are treated fairly thoroughly and in logical order; the relation of the various people who have to deal with material before and after it is purchased, and their relation to others in the factory, are leading themes throughout the book. A close study of the chapter on errors and how they may be detected, will be of use to all who have to organise stores.

The severity of the trade depression would be alleviated if manufacturers would but see that the old-fashioned methods of organisation are a source of unremunerative expense. Some do, but instead of consulting the experienced organiser, they too often scrap their obsolete system, with the hope that by ridding themselves of one source of expense, they have a chance to recover. When they do come to realise that such a passive attitude does not encourage prosperity, they will, perchance, if they still have some life left in them, turn to those, such as the author of this book, who have studied carefully economical organisation. In the handling of material, both physically, and on paper in the form of records, the expert could, if he were called upon, help to mitigate the wholesale loss which is going on. But the manufacturer must have a reasoned and lucid case laid before him, and so presented to him that he will be compelled to act upon it. If this volume had received the master touch that would have made it not only readable, but also compelling, the author would have done a vast service to British industry. The plans are there, but the draughtsmanship will not commend them to the casual observer.

Department of Scientific and Industrial Research; Technical Papers on Illumination Research: No. 1, The Terminology of Illumination and Vision (9d. net); No. 2, The Transmission Factor of Commercial Window Glass, by A. K. Taylor and C. J. W. Grieveson (6d. net); No. 3, Light Distribution from Industrial Reflector Fitting No. 1, by H. Buckley and C. J. W. Grieveson (1s. net). London: H.M. Stationery Office.

In the course of a discussion before the Illuminating Engineering Society early in the present year, it was stated that details of the investigations undertaken by the Illumination Research Committee of the Department of Scientific and Industrial Research would shortly be embodied in a series of technical papers. The three papers above represent the first of the series. In each case a short prefatory note is included, explaining the objects of the investigation—a useful feature. The idea of first publishing definitions of terms used in subsequent papers is a natural one. It is well that those dealing with illumination should be put on record, as some of these terms are somewhat loosely used, even by those vocationally concerned with illumination. The addition of definitions of terms used in connection with vision is, however, a new step. It is rarely that these have accompanied treatment of illumination and their juxtaposition should be helpful to those interested in researches in which lighting experts and physiologists are equally concerned.

Technical Paper No. 2 is useful in showing that the amount of light absorbed by commercial window glass is much greater than is commonly appreciated. Values depend on the inclination of the light, and vary according to whether the rays are direct or diffused. Values range from 62 to 84 per cent. according to the conditions of test. Prismatic glass comes out well, as the absorption is not very much greater than that of plate glass, while the advantages as regards improved distribution of light are often considerable. It is interesting to observe that the method of having the smooth surface facing the light, with the ribbed surface inside, is frequently favourable to maximum transmission, besides enabling the external surface to be more readily kept clean.

Technical Paper No. 3, which amplifies the data already published in the B.E.S.A. specification for industrial lighting reflectors, is of special interest to electrical engineers. It is concerned mainly with the effect of the angle of cut-off on performance. Diagrams illustrating the influence of this angle on efficiency and distribution of light are presented. It is of interest to note that the luminous efficiency falls off at nearly the same rate for all the reflectors studied, namely, a decrease of from 1 to 1.5 per cent. for each increase of 1 deg. in the angle of cut off. The distribution ratio is more affected, the variation being as high as 50-60 per cent. in certain cases—an indication to the contractor and the consumer of how greatly illumination may be affected by inserting lamps in types of reflectors for which they were not intended. Under the conditions studied the extreme variations in the luminous efficiencies of reflectors are from about 50 to 80 per cent. Under normal conditions, with a reasonable angle of cut-off an efficiency approaching 70 per cent. may apparently be expected. There can be no question that the small sacrifice in efficiency involved in having a suitable angle of cut-off, and thus reducing glare, is well worth while. Yet another point brought out by these researches is the effect of variation in the shape of the filament. The ring filament in general leads to greater efficiency than the "festoon" shape, the difference in efficiency in certain cases being as high as 5 per cent.

The researches described in these papers have evidently been made with great care, and it is useful to have the results of impartial and authoritative tests on these somewhat complex problems. Further papers dealing with other researches of the Committee will be awaited with interest.

Alternating-Current Rectification. By L. B. W. Jolley, M.A., M.I.E.E. Second Edition. Pp. xxii+472; figs. 340. London: Chapman & Hall. 1926. Price 30s. net.

The second edition of this valuable work will be found to have been considerably enlarged, owing to the incorporation of a considerable amount of new matter, the necessity for this being indicative of the rapid advances which have recently been made in the development of rectifying apparatus. The preliminary mathematical chapter on the analysis of rectified wave forms has been amplified, and additional notes are given on analytical methods of resolving complicated wave forms. In the chapter on commutator rectifiers, the principles and construction of the transverter have been considered at some length, and a description of a small commutator rectifier is included. The chapter on thermionic rectifiers has been considerably expanded, and some interesting matter has been added, relating to the difficulties attending the design of large rectifiers of this class, in which the filament current exceeds 50 amperes. One of the principal of these difficulties is that of unequal filament temperature, owing to the superposition of the emission current on the heating current. The effect of this is usually to give a higher temperature at the negative end of the filament, and means have to be contrived whereby the polarity of the filament is periodically reversed. When the filament is supplied from a source of a.c. this reversal is conveniently effected by arranging for the frequency of the filament supply to be slightly different from that of the current to be rectified. For 50-cycle work a difference of five cycles has been found effective, this giving a reversal of the polarity of the filament with respect to the current rectified, five times a second. This rate of reversal is sufficient to maintain an approximately constant temperature throughout the whole length of the filament. A new chapter has been added on the installation of thermionic rectifiers, in which is an interesting note on a method of producing a rectified direct-current free from ripples, by the use of a special wave form on the a.c. side. Another new chapter deals with methods of obtaining small supplies for filament and anode circuits in small wireless sets, and a third additional chapter gives a brief account of recent work carried out in connection with the problem of converting direct to alternating current by means of apparatus using thermionic valves.

The amount of work carried out by Mr. Jolley in the revision and amplification of this book must have been very considerable. He will, undoubtedly, have maintained or even enhanced the reputation of his masterly work, which will remain the standard treatise on the subject of alternating current rectification.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

The official report for the week ended February 26th states that demonstration houses were opened at Derby, St. Albans, Portsmouth, and Cardiff. The last has been organised by the Ward Electric Co., and the front is a replica of the prize house. A demonstration house was to be opened at Bradford on Tuesday last, and one was to be inaugurated at Taunton yesterday (Thursday). The Derby house has been well attended, and the electrical contractors are very satisfied with the business results. A successful exhibition was opened at Halesowen on February 15th, and it is being visited by large numbers. During the current month, which is the last of the campaign, houses are to be opened at Chesterfield, Leicester, the Potteries, Birmingham, Dudley and Tamworth. The demonstration house at Sheffield has been so successful that the local circle has decided to keep it open until to-morrow (Saturday). A large increase in the demand for the competition booklet is reported, and ballot forms are reaching headquarters at the rate of over a thousand a day. During the current week the large working model of the prize house is on view at the St. Albans branch of the North Metropolitan Electric Power Supply Co.; the exhibition of the model in the showrooms of the Manchester Electricity Department led to inquiries from a large number of visitors. The North-East Coast children's competition evoked great interest and a high standard was reached in the painting competition.

The all-electric house organised by the Exeter and District Circle closed on February 19th. During the fortnight's run over 15,000 people visited the house. Special arrangements were made with the Exeter Education Committee for the purpose of demonstrating the wonders of electricity to school children. On February 24th, at a meeting of the executive committee of the Circle, the chairman (Mr. Arthur Force) presented Mr. Farthing, the G.E.C. demonstrator, with a silver cigarette case, and Mrs. Petersen, another demonstrator, with a gold wristlet watch.

At Glasgow, on Monday last, Mrs. David Mason, wife of the Lord Provost, formally opened the third all-electric house demonstration. Twenty thousand people have visited the second house at Shawlands. The latest demonstration house is a large self-contained dwelling at Hyndland, which has been specially fitted with every kind of modern electrical domestic appliance.

Aberdeen's all-electric house was opened to the public on February 22nd, and has since been visited by large numbers. The exhibition, which is to continue until March 12th, is under the auspices of the local circle comprising the Corporation Electricity Department, and electrical manufacturers, wholesalers, and contractors. Before the opening ceremony, Mr. J. A. Bell, city electrical engineer, gave a short address on the progress of electricity in Aberdeen. Recently, he said, the contractors and the Town Council had come to an arrangement whereby houses could be wired on the hire-purchase system, a method which allowed them to wire a class of house to which they would never have obtained access without that aid. That scheme had not been running a year yet, but already a sum of £4,000 had been spent in wiring houses on this basis.

Councillor Duncan, convener of the Electricity Department, also addressed the assembly. Tea was afterwards served, and on behalf of the local committee, Mr. A. McRobb presented Mr. Duncan with an electric kettle.

Trade Facilities Guarantees.

A further list of guarantees made by the Government under the Trade Facilities Acts was published recently. These guarantees, which bring the total amount to £70,721,780, include the following:—Ross-shire Electric Supply Co., Ltd. (extension of supply), £20,000; and £1,200,000 for the purchase of electrical equipment in Great Britain for a Hungarian electrical scheme. In the House of Commons on February 15th, Mr. Churchill informed Sir F. Wise that the Government had had to implement its guarantees under the Act in only five cases, involving a total amount of £34,837.

New Italian Company.

Among the companies lately formed in Italy is the Società Telefonica Elettrica Ligure-Lombarda, Milan, with a capital of 100,000 lire.

The Honduras Radio Market.

Reports indicate that the Honduras market for radio supplies, although still restricted, is becoming more important. The receipt of a British-made set has attracted much attention, supplies hitherto having come almost exclusively from the United States. The principal market for sets and components is in Tegucigalpa, the capital, with an appreciable English-speaking population. Few natives as yet own sets, but it is thought that, with well-organised propaganda, considerable progress in this direction might be made—*Reuter's Trade Service* (Tegucigalpa).

Anglo-French Industrial Conference.

The Federation of British Industries has arranged a conference with a number of leading French industrialists to take place on March 7th and 8th. The delegates from France will include M. Hecker, managing director of the French Thomson-Houston Co., and M. Dalbouze, president of the Syndicate of Machinery Manufacturers, Boilermakers and Founders of France. The principal matters down for discussion are:—The economic and fiscal treatment of nationals and companies of one country admitted to settle in the territory of the other; Customs nomenclature and classification; the organisation of production, including in particular international agreements, considered from the point of view of production, of the customer, and of labour, their legal position, and their connection with the Customs problems; the importance of the collection and prompt exchange of statistical information with regard to industrial production; and the limitation of trade fairs and exhibitions.

Hungarian Electrical Exports.

The *Board of Trade Journal* reports that during 1926 Hungary exported electrical machines and apparatus valued at 15,613,000 gold crowns, as compared with 13,982,000 cr. in 1925.

America and the British Market.

In a recent issue of *Commerce Reports*, the Electricity (Supply) Act, 1926, was reviewed at some length, and after stating that this Act and the current E.D.A.-E.L.M.A. Campaign should result in a greatly increased demand for electrical apparatus of all kinds, our contemporary says:—"It would be well for American manufacturers to strengthen or renew their operations in the United Kingdom, as, with the passage of this Act, there should be greater opportunity for the sale of electrical machinery and apparatus to industrial establishments, as well as to the homes. American firms considering competing in this market would do well to carefully analyse the conditions in the United Kingdom to find out the best methods on which to base their business. Considering the potential market for electrical apparatus in general, the future looks unusually bright for the sale of American material to the United Kingdom. If the 7,000,000 homes located in the areas of the present electricity supply undertakings were to be wired, this would in itself mean an expenditure of at least $560,000,000, a large percentage of which should be spent in trade with the United States."

New Municipal Showrooms and Offices.

The Sheffield Electricity Supply Committee has recommended to the City Council that the old telephone exchange be purchased, at a cost of £16,500, for conversion into additional showrooms, offices and stores for the Electricity Department.

German Cable Industry.

The booking of orders for lighting and power cables at the present time is said to be of small extent in accordance with the season, the works being but little employed on this branch. An increase in the orders is expected at the end of April, when the laying of cables will be resumed. The foreign trade is stated not to have undergone any change.

Another Polyglot Pamphlet.

In a recent issue we made mention of a booklet in 16 languages produced by the Brownie Wireless Co. We have now received from Mr. A. Hinderlich, 1, Lechmere Road, N.W.2, a folder dealing with piezo-electric quartz crystals in nine European languages.

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Defective Railway Material in South Africa.

The Johannesburg correspondent of the *Financial News* says that, following close on the disclosure that 13 American locomotives recently purchased were already ineffective, the *Sunday Times* announces that rails to the value of a quarter of a million pounds sterling purchased on the Continent and intended for railway replacements have been condemned. The rails were apparently passed by the oversea official, whereupon the purchase price was paid on their arrival at Cape Town. However, when the rails had been examined by engineers, they were found to be showing cracked treads, and the lot condemned as useless are now hidden in the Cape Town railway yards. The South African railways are slowly and expensively learning that British goods are best.

Local Exhibitions.

Carmarthen.—Mr. A. Preston, engineer and manager of the Carmarthen Electric Supply Co., Ltd., informs us that his company intends to hold a domestic electrical exhibition from March 28th to April 2nd, and he will be pleased to hear from manufacturers and factors who wish to take part. He states that this will be the first exhibition of its kind to be held at Carmarthen, and the furthest west in the country.

Newark.—In connection with the recently-inaugurated electricity undertaking (engineer: Mr. R. W. Willis), an exhibition is being held at the Town Hall from March 7th to 12th.

The "J. & P." Wiring System.

The accompanying illustration depicts an attractive display prepared for electricity suppliers and contractors by Messrs. Johnson & Phillips, Ltd. It comprises a three-ply board measuring 4 ft. 4 in. by 3 ft. 2 in., taking the form of a flat model of a house in bright colours. On the central board are



A "J. & P." Wiring System Display.

fixed examples of the essential features of the "J. & P." wiring system. The company has also issued an illustrated booklet relating the story of "John Green's" conversion to electricity *via* the "J. & P." system. This is arranged for overprinting—the example received bearing the name of the Barnsley Corporation Electricity Department.

Trade Announcements.

Messrs. J. H. Winter & Co., electrical engineers, of Bristol, have removed their business temporarily to Merchant Street, owing to the rebuilding of their premises in Narrow Wine Street.

The Cressall Manufacturing Co. has removed to 31 and 32, Tower Street, Birmingham.

Messrs. E. H. Hunter & Co. have removed to 68, Victoria Street, London, S.W.1.

Premier Cooler and Engineering Co., Ltd., has removed to 429, Strand, W.C.2. Telephone: Gerrard 6161.

Henrion Carbons, Ltd., has removed to Kinnaird House, 1, Pall Mall East, S.W.1. Telephone No.: Regent 3484. Telegraphic address: "Carboneros, London."

Messrs. Drake & Gorham, Ltd., have opened premises at Old Bank House, 105, High Street, Winchester.

New showroom premises have been opened by the Lichfield Agricultural Co., Ltd., Market Street, Lichfield, for the electrical department of the business.

Messrs. J. T. Bowles & Son, of 2a, York Street, Ramsgate, have taken over the management of the wireless business at the Southern Stores, 100, High Street.

Northern Steel & Hardware Co., Ltd., has removed to 1 and 3, Southgate, Manchester. Telephone: Central 4078 & 9. Telegrams: "Assiduous, Manchester."

Frigidaire, Ltd., has opened showrooms at 14, Waterloo Street, Glasgow, and 13, North St. Andrew Street, Edinburgh.

The Alton Battery Co., Ltd., has appointed the Robinson and Hands Electrical Co., Ltd., Barwick Street, Birmingham, as its Midland agents, and Messrs. Paterson & Service, 38, Bath Street, Glasgow, as its agents for Northern Scotland.

New Catalogues and Lists.

Messrs. J. Macgregor & Co., 3 and 5, Mansion House Chambers, Queen Victoria Street, London, E.C.4.—Folder giving prices of "Ferrowatt" lamps.

Messrs. Bronze Agencies, Ltd., 125, Mansion House Chambers, London, E.C.4.—List describing and illustrating in colour the "Lunina" electrically-illuminated fountains.

Mr. O. N. Beck, 11, Queen Victoria Street, London, E.C.4.—Circular describing the "Safegrip" patent drill protector.

Mr. J. S. Plumtree, 90-91, High Holborn, London, W.C.1.—Price list of cables, flexible cords and wires.

The Electrical Equipment and Carbon Co., Ltd., 109-111, New Oxford Street, London, W.C.1.—Three new priced leaflets describing respectively: V.I.R. and lead-covered cables, the "Mego-meter" insulation testing set, and "Elin" bell transformers, transformer bells and buzzers.

Foolprufe Patent Accumulator Co., Ltd., Kettering Road, Market Harborough.—List of "L"-type Lion lighting batteries, with ebonite "lattice" separators, giving dimensions, &c., unpriced. Agent for S.E. and Home Counties, Mr. St. J. Shepherd, Eastwoodbury, Southend.

Messrs. Watson & Sons (Electro-Medical), Ltd., Sunic House, 43, Parker Street, W.C.2.—"Artificial Sunlight," 1927 edition, explaining the therapeutic applications of ultra-violet rays and the apparatus employed, with particulars and prices.

Messrs. Donovan & Co., Cornwall Street, Birmingham.—List No. 1,127, a comprehensive catalogue of electrical accessories, including switches, plugs and sockets, lampholders, conduit fittings, lighting fittings, fuseboards, domestic appliances, &c. Fully priced.

Automatic & Electric Furnaces, Ltd., 173-175, Farringdon Road, E.C.1.—Catalogue Section H, dealing with "Wild-Barfield" small electric furnaces for laboratories and works.

Power Contracts, Ltd., 138 and 140, Southwark Street, S.E.1.—A net trade price list of a.c. and d.c. guaranteed motors and a pamphlet dealing with reductions in the prices of "Batwin" motors.

Messrs. Cecil Hodges & Co., Ltd.—Folders Nos. 127 and 128 illustrating and describing the "Empire" patent power pump.

Unique Patents, 388, City Road, E.C.1.—A pamphlet describing the "Unique" shade carrier and lampholder. Illustrated and priced.

Messrs. Pickerings, Ltd., Globe Elevator Works, Stockton-on-Tees.—A well-illustrated brochure describing the company's electric passenger and goods lifts.

The Lea Recorder Co., Ltd., 28, Deansgate, Manchester.—Booklet M.L. illustrating and describing a number of applications of Lea recorders in power stations, &c.

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.—An attractive cardboard cut-out advertising "B.T.-H." radio valves.

Mullard Wireless Service Co., Ltd., Denmark Street, London, W.C.2.—A "quick guide" for P.M. valves in different circuits, their operating characteristics, and a replacement chart (cardboard, 12 in. by 8 in.) which should be very useful for the trader.

Bankruptcy Proceedings.

J. G. Sandell, 20, Hart Road, and Ansell Road, Dorking, electrical contractor.—The first meeting of creditors was held recently at 29, Russell Square, W.C.1. The statement of affairs showed liabilities of £590, against assets of £79, leaving a deficiency of £511. Debtor attributed his failure to being unable to recover debts due to him and law costs incurred in that connection. In April, 1922, with £60 capital, he commenced business on his own account as an electrical engineer and contractor. The business was successful, and early in 1924 he removed to larger premises. In September, 1925, he obtained a contract for an electrical and central heating installation at a kinema in Dorking for £652. The contract was completed, but he was unable to obtain payment of a balance of £369 owing in connection with it, and debtor said that that loss was the cause of his difficulties. The case being a summary one was left with the Official Receiver as trustee of the estate. The following are creditors:—

	£		£
British Thomson-Houston Co., Ltd.	30	National Radiator Co., Ltd.	70
Curtis, P., Ltd.	25	Sufra Electrical	25
D.P. Battery Co., Ltd.	25	Thomas, F., & Co. ...	40
Dorking Electric Supply, Ltd.	25	Walworth-Munzing, Ltd.	40
General Electric Co., Ltd.	25	Wholesale Fittings Co., Ltd.	35
General Cable Co., Ltd.	60	Walsall Hardware Co., Ltd.	25

Comton Wireless Manufacturing Co. (Alexander Pacy Pacifico, Jack Pacy Pacifico, and Raphael Feitelson, trading as), lately carrying on business at 25-26, Bartholomew Square, Old Street, London, E.C.—The failure of this firm occurred in June, 1926, and on February 22nd an application for an order of discharge was made on behalf of the bankrupt Alexander Pacy Pacifico. The Official Receiver reported that the provable debts of the firm amounted to £2,252, whilst the assets, valued at £1,830, had realised

only £332, owing chiefly to the fact that the stock-in-trade, purchased for £1,250, had yielded only £275. A dividend of 1s. 6d. in the £ had been paid. The bankrupt gave up his business of a fancy goods importer to join the above partnership in March, 1924; they traded successfully until February, 1926, when the business was adversely affected as a result of the general slump, and it was subsequently carried on at a loss. In March, 1926, with the object of obtaining additional capital with which to tide over the slump period and to develop the export side of the business, which was commenced in September, 1925, they endeavoured to obtain £3,000 in the form of investments in the business, but owing to the general strike intended investors withdrew before the negotiations could be completed. In June, 1926, judgment creditors levied execution on the stock and effects, and the business came to an end. The application was opposed by the Official Receiver upon statutory grounds, including unjustifiable extravagance in living and giving undue preference to a creditor. His Honour upheld the report of the Official Receiver, and granted a discharge subject to a judgment for £5 to be satisfied by an immediate cash payment.

E. W. Kirk, lately trading as the Ace Radio Manufacturing Co., 26, Curzon Street, Derby, wireless apparatus maker.—The first meeting of creditors was held on February 24th at the Official Receiver's offices, Nottingham. The statement of affairs showed gross liabilities of £290, of which £285 was expected to rank, and there was a deficiency of £269. Debtor attributed his failure to bad trade accentuated by the coal dispute, to the fact that bigger makers were undercutting, costs on writs, &c. It appeared that he patented a special coil and in October, 1924, with £50 capital in cash and materials, he commenced business on his own account to work the patent. The business was successful at first, but subsequently, owing to a reduction in prices, he was unable to compete. In June, 1926, he sold the patent for £75. Creditors pressed, and several judgments were obtained, and he filed his petition. The matter was left with the Official Receiver as trustee.

C. J. Nichols (C. J. Nichols & Co.), electrical engineer, 7, Park Street, Bridgend.—Last day for proofs for dividend, March 11th. Trustee, Mr. G. G. Poppleton, 26, Corporation Street, Birmingham.

S. T. Hosken, wireless accessories manufacturer and factor, 153, Fleet Street, E.C.—Bankrupt's discharge suspended until January 28th, 1928.

J. E. W. Archer, wireless dealer, &c., late of 259, Crookes, Sheffield.—Last day for proofs for dividend, March 14th. Trustee, Mr. L. J. Clegg, Official Receiver's offices, 14, Figtree Lane, Sheffield.

A. H. Richardson (Radio Supplies), wireless manufacturer, 4, Rose Hill, and Wellingborough Road, Finedon, Northampton.—Receiving order made February 18th on debtor's own petition.

J. Humphreys, plumber and electrical engineer, 1, Yard Behind the Plough Inn, Oldham Road, Rochdale.—Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester, released February 17th.

J. R. Charnock, cycle dealer and electrical engineer, Meanwood Road, Meanwood, Leeds.—First and final dividend of 17s. 3d. in the £ payable March 17th at the Official Receiver's office, 24, Lower Bond Street, Leeds.

G. W. Tempest (Northern Radio Co. and the General Wireless Trading Co.), radio and telephone engineer, 12, Sandhurst Road, Stockport, 40, Brazennose Street, and Arcade Chambers, Manchester, and Commercial Street, Leeds.—First and final dividend of 11d. in the £ payable at 27, Brazennose Street, Manchester.

Company Liquidations.

J. P. Castle & Co., Ltd., 72, Shoe Lane, London, E.C., electrical engineers, &c.—A meeting of creditors was held on February 23rd at 50, Gresham Street, E.C., when a statement of affairs was presented, which showed liabilities of £573. The net assets were £87, and the deficiency was £482. It was reported that the company was registered at the beginning of last year with a nominal capital of £2,000, of which £1,512 had been issued and was fully paid. The vendor was allotted shares of the face value of £1,000, fully paid, whilst shares for £512 were issued for cash. No trading figures had been prepared, but the turnover had probably been about £100 a month. The meeting appointed the principal creditors to act as a committee in conjunction with the liquidator. The following are creditors:—

	£		£
Baxter & Caunter, Ltd.	179	Crane, Bennett & Co. ...	26
Blair, J. F.	20	Girling, L.	70
Chloride Electrical Storage Co., Ltd.	54	Wright, William, & Co.	53

Claremont, Johnson & Co., Ltd., electrical and wireless factors, 4, Union Place, Wells Street, Oxford Street, W.1.—A meeting of the creditors of this company was held on February 28th, at Winchester Street, E.C. The chair was occupied by Mr. W. J. Hodge, one of the joint liquidators. The statement of affairs presented disclosed liabilities of £4,808, and assets, after allowing £214 for preferential claims and £2,545 for loans on debentures, of £4,627, leaving a deficiency of £181. The assets included stock-in-trade £2,650, and good book debts £3,275. Mr. Hodge stated that the company was formed in July, 1922, with a nominal capital of £4,000, to acquire a business formerly carried on under the style of Claremont, Johnson & Co., and to carry on the business of importers and manufacturers of electrical apparatus, the consideration being £906, satisfied by the issue of fully paid £1 shares. The capital had been increased from time to time and the paid-up capital to date was £2,606. There were 1,500 shares, on which 10s. each remained unpaid, but £200 had been paid in advance in respect of them, leaving the unpaid calls to date £550. For the year to March, 1923, the turnover had been £14,903, and there was a net profit of £491. In the following year the turnover was £25,125, and there was a profit of £414. For the year to March, 1925, the turnover was £43,872, and there was a profit of £1,074. In the following year the turnover was £30,976, and there was a loss of £1,373. The liquidator stated that the debenture holder was Mr. David Cohen, whilst he (the chairman) had been appointed receiver on his behalf. He was also a director of the company. When the company took over it agreed to pay the liabilities then existing. The liabilities in the balance sheet of March, 1926, were £7,357. The assets were approximately £9,000. The debentures were created on October 22nd, 1926. An interim statement got out at that time showed a loss of about £500 or £600. A Leeds branch of the business was started just prior to the coal dispute, and that was being continued by the receiver, as was the London business, with a view to a sale as a going concern. The liquidator had had no definite offer at the present time. Mr. Hodge intimated his willingness to resign in favour of Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C., who was appointed joint liquidator, with a committee of five of the principal creditors.

With reference to the above matter, The Castellina Co. (1926), Ltd., of 52, Great Marlborough Street, London, W., has written to us under date February 28th, as follows:—"It appears that many people in the trade are under the apprehension that The Castellina Co. (1926), Ltd., is connected with the firm of Claremont, Johnson & Co., Ltd., now in liquidation. May I point out that the two companies were actually competitors. Although Mr. Claremont and myself were originally directors of Claremont, Johnson & Co., Ltd., neither of us has taken any management in the latter since we left its employ some considerable time ago.—G. W. Johnson, Managing Director."

Orlings Telegraph Instruments Syndicate, Ltd.—Winding up voluntarily. Liquidator, Mr. H. Hagon, 15, Grosvenor Mansions, 82, Victoria Street, S.W. A meeting of creditors was held at the liquidator's offices on March 3rd.

St. Helens Electric Lighting Co., Ltd.—A meeting of members is called for March 25th at Broad Sanctuary Chambers, Tothill Street, S.W., to hear an account of the winding up from the liquidator, Mr. C. H. Jones.

Presland Electric Supplies, Ltd.—A meeting of members is called for March 28th at 84, Eden Street, Kingston-on-Thames, to hear an account of the winding up from the liquidator, Mr. W. Bronson.

Neutron, Ltd.—The first meetings of creditors and contributories were held on March 3rd at Carey Street, W.C.

Dissolution of Partnership.

Glaisher & Dives, dealers in photographic and wireless supplies, 14, George Street, Croydon.—Mr. W. R. Glaisher and Mr. F. V. Dives have dissolved partnership. Mr. Glaisher will attend to debts and continue the business.

Our Electrical Machinery Markets.

With the January trade returns, the Board of Trade resumed the practice of giving details of the destination of electrical machinery exported from this country. The following table shows the distribution of this machinery, and the figures for January, 1926, are also given, with a note of increases or decreases:—

Destination.	Jan., 1926. £	Jan., 1927. £	Inc. or dec. £
European countries	48,757	71,691	+ 22,934
Japan	18,042	36,293	+ 18,251
South America ...	55,501	31,147	− 24,354
South Africa ...	47,892	148,393	+100,501
British India ...	102,131	126,451	+ 24,320
Australia	85,738	66,667	− 19,071
New Zealand ...	32,703	52,603	+ 19,900
Canada	8,730	17,510	+ 8,780
Other countries ...	74,076	62,568	− 11,508
Totals ...	£473,570	£613,323	+£139,753

The Census of Production.

A preliminary report upon the results of the third Census of Production appeared in last week's *Board of Trade Journal*. These deal with the iron and steel trades, and interesting details are given of production in 1907 and 1924, employment, the use of power, &c. The report is the first of a series which, are, presumably, to be published as supplements to the *Journal*.

Prices of Raw Materials.

Reporting on February 26th, Messrs. James Forster & Co. state: "Closing prices of lead yesterday were £28 2s. 6d. for February, and £28 10s. for May, a rise on the week of 10s. per ton. . . . The prospect is for continued firm markets, accompanied by a larger consumption of lead, and a probable small decrease in supplies."

Messrs. F. Smith & Co. report, March 1st: Copper (electrolytic) bars, £63 5s., 55s. inc.; ditto ditto sheets, no change; ditto ditto wire rods, £73 5s., 30s. dec.; ditto ditto h.c. wire, 9¼d., ¼d. inc.; silicium bronze wire, 10¾d., ⅛d. dec.

Messrs. James & Shakespeare report, March 1st: No change in the prices for copper bars (best selected), sheet and rod; English pig lead, £30, 10s. inc.

Messrs. Edward Till & Co. report, March 1st: India-rubber, Para fine, 1s. 4½d., ¾d. inc.

Big Cable Company Deal.

Mr. W. Emlen Roosevelt, chairman of the board of directors of All-America Cables, Inc., and Mr. S. Behn, president of the International Telephone and Telegraph Corporation, made the following announcement after the meetings of their respective boards held on February 23rd:—The International Telephone and Telegraph Corporation has authorised an offer to issue its stock in exchange for All-America stock at the rate of four shares of International stock for three shares of All-America stock, and the board of All-America Cables, Inc., has recommended the acceptance of the offer. The offer contemplates that the All-America stock shall be deposited with a committee nominated by the board of All-America Cables, under a deposit agreement authorising the transfer of the deposited stock to the International Co., when, in order, depositors are to receive certificates of deposit. Messrs. J. P. Morgan & Co. are to be the depositaries of the committee, and the certificates will be registered by the Central Union Trust Co. Further details of the offer will be communicated in a circular presently to be issued by each of the corporations to its stockholders. The consummation of the transaction will require a deposit under the agreement of an amount of stock deemed sufficient by the International for its purposes. It is stated that the successful operations heretofore of each of these corporations in the field of electrical communications will be materially furthered by the affiliation above proposed. The present members of the board of All-America Cables have been requested to continue as such, and certain of these directors will be elected to the board of the International Co. Mr. Merrill, as president, and the other officers and staff of All-America Cables, are to continue in its management. Representatives of the International Co. will be elected to the board of All-America Cables in due course.

Deed of Assignment.

J. B. Braby, electrical engineer, 87, Maybury Road, Woking.—Particulars of claims by March 22nd to Mr. W. A. J. Osborne, trustee, Balfour House, Finsbury Pavement, E.C.

Australian Tariff Decisions.

The duties on certain electrical appliances have recently been decided by the Australian Tariff Commissioners as follows:—Static oil-immersed condensers: free under the British preferential tariff; 5 per cent. under the intermediate tariff; and 10 per cent. under the general tariff. Similar rates apply to electrically-driven human hair-clipping machines, automatic voltage regulators, and auto-synchronous electric motors. Electrically-heated cotton, wool, &c., testing ovens and auto-valve lightning arresters are admitted free of duty under all three tariffs.

Book Notices.

Scientific Papers of the U.S.A. Bureau of Standards, No. 542, "Electric Field of a Charged Wire and a Slotted Cylindrical Conductor" (10 cents).

"The Age of the Earth," by A. Holmes. Pp. 79. Price 6d.; "Modern Scientific Ideas," by Sir Oliver Lodge, F.R.S. Pp. 79. Price 6d. London: Ernest Benn, Ltd.

"Science Abstracts" (A and B). Vol. XXX. Part 2. February 25th, 1927. London: E. & F. N. Spon, Ltd. Price 3s. each.

"Electric Locomotives," by R. H. Wright. Pp. 32; illustrated. London: Association of Engineering and Shipbuilding Draughtsmen. Price 2s.

"Sell's Registered Telegraphic Addresses for 1927." London: Business Dictionaries, Ltd. Price 45s.—This Directory for 1927 is published in a new form so that it can be more easily handled, a broader page has been used and several new features have been incorporated. Chief among the improvements is a system of reference by which the telegraphic address of any firm can at once be found or, *vice versa*, the firm owning any known telegraphic address. Each name has been given a code number, so that in the text of a telegram or cable it may be referred to by number, while the indexing system enables the user instantly to find the number of any firm, or the firm represented by any known number. The classified trade list of 130,000 names and addresses has been rearranged and made more complete, and forms a comprehensive guide to the chief firms in every branch of business throughout Great Britain and Ireland.

"Waterworks Pumping Plant" is the title of a brochure issued by Messrs. Mather & Platt, Ltd., Manchester, dealing with some interesting schemes in various parts of the world where centrifugal pumps are employed. Naturally, electric driving is often adopted for this purpose, but steam turbines and oil engines are sometimes used, and examples of all these are found in this well-illustrated publication, working under a variety of conditions.

"Atomic Theory," by A. Haas. Pp. xiv+222; figs. 56. London: Constable & Co., Ltd. Price 10s. 6d. net.

For Sale.

Burton-upon-Trent Electricity Department has for disposal one 2,000-kW Westinghouse high-pressure turbo-alternator, with surface condenser and auxiliaries. The South London Merchandise Mart will sell by auction on March 10th, at 10, Red Lion Passage, Red Lion Square, W.C., the stock of an electrical and wireless factor. (See our advertisement pages to-day.)

Recent Contracts.

Messrs. Stuart Turner, Ltd., Henley-on-Thames, have just delivered to the Post Office two generating sets for battery charging, the output being 2.28 kW. The engines are of the company's standard two-cylinder, 4-stroke type, direct coupled to "Bull" generators. The sets are fitted for running on gas, but stand-by petrol carburettors are also supplied. A 500-W set has also just passed tests by the Post Office engineers. This plant is identical with the standard "Stuart" country-house plant. These sets are additional to the contract for eighty 120-W sets now going through the works.

Messrs. J. Blakeborough & Sons, Ltd., have received an order for equipment for controlling the water supply to four turbines, aggregating 126,000 h.p., which are being installed on the Sho River, Japan, by the Nippon Electric Power Co. The equipment comprises four "Larner-Johnson" valves, weighing over 50 tons each, to work under a head of 176 ft. They will be 11 ft. in diameter.

Among the orders which Messrs. Yarrow & Co., Ltd., have in hand for their boilers are the following:—Three further h.p. boilers for the Barking station of the County of London Electric Supply Co., Ltd.; three boilers for the Portsmouth Dockyard power station; and four for the City of London Electric Lighting Co., Ltd.

Social Events.

The Social and Athletic Club of Standard Telephones and Cables, Ltd., New Southgate, has recently held several successful functions. The first of these was a whist drive at the works canteen, about 140 being present. After whist, dancing took place to the accompaniment of the works band. The works "Black and White" concert party gave a show before 400 people at a later date; the items, serious and humorous, were greatly appreciated. On Friday last a dance was held at the Alexandra Palace, about 500 attending. A number of future events have been arranged.

Bermondsey Strike Settled.

The strike of workers in the Bermondsey electricity undertaking was settled on February 24th, the man who was the cause of the dispute being transferred to another department.

Unemployment.

Unemployment is still decreasing; during the week ended February 14th the number of unemployed fell by 33,290. The total at that date was 1,270,200, as compared with 1,303,490 on February 7th and with 1,139,228 on February 15th, 1926.

British Representative in Brazil.

It is announced by the Department of Overseas Trade that the address of the Commercial Secretary in Brazil (Mr. E. Hambloch) is now: Rica Municipal 4, Rio de Janeiro.

Lighting and Power Notes.

Asia Minor.—New Power Station.—The Société des Tramways Smyrne-Gueuztepe has commenced the construction of a new power plant at Daragatch. The plant will have an initial capacity of 5,000 h.p. and an ultimate capacity of 30,000 h.p. Electricity will be transmitted by underground cables from Daragatch to Bahri Baba, where it will be stepped down from 6,000 to 600 V.

Australia.—Victoria.—Plans for a new generating station at Richmond are now being prepared by the Victorian Electricity Commission, following authorisation from the Attorney-General at the end of last year. Examination of the Melbourne Electric Supply Co.'s equipment, it is stated, shows that the boiler plant is highly efficient, and in excellent order, and will be available for use in the new power station. The old generating machinery of the company, however, is only adapted for single-phase working, and is unsuitable. Tenders for the supply of the new generating machinery will be called for as soon as the new specifications are completed.

Devonport (Tasmania).—The hydro-electric supply for the North-West was recently formally inaugurated by the State Governor at Devonport. The general manager of the department reports that the State now generates approximately 60,000 h.p. The extension to the North-West has cost £154,000, and there are prospects of the paper pulp industry coming to Burnie at an early date, justifying a further extension. The system will be paying its way this year, and the revenue expected is £262,000. The department does not expect any profit from the north-western extension at present, but it is anticipated that the farmers will use it as they are doing in the midlands and south.

Aylesbury.—Loans.—The Town Council has received sanction to a loan of £3,000 for domestic electrical apparatus to be let out on hire, and is to apply for sanction to a further loan of £15,406 for additional work required in connection with the rural electricity scheme.

Birmingham.—Price Reductions.—The charges for l.p. supplies of electricity are to be reduced by ½d. per kWh after the reading of meters for the March quarter.

Brightlingsea.—Electricity Supply.—The Urban District Council has requested the Colchester Corporation Electricity Committee to meet it to discuss the question of an electricity supply for the town. The County of London Electric Supply Co., Ltd., which is seeking powers to supply electricity in bulk to authorised undertakers in the county, has suggested that the Council should apply for its own Order as distributor. Mr. W. T. Warren has informed the Council of his intention to apply for an Order to supply electricity to the town, and states that he is willing to give the Council the right to purchase his undertaking within the next two or three years, or at the end of 21 or 30 years.

Brighton.—Loans.—The Electricity Committee has recommended that application be made for sanction to the following loans: £50,000 for mains and services; £2,000 for additional cooking and heating apparatus; £13,428 to cover excess expenditure on work at present being carried out.

Chesterfield.—Loans Sanctioned.—The Corporation has received sanction to the following loans: Mains and services, £55,311; hire-purchase wiring installations, £12,353; meters, &c., £11,174.

Continental.—Italy.—A scheme is in hand for the construction of important hydro-electric works in the Val Borbera, which will supply energy for the electrified part of the State railway system. There will be two power stations known as the Persi and the Pian-della-Botte. At the Persi station three sets, of 9,000 kW each, will be installed. The plant at the Pian-della-Botte station will include three sets, each of 4,500 kW.—*Reuter's Trade Service* (Milan).

Germany.—The United Westphalian Electricity Works Company, of Dortmund, has been occupied for a year past in gradually adapting its four generating stations to the use of pulverised coal, and for this purpose the company a little time ago acquired the Alte Haase and Gottessegen collieries. In order to extend the coal basis, the company has now obtained the majority of the shares in the Kleine Windmuhle colliery.

France.—An arrangement has recently been concluded between the Société de l'Electricité de Caen, whose distribution system extends into part of the Department of Calvados, and the Société de Distribution d'Electricité de l'Ouest and the Société des Gaz et Eaux which supply electricity to the Departments of Orne and La Manche, under which the generation of the electricity required for the three Departments will be centralised at the new station which has recently been erected on the banks of the canal at Caen. The three concerns have been amalgamated under the title La Société de l'Union Electrique de l'Ouest, and orders have been placed for the installation of an additional 12,000-kW turbo-generator at the power station.

Switzerland.—As part of the scheme for the completion of the Barberine-Vernayaz hydro-electric power station, the Swiss Federal railway authorities have been engaged for some time past on the erection of a power transmission line between Vernayaz and Rapperswil, with connections to the substations at Puidoux and Kerzers for the supply of electricity for the electrified railways in West Switzerland. The line has for some time past been in operation as far as Puidoux, but energy is now being transmitted over the full length of the line, which is estimated to have cost about £760,000.

Dorking.—Electricity Supply.—The Urban District Council has granted a further lease of the electricity Order to Messrs. Edmundson's Electricity Corporation, Ltd. The charge for lighting is to remain at 10d. per kWh, but the charge for heating and power is to be reduced from 6d. to 3d. per kWh.

Dover.—Electricity from Barking.—It is reported that the Electricity Commissioners have intimated to the Town Council that an electricity supply for the town is to be obtained in bulk from the Barking power station, with another station at Richborough. The change will probably be made in the next three or four years.

Dundee.—Electricity Extensions.—The Corporation electrical engineer (Mr. D. H. Bishop) has reported that during last December the capacity of the rotary convertor plant supplying the central area was heavily taxed, and extensions were now necessary to meet the increasing demand for electricity. The erection of sub-stations at a cost of £25,470 is proposed. Sanction has been received to the borrowing of £250,000 for extensions.

Guildford.—New Power Station.—The foundation stone of the new Corporation power station was laid by the chairman of the Electricity Committee on February 28th. The estimated cost of the station is £140,000, and it is hoped that it will be completed in October next.

Hornsey.—Extensions.—The Electricity Committee is to lay additional feeder cables at a cost of £6,500, and to extend the plant at Highgate sub-station at a cost of £1,500.

Horsham.—Year's Working.—The accounts of the Urban District Council's electricity undertaking (engineer: Mr. F. Ffrench) for the year ended March 31st last show a total revenue of £13,981, as compared with £12,716 in the preceding year. Working expenses increased from £6,678 to £7,661, leaving a gross profit of £6,321, as against £6,038. After deducting interest, capital expenditure charged to revenue, &c., there was a net surplus of £2,383, which was transferred to the district fund. The previous year's working resulted in a surplus of £1,622. The sales of electrical energy increased from 655,345 to 746 013 kWh, and the average price per kWh obtained fell from 4.35d. to 4.10d.

Huddersfield.—Opposition to Bill.—The Town Council is to oppose the Bill which is being promoted by the Yorkshire Electric Power Co.

New Plant.—The Electricity Committee has received sanction to the extension of the generating station by the installation of one 5,000-kW, 3-phase, 50-cycle turbo-alternator.

Lancaster.—Electricity Charges.—The Electricity Committee has announced that it does not propose to make any increase in the charges for electricity to meet the higher cost of coal.

Liverpool.—Contributions to Rates.—The sum of £100,000 is to be allocated by the Tramways and Electric Power and Lighting Committee towards the relief of next year's rates. The quota from the Tramways Department is £75,000, and from the Electricity Department £25,000.

London.—Islington.—The Lighting Committee has recommended the withdrawal of the increase of 10 per cent., imposed during the coal dispute.

Hackney.—The Finance Committee has recommended that application be made for sanction to a loan of £15,000 for cooking and other domestic appliances to be let out on hire.

Poplar.—The Electricity Committee has reported that the new generating station is nearing completion and will shortly be put into commission. As this is the first complete station of its kind to be erected in England, an opening ceremony is proposed, and Sir Andrew Duncan is to be invited to perform the ceremony. The Committee has received sanction to loans totalling £50,000 for electricity purposes.

Macclesfield.—Appointment of Consultants.—The Electricity Committee has recommended to the Housing Committee that Messrs. Merz & McLellan be instructed to prepare a comprehensive report upon the present electricity supply to the town and their recommendations as to a scheme for the future development of such supply. It is understood that the report will take six weeks to prepare. The Housing Committee has approved the recommendation.

Manchester.—Proposed Change-over.—The Corporation has given notice of its intention to apply for consent to alter the system and pressure of electricity supply from 3-wire d.c., 200 and 400 V, to a.c., single-phase, 230 V and 3-phase, 400 V.

Newbury.—Opposition to Bill.—The Town Council has decided to oppose the Bill of the Wessex Company on the grounds that it has power to purchase the undertaking of the Urban Electric Supply Co., Ltd., in 1943, and that in the Bill there is provision that the company will by agreement purchase the undertakings in its area.

Portland.—Special Order.—The Urban District Council has instructed its consulting engineers to take the necessary steps in conjunction with the Parliamentary agents to obtain a Special Order authorising it to supply electricity in the area.

Portsmouth.—Electricity Charges.—The Electricity Committee has recommended that the charges for electricity be reduced to those in force prior to the coal dispute.

Extension of Supply.—The Farnham Rural Council has requested the Corporation to extend the mains to six parishes in its area.

Rhyl.—Wiring of Small Houses.—According to the *Manchester Guardian*, with the rapid development of the district and the bulk supply of electricity to the Council's works from Dolgarrog, the Council has introduced a scheme for the "free" wiring of the smaller residences. Subject to the consent of the Electricity Commissioners, the Council will wire houses free of cost, and charge an extra 2d. per kWh for electricity consumed through prepayment meters until the amount received has covered the cost of the installation.

South Africa.—Electricity Supply Commission.—Arrangements have now been concluded between the Railways and Harbours Board and the Electricity Supply Commission whereby the latter body takes over as from January 15th last the generating station at Colenso, together with the transmission lines and automatic sub-stations at present supplying the railway between Glencoe and Pietermaritzburg, as well as a few of the principal towns along the route. Mr. T. P. E. Butt is the engineer to the Commission in charge of Northern Natal Section.

Durban.—The last addition to the municipal power station, comprising a Metropolitan-Vickers 5,000-kW set, and a Babcock & Wilcox 60,000-lb. boiler, has recently been put into service, and will meet the anticipated demand until the new Congella power station of the Electricity Commission is put into operation in 1928. The domestic load is increasing rapidly, and the recent six months' publicity campaign to popularise electric cooking and heating apparatus resulted in the installation during the six months of 632 cookers and 402 heaters.

Swansea.—Proposed New Station.—It is stated that the Town Council, after discussing a report of the deputation which recently waited on the Electricity Commissioners for guidance as to the attitude the Commissioners may adopt with regard to the erection of a super-power station to replace the present electricity works, has decided, in view of the fact that a larger generating station will in any event have to be provided to meet the future demands, to exercise an option already obtained on a site at Morriston on which to erect the first section of a station. The cost of this section is estimated at £500,000.

Swinton and Pendlebury.—Change-over.—The Urban District Council has decided to change over the electricity supply from the Bridge Street sub-station from d.c. to a.c. The approximate expenditure will be £69,000.

United States.—Electrical Development.—According to *Power*, work on the installation of the first 100,000-kW set of the new Long Beach steam plant No. 3 of the Southern California Edison Co. is to begin at once. Present plans call for the eventual installation of eight such sets, which will bring the total capacity of the entire Long Beach steam plant to more than 937,500 kW. This first set is to be ready for operation February 1st, 1928, and is to cost, together with necessary transmission and distribution equipment, approximately $7,000,000.

The American Gas & Electric Co. announces the purchase for the Philo plant of the Ohio Power Co. of a steam generating set rated at 165,000 kW. The installation of this set, complete with boilers, coal-handling apparatus and h.p. transformers, calls for an expenditure of approximately $17,000,000, and will raise the capacity of the Philo plant to 245,000 kW. This station, with the Windsor, Twin Branch, Cabin Creek, Kenova, Glen Lyn and Logan plants, feeds one h.p. transmission system which extends from Michigan through Indiana, Ohio and West Virginia to southern Virginia and Tennessee on the south and the Ohio River on the east, and is interconnected with the Chicago, Toledo, Cleveland and Pittsburgh lines, making it one of the largest interconnected power systems in the world.

West Ham.—Proposed Electricity Extensions.—The borough electrical engineer (Mr. F. W. Purse) has submitted a report to the Electricity Committee on the future development of the electricity undertaking. He states that there is sufficient accommodation in the engine house for the installation of two turbo-alternators with a rated capacity of 16,000 kW and a maximum continuous overload of 20,000 kW, and in the boiler house four 100,000-lb. water-tube boilers could be installed. When this plant is fully loaded, and if a further supply from the power station is desirable, three of the sets at present installed could be replaced by plant of double the capacity, *viz.*, 50,000 kW instead of 25,000 kW, making a grand total of 110,000 kW installed capacity. The cost of the extension is estimated as follows:—Generating plant, £143,000; boilers and accessories, £120,000; cooling towers, £12,000; switchgear, £10,000; foundations, &c., £25,000; pipework, £10,000; total, £320,000. The scheme would be carried out in two stages, and the first set would be installed in time to meet the winter load in 1929, which it is expected will be 34,500 kW. The second section of the work would be put in hand three or four years later, depending upon the rate of increase in the load. The estimated cost of the first section is £160,000. The report has been adopted by the committee, and application is being made to the Electricity Commissioners for sanction to carry out the extensions. The London and Home Counties Joint Electricity Authority is being given notice of the application.

West Midlands.—Electricity Supply.—The expenditure of £3,600,000 recently sanctioned by the West Midlands Joint Electricity Authority, is for the following purposes: Purchase of generating stations, £1,500,000; mains £400,000; sub-station switchgear, &c., £300,000; Ironbridge generating station, £1,250,000; Ocker Hill extension, £150,000.

Wirral.—Institution Supply.—At a recent meeting of the Board of Guardians, it was decided to ask the president of the Liverpool Engineers' Society for advice as to whether it would be more beneficial for the Guardians to take a supply from the Birkenhead Corporation for their institutions or to generate electricity themselves.

Tramway and Railway Notes.

Continental.—Hungary.—The Budapest correspondent of *The Times* reports that a contract has been signed by the Hungarian Government and representatives of a group of English capitalists known as the Talbot group. This group proposes to erect a large electric power plant in Hungary, at Banhida, for the electrification of the railway, Budapest-Hegyeshalom, the Hungarian section of the Budapest-Vienna line. The same plant would supply the Hungarian capital and the towns in the territory between Budapest and Banhida with electricity. The capital is estimated at about 60,000,000 pengoes (£2,200,000), and is to be provided by the English group under the guarantee of the Trade Facilities Act. It is said that 40 per cent. of this capital must be spent in the English market for machinery and other material necessary for the erection of the plant.

Spain.—Work is shortly to be commenced on the electrification of the railway between Barcelona and San Juan de les Abadesas.

France.—A scheme to replace the tramway between Cannes and Grasse by a railless-car service is under consideration. The tramway track and rolling stock are worn out, and it is considered that it will be cheaper to adopt railless cars than to endeavour to renew the existing plant.

Germany.—Work is well in hand on the electrification of the last section of the railway between Laubau and Breslau, Silesia, a distance of about 130 miles. To meet the increased demand for electricity, the central station at Mittelsteine is being extended to a capacity of 24,000 kW. A sub-station is also to be established at Mettkau.

Switzerland.—Plans have been prepared by the Berne Alpenbahn Co. for the electrification of the railway between Berne and Neuenberg. The cost of the work is estimated at approximately £272,000, half of which, it is suggested, should be furnished by the Swiss Government and the remaining half provided by the authorities of the Cantons of Berne, Neuenberg, and Freiberg.

Czecho-Slovakia.—A scheme is reported to be under consideration for the construction of an underground electric railway in Prague.

Halifax.—Fares Revision.—The Tramways Committee has recommended considerable changes in the tramway fares, with special privileges for long-distance passengers. It is proposed that the 1½d. fare in the town should be increased to 2d., but that a maximum of 3d. be charged for distances beyond the 2d. stage. This means that the fare for the longest stage (from Hebden Bridge, a distance of 7½ miles) will be 3d. instead of 9d.

Telegraph and Telephone Notes.

Australia.—"Beam" Radio-telegraph Tests.—We are informed by Marconi's Wireless Telegraph Co., Ltd., that in a statement telegraphed to London Amalgamated Wireless (Australasia), Ltd., announces that during the past three weeks the "beam" wireless station has been thoroughly readjusted and retested with very satisfactory results. During two days (February 23rd and 24th) beam signals from England were heard in Australia throughout the 24 hours, and two-way communication at speeds ranging from 250 to 3,000 letters per minute has been established daily for several hours on end, the maximum speeds being equal to those obtained on the relatively short-distance beam between England and Canada and higher than any other long-distance telegraph system operating to-day. During a continuous test of seven days the average traffic capacity exceeded 60,000 words per day in each direction, or approximately three times the minimum required in the latest agreement between the Commonwealth Government and Amalgamated Wireless (Australasia), Ltd. Communication tests are being continued, and negotiations are proceeding in relation to finalised traffic arrangements. As soon as these are completed and the British official tests are finalised the service will be opened for public traffic.

France.—International Telephony.—Paris is already well linked with the rest of the Continent by telephone, but improvements will shortly be made which will greatly facilitate international communication, especially with Great Britain. At present 18 circuits link France with Britain, 15 exist between France and Belgium, and 2 between France and Holland; before the end of the year this number will be increased to 21, so far as Britain is concerned, and additional lines are to be laid to facilitate communication with Holland and Belgium. The new Paris-Boulogne-London cable, which is to be completed before the end of the year, will permit of 100 simultaneous telephone communications between the two capitals. Additional lines are being constructed between Paris and Turin, Bale, Zurich, Berne, Geneva, Frankfort, Berlin, Lausanne, Mayence, Cologne, Hamburg, Prague, and Vienna.

The opening up of the new Paris-Milan circuit will permit of telephone communication between Paris and Venice. The Paris-Mulhouse cable has just been linked with the Swiss system, and will shortly also be connected with the German system at Appenweier (Grand Duchy of Baden). A system of relays will shortly enable Paris to communicate with Stockholm and Copenhagen *via* Berlin, and with Budapest *via* Frankfort and Vienna.—*Reuter* (Paris).

Greece.—Telephone Service.—It is announced that the Siemens and Halske Company has acquired 80 per cent. of the capital of the Greek Telephone Company, the former's investment being stated to amount to 10,000,000 marks. The so-called German telephone system is to be introduced into Greece.

Spain.—Radio-Telephony.—The newspapers report that the Government will shortly sign an agreement with the Argentine Radio Company for the establishment of direct wireless communication between Madrid and Buenos Aires by means of the station at Madrilene, Prado del Rey, which is one of the most powerful in existence. The service will probably be opened in six months' time, and later direct wireless telephone and radio-photographic communication will be established. Experiments which have already been made are stated to have been very successful.—*Reuter* (Madrid).

The Telephone Service.—Gloucester Automatic Exchange.—Gloucester City's telephone system has been changed from manual to automatic operation. The automatic equipment, together with the associated manual switchboard still necessary to preserve intercommunication with areas outside the city, has been manufactured and installed to the specification of the Engineer-in-Chief's Department of the Post Office by the Automatic Telephone Manufacturing Co., Ltd., the present capacity of the automatic equipment being 1,500 lines with provision for ultimate expansion to 2,700 lines. The system is 4-digit, and the first selectors are equipped with a digit-absorbing feature and 600-point banks. The object is to enable the first selectors to function as second selectors when subscribers whose numbers lie in the 2,000 group are required: when the first digit 2 is dialled, the shaft ascends, carrying the wipers to the second level, but before it can cut in to this level the mechanism is automatically released, and a relay prepares the bottom line bank wipers for the next digit. The digit-absorbing feature is now cut out for the remainder of the call and the selector functions normally. For example, should the second digit be 2, the shaft again ascends with wipers to the second level, cuts in, selects an idle trunk, and extends the connection *via* the bottom bank to a final selector on the 2,200 unit. Special traffic meters have been installed to enable statistics to be compiled for future guidance. On the manual switchboard suite six operators' positions were already existing, and sections have been added to bring the capacity up to present requirements. The main batteries, of Chloride Electrical Storage Company's manufacture, have a capacity of 756 ampere-hours. The charging motor-generator has an output of 95 amperes at 57 volts, and the ringing dynamotors are in duplicate, one designed to run off the supply mains, and the other off the exchange battery in series with an impedance coil: automatic change-over facilities ensure maintenance of ringing current. Supervision is of the usual high order. A one-position test desk and a one-position supervisor's desk complete this latest successful addition to the Post Office's rapidly growing list of provincial A.T.M. (Strowger) equipped exchanges now in active operation. The Gloucester automatic exchange was cut into public service on February 12th, the city's population being 51,330, so that there is approximately one telephone to every 34 inhabitants.

Letchworth System.—The telephone system at Letchworth was changed to full common-battery working on February 23rd, when a new No. 10 switchboard was brought into use, replacing the old c.b.s. system. The new switchboard has initial equipment for 600 lines and was made and installed by Siemens Brothers & Co., Ltd.

Transatlantic Radio-telephony.—Service Extension.—Recent extensions of the transatlantic radio-telephone facilities have made the service available from any place in Great Britain to any place in the United States of America.

Germany.—Some days ago the London telephone authorities invited the German officials in the Frankfurt-am-Main exchange to try to establish communication with New York *via* London. The line proved to be excellent, and the experiment has since been repeated. A report on these two experiments has been sent to the Reichs Ministry, says *The Times*, and application has been made for the institution of a regular service.

Holland.—The Hague correspondent of *De Telegraaf* understands that the Netherlands Post and Telegraph Administration intends shortly to undertake experiments with the object of establishing wireless telephone communication with North America *via* London and New York by means of the short-wave Marconi "beam" system. It is proposed to link up with the existing London-New York wireless telephone service by means of the submarine cable between Holland and Great Britain.—*Reuter* (Amsterdam). [There seems to be some confusion between the Marconi "beam" telegraph and the London-New York telephone services.—Eds.]

Radio Notes.

Germany.—Advisory Committees.—"Not supervision but promotion of broadcasting" was the motto suggested by State Secretary Dr. Hans Bredow, speaking as State Broadcasting Commissioner at the inaugural meeting of the Funk Stunde (Berlin) Advisory Committee (*Kulturbeirat*)—the first of a number of committees which will advise the existing broadcasting companies and replace the Programme Council which, after a life of only three months, expired on December 15th last. Their constitution was definitely stipulated in the broadcasting concessions granted to the companies a year ago. According to *World Radio*, apprehension has been expressed as to the effect of these officially appointed bodies, exercising only vaguely defined powers (except in so far as they suppress political tendencies) and without any definite responsibility, but Dr. Bredow does not share them.

Peru.—New Regulations.—The Government having taken over all broadcasting in Peru, station OAX has become State property and new regulations have been issued by the Administration of Posts, Telegraphs and Wireless applying to all receiving sets. It is pointed out that a licence does not authorise the use of a set for commercial purposes; that single-wire antenna must not be over 100 ft. long, nor double wire over 140 ft.; that the owner of a set may not use in any way whatever information so received, and that if the owner wishes to remove his set to another locality notice must be given previously to the Director of Radio Telegraph Services. Licences will not be transferable and they may be revoked by the Director should any of the regulations be infringed.—*Reuter's Trade Service* (Lima).

Russia.—High-power Stations.—The idea of erecting a 1,000-kW station, which has for some time been advertised widely in Soviet Russia, has been discarded as impracticable at the present moment, says *World Radio*. The Commissariat for Posts and Telegraphs has decided, however, that the immediate object of its constructive programme must still be to make multi-valve sets unnecessary by increasing the power of stations in several centres. There is much discussion as to what the power of individual stations should be, the most favoured proposal being that European Russia should have five or six stations of 25 kW (Moscow, Leningrad, Kharkoff, Tiflis, Saratoff, and Sverdlovsk *alias* Jekaterinburg), and about the same number of 10 kW each (Minsk, Kieff, Odessa, Kazan, and Rostoff-on-Don). Siberia presents a serious problem, being so vast and so thinly populated; the complete "radiofication" of Siberia has, therefore, been "postponed to the more distant future." A 10-kW station is being planned for Tashkent, to serve Turkestan.

South Africa.—Johannesburg Station Closes.—Lack of financial support has been the reason for the closing down of the "JB" (Johannesburg) station after having been in operation for over two years. Very strong efforts were made to enable "JB" to carry on, including a three-months' subsidy of £300 from the Johannesburg Municipality in the hope that some permanent arrangements would in the meantime be made to place the station on a sound footing, including Government support, but so far without effect. February 1st, however, was the time limit, and the station very reluctantly ceased to operate, but it was "on the air" again on February 5th, the Transvaal Radio League having arranged to carry on a partial service.

United States.—Proposed Censorship.—A Bill introduced by Assemblyman Edwin J. Coughlin, of Brooklyn, N.Y., at the present session of the New York Legislature in Albany, proposes the regulation and consorship of radio broadcasting. The Bill exempts from control stations owned by the Federal Government, by the State, and by a municipality. Privately-owned stations, however, would be required to obtain a certificate of necessity and convenience from the Department of Public Service. The annual licence fee for each station would be $100, and each would be required to deposit a bond of $10,000 as a guarantee that the rules and regulations laid down by the Public Service Commission would be observed. Under the terms of the Bill, the State would have jurisdiction over rates charged by commercial stations for broadcasting advertising matter, wave-lengths, and all pertaining to the operation of a broadcasting plant. The measure, if enacted, would become effective on July 1st, says *World Radio*, but existing stations would be permitted to operate without a licence until July 1st, 1928.

Control Bill.—The Wireless Control Bill was signed by President Coolidge on February 23rd. The Bill, which is intended to prevent any wireless interest obtaining a monopoly of the ether, provides for the establishment of a Federal Wireless Commission which will have power to make regulations and grant licences. After a year the powers vested in the Commission will be transferred to the Secretary of Commerce, but the Commission will remain in existence as a sort of court of appeal. The Bill was passed by the U.S. Senate on February 18th.—*Reuter* (Washington).

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Aberdeen.—March 10th. Northern Co-operative Society, Ltd. Refrigerating and cold store installation. Messrs. Tawse and Allan, architects, 10, Bon-Accord Square, Aberdeen.

Adwick-le-Street.—March 21st. Urban District Council. Cables, boxes, pillars, and necessary materials and apparatus for a distribution network scheme. (See this issue.)

Ashford.—March 14th. Electricity Department. Two electrically-driven centrifugal pumps (capacity 30,000 gal. per hour). (February 25th.)

Australia.—Melbourne.—April 26th. Postmaster-General's Department. Telephone switches. (B.X. 3254).* **Instrument** cords. (B.X. 3255.)*
April 12th. Cord-type switchboards. (B.X. 3280.)*

Brecon.—March 16th. Electricity Department. Generating plant and switchgear, battery of accumulators and connections, underground and overhead lines. (February 25th.)

Bridlington. — March 9th. Electricity Department. Stores for 12 months, including lamps, electrical sundries, v.i.r. cables, &c. (February 25th.)

Colwyn Bay.—March 11th. Electricity Department. Twelve months' supply of cables, joint boxes, house service cut-outs, joint-box compound, sundry stores, house service meters. (February 25th.)

Dover.—March 9th. Harbour Board. Electrical cables and sundries for a year. Mr. Rutley Mowll, registrar, Castle Street.

Durham (Co.).—March 12th. County Council. Electrical work for the Seaham Hall tuberculosis hospital. W. and T. R. Milburn, architects, 19, Fawcett Street, Sunderland.

East Ham. — March 10th. Electricity Department. 3,900 yd. cable. (See this issue.)

Edinburgh.—March 5th. Education Authority. Electrical work at the new Technical School. Mr. J. Carfrae, architect, 3, Queen Street, Edinburgh.
March 21st. Twelve months' supply of cables, box frames and covers, house service fuse boxes and fuseboards, meters and meter boards. (See this issue.)

Hazel Grove and Bramhall.—March 23rd. Urban District Council. One oil circuit breaker and kiosk and seven 20-kW transformers and kiosks, cables and two e.h.p. sub-station switchgear panels. (See this issue.)

Holmfirth (near Huddersfield).—March 8th. Electricians' work required in connection with the erection of a children's ward at Holme Valley Memorial Hospital, Elmwood. Mr. P. N. Brown, architect, Hollowgate, Holmfirth.

Ilford.—March 8th. Electricity Department. Twelve months' supply of house-service boxes, lamps, main cut-outs, meters, and pavement box covers. (February 25th.)
March 22nd. One 500-kW rotary convertor, with transformer, switchgear, &c. (See this issue.)

India.—March 22nd. India Store Department. Two 250-kW Diesel-engine alternator sets, with switchgear, transformer, &c. (February 18th.)
30,000 oil insulators. (See this issue.)
Delhi.—March 17th. India Stores Department. Oil-engine-driven generator sets with switchboard. (B.X. 3264.)*

Kettering.—March 23rd. Electricity Department. E.h.p. and l.p. armoured cables and one 1,000-kVA transformer. (See this issue.)

Lithuania.—Kovno.—March 10th. Department of Posts, Telegraphs and Telephones. Transformers, valves, &c., for the Kovno radio station. (B.X. 3283.)*

Littlehampton.—March 8th. Sussex Electricity Supply Co., Ltd. One 150-kW Diesel engine and generator, with auxiliaries, switchgear and cables. (February 18th.)

London.—Bermondsey.—March 16th. Board of Guardians. Six months' supply of electric lamps. Mr. H. H. Reeve, clerk to the Guardians, 283, Tooley Street, S.E.

Manchester.—March 18th. Electricity Committee. Three 500-kVA and two 250-kVA static transformers. (See this issue.)

Oldham.—March 7th. Board of Guardians. Electric lamps and fittings. Mr. Fred. W. Fletcher, clerk.
March 26th. Electricity Department. One 80-ton electric travelling crane. (See this issue.)

Rhondda.—March 26th. Electricity Department. Twelve months' supply a.c. ordinary and prepayment meters, mains and house service material. (February 25th.)

South Africa.—Johannesburg.—March 19th. Municipal Council. Single-phase concentric cable. (B.X. 3236.)*
Cape Town.—March 9th. Electricity Department. Insulated wire. (B.X. 3233.)*

South Elmsall.—March 19th. Electric lighting installation at Westfield Lane Council School. Education Department, County Hall, Wakefield.

Stoke-on-Trent.—March 8th. Electricity Department. De-aerating plant and electrically-driven boiler-feed pumps. (February 18th.) Twelve months' supply a.c. and d.c. meters, mains and cables. (February 25th.)

Torquay.—March 11th. Electricity Department. Two water-tube boilers with chain-grate stokers, induced draught plant, pipework and economisers. (February 18th.)
March 16th. One 6,000-kW turbo-alternator, with surface condenser and auxiliary plant. (February 25th.)

Tynemouth.—March 14th. Electricity Department. Three 250-kVA and one 500-kVA transformers. (See this issue.)

Warrington. — March 14th. Electricity Department. Motors and transformers. (February 25th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Aberdeen.—Corporation. Accepted:—
Electric lighting work for the new buildings, including restaurant, dance-hall, pavilion, shops, &c., at the Beach. Malcolm & Allan (£2,354 and £1,012, respectively).

Barking Town.—Electricity Committee.
1,000-kW motor convertor:—

Metropolitan-Vickers Electrical Co., Ltd. ...	£3,750
Bruce, Peebles & Co., Ltd.	4,158
Brush Electrical Engineering Co., Ltd. ...	3,262
British Thomson-Houston Co., Ltd.	4,350
English Electric Co., Ltd.	3,750
General Electric Co., Ltd.	3,749
General Electric Co., Ltd.	4,037
Ateliers de Constructions Electriques de Charleroi. (Recommended.)	**2,875**

Bexhill.—Electricity Committee. Recommended:—
Cable (£4,122).—Enfield Cable Works, Ltd.
Three seven-way feeder pillars (£158).—W. T. Henley's Telegraph Works Co., Ltd.

Birmingham.—Education Committee. Accepted:—
Electric light installation, Stechford Council School.—Brightside Foundry and Engineering Co., Ltd.
Electricity Committee. Accepted:—
Three centrifugal pumps at Nechells generating station.—Pulsometer Engineering Co., Ltd.
Transformers for Selly Oak sub-station, Brush Electrical Engineering Co., Ltd.; switchgear, A. Reyrolle and Co., Ltd.; installation of electric light at Town Hall, Allom Bros.

Bradford.—Tramways Committee. Accepted:—
Tramway poles (£2,332).—British Mannesmann Tube Co., Ltd. (in preference to a Continental tender at £1,899).

Chelmsford.—Essex C.C. Accepted:—
Internal telephone system for the County Offices (£101).—Mr. A. Shearman.

Dundee.—Electricity Committee. Accepted:—
Cable (£572).—Standard Telephones & Cables, Ltd. (The lowest foreign offer was £521, by the Bergmann Electrical Works, Ltd.)

Guildford.—Electricity Committee.
Converting plant for central sub-station :—

British Thomson-Houston Co.	£15,506
Bruce Peebles & Co., Ltd. (Accepted.) ...	**13,648**
English Electric Co., Ltd.	13,469
General Electric Co., Ltd.	13,246
Metropolitan-Vickers Electrical Co., Ltd. (for part only)	9,965

Baths Committee. Accepted :—
Filtration plant at swimming baths.—Bell Bros.
Works Committee.
Additions to air compressor plant at destructor works :—

Mather & Platt, Ltd.	(*a*)	£1,656
Mather & Platt, Ltd.	(*b*)	2,412
Worthington, Simpson, Ltd.		2,150
Reavell & Co., Ltd.		1,393
Browett, Lindley & Co., Ltd. (Accepted.) ...		**1,490**

Hull.—Electricity Committee.
Additional turbo plant—

Oerlikon, Ltd.	£61,900
British Brown-Boveri, Ltd.	76,374
Brush Electrical Engineering Co., Ltd. (Accepted.)	**84,332**
English Electric Co., Ltd.	87,776
C. A. Parsons & Co., Ltd.	88,000
Richardsons, Westgarth & Co., Ltd.	88,900
Jas. Howden & Co., Ltd.	88,985
Metropolitan-Vickers Electrical Co., Ltd. ...	89,660
Fraser & Chalmers Engineering Works ...	90,655
Do. Do. ...	92,639
Metropolitan-Vickers Electrical Co., Ltd. ...	92,640
British Thomson-Houston Co., Ltd.	92,928
Peter Brotherhood, Ltd.	95,124
Do.	96,543
Do.	97,202
Do.	98,621

Ilford.—Town Council. Accepted:—
12 miles of cable (£7,051).—Union Cable Co., Ltd. This was the lowest British tender, and was £1,051 above the lowest quotation.

Leeds.—General Purposes Committee. Accepted:—
Electrical fittings for a year.—Sun Electrical Co., Ltd., and Mr. G. Casperson.
Electricity Committee. Accepted :—
Cable : (£9,027) Macintosh Cable Co., Ltd.; (£8,388) W. T. Henley's Telegraph Works Co., Ltd.; (£4,183) Enfield Cable Works, Ltd.; and (£1,225) Greenwich Cable Works, Ltd.
Portable air compressor (£750).—Lead Wool Co., Ltd.
Double transformer kiosk (£275).—Yorkshire Switchgear and Engineering Co., Ltd.
15 three-phase truck type switches (£1,433).—English Electric Co., Ltd.
Six two-phase truck-type switches (£550).—Ferguson, Pailin, Ltd.
Four transformer kiosks (£496).—Park Royal Engineering Co., Ltd.
Health Committee. Accepted :—
Electric lamps for Seacroft Hospital.—Nox Electric Lamp Co., Ltd.
X-ray plant at tuberculosis dispensary (£687).—Watson and Sons (Electro-Medical), Ltd.

Letchworth.—First Garden City, Ltd. Accepted:—
1,000-kW La Cour motor convertor.—Ateliers de Constructions Electriques de Charleroi.

London.—Admiralty. Accepted:—
Insulated electric cable.—Edison Swan Cables, Ltd.

Oldham.—Electricity Committee. Accepted:—
Three 250-kVA transformers.—Ferranti, Ltd.

Padiham.—Urban District Council. Accepted:—
Wiring 50 houses on the Dryden Street housing site.—Mr. R. B. Beattie (Burnley).

Salford.—Electricity Committee. Accepted:—
1,773 yd. e.h.p. cable and 11,100 yd. l.p. cable (£5,547).—N.V. Nederlandsche Kabelfabriek, Delft, Holland.

Sheffield.—Electricity Committee.
Sub-station switchgear (£11,132).—A. Reyrolle & Co., Ltd. (Accepted.)
Tramways Committee.
1,500 mild steel tie bars.—Hadfields, Ltd. (Accepted.)

Stoke-on-Trent.—Electricity Committee. Accepted:—
3-phase static transformers and truck-type sub-station switchgear for 12 months.—Metropolitan-Vickers Electrical Co., Ltd.
Steam and water piping at central power house (£14,100).—Brightside Foundry & Engineering Co., Ltd.
Constructional steel work at power station (£2,574).—W. J. Jenkins & Co., Ltd.

West Ham.—Education Committee. Accepted:—
Installing electric light at South Hallsville Schools (£460).—Corporation Electricity Department.
The tenders varied from £417 to £711.

Forthcoming Events.

Ideal Home Exhibition.—Olympia, W. March 1st to 26th.

Electrical Power Engineers' Association (Southern Division).—Friday, March 4th. Institution of Electrical Engineers, London. 7 p.m. "The Installation and Maintenance of E.h.p. Cables." Mr. E. Bowden.

(Glasgow Section).—Friday, March 11th. Reid's Restaurant, Gordon Street. 7.30 p.m. "Illumination." Mr. H. E. Hughes.

Junior Institution of Engineers.—Friday, March 4th. 39, Victoria Street, S.W. 7.30 p.m. "An Evening with the Old Brigade."
Saturday, March 5th. Suffolk Street Galleries. 6.30 p.m. Annual dance.
Friday, March 11th. "Cupolas." Mr. J. Wolstenholme.

London Association of Foreman Engineers.—Saturday, March 5th. Cannon Street Hotel, E.C. 6 p.m. Anniversary Festival.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, March 5th. Cardiff. 6 p.m. Discussion, "Can Electricity Replace Compressed Air in the South Wales Mines?"

London Lighting Service Bureau.—Evening Illumination Design Course : Concluding Lecture. Monday, March 7th. 7.30 p.m. "Selling Better Lighting." Mr. W. E. Bush.

Institution of Electrical Engineers.—Informal Meeting.—Monday, March 7th. London. 7 p.m. Discussion to be opened by Capt. P. P. Eckersley.

(North-Midland Centre). — Tuesday, March 8th. Hotel Metropole, Leeds. 7 p.m. Address by the President, Dr. W. H. Eccles, F.R.S.

(North-Western Centre). — Tuesday, March 8th. Engineers' Club, Manchester. 7 p.m. "Illuminating Engineering," Mr. J. W. T. Walsh; and "Problems of Public Lighting by Electricity," Mr. H. T. Harrison.

(Scottish Centre).—Tuesday, March 8th. North British Station Hotel, Edinburgh. 7 p.m. "High-power Fusible Cut-outs." Mr. L. G. Grant.

(South-Midland Centre).—Wednesday, March 9th. University, Birmingham. 7 p.m. "Illuminating Engineering," Mr. J. W. T. Walsh; and "The Problems of Public Lighting by Electricity," Mr. H. T. Harrison.

(Dundee Sub-Centre). — Thursday, March 10th. University College. 7.30 p.m. "The Jubilee Year of the Telephone." Mr. G. H. Taylor.

(North-Western Students' Section). — Saturday, March 5th. Manchester Municipal College of Technology. 7 p.m. Dance.

Institution of Rubber Industry.—Monday, March 7th. Engineers' Club, W. "Some Electrical Properties of Rubber." Mr. P. Dunsheath.

Society of Engineers.—Monday, March 7th. Burlington House, W. 5.30 p.m. Ordinary meeting.

British Electrical Development Association (North-East Area).—Wednesday, March 9th. Sopwith's Lounge, Newcastle-on-Tyne. 7 p.m. Discussion on W.O.B. Campaign.

Birmingham Electric Club.—Friday, March 11th. Grand Hotel. 7 p.m. Annual Dinner.

Physical Society.—Friday, March 11th. Imperial College of Science, South Kensington. 5 p.m. Ordinary meeting.

Notes.

British Insulated Cables, Ltd., Secures Big Contract for Indian Railway Electrification.

At the present time, when industry has to rely to such an extent on orders from overseas, it is of interest to note that British Insulated Cables, Ltd., of Prescot, has secured the contract for the main-line electrification of the Great India Peninsula Railway (Indian State Railways). The contract involves the equipment of 334 miles of track, running from Kalyan to Igatpuri in a northerly direction, and from Kalyan to Poona in a southerly direction, including sidings, storage yards, &c. The line to Poona includes the special equipment of the "Ghats," a particularly mountainous region, and about four miles of tunnels. The overhead equipment contains several novel features. The total section of copper to be carried per track is one square inch divided into three parts: 0.5 sq. in. main catenary, 0.2 sq. in. auxiliary catenary, and 0.3 sq. in. British standard section grooved contact wire. The main catenary is suspended at 220 ft. intervals by double porcelain disk insulators of the ball and socket pattern, and the contact wire is suspended by loop-type droppers from the auxiliary catenary, thereby providing an exceedingly flexible line. Provision for tensioning is made at distances of approximately one mile, and at these points every cable is dead-ended, the continuity of contact being maintained by a patented form of overlap span, which permits the tension stresses to be balanced, and so reduces to a minimum the amount of steel required in the structures at these points. Current is transmitted at 120,000 volts a.c. to sub-stations, where it is transformed to 1,500 volts d.c. for feeding the line.

Lake Lugano as a Reservoir.

For some time past engineering circles at Milan have been considering the use that can be made of the waters of the river Tresa, by means of which Italian river the overflow of the Lake of Lugano escapes; it is rumoured that the idea of Italian engineers is to utilise the difference of levels between the lakes of Lugano and Maggiore. A powerful waterfall would be thus constructed, capable of feeding considerable hydro-electric works, the buildings of which would naturally be erected on Italian soil. It is asserted that the greater part of the capital necessary for the enterprise has already been subscribed. The result of such a project would certainly have distinct repercussions in Switzerland, and the scheme is being followed with the greatest attention by the Tessinois Government. The building of a power house fed by the waters of the Lake of Lugano has a bearing on the question of the lake-level, which would be menaced or modified by the operation of hydro-electric works. Several of the lake-shore villages have already voiced their anxiety as to possible changes in water supply, and it is urged that the proposed use of the Lake of Lugano as a reservoir for Italian industry would be disastrous for certain Swiss villages on its banks. Swiss authorities, therefore, are keeping a sharp look-out on the developments of the plans that are being drawn up at Milan.

The Electricity (Supply) Act, 1926.

We have received from the Electricity Commissioners a "Memorandum on the Provisions of the Act" which they have prepared (H.M. Stationery Office, price 3d. net, post free 3½d.). It is announced by the Stationery Office that the Act has been reprinted, and the price reduced to 9d. net (post free 9½d.).

A New Electrical Illuminant.

A demonstration was recently given to the Press by Messrs. Fluor Light, Ltd., at their Shaftesbury Avenue, London, showrooms, of their new electrical illuminant, "Fluor Light," the invention of Mr. Ashton Wolfe, which they are introducing to the public. The light is produced in vacuum tubes at high voltage, 3,000 to 5,000 V, and by means of special electrodes at the ends of the tubes, containing a substance with a radium basis, gases are introduced which control the ether vibrations and thereby define the actual colour waves of the light. The gas also serves as a stabilising medium and renders the lighting, after a short period, quite steady. In addition to the variety of colours which can be obtained by this means for effective lighting, a most important feature is the production of true natural light, which should prove of great value in connection with colour matching in dye works and so on, and also to the medical profession, which, it is claimed, is giving the new illuminant favourable consideration. Another interesting feature is the possible production of only those light waves which are capable of penetrating fog, and this was demonstrated to some extent by creating an artificial fog in the room. The illumination was not obscured to any perceptible degree, and there was no halo observable around the light. It is claimed that the current consumption is 60 per cent. less than that for ordinary electric lighting by means of "half-watt" lamps. It is hoped to develop this means of illumination for ordinary house interior lighting by installing the tubes in a similar manner to ordinary cornice-lighting apparatus. The system has already been adopted for illuminated signs, and also for shop-window lighting. In the latter case the transformer and tube terminals and the leads are enclosed in glass tubing to afford adequate protection against accidental shock. The system can, of course, only be employed with a.c. supply.

The Electrification of French Railways.

The commercial counsellor at Paris informs the Department of Overseas Trade that the Southern Railway Co. is about to push on with its electrification programme, which has been temporarily in abeyance. It is stated that several lines will be completely electrified, including those from Pau to Laruns and from Pau to Bedous, with an extension to the international frontier station at Los Aranones. The last-named line will be operated in the course of 1928. The work is making rapid progress; the rails have been laid and stations are being built.

The British Legion.

The annual report of the British Legion shows that it has developed steadily on sound lines, and now has 2,774 branches in England and Wales. Unemployment was rife last year, but up to September 30th, 423 ex-service men had been placed, 2,625 introductions given, and 5,536 applicants for employment interviewed. Men are being trained in workshops, and others prepared for emigration. The number of disabled ex-service men registered at Employment Exchanges at the date of the report was 28,676, as compared with 32,350 in December, 1925. A full account is given of the administration and activities of the Legion. The relief fund (nine months) expended £147,092 on the relief of distress and for similar purposes.

Electrical Association for Women.

The first annual conference of the Birmingham and Midlands Branch of the Association was held recently at Birmingham, and was largely attended.

Mrs. Christine Frederick, in an address, pointed out the advantages secured by the use of mechanical appliances, but added that for their proper use a full and universal electricity supply at moderate rates was necessary.

At a luncheon presided over by Lady Brooks, president of the branch, Mr. H. K. Beale, chairman, Birmingham Electric Supply Committee, said that if any ladies were thinking of installing electricity in their homes, he would give them a tip: start with a kettle. Once it was seen how quickly and easily an electric kettle could be brought into operation, the rest of the household would be converted.

Mr. R. A. Chattock, city electrical engineer, said he was convinced that the women of this country would eventually insist on their homes being provided with electricity. Dr. S. Z. de Ferranti remarked that the great thing that stood in the way of electrical development was a general want of knowledge of the handling of the commodity and the apparatus connected with it. Visits were paid to the Nechells power station and the Witton Works of the General Electric Co., Ltd.

At the annual meeting of the branch, Professor W. Cramp said that the problem of cheaper electricity in this country would not be solved until that of electrical storage was solved.

The annual general meeting of the Manchester District Branch of the above Association was held on February 22nd, the chair being taken by Alderman Dagnall, chairman, Manchester Electricity Committee, when it was decided to re-elect all the officers and members of the committee. The meeting was followed by a lecture by Mrs. Christine Frederick, U.S.A., who described the methods adopted by American housewives to save labour in the home.

Faraday House Old Students' Association.

The Association has arranged to hold a dance on March 18th (8 to 12 p.m.), at Bush House Restaurant, Aldwych, in co-operation with the Faraday House Rugby Club. The dance will be the first of its kind and in some respects will take the place of the annual smoking concert. The price of the tickets is 8s. double (including light refreshments).

A Memorial to Faraday.

As we go to press we have received the following letter, with the tenor of which we cordially agree:—

I have read with great interest and appreciation the letter to you from the Mayor of Southwark published in your last issue, and think that he and the Borough of Southwark are to be congratulated upon the action it is intended to take in this matter.

It has always seemed to me that outside purely scientific circles the work of Faraday and the nature of its presentation to the public by him have received quite inadequate recognition. Of course, after the great lapse of time and under the stress of modern conditions of living and working, it is not easy for the present generation of electrical men to recognise and appreciate what it owes to his work and to the impetus it gave to the founding of our great industry.

But the efforts now being made by Mr. Hewitt serve as a reminder in this matter, and it is sincerely to be hoped that they will meet with complete success. With this object it is certain that the Electrical Review will be in complete sympathy.

A. C. Eborall, M.Inst.C.E., M.I.E.E.

Trafalgar House, S.W., *March 1st*, 1927.

Ideal Home Exhibition.

The eleventh Ideal Home Exhibition was opened at Olympia, London, on March 1st by the Hon. Mrs. Esmond Harmsworth. Many new features, both with regard to the decoration and lay-out of Olympia itself and the exhibits, are introduced this year. There are quite a number of electrical firms showing, and we hope to review their exhibits in a later issue.

Molybdenite as a Photoelectric Material.

According to Dr. W. W. Coblentz, of the U.S. Bureau of Standards, a piece of the mineral molybdenite, one of the chief sources of the metal molydenum, may replace the fragile photoelectric cell in some forms of scientific work. Dr. Coblentz has been studying what he calls the antinoelectric effect of molybdenite, the property that causes it to convert light energy falling on it into electrical energy. Previously he found that pieces of the mineral had closely adjacent spots which generated either positive or negative electricity. The result was that when the whole crystal was exposed to light the positive and negative currents neutralised each other, and very little effect was noted; but if a single spot was selected and illuminated, a current was produced of sufficient intensity to be indicated by a galvanometer. Recently, however, Dr. Coblentz has found crystals of which all the sensitive spots give the same kind of electricity, either positive or negative. When one of these crystals is completely illuminated, a considerable current, as compared with the others, is produced. By using vacuum tube amplifiers, the current may be magnified greatly and the crystal made available as a delicate detector of light. Such a crystal is sensitive to visible light waves and to the infra-red, or heat waves.—*Science.*

Electric Heating with Thermit Welding.

Electric heating has now been applied in connection with thermit welding by the Metal and Thermit Corporation, Jersey City, N.J., which has introduced heating units on its track-welding equipment to assist the vaporisation of the kerosene oil used for preheating the work. The oil is passed through the heating unit and is then mixed with compressed air at approximately 1 lb. pressure, after which it passes through a rubber hose to the torch used in applying heat to the rails. The heating unit also acts as a resistor. The equipment is electrically operated from the standard trolley circuit, and the group of two heating units connected in series is placed in series with the 230-volt d.c. motor that drives the air compressor. With this arrangement a snap switch can be used to start the motor as the heating units act as starting resistances.—*Times Trade and Engineering Supplement.*

Appointments Vacant.

Assistant mains engineer (£238) for the Peterborough Corporation Electricity Department. Mechanical and electrical draughtsman for the Air Ministry, W. & B. Department, Egypt. Temporary shift engineer for the Crewe Corporation Electricity Department. Plumber-jointer for the Hove Corporation Electricity Department. (See our advertisement pages to-day.)

The Engineers' Club (London).

During March eighteen meetings are being held at the Engineers' Club, including those of the Wireless Section of the I.E.E., the A.M.E.E., the Institute of Wireless Technology, and the Junior Institution of Engineers.

Battery Electric Rail Cars.

Recent annual reports of the railway companies of this country do not make pleasant reading. At a time when they are bemoaning their fate the lack of evidence of more apparent consideration being devoted to means of more economically utilising the many miles of expensive permanent way that exist in the form of country and branch lines seems strange. A steam locomotive hauling a normal train of from six to eight composite coaches is anything but pleasing if the carriages be nearly empty, and the only way of reducing the wasteful expenditure represented by such trains is to operate short ones on lines of that nature during those periods that traffic does not warrant the use of a standard train: in other words, a 'bus car on railway lines run often enough to ensure that reasonable service is provided. There are, of course, various methods of doing this, and undoubtedly there lies in this connection a great field for the use of battery electric coaches: Germany has found such vehicles to be quite a sound proposition, and an example in England was cited in our issue of February 18th, 1927, p. 264, whilst the installation of a rail-car service on the New Zealand Railway between Christchurch and Oxford West has proved so successful from the passengers' point of view that people deliberately wait for the electric car rather than travel by the steam train! An account of this interesting innovation appears in the *Electric Vehicle*, which commends the idea to the attention of those responsible for railway operation in this country.

Electrification of steam lines is admittedly a costly process, but fortunately the advantage of electric traction can be obtained without the necessity of electrifying the track; battery electric shunting locomotives have proved an eminently practical and economical proposition, while by keeping down the weight of the coach to a minimum, in some ways deviating from the expensive and heavy methods of construction that are employed in present-day railway coach design, it is quite practicable to produce a battery-driven coach that will prove a real boon both to railway companies and passengers on country lines, and for suburban services during the development period. Charging the batteries could be carried out at night, when electricity could be obtained at very favourable rates, or in areas where a public supply of electricity is not available petrol-electric charging stations could be installed (and used possibly during the day for giving a supply of power to consumers in the locality of the station).

The battery electric coaches for use on the branch line of the New Zealand Railways are designed on modern lines; the cars are fifty-five feet in length over the vestibules, seating accommodation being provided for 60 passengers in comfortable upholstered seats fitted with reversible backs. The two compartments are well lighted by wide windows, extending practically the full length of the car. The seats are spaced transversely on either side of a central aisle and, for night operation, electric light is supplied from a separate battery. While being tried in the Lyttleton-Christchurch service the first car was frequently called upon to carry as many as 140 passengers, and easily handled the heavy overload without any apparent effort. Power for the four 30-h.p. motors is supplied from 240 type A12.H Edison cells, sufficient for a 100-mile run under ordinary service conditions. This car was designed to maintain a speed of 35 miles per hour, but actually it has attained a speed of 40 miles per hour on long straight runs, and under service conditions a schedule speed of 35 m.p.h. is easily maintained. The car is provided with hand, straight-air and dynamic braking, the latter being primarily intended for holding the car to a reasonable speed on long down grades without the usual heavy wear on the brake blocks and wheels; the car is charged at night during "off peak" hours when power is available at a very low rate, and a return journey of 84 miles was accomplished with an expenditure of electrical energy from the battery amounting to 335 amp.-hours; the outward journey, owing to the gradients encountered, took about fifty per cent. more electrical energy than the homeward journey, for a considerable part of which the train was coasting. When it is not desired to take advantage of economies resulting from the design of lightweight coaches, it should be possible to convert old-type saloon coaches to battery electric coaches, and thus at minimum cost to put into operation electric motor-coach trains on lines at present expensively served by the usual steam locomotive of a size greater than the traffic calls for.

Fatalities.

A verdict of "Accidental death" was returned at the inquest on February 23rd on Mrs. Elizabeth Waterworth, who died recently from injuries received in an explosion that wrecked a house and shop in Beaconsfield Road, Acton Green. Evidence was given that fire was noticed to start where an electric cable entered the shop. It was stated that a few minutes before the explosion the electric light flickered and went out in a bakehouse 100 yards away. An electrician said that the distributor crossing the road to the premises had been partly blown out. A feeder cable laid in the road 25 years ago was encased in bitumen, but the distributor was modern, and had no connection with any bitumen. Periodical overhauling was carried out. The jury found that the explosion was accidental, but could not say how it was caused. It added a rider that the cable should be thoroughly overhauled.

The Times reports that Edward Brown, a Southern Railway driver, was killed by an electric shock on February 24th at Sutton station through his head touching an overhead electric wire while he was standing on the coal in the tender.

An inquest was held on February 16th, on the death of W. J. Thomas, of Trecynon, a shift engineer, employed by the Aberdare District Council for 12 years at the tramway depôt, who was killed by an electric shock on February 13th. According to the evidence reported in the *Aberdare Leader*, the deceased was working in a cubicle which had been made "dead"; nevertheless he touched live metal and was instantly killed. The switch, though interlocked, was found "just on." The verdict was "Death by misadventure."

An E.P.E.A. Dinner.

A company of over 100 attended the eighth annual dinner of the Portsmouth branch of the Electrical Power Engineers' Association, which was held at Kimbell's Café, Southsea, on February 19th. Mr. J. Ryan, chairman of the South Coast Section of the Association, presided, and among those present were Alderman A. Hemingway (chairman of the Portsmouth Electricity Committee), Mr. B. Handley, engineer and manager of the Portsmouth undertaking, and the Mayor and Mayoress of Chichester. The great developments that had taken place in the electrical world during the last 25 years were spoken of by Mr. H. Martin, Senior Electrical Engineer at Portsmouth Dockyard, in proposing "The Electrical Industry," and the beneficial effect of electricity upon health and comfort in home life was referred to by Alderman A. Hemingway in response. Councillor W. J. Lewis, vice-chairman of the Portsmouth Committee, also spoke of its potentialities in the future. Mr. Handley proposed "The Electrical Power Engineers' Association," remarking that the policy which the Association had pursued since its inception showed that it possessed wisdom, despite its youth. The conditions existing in the industry to-day, he added, had been largely obtained by the Association's efforts, and had been procured with hardly any turmoil at all. The Association had also got out a very good apprenticeship scheme. The chairman responded, and pointed out that the Association was not entirely out for remuneration. An excellent musical programme was arranged, and the evening concluded with dancing.

Institution Notes.

Institution of Electrical Engineers.

INFORMAL MEETING.—On February 21st, Mr. M. Whitgift was in the chair when Mr. R. O. Kapp opened a discussion on "National Bus-bars in Central Europe," describing his remarks as notes compiled on a holiday last year, but they showed a close and comprehensive survey of a large part of Austria, Germany, and Switzerland. He also had a number of slides showing the areas covered by interlinking, and remarked that Switzerland was the only country with an entire set of national bus-bars; they had come about by natural development into a complete system, but, consequently, without uniform voltages. Austria, with very little coal, but with much water-power, had turned to electrical development to help solve the problem of her acute post-war poverty, and truly remarkable progress had been made. The hydro-electric stations were detailed, and the great undertaking at Aachensee described in some detail, for from this station export of surplus power to Germany and Switzerland was now arranged. Germany had as yet no continuous system, but very extensive sets of mains carried power at 110,000 V over large areas. Long lines now operating at 110,000 V, it was contemplated, would be raised to 220,000 V, and were even designed for 380,000 V. An excellent discussion followed. Mr. W. E. Highfield said that Mr. Kapp had made extraordinarily clear the outline of the systems described. With regard to the comparative immunity from breakdown which was reported on the 110,000-V lines, Mr. Highfield said he had noticed that long spans of line had a better vibration period and often suffered fewer stresses. He had observed, too, that with the supply to rural districts in South France the saving in cost was not made on the h.p. lines, but on the l.p. distribution.

LONDON STUDENTS' SECTION.—Improvements have been made in the programme for the second half of the session. To-night there will be a theatre party at Victoria Palace, an item which has just been re-instituted after a lapse of two years. Next Friday there will be a joint meeting with the Students' Sections of the Institutions of Civil and of Mechanical Engineers for a discussion on "Patents," to be opened by Mr. A. C. Price, and on Friday, March 18th, the twentieth annual dinner will be held at the Imperial Hotel, Russell Square. This year the dinner will be more enjoyable and informal than usual. Dr. W. H. Eccles and Capt. P. P. Eckersley have promised to be present.

Association of Consulting Engineers (Incorporated).

On Wednesday last week the annual dinner of the Association was held at St. Stephen's Club, Westminster, about 150 members and guests sitting down, with Mr. W. J. E. Binnie, chairman of Committee, presiding. Amongst those present were Sir Charles Parsons, Sir Joseph Cook, Sir Alex. Gibb, Sir Harry Haward, Mr. W. W. Lackie, Sir Halford Mackinder, Mr. C. le Maistre, Sir Ernest Moir, Col. R. K. Morcom, Mr. Basil Mott, Mr. S. L. Pearce, Col. T. F. Purves, Lord Queenborough, Sir Henry Slesser, Sir Henry Tanner, and Mr. T. P. Wilmshurst. After the loyal toasts, Sir Cyril Kirkpatrick proposed "The British Empire," remarking that the work of engineers brought its components closer together—aviation in particular was annihilating time and space. The Hon. Mr. J. S. Smit, High Commissioner for the Union of South Africa, in responding, repelled the charge that South Africa preferred foreign markets to the British. Mr. S. C. Lewis proposed "The Bench and Bar," Lord Hanworth, Master of the Rolls, and Mr. W. E. Tyldesley Jones responding. The toast of "Science" was proposed by Lt.-Col. N. G. Gedye, who emphasised the close interdependence of pure science and engineering in these days; Dr. J. V. Elsden, responding, pointed out that the pure science of to-day was the applied science of to-morrow. Mr. Fredk. Palmer, president, Inst.C.E., proposed "The Association of Consulting Engineers," and the chairman, responding, said that the Association owed a debt of gratitude to the honorary officers, especially the hon. secretary, Mr. A. H. Dykes, who devoted an immense amount of time and labour to its interests. The hon. treasurer, Mr. S. R. Lowcock, having resigned, the members had presented him with a desk and bookcase; Mr. S. C. Lewis was his successor. Mr. Lowcock was called upon to speak, and expressed his grateful appreciation of the present and of the very great kindness he had experienced from the members during the past 20 years.

Junior Institution of Engineers.

At the meeting held on February 25th, Dr. C. M. Walter showed a number of photographs and four kinematograph films taken by him during his recent visits to the Norwegian fjords, which held the interest of the members for over two hours. To-night the "Evening with the Old Brigade" will be opened at 7.30 p.m. by Mr. Walter T. Dunn, M.I.Mech.E., secretary of the Institution for the first 27 years, and member for 43 years; afterwards past-chairmen successively will occupy the chair, and lecturettes will be delivered by other members of long standing.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Representatives of East Midland electricity authorities assembled at Nottingham on Thursday last week, when a presentation was made to Mr. T. P. Wilmshurst, late borough electrical engineer of Derby, in recognition of his appointment as an Electricity Commissioner. Mr. Wilmshurst was invited to accept a small copy of the historic vase which forms one of the notable treasures of Warwick Castle, and he was also given a wristlet watch. Alderman Huntsman, who made the presentation, observed that in the area covered by the operations of the Board of which he had the honour of being the chairman, they had never faltered in their support of the technical policy to which the new Act was intended to give effect. That area was about the only one in which stubborn opposition had not been presented to the policy. His only doubt about the future success of the policy which should be carried out was that its execution would have to be entrusted to some of the men who had been its most strenuous opponents. The electricity supply industry had been singularly fortunate in having had at its disposal the services of those who constituted the Electricity Commission, who were not only technically eminent, but were also just, courteous, and devoted to the public interest. In the East Midlands area the authorities had prepared themselves to co-operate in carrying out whatever might be called for with regard to a larger policy. They would, however, be poorer in that area by reason of the circumstance that he who had presided over other able electrical engineers and who had guided their footsteps, would be no longer with them to give them the benefit of his knowledge. He felt that they owed a vast debt to the wise judgment of Mr. Wilmshurst. Mr. Wilmshurst, in responding, observed that one reason for the friendly feeling which prevailed in the area was to be found in the large humanity of the chairman of the Board, Alderman Huntsman. An excellent example was furnished by the time and ability which such men as he devoted to the public service. He believed that the new Act constituted a great landmark in the electrical history of the country. It had been suggested that it would prove of no use to towns which were making cheap electricity; but it should be remembered that two-thirds of the places in the country had either no supply at all or only poor supplies. The Act would not rectify everything at once, but it would provide "tapping points" in rural districts, so that a supply could be given at a reasonable price. The scheme for central industrial Scotland was now completed and ready for transmission to the Board, and that for Central England, embracing the territory from North Derbyshire to the Thames, would be ready for transmission within the next two or three months. These schemes had been prepared with the most meticulous care. Not a single authority would be penalised by the Act, and when all the transmissions had been completed every authority in the country would benefit therefrom.

The Government *Gazette*, Gold Coast Colony, recently announced that Mr. F. T. BILLINGSLEY, assistant electrical engineer, Gold Coast Government Railways, had been appointed to act as chief electrical engineer to the Railways from November 7th, 1926.

Dr. S. Z. DE FERRANTI has been selected by the Council of the Royal Society for election as a Fellow of that body.

The Lancaster Town Council last week decided to increase the salary of Major G. C. MILNES, M.C., the borough electrical engineer since 1910, from £680 to £780.

The Leeds Corporation Electricity Committee recommends increasing the salary of Mr. C. NELSON HEFFORD, the manager of the Electricity Department, from £1,600 to £1,650 per annum.

At a social gathering at Keyham in connection with the electrical department of Devonport Dockyard, a presentation, consisting of a pair of binoculars, was made to Mr. HOWE, assistant electrical engineer, upon his approaching departure for Gibraltar.

On resigning his position as electrical engineer at the Winwick Mental Hospital, Mr. A. DAVIS was presented with a gold watch by the staff.

Dr. S. ENGLISH, D.Sc., F.I.C., F.Inst.P., late Senior Lecturer in the Department of Glass Technology, Sheffield University, has joined the staff of Holophane, Ltd., as Research Engineer, in connection with the use of glass in all types of illumination.

Obituary.—SIR J. HARMOOD-BANNER.—We regret to record the death of Sir John Sutherland Harmood-Banner, which occurred on February 24th, at the age of 80 years. By profession he was an accountant and had very large business interests. He was a member of the House of Commons for many years. The honour of knighthood was received in 1913, and he was created a baronet in 1924. He was very closely associated with the electrical industry and at the time of his death was vice-chairman of the following companies:—British Insulated Cables, Ltd.; Midland Electric Corporation for Power Distribution, Ltd.; the Electric Supply Co. of Victoria, Ltd.; the Electric Supply Co. of Western Australia, Ltd.; and the Telegraph Manufacturing Co. (Colonial), Ltd. He was also a director of the Automatic Telephone Manufacturing Co., Ltd., and the La Plata Electric Tramways Co., Ltd.

Mr. C. E. Davies.—The death has occurred, at his residence, Church End Farm, Billingham, following an attack of pneumonia, of Mr. C. E. Davies, electrical engineer on the staff of the Chief Engineer to the Synthetic Ammonia and Nitrates, Ltd., Billingham, near Stockton. Mr. Davies, who was 54 years of age, had had a wide experience in electrical engineering, in London, Cardiff, and South Wales. He went to Billingham about five years ago from the British Thomson-Houston Co., Ltd., Rugby.

Mr. R. W. Hogarth.—We regret to learn of the death of Mr. Robert W. Hogarth, senior partner in the firm of Buchan and Partners, consulting engineers, of London and Edinburgh. Mr. Hogarth, whose years did not number many over fifty, is described as a pioneer in Scottish water power utilisation, and as being prominently identified with important Scottish electrical development schemes, including the Fall of Clyde hydro-electric scheme, for which he acted as consulting engineer to the promoters.

Mr. H. O. H. Wenman.—The death has taken place at Smethwick of Mr. H. O. H. Wenman, who was the pioneer of electricity at Bishop's Castle, Salop. Many years ago he purchased the old gasworks, where he installed electrical plant.

Dr. Luigi Casale.—Quoting the *Chemical Age*, the *Daily Telegraph* reports the death at Milan of Dr. Luigi Casale, inventor of the Casale process for the fixation of atmospheric nitrogen.

Ald. J. W. Henderson.—The death has taken place suddenly of Ald. John Watt Henderson, chairman of the South Shields Corporation Electricity Committee and a former mayor. He was for many years vice-chairman of the Tramways Committee.

Wills.—The late Mr. C. L. Troup, electrical engineer, of Victoria Dock Road, Canning Town, left £5,518 net and £7,977 gross personalty.

The late Sir Francis Fox left £40,615 gross and £32,345 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

W. G. Hodgson & Co., Ltd.—Private company. Registered February 24th. Capital, £1,000 in £1 shares. Objects: To acquire the business of an electrical engineer and contractor now carried on by W. G. Hodgson at 7 and 8, Broad Street, Cheapside, E.C., as "W. G. Hodgson & Co." The permanent directors are:—W. G. Hodgson, A.M.I.E.E., 24, Nella Road, W.6, electrical engineer; Mrs. E. Hodgson, 24, Nella Road, W.6. Qualification, £100 shares.

Phone Conversion, Ltd.—Private company. Registered February 22nd. Capital, £3,000 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, manufacturers and workers of and dealers in electricity, manufacturers of and dealers in wireless apparatus, &c. The subscribers (each with one share) are:—A. Marr, 23, Reynell Road, Longsight, Manchester, telephonic expert (late Lieut. R.A.F., Technical); Col. A. Young, 135, Colinton Road, Edinburgh, surgical instrument manufacturer. A. Marr is permanent governing director. Qualification, £100. Registered office: Leinster Chambers, 4, St. Annes Square, Manchester.

J. L. Gottlieb & Co., Ltd.—Private company. Registered February 21st. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in drawn wire, electric cabling, electric lamps, and all parts used in connection with electrical, telegraphic, telephonic, and wireless instruments, &c. The first directors are:—Miss Kathleen Hosler, 19, College Road, Bromley, secretary; J. L. Gottlieb, 10, Hillcrest Avenue, Golders Green, N.W.11, merchant (permanent). Secretary: F. Lacey. Registered office: 89, Upper Thames Street, E.C.4.

Red 'Phone Book (Newcastle), Ltd.—Private company. Registered February 22nd. Capital, £500 in £1 shares. Objects: To adopt an agreement with The Trade Telephone Books, Ltd., to carry on and develop the business of publishers of "The Red X Phone Book," &c. The first directors are:—D. I. Munro, "Lynn Garth," Gowland Avenue, Milvain Estate, Newcastle-on-Tyne; J. W. Driffield (permanent managing director), 6, Curtis Road, Newcastle-on-Tyne. Qualification, £10 shares. Solicitor: V. Hadaway, 50, Pilgrim Street, Newcastle-on-Tyne.

Lincoln Radio Supplies, Ltd.—Private company. Registered February 25th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers, assemblers, installers and repairers of wireless telegraphic, television and telephonic apparatus, &c. The directors are:—C. W. Cottam, 15, The Strait, Lincoln; A. G. Shipley, The Limes, Lindum Terrace, Lincoln. Qualification, 50 shares. Secretary: H. R. Sharpe. Solicitors: Langley, Stevens & Phillips, 34, Silver Street, Lincoln. Registered office: 14, Silver Street, Lincoln.

British Electric Meters, Ltd.—Private company. Registered February 24th. Capital, £50,000 in £1 shares. Objects: To acquire from R. W. Jolly, N. B. Coop and Meters, Ltd., certain letters patent or patent rights relating to electric meters; and to carry on the business of manufacturers of electric and other meters, dynamos, magnetos, storage batteries, electric motors, lamps, bells, horns, telephones, telegraphs, &c. The subscribers (each with one share) are:—R. W. Jolly, 10, South Park Road, Wimbledon, S.W.19, electrical engineer; N. B. Coop, "Hartford," Ebbenston Road, Colwyn Bay, electrical research engineer. The first directors are to be appointed by the subscribers. So long as Meters, Ltd., holds more than one-half of the capital, it may appoint five directors. Qualification, £200 shares. Manager: R. W. Jolly. Solicitor: J. R. Knott, 103, Union Street, Oldham. Registered office: 45, Westminster Bridge Road, S.E.1.

Clear Hooters, Ltd.—Private company. Registered February 16th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of, agents for and dealers in electric horns and hooters, and all kinds of electrical, mechanical, and other signalling devices, &c. The first directors are:—J. H. Mills, Heath Lea, Castle Bromwich, motor accessory manufacturer; T. S. Rogers, 25, Edmund Lane, Saltley, Birmingham; L. J. F. Austin, "Sherington," Hadzer Road, Warley, Worcs., C.A. Qualification, 2 shares. Registered office: Lichfield Chambers, 1-2, Upper Priory, Birmingham.

Official Returns of Electrical Companies.

Walker, MacEwen & Co., Ltd.—E. H. Willoughby, of 63, Loraine Mansions, N.7, was appointed receiver (in place of E. L. Holford), on February 8th, 1927, under powers contained in debentures dated November 30th, 1922.

Deansgate Electric Radio (Manchester), Ltd.—C. A. Leeming, of 11, Dartmouth Road, Whitefield, Manchester, was appointed receiver and manager on February 9th, 1927, under powers contained in debenture dated January 10th, 1927.

Almondsbury and District Electric Supply Co., Ltd. (183,582).—Capital, £3,000 in 1,000 preference and 2,000 ordinary shares of £1 each. Return dated December 16th, 1926. 1,000 preference and 1,115 ordinary shares taken up. £2,115 paid. Mortgages and charges, nil.

Auto Mechanical Rectifiers, Ltd.—R. S. Andrews, of 448, Strand, W.C.2, ceased to act as receiver or manager on February 14th, 1927.

Electricity Distribution of North Wales and District, Ltd.—Second mortgage debenture dated February 10th, 1927, to secure £150,000, inclusive of £100,000 secured by charge dated March 12th, 1926, already registered, charged on certain freehold and leasehold properties at Rhyl, Meliden, Denbigh, Sandbach, Alsager, Elsworth and Flint, and the company's undertaking and property, present and future, including uncalled capital. Holder: H.M. Treasury Solicitor.

Newton Brothers (Derby), Ltd.—Satisfaction in full (1) on January 10th, 1927, of mortgage dated May 29th, 1923, securing £12,000; and (2) on February 11th, 1927, of debentures dated September 16th, 1925, securing £50,000.

East Lancashire Electrical Co. (Accrington), Ltd. Capital, £3,000 in £1 shares. Return dated August 10th, 1925 (filed January 15th, 1927). 1,475 shares taken up. £1,325 paid. £150 considered as paid. Mortgages and charges, nil.

Neutron, Ltd.—R. S. Andrews, C.A., of 448, Strand, W.C.2, was appointed receiver (with other powers) on February 7th, 1927, under powers contained in second mortgage dated November 5th, 1926.

Accumulators of Woking, Ltd.—H. T. Witt, of 5, Chancery Lane, W.C., was appointed receiver on February 16th, 1927, under powers contained in debenture dated November 30th, 1920.

C. & J. Arrigoni & Co., Ltd.—H. F. Crowley, of 65-66, Chancery Lane, W.C.2, was appointed receiver on January 24th, 1927, under powers contained in debentures dated December 4th, 1925.

Liverpool Electric Cable Co., Ltd.—Capital, £50,000 in £1 shares. Return dated December 14th, 1926. All shares taken up. £7,833 paid. £42,167 considered as paid. Mortgages and charges, £1,372 3s. 7d.

City Notes.

The "Underground" Group.

The annual meetings of the four electric railway companies and the London General Omnibus Co., Ltd., forming this group, were held on February 24th, Lord Ashfield (chairman) presiding. In moving the adoption of the reports and accounts, which were dealt with at length in our last issue, the chairman said that having regard to the troubles of the year, the position could be considered satisfactory; the companies had come through without permanent impairment of their financial condition. The working of the Common Fund had permitted the repetition of the 1925 dividends; the railway companies, which had suffered, had benefited by the larger contribution of the omnibus company. Although the railways had been extended, they lost nearly nine million passengers. Had it not been for the industrial troubles, all the members of the group would have shown a record expansion. To indicate the effect of the general strike upon their traffic, Lord Ashfield mentioned that there were no fewer than 28,000 factories of all sizes in the Greater London area. Even after the resumption of work, the effects continued to be felt, and they spread to the residential areas, depleting the shopping crowds which the companies normally carried. As a consequence, the number of journeys per head of the population served had fallen from 503 to 494. The traffic on the extended City and South London Railway continued to grow rapidly, but the Edgware extension traffic had not advanced as quickly as was anticipated. They hoped for good results from the erection of houses at Burnt Oak and Morden by the London County Council. Inquiries by the London Traffic Advisory Committee had shown that further underground railways were wanted, and the companies would be gratified to undertake the work, with some of which they were in cordial agreement. Unfortunately, the capital costs would be enormous, and in their present condition the companies could never raise the amount of money required at reasonable rates. The Committee would have to wait until means had been devised of assuring the companies an adequate return upon the money which they had already spent. Many working economies had been effected, and the cost of operation per car-mile had thereby been reduced, but in the meantime further burdens in the way of taxation had been imposed, especially upon the motor-'bus undertaking. Income tax had proved a very onerous burden to the whole group; while the ordinary shareholders received £648,000, the Government received £751,000 out of the year's earnings. In conclusion, Lord Ashfield said he hoped that in future it would be realised that the stoppage of a public utility was not a legitimate means of furthering an industrial dispute.

The report and accounts were adopted.

London Tramway Companies' Reports.

Four of the London tramway companies published their reports for the year ended December 31st, 1926, last week, and these are summarised below. The annual meetings were to be held on March 2nd:—

South Metropolitan Electric Tramways and Lighting Co., Ltd.—The balance on working (net income) was £46,081, as compared with £48,248, and after deducting interest, rentals, and other fixed charges, a balance of £36,495 remains, plus £10,244 brought forward. From this £15,000 is again allocated to renewals, a dividend of 5 per cent. is to be paid on the ordinary shares (as for 1925), and a balance of £9,379 is carried forward.

Metropolitan Electric Tramways, Ltd.—There was a loss on working of £3,844, the traffic revenue being £628,569 and the expenses £632,413. Other income amounted to £127,047, which gave a net income of £123,203, as compared with £110,066 in the preceding year. After meeting interest, rentals, and other fixed charges, there was a deficiency of £28,788, as compared with £43,846 in 1925.

London United Tramways, Ltd.—The traffic receipts amounted to £390,894 and the expenditure to £363,698, leaving net receipts of £27,196, to which is added £7,006 representing other income, making £34,202. After meeting interest, rentals, &c., there is a deficiency of £20,070, as compared with £29,149 in 1925. A total deficiency of £65,575 is carried forward.

London and Suburban Traction Co., Ltd.—This company, which combines the foregoing companies and the Tramways (M.E.T.) Omnibus Co., reports total receipts from dividends, &c., of £52,583. Expenses amounted to £49,880, leaving a net revenue of £2,703. To this is added £17,066 brought forward, making £19,769, which has been carried forward. The previous year's net revenue was £4,362. The summarised figures of the four companies show that the number of passengers carried rose by 393,543 to 282,844,803, while the gross receipts at £2,134,636 were £3,643 higher; the net deficiency was £6,185.

North Metropolitan Electric Power Supply Co.

The net revenue for the past year was £293,195 (as against £315,292), and to this is added £6,676 brought forward, making £299,871. After providing for debenture interest and redemption and transferring £100,000 to reserve, there remains £154,706. As already reported, the final ordinary dividend is at the rate of 10 per cent. per annum, and £9,149 is carried forward. The capital expenditure during the year was £510,197, mainly in respect of plant, machinery, trunk and distributing mains, and new sub-stations. Approximately 145 miles of mains was laid and 39 new sub-stations were put into service. The energy sold rose from 112,000,000 to 118,900,000 kWh, and the number of consumers, supplied directly or indirectly, from 56,000 to 69,000. The financial results were adversely affected by the company's policy of not increasing charges to consumers on account of the coal dispute; indeed, in certain districts the rates were reduced. Supply was commenced during the year to Boreham Wood and Elstree, Cuffley, Great Amwell, Harmer Green, Stanstead and Wormley. The report makes reference to the registration of the North Metropolitan Power Station Co., Ltd., which has received a Government guarantee for £850,000 of 5 per cent. debenture stock, providing funds for the construction of the Brimsdown station. Since the last report 199,980 ordinary and 300,020 6 per cent. cumulative preference shares have been issued at a premium, and the total premium (£55,620) has been transferred to reserve. The holders of the 8 per cent. second preference stock have received notice that their holdings will be redeemed at par on July 1st, but they will be given an opportunity of exchanging the stock for new stock or shares. A Bill has been deposited in the present session of Parliament to increase the authorised capital by £1,500,000 and to extend the borrowing powers. The annual meeting was held on Tuesday last.

Lancashire United Transport and Power Co., Ltd.

The total receipts of the combined undertaking for 1926 were £283,177 and the gross profit £54,454. The loss of profit occasioned by strikes is estimated at £20,000. Motor-'bus and sundry receipts, including an amount received from the South Lancashire Tramways Co., amounted to £147,591. After deducting depreciation and interest, &c., on first mortgage stock, it is proposed to pay interest at 4 per cent. on the second mortgage stock and to carry the balance (£122) to depreciation account.

Sir Arthur Stanley, G.B.E., presided at the annual meeting on February 24th, and in moving the adoption of the report, said that the tramway traffic had been depleted by the general strike and the coal dispute, but the number of passengers carried by the omnibuses had increased. The profit on the sale of electricity (£11,381) was by far the highest yet obtained. The company had borne its troubles well, and a period of industrial tranquillity was now looked forward to. The prior lien debenture stock had been redeemed out of the proceeds of an issue of first mortgage debenture stock. The report and accounts were adopted.

Midland Counties Electric Supply Co., Ltd.

The trading profits of the undertakings owned and operated by this company for 1926 amounted to £186,189. From this the undertakings appropriated £21,625 for depreciation and reserves. Including £4,733 brought forward, the balance at credit and profit and loss account is £162,905. As announced last week, a dividend at the rate of 6 per cent. has been declared. £6,183 is transferred to debenture redemption account, and £10,000 to reserve, leaving £4,023 to be carried forward. The progress of the lighting and power undertakings continued, but at a lower rate, on account of the coal dispute. The traction properties were seriously affected, and did not show improvement. The company continued the extension of its network, and good results were obtained from the extensions. The amounts set aside for reserve and depreciation are lower on account of the loss of revenue due to the coal stoppage. During the year 250,000 preference and 250,000 ordinary shares were issued. The meeting was held on Tuesday last.

German Companies.

The directors of the *Siemens and Halske Company*, in their report for 1925-26, state that although the influx of orders was not greater than in the previous year, standardisation and improved methods of production gave larger profits. It was possible to lower prices in important branches. The orders received from abroad exceeded those booked in the previous year, notwithstanding the difficulties of high tariffs and other

protective measures. In the telephone cable branch, while orders from the Reich postal authorities had been few, large orders were received from Belgium on reparation account for the Vienna-Passau route, and also indirectly for that between Vienna and Budapest, and connecting links were also delivered for the connection of Switzerland and Holland to the German network. Large orders for automatic telephone plant were received from Italy, Japan, and Finland.

The report of the *Siemens-Schuckert Works* states that, despite the falling off of orders, the turnover was greater than in 1924-25. Greater attention was devoted to foreign business, although conditions were difficult. Large orders were received in connection with the Shannon hydro-electric scheme, and the company obtained important Russian orders. The works erected with the support of the company in Japan suffered from the economic difficulties in that country. An improvement occurred at the close of the year, orders being received from the iron and steel industries. Orders from the chemical industry had been satisfactory, and the business with the electricity supply concerns was about on the level of that in the previous year. The cable and overhead line branches were satisfactory. Large orders are expected in connection with the electrification of the Berlin city railway.

Belgian Company.

The *Union Electrotechnique* (*S.A.*), which absorbed an already existing firm in 1925, has issued its report covering the 14½ months to the end of 1926. The directors state that the results for this period were satisfactory, the net profits being 173,000 fr., permitting of the payment of interest on instalments and a "super-dividend" of 5 fr. per share. It is stated that the exports have increased by 253 per cent.

Ceará Tramway, Light and Power Co., Ltd.

The report for the year ended June 30th, 1926, shows a rise in the net receipts from 994,780 milreis to 1,043,915 milreis. The increased tariff which was put into force during the year was offset by wage increases, and the rise was due to the expansion of the lighting and power section of the business. A rise in the value of the milreis increased the sterling net results, but the exchange has since fallen. Although the results from the tramways are disappointing, there appears to be a steady improvement, and expenses should not increase. Out of the year's profits £12,026 has been put to reserve. If the results of the next few months warrant it, the directors propose to pay a dividend not exceeding 2½ per cent., free of tax, upon the issued capital.

Mersey Railway Co.

Speaking at the annual meeting on February 24th, the chairman (Mr. J. Falconer) said that in spite of the industrial disputes, the traffic had been maintained last year. After December 31st, 1925, the interest on certain classes of debenture stocks had become a fixed charge upon the revenues of the company, and since that date had been paid half-yearly. The company's report was summarised in our last issue (p. 312).

Quebec Power Co.

The *Financial Times* states that the report for 1926 shows gross income of $1,238,301, compared with $1,046,943 in 1925. Operating expenses were $271,034, compared with $236,644, leaving net operating income at $967,267, compared with $810,499. The report shows $7.84 per share earned on common stock, compared with $6.07 on less stock in 1925 and $4.37 on still less stock in 1924.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted:—

County of London Electric Supply Co.—1,773,334 ordinary shares of £1 each, fully paid, Nos. 1,330,001 to 1,500,000 and 4,000,001 to 6,603,334.

South London Electric Supply Corporation.—234,000 ordinary shares of £1 each, fully paid, Nos. 310,001 to 544,000.

Launceston and District Electric Supply Co., Ltd.

A gross profit of £2,158 was reported at the annual meeting on February 18th. The vice-chairman (Mr. W. H. Symons) said that a number of new houses were being wired, including the last batch erected by the Council, and with the exception of eight or nine, all the business establishments in the town were consumers of electricity. A dividend of 6 per cent. was declared.

Montreal Light, Heat and Power Co.

The report for the past year records a gross revenue of $18,907,382 and a net income of $7,082,567. Dividends absorbed $5,135,041, insurance fund $58,644, and pension fund $20,000, leaving $1,869,482 to be transferred to capital and surplus. The report refers to a re-arrangement of the debenture capital during the year.

National Gas Engine Co., Ltd.

The profit for the past year was £27,467, and to this is added £15,894 brought forward, making £43,361. After meeting the preference dividend, it is proposed to pay a dividend of 2½ per cent. on the ordinary shares, leaving £16,360 to be carried forward.

Colombo Electric Tramways and Lighting Co., Ltd.

Negotiations have been reopened with the Ceylon Government for the sale of the company's power plant and distribution system. The company previously accepted an offer of £250,000, but cancelled the acceptance later on account of a variation of the terms.

Atlas Light and Power Co., Ltd.

The directors of this company (formerly the Argentine Light and Power Co., Ltd.) have declared an interim ordinary dividend of 2 per cent. No interim dividend was paid last year, but the full dividend was 4 per cent.

Direct West India Cable Co., Ltd.

A dividend at the rate of 3½ per cent. per annum, free of tax, has been declared on the ordinary shares for the past half year, as compared with a rate of 10 per cent. last year.

Halifax and Bermudas Cable Co., Ltd.

The ordinary shares are to receive a dividend at the rate of 10 per cent. per annum, free of tax, for the past half year, as in 1926.

Elgin Electric Supply Co., Ltd.

The profit for the past year was £1,447, as compared with £836 for 1925, and after paying a dividend of 5 per cent., £669 is carried forward.

Telegraph Construction and Maintenance Co., Ltd.

A final dividend of 7½ per cent., free of tax, is recommended, making 10 per cent., free of tax, for the year, as for 1925.

American Telephone and Telegraph Co.

A quarterly dividend of $2¼ per share has been declared on the common stock, as in 1926.

Pennsylvania Water and Power Co.

A quarterly dividend of 2 per cent. has been declared on the capital stock.

Canadian General Electric Co., Ltd.

A dividend of 1¾ per cent. has been declared on the preference stock for the quarter ending March 31st.

Stocks and Shares.

Monday Evening.

While the tendency of prices in the purely gilt-edged market remains dull—almost depressed—the disposition in other Stock Exchange departments is to put things better. A considerable volume of business is afoot. Slowly it becomes obvious that one effect of the war was to introduce Stock Exchange affairs to wide circles of the population which, previously, put their savings into the Post Office or equivalent old stockings. Every new issue that appears nowadays is accorded a closer inspection than it would ever before have received, and the war loans, so vigorously pushed by the Government, proved the means for popularising, to a remarkable degree, the wares of the Stock Exchanges.

The markets with which we deal here are amongst those that have benefited largely from this extension of public interest. The new investor displays a partiality for stocks and shares in companies that he can see at work. Taking the 'bus and tube group as an example, nobody—in London and its sprawling suburbs—can escape its penetrating presence. Electric lighting schemes, the country through, are of insistent and persistent interest. People like to "see their money in front of them," according to the fancy of a great many. The dominant wireless note struck in thousands of homes every night is a recurring reminder of Marconi, and although the past few years have been so unhappy for older purchasers of Marconi shares, the speculative fancy lightly turns towards them as holding promise for future prosperity.

And the "new investor" asks for prospects of capital appreciation, besides security of his money. We find, for instance, the holder of London electricity supply shares looking at these with the slightly dissatisfied air of one in whose investment the chance of improvement in value is but slender. He turns to the shares of the big provincial power supply companies, Midland Counties, Yorkshire, Newcastle-on-Tyne, Lancashire, and the Scottish undertakings. In the good concerns of this class, there is obvious scope for extension. Dividends are of the 6 per cent. to 8 per cent. order; prices stand relatively high, and yields are not liberal. But the investor of to-day foresees the likelihood of more capital being required; therefore, more issues of shares at bonus prices, more chance of profits in this direction than in bumper dividends. The policy of following this line of argument is reasonable: the main uncertainty, mentioned for what it may be worth, is the Government's possible action in the popularisation of electricity. To the ordinary man, the wisdom of using the existing stations, where suitable, would seem too plain for the admission of a doubt.

The County of London final dividend of 5 per cent., on old

and new shares alike (Electrical Review, p. 313), provoked a shade of disappointment in the market, where 6 per cent.—to make 11 per cent. for 1926—had been expected. The price reacted to 26s. 9d. and rallied to 27s. 6d., leaving a loss of 6d. on the week. Metropolitans drooped to the same extent, while Westminsters hardened to 25s. 6d. Midland Counties are 6d. up at 21s. 6d. Yorkshires and South Metropolitan preference regained the dividend deductions made from their prices last week.

The North Metropolitan Electric Power Supply Company seeks Parliamentary sanction to raise its capital by £1,500,000 to £3,500,000, with a corresponding increase in its borrowing powers. The Bill will pass unopposed through the House of Lords. The Company lately offered £850,000 5 per cent. debenture stock, under the Trade Facilities Acts, at 100½, the price of which stands at ⅛ discount; fully-paid scrip is quoted 100¼. In its report, issued the other day, the North Metropolitan shows an increase in the number of its customers, of 23 per cent., whose consumption of energy was 6 per cent. greater than that in the 1925 period. The Company's 6 per cent. first preference are quoted 22s., the 8 per cent. second preference stock at 100, and the 5½ per cent. debenture stock at about the same price. London Power 5 per cent. debenture can be bought at 98½, free of stamp and fee, with three months' interest due on April 1st. The yield is £5 1s. 3d. per cent. on the money, and the security stands in the front rank. County of London 7 per cent. debenture is on offer at 107, April and October interest. The stock can be repaid by the Company at 100 any time after 1931, and holders will do well to bear in mind the strong probability of redemption being effected at 100, in a few years' time. Also, there is a sinking fund, now in operation, for repayment at 100.

Piedmont Hydro Electric Company shares were thought to be on the point of introduction to the market, and their advent aroused attention. Advance details showed the Company to have an authorised and issued share capital of 600 million lire, divided into 4,800,000 shares of 125 lire each. The undertaking is stated to comprise over 40 hydro-electric power companies and telephone companies, the latter operating about 50 per cent. of the telephone services of Italy, under agreement with the Italian Government. For the three years 1922-1924 inclusive, annual dividends of 8 per cent. were paid. In 1925 the dividend was 9 per cent., and in 1926 9.60 per cent. Caution will recognise the speculative element that must attach to any industrial company working in Italy. Some hitch is said to have occurred in the negotiations, and the issue may be postponed for a time.

Mexican Utility issues remain in request, and a rise of 5 points brought the Light and Power preferred shares to 97½. The Company is expected to deal with the arrears of dividend on these shares, accumulated since October, 1913, by the allotment of a new stock carrying 4 per cent. interest. Nothing definite is known on the point, but an official statement is looked for in March. Other Mexicans are firming up. Anglo-Argentine Tramways preferences have improved, and Brazilian Tractions went ahead with a rise of 3½ points. On the other hand, British Columbia issues further reacted, the deferred and preferred being 3 and 2 down respectively. There is no fresh movement in the London tramways' prices. The reports of the companies are out, and the Metropolitan Electric Tramways have declined to renew their lease in 1930 unless the competition from omnibuses is restricted.

Lord Ashfield has promised to deal with the question of unifying London transport when he addresses the Underground Electric Railways of London meeting on March 15th. His speech is awaited with keen curiosity and interest. He foreshadowed a substantial raising of new money for the London General Omnibus Company. Last year, said Lord Ashfield, was a good one, but this year should be a better. Districts, Central Londons, Metropolitans, are all higher. The Underground £1 shares have advanced to 15s. 6d., at which the current yield on the money is £1 18s. 9d. per cent. The Southern Railway, according to a statement made in the House of Commons last week, is so satisfied with the electrification of the Company's London suburban lines, that it is anxious to proceed with further extensions.

United River Plate Telephone shares are 10s. up at 8⅞, the demand being pressing. Automatic Telephones lost a trifle at 53s. 6d., and International deferred sagged to 40s. 6d. The shrinkage in the price of the latter is arousing some little uneasiness in the minds of people who bought at several shillings above the present price, when speculation was active in the shares. It is now thought that the dividend will be 10 per cent., or possibly rather more. Cable stocks and shares have not changed in price for a week.

Johnson & Phillips gave way abruptly to 55s. 6d.; a subsequent rally to 56s. 3d. has left the price 2s. 6d. down on balance. Small losses occurred in British Insulated, English Electric, and General Electric. Henleys are easier at 89s. 3d., but the preference at 4½ have regained the dividend taken off the price a week ago. Iron, steel, and engineering shares display a harder disposition. The rubber share market is bracing up; the raw produce looks firmer, and there is not much floating supply of shares to satisfy the mild inquiry of the past few days. Speculation does not exercise a great deal of discrimination nowadays if it sees a possible chance of a rise, but a general advance in rubber shares at the present time might easily prove to be premature. In wireless shares, Marconis are 1/16th up at 16s. 3d., and Canadians at 3s. 10½d. have gained a few halfpennies.

Share List of Electrical Companies.

	Nom. £	Dividend. 1924.	Dividend. 1925.	Price Feb. 28 1927.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	14	14	60/9	—	4 12 0
Brompton Ordinary	1	10	10	25/-	—	5 12 0
Charing Cross Ordinary	1	15	15	25/6	—	5 9 10
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	12	12	25/-	—	5 12 0
City of London	1	15	15	2 1/16	—	... ...
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	29/6	—	5 8 4
County of London	1	15	15	27/6	—6d	5 1 10
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/3	—	6 2 0
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	30/6	—	6 11 2
Kensington Ordinary	1	15	15	24/6	—	5 14 3
Lancs. Light and Power	1	7½	7½	24/-	—	6 2 5
London Electric	1	10	10	24/-	—	5 17 8
do. do. 6% Pref.	5	6	6	5 1/16	—	5 10 4
Metropolitan	1	11	11	25/3	- 6d	5 9 10
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	21/6	+6d	5 14 8
Newcastle-on-Tyne Ordinary	1	7	7	21/3	—	6 11 0
do. 5% Pref.	1	5	5	17/6	—	5 14 8
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	25/-	—	5 12 0
South London	1	15	15	24/6	—	6 8 0
South Metropolitan Pref.	1	7	7	1½ xd	+6d	6 8 0
Urban Ordinary	1	4	7	25/	+6d	5 12 0
do. 6% Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	25/6	+6d	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/8	—	7 8 2
Yorkshire Elec.	1	8	8	29/6xd	+9d	5 8 4
Home Rails.						
Central London Ord. Assented	Stock	4	4	70 xd	+½	5 14 4
Metropolitan	,,	5	5	63½ xd	+15/-	4 14 6
do. District	,,	3½	3½	59½	—	5 18 8
Underground Electric	£1	Nil	Nil	15/6	+6d	1 18 9
do. do. Income	Bonds	6	6	104	—	*5 15 5
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	100	—	6 0 0
do. Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	1	8	10	53/3	—6d	3 15 0
Chili Telephone	5	5	6	6½	—	4 12 4
Cuba Sub. Ord.	10	5	5	7	—	7 5 6
Eastern Extension	10	10	10	17⅝	—	*5 13 4
Eastern Tel. Ord.	Stock	10	10	172½	—	*5 16 0
Globe Tel. and T. Ord.	10	10	10	18⅝	—	*5 6 8
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	22	20	26¾	—	7 10 0
Indo-European	25	8½	10	46½	—	*3 7 6
Marconi	1	10	Nil	16/8	+ 1/16	... ...
Marconi-Marine	1	10	7½	1⅛	—	6 13 4
Oriental Telephone Ord.	1	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	5	8	8	8⅞	+½	*4 10 2
Western Telegraph	10	10	10	17	—	*5 17 8
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3⅜	+⅛	8 16 0
do. do. 2nd Pref.	5	6	6	3 1/16	+ 1/16	9 16 0
do. do. 5% Deb.	Stock	5	5	71½	—	7 0 0
British Electric Traction Ord.	,,	7	8	145½	—	5 10 0
do. do. 6% Pref.	,,	6	6	109	—	5 10 1
Brazil Traction	100	4	5	124½	+3½	4 1 5
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	96/-	136/9	120½	—3	*5 3 9
do. do. Deferred	,,	129/5	8	157½	—3	*5 2 6
do. do. Deb.	,,	4½	4½	81½	—	5 4 4
London & Sub. Trac. 5% Pref.	1	2½	Nil	6/6	—	Nil
London United Tram. Deb.	Stock	4	4	49½	—	8 1 8
Mexico Trams, 5% Bonds	—	5	5	69½	+2	7 4 0
Mexican Light Common	100	Nil	Nil	42	—	Nil
do. Pref.	100	Nil	Nil	97½	+5	Nil
do. 1st Bonds	—	5	5	70½	—	7 1 10
Yorkshire (West Riding)	1	5	—	10/-	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	1	12	13	52 6	—	4 19 1
British Aluminium Ord.	1	5	10	46/3	—	4 6 7
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 18 5
British Insulated Ord.	1	15	15	68/9	- 3d	4 7 3
Brush Ord.	1	10	10	28/3	—	7 1 7
Callenders	1	15	15	8½	—	4 5 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	84	—	5 19 1
Electric Construction	1	10	10	31/3	—	6 8 0
Enfield Cable Pref.	1	7½	7½	1½	—	6 6 4
English Electric	1	5	Nil	14/6	- 6d	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	5	7½	31/-	—6d	4 16 9
Henley	1	16	20	89/3	—9d	4 9 8
do. 4½% Pref.	5	4½	4½	4½ xd	+2/-	5 6 0
India-Rubber	1	5	5	1	—	*5 0 0
Johnson & Phillips	1	10	17½	2 1/16	— ⅛	6 4 7
Met.-Vickers Ord.	1	8	8	28/3	—	5 13 3
do. Pref.	2	8	8	2 5/16	—	6 18 4
Siemens Ord.	1	7½	7½	29/6	—	5 1 8
Telegraph Construction	12	20	10	29¾	—	*4 0 8

* Dividends paid free of Income Tax.

The British Industries Fair.—III.

Functions and Exhibits at London and Birmingham.

THE heavy section of the British Industries Fair at Castle Bromwich, Birmingham, opened under the most auspicious circumstances, and on a note of optimism. The attendance of buyers from overseas, and also from this country, has been in excess of former years from the first week of the Fair, and the authorities issued an official statement on Saturday last to the effect that the buyers up to the previous night had numbered approximately 31,000. In very many instances buyers spent two and three days at the Fair. It was also officially estimated that the value of the business actually done during the first five days of the Fair was one and a half million pounds, whilst the number of business inquiries from all parts of the world, and particularly from the Dominions, was substantially in excess of those in previous years. It was pointed out that a good deal of business was re-opened with small far-away countries, from which, in a commercial sense, very little has been heard for several years. Another point of interest is that Australia, and some parts of South America, are buying on bulk lines, and this tendency is also a little more noticeable with regard to India, although it is still to a large extent what the export merchants describe as a "cheap market." On Saturday, there was a huge attendance of employés from all parts of the Midlands. The six miles of avenues were crowded in the afternoon, when over 30,000 persons were in the exhibition at one time.



Chloride Electrical Storage Co., Ltd.



British Thomson-Houston Co., Ltd.



General Electric Co., Ltd.



Metropolitan-Vickers Electrical Co., Ltd.

Four Electrical Stands at Birmingham.

The number of official delegations of trade and professional organisations has been larger than on any previous occasion, and every day last week from six to ten societies were entertained by the Council of the Fair at luncheon, and during the current week a similar programme will be gone through. There is no doubt that the visit of the Prince of Wales on Tuesday last week gave a very great impetus to the Fair, and the presence on the same day of Lord Mayors, Lord Provosts and Mayors of industrial towns also had a good influence in a similar way. The Lord Mayor of London, with the

Sheriffs of London, intimated their intention to pay a visit in civic state to the Fair on Wednesday this week. Wednesday last week was exporters' day, and other delegations then present were the members of the Consular Association of Birmingham, the Metal Thread Screw Manufacturers' Association, and the National Hardware Association. Mr. Stanley Baldwin, the Premier, had a most enthusiastic reception on Thursday last, and in company with Mr. L. S. Amery, Colonial Secretary, and the leading officials of the Department of Overseas Trade, made an extensive tour of the Fair. The Prime Minister described the heavy section of the Fair as an unqualified success, and declared that there could be no more convenient place for such a movement than Birmingham, which was in the heart of the country, and accessible from all parts.

On Thursday, the visitors included the Ironmongers' Federated Association, the British Commercial Gas Salesmen, and the British Society of Gas Undertakings. Having regard to the fact that the electrical industries' display is by far the biggest ever seen in the provinces, it is not surprising that there should have been a record attendance of electrical men. From Fr day to Monday, no fewer than 16 electrical delegation attended, and others were expected yesterday (Thur day). These bodies included, of course, the Institutio of Electrical Engineers, the Wholesalers' and Co tractors' Associations, tramway engineers, and civ engineers. Substantial business for shipment has bee done by the electrical manufacturers, particularly i the direction of power plant for Australia, New Zea land, India, and South Africa.

We reproduce on p. 359 photographs of the stand of four leading electrical companies, and below w give brief reports of the proceedings at some of th luncheons held at Birmingham.

The London Section at the White City also repor good business. An official report recorded an averag daily attendance last week of 1,200, with the exceptio of Saturday, when there was an influx of over 18,00 more than half being members of the public. Foreig buyer-visitors last week numbered about 1,500; Ge many, the United States and Holland were very we represented, and the Dominions also sent many buyer

THE BIRMINGHAM SECTION.

As mentioned previously, the principal guest at a luncheon given at Castle Bromwich on Thursday last week was the Prime Minister, who was accompanied by Mr. L. S. Amery, Colonial Secretary, Mr. A. M. Samuel, Parliamentary Secretary to the Department of Overseas Trade, and Sir Wm Clarke, Comptroller of the Department.

The toast of "His Majesty's Government" was submitted, in a brief speech, by Mr. Gilbert Vyle, president of the Association of British Chambers of Commerce, who said that he thought that the Premier would be convinced as a result of his tour of the Fair that British manufacturers were progressive and endeavoured to adapt themselves to present-day needs of British and foreign consumers.

Replying to the toast, the Prime Minister pronounced the Fair to be an unqualified success. He paid a tribute to the courage and foresight of British business men, and touched on the evidence which the Fair afforded of a new co-operative spirit in industry, marking a departure from the old English habit of secrecy and reserve. The other thing which interested him was the amount of space devoted to lighting and heating. The solution of the coal problem would undoubtedly come when the electrical people, the gas people, and the makers of stoves and modern fireplaces could bring into every cottage in the country, or every cottage within reach of gas or electricity, the means of cheap and clean heating which would eliminate the need for that most expensive method of distribution, the selling of small quantities of material like coal.

The delegations on Friday last were from the Association of Mining Electrical Engineers, the Incorporated Association of Electric Power Companies, the Institution of Electrical Engineers, the Municipal Tramway and Transport Association, and the Tramways and Light Railways Association. At the luncheon, Mr. R. A. Chattock, city electrical engineer, Birmingham, presided, and among those present were Mr. Roger T. Smith, Dr. A. H. Railing, Col. W. T. Kent, Messrs. H. H. Berry, D. Martin, Theodore Stretton, G. M. Harvey, F. Austen, C. Spencer, R. P. Sloan, J. T. H. Legge, W. J. Binnie, and A. H. Dykes, Ald. J. Bowes, Ald. Sir John Timson, and Mr. R. L. Horsfield.

The Chairman, apologising for the absence of Dr. Ferranti, who was indisposed, expressed the hope that the visit of the various representatives of the electrical industry would be profitable to them and would demonstrate that there was no intention that the old country should be left in the cold in the future.

Dr. A. H. Railing, proposing the toast of "The Visitors," said to him the Fair was full of indication that the industrialists of the country possessed common sense and intuition. Many of them had been to the exhibitions of Paris, Brussels, Dusseldorf, Leipzig, and Lyons, and had seen more spectacular displays, but what struck him as an engineer and manufacturer most forcibly in the Fair was that there was very little commonplace in it, that each piece of apparatus represented a deliberate pressing forward in speciality work, and not done haphazardly any more like of old. They wanted to see that those who had the direction of supply companies, manufacturing companies, and mines did not provide just for tomorrow, but for a long period ahead. They wanted supply companies and consulting engineers to realise that they must waive their personal opinions on minor matters to enable the manufacturers to get out of the manufacture of specialities in order to enable them to manufacture standardised articles on quantity production lines. The mine-owners must realise that they had to raise money for modern electrical equipment or else go under. Electrical manufacturers must go in for research so as to be pioneers, not imitators, and the big supply companies must assist those concerns who undertoo pioneer work. He thought that it was necessary for t horse-power per man in this country's factories and min and means of transport to be trebled or quadrupled to comparative with some other countries, and that was the on way largely to increase our output per man, and raise h wages, and thereby raise our export possibilities and increa our inland market.

The toast was responded to by Mr. Roger T. Smith, pa president of the Institution of Electrical Engineers.

Mr. T. R. Martin (J. H. Tucker & Co., Ltd.), Chairman the Management Committee of the Fair, and of the Adviso Committee of the electrical section, presided at a luncheon Saturday last, when representatives of the Electrical Pow Engineers' Association, the Meter Engineers' Technical Ass ciation, the National Association of Supervising Electrician the Birmingham and District Association of the Institution Civil Engineers, and the Institution of Electrical Engine (Students' Section) were present.

The Lord Mayor of Birmingham, with whom was t ex-Lord Mayor (Sir Percival Bower) extended a hearty cir welcome to the visitors. The electrical industry, he said, h set up a remarkably high standard, and it was warmly to commended for its enterprise.

The toast of the "Visitors" was proposed by Mr. R. Chattock, who warmly welcomed the numerous body of jun electrical engineers. During the past eight years, the peri in which that fair had been held, enormous progress h been made in electrical engineering, and much of the new equipment was to be found on the stands. The main adva tage of the Fair was that it enabled those in the industry compare one set of apparatus with another, which could n be done in any other way so satisfactorily.

The toast was replied to by Mr. A. W. Crompton (E.P.E.A and Mr. G. F. Shotter (M.E.T.A.).

Mr. T. R. Martin presided at another luncheon on Mond February 28th, at which the following bodies were rep sented:—The Council of the Birmingham Chamber of Co merce; the Electrical Contractors' Association; the Electri Contractors' Association of Scotland; the Electrical Who salers' Federation; the Illuminating Engineering Society; a the National Register of Electrical Installation Contractors

The toast of "The Visitors" was proposed by Mr. H. Berry, a member of the Fair Management Committee. referred with satisfaction to the growth of the electri section, which was instituted last year, and said that they, manufacturers, desired the co-operation of all the trade orga sations to help in the increasing prosperity of the Fair, its effect upon the British electrical industry, especially relation to foreign markets, was obvious. They would l the Fair to be looked forward to annually as a great tr effort. Apart from Press publicity, there were two ways bringing merchandise under the notice of buyers. One v by sending out commercial travellers, and the other by su exhibitions as the Fair. Mr. H. J. Miles (president of Electrical Contractors' Association) said that the Fair wa business-like display of British products; and Mr. Mackintosh (president of the Scottish Electrical Contracto Association) observed that while the Electricity Bill did mark the millennium, it would be to the benefit of the dustry. He said that he did not think adequate attention v paid to salesmanship; it was the predominant factor in th business. Mr. G. P. Dennis (president of the Electri Wholesalers' Federation) expressed the opinion that the el trical industry was not fully represented, and ur B.E.A.M.A. to make itself responsible for the electrical sect of the Fair in future years to ensure adequate representati

British Electric Transformer Co., Ltd.

This company's exhibit consists of three separate transformers in various parts of the buildings. One, a 1,000-kVA, 10,500/3,000-V, 3-phase, oil-cooled, core-type transformer (fig. 11), is displayed in the engine house. A 100-kVA, 3-phase, oil-cooled, core-type transformer, with switchgear, is to be seen in actual use supplying power for the exhibition, the power being derived from the Birmingham Corporation's mains. The other, a 33⅓-kVA, single-phase, radial-type, air-cooled transformer, is installed in a kiosk built by the Yorkshire Switchgear and Engineering Co., Ltd. The core-type transformers are of the "Berry" standard pattern, with cores interleaved and split to provide a cooling duct. The framework is of a patented box girder construction which is lighter and stronger than the usual channel steel section. The windings are concentric, mounted on bakelite cylinders, vacuum dried and impregnated. The ends are securely fixed by bakelite end blocks, the h.p. windings being provided with adjustable compression screws. Ample attention has been paid to the cooling of the h.p. windings by means of

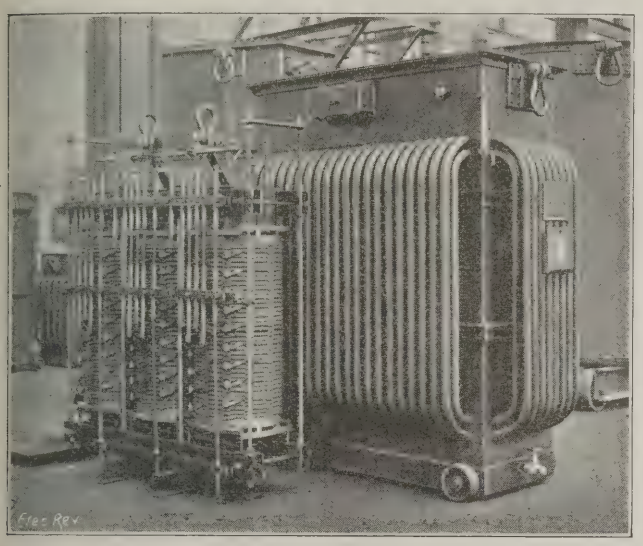


Fig. 11.—A 1,000-kVA, 10,500/3,000-V. Transformer.

vertical ducts through both h.p. and l.p. windings, with the addition of horizontal ducts in the h.p. windings only. The tanks are of the usual boiler-plate construction, with external cooling tubes for the oil. The 100-kVA, three-phase transformer, which is supplying power to the exhibition, is equipped with a special combination of h.p. switch- and fuse-gear made, so far as is possible, "foolproof" against improper use. The apparatus is entirely ironclad, and consists of a three-phase oil-break switch connected in series with three liquid-filled "Empire" fuses. The interlocks on the apparatus ensure that the following cycle of operations is observed, preparatory to the replacement of the fuses should they blow, or should circumstances necessitate the transformer being examined. The oil switch is opened, thus breaking the h.p. circuit; the entire oil switch is then lowered, and insulating barriers are interposed covering all the "live" ends of the cable. The same operation permits of the door of the fuse cubicle being opened, and access gained to the fuses, which are now entirely "dead." Similar operations carried out in the reverse order provide for putting the transformer back on to the supply. The small 33⅓-kVA air-cooled unit is of the original "Berry" radial pattern. It is specially designed for lighting purposes, having a very low open circuit loss with correspondingly good efficiencies at the lower loads. The actual figures are 98.1 and 98.25 per cent. at full and half loads respectively. The primary winding is sandwiched between the two halves of the secondary, giving an impedance value of about 3 per cent., and the secondary is wound in layers direct on under heavy tension. The primary consists of a number of separate coils former wound and assembled on the job. The main insulation used between windings and also iron consists of best-quality micanite gradually formed in position. Insulation between layers consists of linen fabric impregnated in vacuum with special "Berrite" insulating compound.

London Electric Wire Co. & Smiths, Ltd.

Upon this stand is a display of "Lewcos" products, which include silk, cotton, asbestos, covered and enamelled wire and strip of all sizes, as well as various types of wire for specific purposes. Insulating materials and wireless products are also displayed. The last section includes aerial and Litzendraht wire, screened coils, multi-way battery leads, &c.

K.F.M. Engineering Co., Ltd.

This company is a manufacturer of electric and other signs, and a number of these are exhibited on its stand. Some of these are distinctly original in construction and appearance.

Rees Roturbo Manufacturing Co., Ltd.

This company is showing running models of four Rees Roturbo pumps. The first is a boiler-feed pump, driven by a turbine. On this model the pump is carried from the turbine pedestal bearing, thus eliminating the baseplate and making a very compact arrangement. This is a comparatively new model, and although it has not long been on the market, we understand that there has been a good demand for it. The next exhibit is a pump of the "UCV" type, coupled to a Rees-Roturbo motor. This is of the medium lift type, and the casing is split on the centre line, allowing the whole of the internal parts to be readily examined or removed without disturbing the pipe connection. A multi-stage pump coupled to a Rees-Roturbo d.c. motor is shown, and an interesting exhibit is a self-contained pumping set of the "UH" type. This has been designed to meet the demand for a simple and cheap type of pump of moderate capacity. It is very compact, occupying minimum ground space, and very simple in design and construction. It embodies the Rees-Roturbo self-regulating properties with consequent immunity from overload of the driving motor through variation in head and volume when running at constant speed.

Stewarts & Lloyds, Ltd.

The exhibits on this stand comprise wrought iron and steel tubes for the conveyance of gas, water, steam, compressed air, &c., with all the necessary fittings. These tubes, ranging from ⅛ in. to 60 in. bore, are manufactured by the lapwelded, buttwelded, or solid drawn processes, according to size and quality. Of particular interest is the "Victaulic" joint, which is a cheap and efficient means of jointing tubes. The special feature of the joint is a flexible rubber ring on the principle of the "U" washer used by hydraulic engineers.

A. Reyrolle & Co., Ltd.

Substantial design is the keynote of this company's display. The switchgear section includes examples of air-break switches suitable for factories, foundries, ship yards, &c. Double- and triple-pole patterns are shown for currents of 30 and 60 A, and one notable item is a 60-A, triple-pole switch, combined with a 30-A plug and socket. The principal oil-break switch on view is a 60-A gate-end switch with boiler-plate tank (fig. 12). This is fitted with a mechanically-interlocked 60-A, 3-phase and earth pin plug and socket. It is claimed to have received the first "flameproofness" certificate from Sheffield University. A selection of cable boxes is exhibited. Among these are 6,000-V and 660-V, 3-phase dividing boxes with glands and armour clamps; 4-core and 20-core pilot dividing

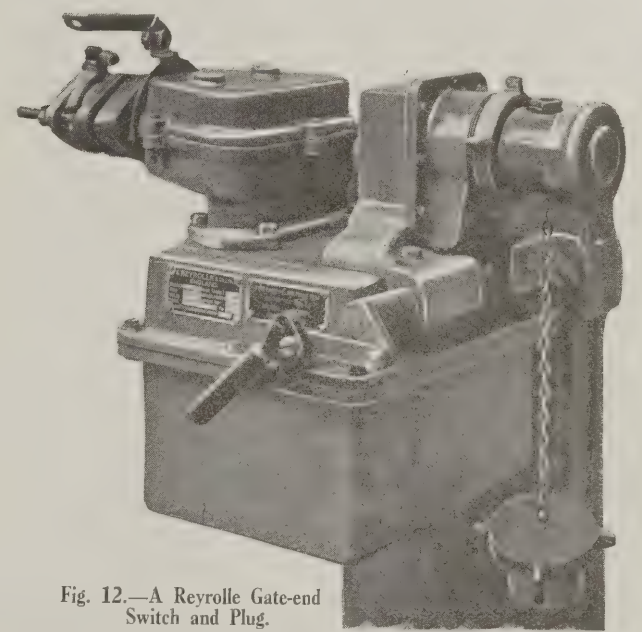


Fig. 12.—A Reyrolle Gate-end Switch and Plug.

boxes; an up-to-date telephone dividing box; and examples of sealing bells for general purposes. A combination of gear is a 100-A, double-circuit combined switch and fuse panel, a 60-A similar panel, and a 30-A single-circuit fusebox. The board forms one complete floor mounting distribution board, with incoming dividing box and cone gland on the left, extension end plate on the right, and outgoing circuit dividing boxes with universal glands and clamps. It may also be supplied for wall mounting and for use on any combination of circuits up to 500 A. A selection of ironclad distribution boxes is shown. Among these are a 60-A, two-way triple-pole weatherproof fusebox, complete with one incoming and two outgoing dividing boxes, each with universal gland, and a 30-A, four-way, single-pole dustproof fusebox. A demonstration board on the stand bears a number of domestic and industrial plugs and sockets. The industrial plugs shown include a 100-A flameproof combination, a 60-A, 3-phase, weatherproof pattern, vehicle-charging plugs, &c. Another demonstration board displays the company's standard self-aligning porcelain-handled fuses.

Blackstone & Co., Ltd.

Five models of the Blackstone "Spring Injection" cold-starting oil engine are the principal exhibits on this stand, other exhibits being the "Spring Injection" mechanism, the Blackstone combined petrol engine and compressor, a fuel oil filter tank, and Blackstone petrol engines of 4 and 5 b.h.p. The advantages claimed for the "Spring Injection" engine are that it will start from cold on any grade of fuel oil which can be pumped; the fuel is injected mechanically into the combustion chambers at the same point at the end of each compression stroke by a simple device, ignition taking place through the heat of compression in the cylinder; a more prolonged combustion can be obtained, with the result that the engine is not subjected to unnecessarily severe stresses, and the efficiency, both mechanical and thermal, is greatly improved. The fuel consumption per b.h.p.-hour is guaranteed in the single-cylinder sizes, developing 50 b.h.p. upwards, to be only .4 lb. for full and three-quarter load.

Belliss & Morcom, Ltd.

The principal exhibit on this stand is a 750-kW high-pressure steam turbine. This is coupled to a 750-kW alternator by the Lancashire Dynamo & Motor Co., Ltd. It has a speed of 3,000 r.p.m., is adapted for about 180 lb. steam pressure, and any temperature up to 450 deg. F. and 28½ in. vacuum. The diaphragms are rolled steel, fitted with standard brass blades throughout. For high temperatures the casing would be of steel and the high-pressure blades of Monel or stainless steel depending on the conditions. Both wheel and diaphragm constructions are illustrated by separate exhibits. The turbine has the standard governor gear for turbines of the size, the governor box at the end containing the oil relay mechanism. Another important exhibit is a Belliss "V" type enclosed compound high-speed engine, with forced lubrication. This is designed to develop 290 b.h.p. at a speed of 425 r.p.m., and will withstand a 25 per cent. overload. The slide valves are arranged between the steam cylinders, the centre lines radiating from the shaft centre in V form. The valve chests being so disposed, the necessity for outside receiver pipes is avoided. All bearings, including the joints of the governor, are lubricated with oil under pressure. The front doors are removed to show the working parts and the forced lubrication system, the engine being rotated at a speed of 25 revolutions per minute by means of a 3-b.h.p. motor supplied by the Crypto Electrical Co., operating through a Wallwork worm gear and a Hans Renold chain drive.

The 750-kW alternator made by the Lancashire Dynamo and Motor Co., Ltd., used with the steam turbine, is of the "Lancashire" turbo type with direct-coupled exciter. It has an output of 937 kVA at 5,000/5,500 V, with a power factor of 0.8. It is arranged for closed air circuit cooling, and with thermo-electric detector for recording the temperature at the switchboard. A separate exhibit is the "Arca" regulator, manufactured by British Arca Regulators, Ltd.

Kelvin, Bottomley & Baird, Ltd.

The principal exhibit on this stand is the "K.B.B." quartz mercury-vapour lamp, designed for scientific, medical and commercial application. The feature of this lamp is that the quartz envelope is not exhausted, the arc working at atmospheric pressure. Another feature is the slow rate of decrease of the ultra-violet output with usage, and the richness of the rays. The "K.B.B." "Pneumercator" distant boiler-water gauge, which is exhibited, can be placed in the best position for observation below, above, or at any reasonable distance from the steam drum, and as it is charged with cold water when in operation, the life of the gauge glass is considerably prolonged. It enables the water gauge to take its place amongst other boiler control instruments at a level which admits of constant and convenient observation. The "K.B.B." "Econometer" CO_2 tester is an instrument for analysing flue gases for CO_2. Of robust construction, it is charged with dry absorbents and gives high accuracy without the use of laboratory glassware, glass cocks, &c. There are no delicate parts, and no skilled adjustment is necessary. An interesting exhibit is the "Macbeth" artificial daylight lamp. The transmission filters used in this lamp are spectrographically tested, and their efficiency as a substitute for daylight has been certified by the N.P.L. Other exhibits on the stand include the "Pneumercator" tank-gauge, which provides a means for indicating at a distance the height, weight of volume of liquids in tanks; the "K.B.B." smoke warning and fume indicator, a simple device that renders the condition of the uptake gases visible at all times; the "K.B.B." vibrometer, providing a ready means for the detection and investigation of vibration; the "K.B.B." thermo-electric pyrometer; and samples of transparent fused quartz.

Hunt & Mitton, Ltd.

This firm is showing a representative selection of its steam fittings, boiler mountings, lubricators, &c., and also steel valves in all sizes from 1¼ in. downwards. The principal feature is a 12-in. "Supertite" cast-steel parallel slide valve, of massive pattern, for working pressures up to 450 lb. per sq. in. This is fitted with the Dean system of electric control for easy opening and closing. Developments in small stamped steel valves are shown, as well as samples of "Nickloy," a metal compound for valve faces under superheated steam.

National Gas Engine Co., Ltd.

This company displays examples of its "CS" type, 31-b.h.p., horizontal oil engine, a "CX" type, 66-h.p., horizontal oil engine, a "5V" town's-gas engine, a "National-Wallwin," non-chokeable pump, and a "10V" town's-gas engine and dynamo. The type "CS" is of massive construction, and designed to operation with a low consumption of fuel and lubricating oil; the special fuel pump and atomiser secure effective consumption at all loads. The atomiser passes through the water jacket to the combustion chamber, the entire surface of which is water cooled. Oil tanks and sprayers are provided for the use of light and heavy oils, the heavy-oil tank being arranged in conjunction with a strainer and heater attached to the exhaust pipe of the engine. The "National" "5V" and "10V" gas engines are fitted with a centrifugal governor of the latest type, which reduces friction to a minimum and controls the engine in an efficient manner. An arrangement is fitted so that slight speed adjustments may be made while the engine is running. A special mixing valve, entirely automatic in operation, gives the correct mixture of air and gas at all loads.

Record Electrical Co., Ltd.

This company exhibits a complete range of switchboard and portable measuring instruments, also automatic battery cut-in and cut-out switches for accumulators, automatic circuit breakers for power circuits, and electrical tachometers. There is a range of moving iron and moving coil "Cirscale" instruments, suitable for a.c. and d.c., respectively. These are provided with circular scales and a pointer which deflects through an arc of approximately 300 deg. This deflection is obtained entirely without gearing. For the mains engineer and electrical inspector, the new change coil test set for a.c. or d.c. will have a special interest. This set covers a very wide range from 0/1 amp., up to 600 amps., 0/6 volts up to 750 volts. There are no weighty accessories, such as shunts or transformers, which is an advantage. Among the newest developments is shown a range of skeleton instruments fitted in glass cases with transparent scales, so that readings may be observed from either side. These are for demonstration purposes in technical schools and colleges.

Vickers-Petters, Ltd.

This company, which has just changed its name to Petters (Ipswich), Ltd., is showing two types of heavy-oil engine, a "Petter-Light" set, and three other engines. Four of the exhibits are shown under working conditions. The Petter "C" type heavy-oil engine is a development of the hot-bulb semi-Diesel type, and has been developed to meet the need for an engine to give Diesel-like economy in fuel and lubricating oil combined with simplicity. It has a medium compression, and the cylinder head and combustion chamber are completely water-cooled. Ignition is effected solely by the heat of compression, no "hot-bulb" or other device being used.

Falkirk Iron Co., Ltd.

The principal exhibit of this company is, as last year, the "Falco" electric iron, several types of which are displayed. In addition, it is showing three models of the "Falco Livecoal" electric fire. These fires are designed to give an appearance of a live coal fire, the effect being helped by the manner in which the fire itself is raised from the floor in the old English style. One of the fires is a "period" rustless steel dog grate, the other two being of smaller, less expensive, sizes.

Harcourts, Ltd.

The principal exhibit on this stand is a process for depositing unstainable chromium on metal articles, called "Perchromia." This leaves the deposit glass-hard, and enables it to withstand attack from all household acids and salts. It does not tarnish in foggy or sulphurous atmospheres.

Ruston & Hornsby, Ltd.

The feature of this exhibit is a running model of the Ruston cold-starting horizontal oil engine, of the "Mark 13H," 130-b.h.p. type. This engine is made in sizes varying from 16 to 340 b.h.p., and the special claims made for it are low fuel consumption, low maintenance costs, continuous operation over long periods, ease of handling, and the ability to start from cold under any conditions. Another running exhibit is a Ruston two-stage air compressor, as used for charging self-starter air receivers, and the stationary exhibits include a 3-cylinder vertical oil engine of 57 b.h.p. and a Ruston patent "Thermax" boiler.

Batteries, Ltd.

The exhibit of this company consists of "Nife" batteries of the nickel-iron-alkaline type, which are specially suited to both light and heavy industrial purposes, as well as wireless and domestic uses. The principal point claimed in this type of battery is that it contains no lead or acid, but uses instead steel plates in a steel-preserving alkaline solution. On account of these elements the "Nife" battery has a number of advantages. There can be no sulphation or corrosion, no self-discharge or acid fumes, the battery can remain idle for an indefinite period, and it has a very long life and a high reliability factor.

Ward & Goldstone, Ltd.

The main feature of this exhibit is a comprehensive range of insulated wires, cables and flexibles for the electrical and automobile industries, and the ordinary range of commercial wires used for heating, power, and so on. The range of insulated flexible wires and cables for general electrical purposes covers every requirement, both in the quality of insulation and the style of finish, and embraces such specialities as "Negrolac," "Feroflex" and anti-shock flexibles. "Negrolac," a glossy black varnished cable, has been introduced especially to meet a demand for a cable of great flexibility, oil- and waterproof, and capable of withstanding extreme climatic conditions. A representative range of bell wires, telephone wires, and multi-telephone cables is included in the exhibit, as also are instrument wires with cotton, silk and enamel coverings. A range of some interest is the "Astra" and "Litz" special multi-stranded wire for plug-in inductance coils and transformers. In addition, there are being shown one or two models of high-tension battery eliminators for a.c. and d.c. circuits, and samples of battery-charging devices.

With the installation of a set of hydraulic presses at their factory, Messrs. Ward & Goldstone are now in a position to furnish large and small mouldings, and they are exhibiting a full range of these. A feature of the mouldings is that various colours with heat-resisting properties can be supplied.

Telegraph Construction and Maintenance Co., Ltd.

The exhibits on this stand, which are mainly the products of the Gutta-Percha Company, comprise two distinct sections. The first consists of special magnetic alloys. These have been named "Mumetal" and "Rhometal." "Mumetal" is characterised by its high magnetic permeability in very weak fields. It is in the form of fine wire, and has been successfully used for the inductive loading of high-speed submarine telegraph cables. In this respect it is interesting to note that section of the Pacific cable from Bamfield to Fanning Island, the longest single length of submarine telegraph cable in the world, was loaded with "Mumetal" wire, as the result of which the new cable can transmit signals at six times the rate of the old cable. In addition to this type of application, "Mumetal" has been used with success in current transformers. For certain requirements, however, the permeability of "Mumetal" is too high, and to meet these requirements "Rhometal" was produced. This alloy is characterised by its high electrical resistance, which is of the order of 100 microhms per cm. cube. Its permeability in fields tending to zero is of the order of 1,000. The second section consists of an electrical resistance alloy named "Pyromic," which contains no carbon, manganese, silicon or aluminium. It is a ternary alloy prepared in h.p. electric furnaces, and is manufactured in the form of wire, ribbon and tape. Also exhibited on the stand are three electric radiators, made by the British Electric Transformer Co., Ltd. These are wound with "Pyromic" resistance wire and tape.

Fielding & Platt, Ltd.

This company exhibits examples of its latest type semi-Diesel oil engine. These have been designed for use with fuel suitable for Diesel engines, but with less capital outlay, and they are specially suitable for dynamo driving, being quickly started and giving steady running, the cyclical variation being within very fine limits. The engine works on the four-stroke cycle of operation, and the oil injector is fitted with a cut-off valve which is controlled by the governor, so that the oil is cut off earlier or later in the stroke, according to the load on the engine. The combustion chamber is of patent design, and its action, in conjunction with the method of spraying the oil into it, ensures complete combustion.

Mouldensite, Ltd.

This company, which is associated with the Damard Lacquer Co., Ltd., Redmanol, Ltd., and the Bakelite Corporation of Great Britain, Ltd., is exhibiting samples of phenolic condensation products. These include moulding powders of various grades and colours, together with mouldings made from these, synthetic resins, varnishes, cements, and also laminated material in black and brown for electrical and radio work, punching, gears, &c.

Coventry Electrical Accessories, Ltd.

This company is showing its "Patent Point" electric iron, the particular feature of which is the special material inserted in the nose of the iron, enabling it to be used for at least half-an-hour after the current has been switched on for five minutes or so. The following appliances are also displayed: The "Ceal" electric iron, the "Wonder" iron, a grill toaster, an electric kettle, and a bowl fire.

British Vacuum Cleaner and Engineering Co., Ltd.

One of the most interesting of the exhibits on this stand is the "BVC." electric vacuum cleaner, which is the company's latest production. It is made in four sizes and is guaranteed against flaws or mechanical or workmanship defects for 12 months. Other exhibits are non-electric vacuum cleaners, in which line the company has specialised for many years.

The Steam Power Section.

An innovation in this year's Fair is a section devoted wholly to steam power plant and equipment. There are five large stands, three of which are equipped with boiler plant, while the other two show generating plant and auxiliaries. We have already dealt separately with a number of the components of this exhibit under the name of the responsible companies, but the following is a brief description of the arrangements. One stand bears a complete pulverised fuel installation (not working) consisting of an "Atritor" pulverising unit (Alfred Herbert & Co., Ltd.) fed by an Avery 2-cwt. automatic coal scale. The pulveriser is capable of dealing with 500 lb. per hour normal rating. The supply from the pulveriser is dealt with by a furnace embodying a flat double suspended arch (Liptak Furnace Arches, Ltd.) and air-cooled side walls. The boiler is one made by John Thompson Water Tube Boilers, Ltd., with a heating surface of 500 sq. ft. and a working pressure of 300 lb. per sq. in.; it is fitted with an integral-type superheater and fuel economiser, the latter being a product of the Clay Cross Co., Ltd. There are two boiler-feed pumps and a rapid feed-water heater by Frank Pearn & Co., Ltd., and the boiler is also equipped with soot-blowing apparatus by the British Soot Blower Co., Ltd. A "Sirocco" induced-draught fan and flue dust collector also form part of the installation. The instruments include steam flow and pressure indicators, CO_2 recorders, &c., by the Electroffo Meter Co., Ltd.; a Cope's automatic feed water regulator (Jas. Gordon & Co., Ltd.); a Kent boiler-level indicator; draught gauges, CO_2 recorders, temperature indicators, &c., by the Cambridge Instrument Co., Ltd.; and various indicators by Negretti & Zambra.

Another boiler installation which has been erected in the section comprises a John Thompson Lancashire boiler fitted with a mechanical stoker, made by the Crosthwaite Engineering & Furnace Co., Ltd. The stoker is fed by an Avery 2-cwt. automatic coal scale. The auxiliaries include a sectional superheater supplied by James Gordon & Co., Ltd.; flue-cleaning and soot-blowing apparatus by the British Soot Blower Co., Ltd.; an induced-draught fan by Musgrave and Co., Ltd.; water-softening plant made by the Paterson Engineering Co., Ltd.; a Lea "V" notch boiler feed meter; a Venturi recording water meter and a boiler load indicator (George Kent & Co., Ltd.); a Rees-Roturbo boiler feed pump; and an automatic feed-water regulator made by the Drayton Regulator & Instrument Co., Ltd.

One of the "engine-room" stands bears a Belliss & Morcom steam turbine, direct-coupled to a 750-kW Lancashire alternator. Near this set is a "Visco" water cooling tower and examples of "Visco" air filters. The tower is equipped with a Rees-Roturbo circulating pump. On the same stand is a 1,000-kVA transformer made by the British Electric Transformer Co., Ltd. There are also examples of "Cambridge" instruments on view. The *pièce de resistance* of the other "engine-room" stand is a compound steam engine direct-coupled to a 100-kW generator, by W. H. Allen, Sons & Co., Ltd. A steam meter supplied by Industrial Combustion Engineers, Ltd., is also shown. The last stand is devoted to an oil-fired vertical "Cochran" boiler, with a feed-water pump by G. & J. Weir, Ltd., and a temperature and pressure regulator by the Drayton Regulator & Instrument Co., Ltd.

Most of the exhibitors in this section also have stands near the section or in other parts of the building.

L. Gardner & Sons, Ltd.

This company is exhibiting a "12H.F." heavy-oil engine (65/69 b.h.p.), a "6H.F." heavy-oil engine (17/19 b.h.p.), a "4T6" heavy-oil engine (96 b.h.p.), and an "OVC" compressing set. The two "H.F." engines are of the horizontal (cold-starting) type, and the "4T6" is of the vertical 4-cylinder type, all these being constructed along recognised lines. The "OVC" is a combined engine and compressor, and its primary object is the initial charging of the air receivers for Gardner heavy-oil engines after installation of the main engine, or in cases where the pressure in the receiver has been lost.

Tangyes, Ltd.

Working models of a 47-b.h.p. heavy-oil engine (cold-starting type) and the "O.W.E.1" oil engine, lamp-starting type for electric lighting purposes are the principal exhibits of this company. The latter engine works on the four-stroke cycle, and has been developed to meet the demand for a small engine using lower compression and initial pressures than is possible with the cold-starting type, thus reducing the pressure on the various working parts. Other exhibits include Tangye centrifugal pumps, a vertical triple-ram pump, and a series of newly designed vertical single-ram pumps, a six-stage turbine pump, a horizontal duplex boiler feeder, a 40-ton hydraulic experimental press, and a selection of various types of pulley blocks, lifting jacks, &c.

Wolseley Sheep Shearing Machine Co., Ltd.

The exhibits of electrical interest on this stand are the electric lighting sets for farm and country residences and the electric sheep shearing and horse-clipping machines. The generating sets are made in four sizes, ranging from 1 to 3 kW. They all include a vertical single-cylinder petrol-paraffin engine, and the dynamo is arranged for belt or geared drive. The equipment is completed by a suitable accumulator battery and switchboard.

THE LONDON SECTION.

On passing through the Wood Lane entrance to the White City the trader cannot fail to admire the series of exhibits of Empire products and foodstuffs; it is indeed an object lesson on how such stands should be dressed, and the general scheme is considerably enhanced by the electric lighting scheme which has been admirably executed.

In the China and Glass Section of the Fair Mr. W. Moorcroft has some attractive pottery in the form of decorative table-lighting ware on view, whilst the Stourbridge Glass Co., Ltd., exhibits bowls and vases in the shape of table lamps of handsome appearance; illuminating glassware is also exhibited by John Walsh, Walsh, Ltd., and Thomas Webb and Corbett, Ltd.

Artistic Lamp Shades.

On several stands decorative electric lamp and candle shades are displayed, made of different materials in numerous styles: amongst them are the Artistic Shade Co. (hand-painted and washable), C. & O. Goring (vellum and parchment), J. M. Joseph (hand-painted silk), F. Parks, Ltd. (silk, parchment and vellum; painted wood table and standard lamps), Waite & Son (silk and linen), Wickins Durable Lamp Shade Co. (silk).

Electric Toys.

In the Toy Section of the Show several exhibitors use electric motors for imparting movement to objects displayed, and amongst the large selection of Meccano, Ltd., are toy electric motors and a large well-made model of a 3-rail railway system.

Ross, Ltd.

In addition to photographic and optical apparatus, a recently-introduced school and home kinema projector is shown; it is a portable outfit (fig. 13) weighing about 90 lb., and the illuminant consists of a 30-volt, 10-ampere filament lamp, and the light is concentrated upon the film by means of a double condenser and mirror at the back of the lamp. Before reaching the film the light passes through a water bath about 3 in. thick, which extracts the heat from the light rays so that the film may remain stationary in the gate aperture for a reasonable length of time without danger of catching fire.

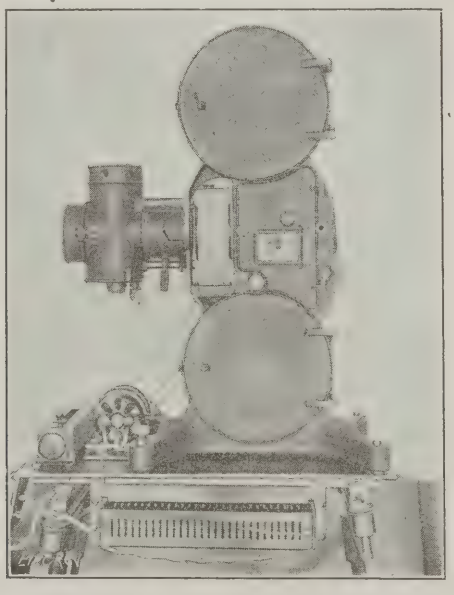


Fig. 13.—Ross Home and School Kinema Outfit.

The machine is substantially built; the main casting is of aluminium, as are also the lamphouse and condenser mount; the mechanism is mainly gunmetal and steel. A universal motor for use on alternating or direct current is provided, with the necessary voltage reduction resistance; a 3-in. lens will give a picture about 8 ft. by 6 ft., and standard films are used. The type of projector fitted in some of the largest London kinema theatres is also on view, the favourite being one provided with a "searchlight" arc lamp.

Watmel Wireless Co.

Besides screened coils, amongst the components displayed is a h.f. choke, the winding of which on an ebonite tube appears to be of a duolateral type in four sections, each bank spaced from the next, and all four in the form of a continuous winding. It is claimed that this type of winding cuts down the self-capacity, though the inductance is also reduced to some extent. The winding is mounted vertically in a celluloid tube on an ebonite base, provided with terminals and tags. In addition to a low-frequency auto-choke coupling, the firm has placed on the market a plain tapped l.f. choke, which is similar, with the exception that no coupling condenser and grid leak are incorporated. The winding is connected to three terminals giving three combinations, so that the value of the choke may be adjusted to suit any particular valve.

New London Electron Works, Ltd.

Among the radio receiving sets on view is the 5-valve model with three condensers in line with single control; cabinet work and loud-speakers, aerial wire, earth mats, &c., are also shown, and "Superial" flat copper strip, perforated to take 4 B.A. connections without solder; it can be turned and twisted easily with the fingers for wiring-up purposes.

Hart Accumulator Co., Ltd.

The company manufactures accumulators for all purposes, and its stand is one of the two largest devoted to batteries. A large variety of types is displayed, including several kinds suitable for radio reception work.

Whittingham, Smith & Co.

As their name implies, "Portadyne" radio receivers are portable sets enclosed in cabinets measuring 17 in. by 14½ in. by 8 in. deep, and provided with a carrying handle. Both four- and five-valve outfits are self-contained, including loud-speaker and batteries, but an external speaker may be "plugged in," which action disconnects the enclosed instrument.

Mr. Ernest Turner.

On this stand electrical measuring instruments for general use and wireless purposes are displayed; also a selection of condensers and coils, &c.

Universal Postal Frankers, Ltd.

Amongst this company's exhibits are electrically-driven postal franking machines containing three or six different denominations governed by one meter registering in the currency of the country.

I. Calvete, Ltd.

Besides electro-medical light-therapy apparatus and artificial sun-light lamps, electrical equipment for hairdressers is displayed on this stand, such as vibro-massage devices and hair-dryers and waving machines.

C. W. Dixey & Son.

Amongst the optical devices exhibited by this firm are various electrical aids for the deaf.

Technical Agencies Co.

This company is the agent for manufacturers of "Indurite" moulding powder and also moulded articles for the electrical and wireless trades.

Beetle Products Co., Ltd.

This company makes white moulding powders for electrical fittings, &c., and coloured powders for obtaining a translucent effect; also synthetic resins.

Birkbys, Ltd.

This company shows "Elo" synthetic resin moulded articles for the electrical and wireless trades in black, coloured and mottled colours; also moulding powders and varnish.

Scriptograph Co., Ltd.

The advertising devices shown consist of a lantern which projects moving pictures and script on to a ground-glass screen.

Radio Components.

In addition to the exhibitors of broadcast radio apparatus already mentioned, component parts and accessories are to be seen on the stands of Sidney S. Bird & Sons, Britains' Best Crystal, Ltd., Camden Engineering Co., Ltd., J.M.O., Ltd., Lissen, Ltd., Priory Loud Speaker Co., Ltd., Truphonic Wireless Co., Ltd., Western Laboratories, Ltd., M. & A. (Etherplus) Wolff, Edystone Radio Co., Ltd., and the Dubilier Condenser Co., Ltd.,

Manufacturers of cabinets for wireless receiving sets are represented by the Caxton Wood Turnery Co. and Universal Cabinets, Ltd.

Brilliant Sign Co. (1907), Ltd.

When referring to this company's display, we regret that the name "Internalite" day and night sign was applied to one of its exhibits, which, we are informed, is known as the interior lighting "Brilliant" sign.

Finally, mention must be made of the fact that, in addition to the usual postal and telegraph facilities and numerous public telephone call boxes, some three hundred special telephones have been installed on the stands of exhibitors in the section of the Fair housed at the White City.

Assisted Wiring Schemes.

The Fifth E.D.A. Conference.

THIS subject was again discussed at the E.D.A. Conference, held on February 18th, by Mr. W. F. T. Pinkney, of the Newcastle-upon-Tyne Electric Supply Co., Ltd. Mr. E. Slater (Editor of the *Electrical Times*) presided.

Mr. PINKNEY regarded assisted wiring as only a temporary measure, his view being that in the course of two or three years the necessity for it—at any rate for lighting—would cease to exist; the majority of houses would then be wired, and all new property was wired nowadays as a matter of course. He divided the methods of payment for assisted wiring into four categories, *viz.*, (*a*) short-term easy purchase of from one to two years; (*b*) medium-term easy purchase of from 2 to 7½ years (usually between 3 and 5 years); (*c*) long-term easy purchase from, say, 7½ to 10 years; and (*d*) simple hire. Generally speaking, the ordinary hire system, based upon a perpetual rental, would not become very popular with the public, nor would supply authorities be willing to offer terms which did not provide for redemption at the end of ten years or so. The companies with which he was associated had offered a system of short-term easy purchase over a period of one or two years, but it was not popular. The people who would agree to it as a rule were just as willing to purchase outright, and the system did not appeal to the tenant. The three to five years' scheme secured more business than the short term period, and, in his opinion, the 7½ to 10 year period was the best for lighting installations. The period was not so long that, with a reasonable standard of wiring, considerable cost was likely to be involved in maintenance, and the installation should still be in good condition when handed over to the consumer. Again, the tenant (as opposed to the property owner) did not consider it a great risk to make the relatively small rental payments required on a long-term easy purchase if he had to leave the premises after having paid his rental for a few years. The three main methods of payment for assisted wiring installations were: (1) the quarterly or monthly rental; (2) the prepayment meter system, with an increase in the price to cover rental; and (3) the additional price charged per kWh on quarterly or monthly accounts. He was in favour of charging rentals with the monthly or quarterly accounts, because it was the only system which did not affect the rate per kWh, and, therefore, was the only one which did not penalise liberal use. A large class of persons who were used to the slot meter system, still preferred that system. Until the problem of getting the consumer to take a supply other than through a prepayment meter had been solved, he did not see that full advantage could be obtained from assisted wiring schemes. To charge a monthly or quarterly rental for installations and to supply energy through a prepayment meter would mean doubling the cost of collection. Where it was possible to collect a weekly rental with the weekly house rent, as at West Hartlepool, this might solve the difficulty. No provision was necessary so far as lighting installations were concerned to cover the risk of disuse in the event of a change of occupancy and the new occupant refusing to rent the installation, because if a lighting installation were in a house it would be used. The danger did exist with heating or cooking circuits, however. In the case of the North-East Coast Companies the wiring was done by contractors, and so long as the contractors would work with the supply authority in a reasonable manner he saw no reason for setting up a wiring department. Only registered contractors were employed, and they had all agreed to schedule prices. For single installations these prices would not leave a large profit, but the method of canvassing enabled the companies to place orders for whole streets at a time, and a contractor able to carry out twenty or more installations could do so very economically. For a two-light installation the selling price to the consumer was £3 3s. 4d., the net price to the company £2 17s., and the monthly rental for 120 months, 1s. 3d. The prices increased progressively up to a 20-light installation, in which case the selling price to the consumer was £22 1s. 8d., the net price to the company £19 17s. 6d., and the monthly rental for 120 months, 5s. 6d. Plug points and two-way switching were installed as extras if desired. For installations of six lights or fewer the consumer had the option of paying 2d. per kWh extra on a prepayment meter. The company specified the class of material to be used, which was required to be of British manufacture. The great increase in the demand for accessories created by assisted wiring schemes, should result in lower prices, but there was a tendency towards increased prices. He hoped that the object of the Electrical Accessories Manufacturers' Association was not merely price maintenance. All supply authorities promoting assisted wiring schemes might get together and say what they required, what they considered to be a reasonable price, what a similar article could be bought for abroad, and that if they could buy at that price they could buy of British manufacture. In the case of assisted wiring schemes it was necessary to supply the first lamps; to omit to do so, particularly in the case of smaller consumers, meant that in order to cut down initial expenditure they would purchase one lamp only and carry it from room to room. There was also a tendency to use carbon lamps. With each monthly rental installation his company also included an electric iron free. That did not apply to prepayment installations. It was the practice of the company to maintain the installation (lamps excluded) for the first twelve months, but thereafter maintenance was undertaken by the consumer. It was necessary that application forms should be as simple as possible, in order that the consumer might understand them. For tenanted property a landlord's agreement was necessary. A standard figure of 30s. per service up to a certain length was charged for all services for small consumers, and this applied also to assisted wiring consumers, provision being made to cover this figure in the rentals. Particulars of service costs for underground services were given. The results obtained in 1926 were as follows:—

	Monthly.	Prepayment.	Total.
No. of applications received ...	3,021	9,064	12,085
No. of consumers connected ...	2,689	7,382	10,071
Net amounts paid to contractors	£25,052	£40,293	£65,345
Average net cost of installation...	£9 6 4	£5 9 2	£6 9 8 (average)
Annual revenue (energy only) ...	£11,500	£23,600	£35,100
Average No. of kWh used per annum	165	110*	
No. of electric irons supplied (10 months)	1,735	nil	

*Estimated.

In 1926 the actual consumption of prepayment consumers had fallen, due to the trade depression. In 1925 there were added 5,220 new consumers (apart from assisted wiring), and this could be taken as the normal rate of development. In 1926 there were added 16,472 new consumers, which included 10,071 assisted wiring consumers. The difference of 6,400 was nearly 25 per cent. above what was then the normal rate of development, so that the mere fact of offering hired wiring had secured many new consumers who had paid outright for their installations. The company was contemplating offering an assisted wiring scheme for cooking and heating circuits in residential property, and probably also water heating. Here there was risk of a hired circuit becoming disused before redemption if the period of hire were a long one. At the same time, the consumer would pay outright just as readily as he would pay rental over a very short period. The proposals provided for a five years' redemption period, and the intention was to require the consumer to guarantee to pay the rentals for three years. Heating circuits would be carried out by the contractors on a schedule, tentatively agreed upon, as follows:—

No. of radiator circuits up to 10 yds. run.	Contractors' price subject to 10% to company.	Monthly hire payments.
One	£2 12 6	1s. 0d.
Two	£5 0 0	1s. 10d.
Three	£7 2 6	2s. 8d.
Each additional circuit above three	£2 5 0	0s. 10d.
For lengths in excess of 10 yd. average run	1s. 7d. per yd.	1d. per 3 yd. or part thereof.

Cooker circuits would be run by the company's own men, because a cooker circuit could be carried out as a rule in half a day. The circuits would be surface jobs, in c.t.s. cable.

Discussion.

Opening the discussion, the Chairman gave particulars of an assisted wiring scheme in a town of 500,000 inhabitants in the United States, which he had received from Mr. A. Dow, of Detroit. There was vigorous competition by the gas company in the town. The metropolitan territory of the town had only 44,000 houses wired at the beginning of 1921, and in 1924 there were 110,000 residential consumers in that territory, as the result of the assisted wiring scheme. They were still adding at the rate of 1,500 monthly. In the period referred to, 66,000 homes were wired, and practically half the work was done by independent contractors, this representing three times the normal rate of increase of business before the campaign was started. It resulted in a total business amounting to well over £1,000,000 sterling. The

increased business of the central station had to be added to that. The scheme had prevented depression, which was imminent.

Mr. Edgar (South Shields) said that the prepayment meter was necessary in some cases. A considerable number of consumers were using irons, kettles, and other small apparatus on assisted wiring installations where prepayment meters were installed. The question of using larger apparatus, such as cookers, was a subject to be considered in relation to an alternative scheme to that of lighting. In no case at South Shields had there been the slightest difficulty with new tenants. In a number of cases the incoming occupier had paid the outstanding balance for the installation. At South Shields everything was supplied up to the lampholders. His experience showed that if schemes were carefully considered there was not the slightest doubt about their paying. The scheme in South Shields was commenced on May 12th, 1925. For the year ended March, 1925, there were connected to the supply mains a little over 4,000 domestic premises. At the end of June, 1925 (six weeks after the commencement of the scheme), there were an additional 750. At the end of December, 1925, there were 3,750 additional consumers; June, 1926, 8,902; December, 1926, 10,856. During 1926 the scheme was curtailed considerably owing to the indifferent coal obtainable, but the number of consumers actually connected under the scheme to date was 11,231. The average revenue per consumer was equal to 18.06 per cent. of the capital cost for mains and services, after deducting the extra charge of 2d. per kWh to cover the cost of installation and prepayment meter. Only a limited number had been connected for a full twelve months, and when the 11,231 consumers had been connected for twelve months the average revenue per consumer, as compared with the capital cost of mains and services, would probably reach a figure of 25 per cent. The capital cost of consumers' installations and meters from the inception of the scheme to date was £93,073, of which 6 per cent. had been recovered by the extra charge of 2d. per kWh, and the total revenue to date was £23,398.

Mr. C. H. Rayner (Manchester) said there had been some very satisfactory cases in Manchester recently in which landlords had wired a number of the houses they owned, in consideration of a small increase in the weekly rents.

Mr. A. C. Bostel (Hackney) said that in his district assisted wiring schemes were carried out under two systems, *i.e.*, extended payments for purchase, and free wiring. In such a district it was necessary to use prepayment meters to a large extent, and the charge for energy through those meters was 8d. per kWh, as compared with the ordinary flat rate of 5d. The lead-covered system of wiring was adopted, and the cost varied according to the number of lights. For a six-light installation the cost was sometimes as much as 27s. 6d. per point, which included switches, lampholders, ceiling roses, and lamps. If a cooker were installed, the supply authority provided it, carried out the wiring, and supplied through a separate prepayment meter calibrated at 1½d. per kWh: that was all the consumer paid.

Mr. F. H. Howell (Battersea) said that at Battersea there was a free-wiring system, which had been in operation for nearly two years, but there were not yet 1,000 consumers under that scheme. There was a standing charge per quarter of 16s. 3d. for six lights, plus 1d. per kWh for energy consumed. Very heavy lampholders were installed, so that consumers could use other apparatus. Irons were hired at 1s. per quarter, and kettles at from 1s. 6d. to 2s. (according to size), as well as cookers and fires. The scheme worked very well, and about 1,200 pieces of apparatus had been installed in 18 months.

Mr. F. W. Leevers, commenting on Mr. Pinkney's reference to price maintenance, said that the manufacturers to-day were very keenly alive to the necessity for the maintenance of quality. Cost of maintenance must be considered as well as first cost. "Electricity is cheap" was a "slogan" which should be constantly employed. He thought that electricity supply authorities might offer assisted wiring schemes to manufacturers to help them in the installation of the larger current-consuming apparatus.

Mr. H. W. Watts said that twelve months ago he had got a two-part prepayment meter into this country. They were used in thousands on the Continent, and the makers had a switch which would control the meter up to 20 A. The meters could be calibrated for any amount of shillings up to 15, and for any price per kWh. Such a meter was wanted badly for assisted wiring schemes, and he was sorry that no British manufacturers had placed one on the market.

Mr. S. B. Howard (Marylebone) said that in his area in the case of assisted wiring installations, the two contractors nearest to the premises to be wired were asked to tender, and the better was accepted. There were slot meters for any size of cooker. For one room they charged 6s. 6d. per quarter plus 1d. per kWh, and for two rooms, 7s. 6d. plus 1d. No charge was made for services.

Major Whittingham (managing director, Sussex Electricity Supply Co.) said his company had started an assisted wiring scheme, and provided lamps and shades. If they were not supplied, what assurance was there that the right type of globe and shade would be used? Should two-way switches be supplied as an extra, or omitted?

Mr. W. Ritchie (Hendon) stated that a weekly rental, ranging from 8d. for a four-point installation to 1s. 1d. for a nine-point house, plus the charge per kWh, was offered to his consumers, or alternatively, a supply through a slot meter, with an extra charge of 2½d. per kWh, and no fixed charge. He preferred the 1s. rather than the 1d. slot meter.

Mr. W. H. Edridge asked if assisted wiring schemes were wholly self-supporting?

Mr. Pinkney, replying to the discussion, said the selling prices of the installations provided by his company included lamps and shades. Two-way switching was supplied as an extra, if required. He could not see the advantage of the two-part prepayment meter. The collector had to take the ordinary money for energy from the meter, and it was just as easy to take the standing charges from the consumer as from another part of the meter. A disadvantage was that if a consumer had been away for a considerable time, he would have to put in a number of shillings to cover the standing charge for that period before he could get energy—and he did not like doing that, and the meter would have to be separately calibrated for every consumer. In reply to Mr. Leevers, he said his company would consider any industrial case that would show a commercial result. His scheme was self-supporting. The mains were not extended unless the company was satisfied that the business resulting would jutify it. Propaganda costs were included in the general costs of supply, but he could not say what percentage of the revenue had been charged to propaganda to obtain the new consumers connected under the assisted wiring scheme.

The Canadian Market.

General Prospects and Methods of Attack.

THE British exporter who wishes to extend his sales in the Canadian market has many problems to face. His chief difficulty is the presence just across the southern border of the Dominion of a formidable competitor who has penetrated the market in many directions and in many ways. The substantial financial interest of the United States in Canadian industries has led to the installation of a great deal of American machinery, the appointment of numerous American managers and foremen, and the fairly widespread adoption of American standards and methods. It is largely under these conditions that Canada has become as important industrially as agriculturally; consequently, keen competition has also to be faced from the factories of Ontario.

Another fact which is probably insufficiently recognised is that Canada is not one but several markets. There is Quebec, served by two great open ports in summer and by Halifax and St. John's in winter; in this province 80 per cent. of the population speak French. The sale of equipment and machinery must usually be effected by calling at works in various sections of the province. There is Ontario, with its active industrial cities of Toronto and Hamilton—the largest distribution centres of the province. The northern Ontario mining camps are large buyers of machinery, chiefly through Toronto and Montreal. Then there are the three Maritime Provinces containing, in Nova Scotia, the extensive works of the British Empire Steel Corporation. Turning west, the Prairie Provinces of Manitoba, Saskatchewan, and Alberta, have few factories, and at present mainly depend for their purchasing power on the success of agriculture, though mining and oil exploration are developing. This territory is being supplied to an increasing extent through Vancouver—an important change from the point of view of the British exporter, as will be seen later. Finally, there is British Columbia, formerly the most inaccessible province of the Dominion and now one of the most easily reached, owing to the opening of the Panama Canal and the establishment of direct services between British ports and Vancouver.

The many questions involved in catering to Canada's varied requirements are dealt with exhaustively in an admirable report by Mr. F. W. Field, H.M. Senior Trade Commissioner in

Canada, which has just been issued by the Department of Overseas Trade.

The value of the market, he points out, is materially increasing, and those firms who grow with the market will have substantial advantages. It is 3,729,665 square miles in extent, and over this large area is scattered a population of about 9,364,000.

Branch Works.

Mr. Field discusses in detail the several methods of representation which have been adopted by British firms with varying success. He gives first place to branch works, and on this subject his remarks will be of particular interest to the electrical manufacturer. Several British firms, he points out, have acquired an interest in Canadian manufacturing firms, but in these cases the British firms do not export to Canada.

One of the principal reasons for the substantial investment of the United States in branch factories is the desire to secure, as Canadian manufacturers, the benefits of British preferential tariffs. In the majority of cases it will probably be found that British manufacturers are able to export from their home works and do a profitable business in Canada. In certain industries, for various reasons, branch works of some sort may be necessary in order to transact a business of permanence and value. But many British firms might give careful consideration to the question of establishing a branch works in conjunction with an adequate selling organisation. If, after the most searching investigation, this course should be chosen, the firm may find it desirable to limit its initial operations to the assembling or manufacture locally of staples in everyday demand in the Dominion, utilising the distributing organisation of the local branch factory for the sale of the firm's more specialised finished products, which can be imported from the home factory, along with such semi-finished products or parts as are necessary.

In deciding to establish branch works, one of the first questions demanding consideration is whether it is more satisfactory to start an entirely new organisation or to proceed by associating British capital and experience with those of an existing Canadian organisation. Mr. Field says that a definite recommendation cannot be made in regard to a matter of this kind, but that there are many advantages in adopting the latter course.

A policy which has been followed by makers of machine tools, electric motors, and other machinery and equipment, is to establish their own branches in the Dominion, with repair shops. They must be careful to maintain stocks at important points adequate to, but not in excess of, actual requirements.

On the subject of agents on commission, Mr. Field considers it desirable, in view of the losses which some British firms have sustained in recent years through the appointment of unsuitable agents, or because suitable agents have not received the proper support, to repeat certain cautionary remarks which he has made in previous reports.

Hope for Trade Expansion.

For engineering firms a method of representation which has proved successful in more than one market is that of a joint arrangement among non-competitive concerns. Mr. Field's belief is that in this method, properly operated, lies considerable hope for the expansion of British trade. He supports his opinion by pointing out that three of the factors which have operated in the past against greater business in machinery and engineering supplies are the lack of sufficient local representation and active salesmanship, the failure of British manufacturers to keep in constant touch with those who have purchased their machines, and the inability to effect repairs and supply spare parts at short notice.

While the business in any one line may not be large enough to justify the establishment of a proper local organisation, which should remove the difficulties noted, it might prove feasible for several manufacturers of non-competitive machinery to have joint representation here, with a technical man to look after repairs, a good sales organisation which would adopt the American "follow-up" system, as it is termed, and a stock of the spare parts which are most likely to be needed.

Mr. Field adds:—"Several British firms who have either Canadian branch factories or offices are in a position to represent other British firms. By undertaking the representation of other British firms in somewhat similar lines the overhead expenses of the firm already established here are reduced and a good selling organisation is provided for other British firms at comparatively low cost."

The Personal Touch.

The Trade Commissioner emphasises the desirability of a personal investigation of the market in order to ascertain its possibilities and decide upon a course of action. In this connection he makes some useful suggestions regarding a suitable itinerary and also gives details of the time and expense involved. The best procedure to follow in respect of samples is also described. Attention is drawn to the facilities for storage and distribution which have been established by several reliable firms in most of the important cities of Canada

Mr. Field finds it necessary to draw particular attention to the fact that Canadian buyers attach much importance to deliveries, not only for the usual commercial reasons, but often on account of special considerations. The construction season in certain parts of Western Canada is of short duration. Contractors time their operations to a day, and are often under heavy penalties if their work is not then concluded. Sometimes delivery is required at a particular time because navigation to a certain port closes for the winter, or because machinery can be taken into a lumber, mining, or construction camp only on sleighs over the snow. Thus there are many good reasons why Canadian buyers must often insist on delivery by a certain date.

Publicity.

An interesting section of the report is devoted to publicity, embracing such varying media as kinema films, press advertising, attendance at conventions, exhibitions, and wireless programmes. In introducing the subject, Mr. Field makes the rather startling pronouncement that the cause of British trade has undoubtedly suffered from despatches which have appeared in sections of the Canadian Press. It appears that doleful and even harmful news concerning economic conditions at home finds its way through the foreign agencies.

Mr. Field observes that anything further which can be done by British manufacturers collectively and by the United Kingdom and Canadian Press and Press agencies in this direction, will be of immense value in helping to create a better selling atmosphere for British goods. He adds that the kinema film has also operated against British trade. The production, distribution, and exhibition of films in Canada is almost entirely controlled by foreign interests.

After referring to the necessity for keeping in personal touch with consumers, the report discusses the question of advertising generally. He says that while British firms, as a group, have increased their advertising in the Canadian market in recent years, firms of United States origin are still among the largest patrons of advertising space in Canada. Good results have accrued from advertising in Canada which has been properly planned and directed. There are so many factors peculiar to the Canadian market to be considered in an advertising campaign that he suggests expert knowledge of the Canadian market should be secured, say, by the combined assistance of United Kingdom and Canadian advertising agencies.

The manufacturers of the North American continent look upon advertising in the daily, weekly, monthly, trade and technical Press as an excellent investment. While this may be the same in the United Kingdom the policy of the United Kingdom firms, as far as advertising and publicity in the Canadian market is concerned, is, generally speaking, weak. Yet, with the keen competition to be met in all lines and in a market which buys largely the goods for which publicity has helped to create a demand, it is necessary to have a continually favourable atmosphere to assist a salesman. Spasmodic advertising is of little value. A well prepared and properly conducted campaign, over long and repeated periods, gives the greatest service. This market lacks the favourable publicity atmosphere which our competitors have there, and a change in this condition is a matter of great importance.

Mr. Field makes some observations regarding the Chicago Underwriters' Laboratory and the effect of its rulings on the sale of British electrical appliances in Canada. He refers in his report to the provision in the Dominion tariff for assisting the development of industries in Canada by exemptions from, or reduced rates of, duty on certain articles utilised in such industries. It is to be feared, however, that this concession is not likely to be of much service to the British electrical manufacturer.

Switchgear in the United States.

Writing to the *Electrical World*, Mr. M. M. Samuels, of the J. G. White Engineering Corporation, says: "Rupturing capacity guarantees were always a joke. No manufacturer was ever ready to submit the figures upon which his breaker rating was based. When a transformer or a motor or a turbine is purchased, there is no mystery about the guarantees; the constants and calculations upon which they are based are available. Not so in the field of breakers. . . . Large public utilities did make a great many tests recently at their own expense—the only tests of any value so far. But why did these public utilities undertake these tests? Why did they select breakers instead of any of the other thousands of articles which they are regularly purchasing? They found that they were spending millions on switches about which they could get very little information, and after spending all these millions they found themselves losing fortunes through service interruptions without any possibility of ever collecting anything from the manufacturer on a rupturing-capacity guarantee. Therefore they made up their minds that they were going to find out for themselves. All credit to them. If they keep up the good work, they will find out a great deal. They have already found enough to make the manufacturers refuse to give any guarantee on rupturing capacity. Who ever paid money for a piece of property because the man who sold it 'believed' that he had a deed? What is needed in the switching game is not merely bigger tanks, more oil, heavier contacts, &c., but new ideas, radically new ideas. Not development, but invention. What is the matter with the American inventive genius?"

Electrical Wholesalers Federation.

Annual Dinner.

THE annual dinner of the Electrical Wholesalers Federation was held at the Savoy Hotel, London, on February 24th, when some 230 members and guests were present. and Mr. G. P. Dennis, president, took the chair.

The Rt. Hon. Viscount Peel, P.C., proposed "The Reorganisation of the Electrical Industry." He said that in the Electricity (Supply) Act, 1926, the Government had taken full advantage of the knowledge of the State. The connection between the Government and science was growing closer each day. He thought that perhaps it was unfortunate that in this country we were the pioneers of the electrical industry, which had had to adapt itself to old houses. He agreed that there had been some State interference in the industry; but the Government was trying to harmonise those imperfections which the lack of co-operation between politicians and science had brought about. What was wanted was the minimum of State interference compatible with the production of electricity on the maximum scale. He did not think that any measure had been submitted to such thorough investigation as the Act had. As a result of the Act there must be a vast increase in the use of electricity, and if it did not also result in a large reduction in the price of electricity then the Board and the Commissioners should be scrapped. He congratulated the societies who had brought about the concordant clause in the Act. He believed that the country would return to those simple virtues which had made us great. In the chairman of the Board they had a man with all the qualities essential for the control of a great business.

Lt.-Col. J. T. C. Moore-Brabazon, M.P., seconded the toast. He said that he had been associated with the electrical industry for two years in trying to build up a measure of reorganisation, and he had no lack of confidence in the Act. He felt that it would result in progressively greater benefit as the years passed. In referring to his new enterprise in the treatment of coal, he said that they must face the cardinal fact that coal was the basis of industry in this country. It was necessary for all parties to put in the whole of their weight; he did not think that the railways were doing this. Was it right that on the north-east side of London there were no plans for suburban electrification? The railways had recently taken £6,000,000 out of reserve, but there was not a word of electrification. He had recently seen the domestic power curve of an important American company, which showed its maximum load in the summer, due to the refrigerating plant installed; that showed what could be done.

In reply, Mr. R. W. L. Phillips, president, I.M.E.A., heartily congratulated all those who had been elected on the Board. His Association was looking forward with the utmost confidence to the result of their deliberations. Most supply engineers would soon cease to be manufacturers and become distributing factors. But the electrical engineer had always been used to reorganising, and had worked along the lines of the Royal slogan, "Adopt, adapt and improve."

"The Electrical Wholesalers Federation" was proposed by Mr. D. N. Dunlop, director, B.E.A.M.A., who reminded the company that at the last dinner it was suggested that his Association did not do all that it might for the contractor, and that the conference which was arranged for the next morning had resulted in Clause 48 in the Act, which gave the contractors a status. Success was impossible without the hearty co-operation of all the representative bodies. He suggested that Sir Andrew Duncan and his colleagues, without waiting for the "grid," might bring pressure to bear upon those undertakings where the charges were high. He thought the people of the country were sufficiently well educated electrically to adopt electricity if it were obtainable at a reasonable price. Cheap electricity in this country was only possible with cheap coal; he was pleased that there was to be a fuel congress in 1928. The wholesalers excelled in salesmanship—not to the public, but to experts. If Clause 48 overcame the tendency to buy off the foreigner, it would bring about a reduction in unemployment. He suggested a further conference of all the associations to evolve a scheme which would be to the benefit of all interested.

In reply, the President said that all were greatly impressed by the responsibilities that had to be taken, not only by the Government and the Electricity Commissioners, but by the whole of the electrical industry, in order that there should be a co-ordinated system of all concerned. The underlying principle governing the organisation of the industry was to do the best for Britain. The greatest good could only come to the nation when all its members put into the industries the maximum amount of energy, time and thought of which they were capable. The electrical industry was, next to coal, the key industry of the country; it was safe to prophesy that electricity would be available in every household throughout the country. The problem of electrical service was not only to generate cheaply, but to endeavour to supply the complete installation, at the least possible cost. One of the chief aims of the Federation in supporting and sustaining the manufacturers was to guard and protect them against the financial bad patches that existed in Great Britain. They required in British-industry leadership three essential qualifications, vision, vigour, and insistence. All must work to the same end, stimulated by a common purpose to place Great Britain pre-eminent in the manufacturing world. The labours of the trade combines in the country had not produced the results hoped for, because they had been individualistic. They had recently had a glaring example of the effect on British industry of sectional working. A number of battery manufacturers formed a ring, the object being to sell to the user only. The wholesaler and contractor naturally looked about for fresh supplies. His Association endeavoured to get in touch with the ring to see if a working arrangement could not be made, but could not even get a reply to the letters sent. The result was that there was an enormous increase of imports, and the manufacturers themselves lost thousands of pounds of orders.

In proposing "The Guests," Mr. A. G. Beaver said the Federation was particularly honoured by the presence of Sir Andrew Duncan; it was the first electrical function that Sir Andrew had attended. The chairman of the Board could see the harmony which existed between the representative bodies in the industry, all of which would give him every assistance.

Sir Andrew Duncan, in reply, said he was glad to have accepted a position of service in an industry which would play such an important part in the future progress of the country. He felt that it would be wise to approach his new sphere with caution and not disclose too much too early. He thought that if the new child, the Electricity Act, was not nursed into healthy manhood, then the blame should rest with Col. Moore-Brabazon.

Mr. H. J. Miles, president, N.E.C.T.A., also replied, as did Mr. P. J. Brewer, chairman, E.L.M.A.; the former said that the bringing together of all sections of the industry, due to the efforts of Mr. Dunlop, had made the position satisfactory. Mr. Brewer stressed the point that the machine of co-operation was not yet ideal. Whatever happened, the fullest co-operation possible was wanted between the various associations.

The proceedings concluded with the toast, "Our Chairman," proposed by Mr. George Donovan. During the evening musical items were rendered by Mr. Topliss Green and Miss Ethel Sanders.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Electric Power on the Farm.

As a result of my article on "Rural Electrification and Agriculture," published in your issue of February 11th, I have had many letters from technical experts questioning the advantages of direct haulage of ploughs, &c., over the old wire-winding system.

Let us look broadly at this question and take East Lothian, where the standard of cultivation is second to none, as an example.

Some years ago there were many steam ploughing sets at work here—to-day I do not know of a single set, the wire winders are extinct. On the other hand, practically every farmer has a tractor, and a good proportion have two; in other words, direct haulage is universal.

Another example: Edinburgh 20 years ago equipped herself with a well-laid-out system of steam-driven cable cars, wire-hauled. They were scrapped last year and the direct haulage electric trolley has turned what was a failure into a conspicuous success.

I don't know of a single surviving example of wire-hauled cars; are they, too, extinct? In other words, practice has proved that it is more efficient to transmit power electrically than through a wire-haulage system.

Again, let us look at the problem from the farmer's economic standpoint.

Let us suppose the big wire-winders are the only practical machines; the farmer hires a set, gets his ploughing done, and the wire tackle moves on. The farmer is left in the spring time (when his peak load occurs) without any power-driven implement on his farm, and presumably with fewer horses than he normally would keep. How is he to carry on? He is in a similar position to that which he occupied with the old steam winders which he has ceased to employ.

No, Sirs, what the average farmer with 250 to 500 acres requires is a light tractor—reliable, cheap, and long lived; he must have it all the time, and his power unit should be so designed that normally the ploughing of the farm should be a one-man job. With cheap power this will lead to an increase in arable and a reduction in grass land, for the farmer will strive to keep an economic machine at work, and the horses, which will be considerably reduced in number, will mainly be used for the farm transport work except in the spring, when they will follow the power-driven cultivator and grubber and generally do what we may call the "gentleman's jobs." Then, again, when the crops are sown and the increased acreage of arable has led to an increased green crop of turnips, potatoes, and sugar-beet, the decreased horse staff

will be unable to undertake the drill-grubbing and cultivation which is essential to the success of these crops.

The tractor must again come to the rescue, and I may say that in designing my tractor this drill work was specially kept in mind; the flank wheel forming the third point of support is mounted on a slotted shaft, so that the breadth of track may be altered to suit any width of drill.

When the foliage closes the drills, hay and grain harvests are waiting, and again, if required, the light tractor can do the reaping; and when the stubbles are cleared the tractor-man hitches on his plough and starts his cycle afresh. How can the wire winder, which is useless among crops, hope to compete with the above?

It will require a bellyful of power for a short period and a power line designed and built to supply that power (which will be idle 70 per cent. of its time).

As a farmer I don't like the idea, and I think I can guess the feelings of the power engineer.

Andrew McDowall.

Mungoswells, *February 22nd*, 1927.

Power Supply for Wireless Sets.

I trust you will allow me a final letter in reply to that of Mr. Turner in your issue of February 18th, after which I will not trouble you further.

Briefly, the receivers I had in mind are manufactured by Standard Telephones & Cables, Ltd., although they are not marketed under that name, and as apparently Mr. Turner has acquaintances connected with that company, it should not be very difficult for him to obtain the apparatus for test. He admits he has not tested it, but allows that Standard Telephones *should* be able to make a good receiver, which is not surprising in view of the fact that this company was responsible for most of the apparatus in connection with the recently inaugurated transatlantic telephone service.

Should Mr. Turner be able to obtain facilities for a test of this 4-valve receiver, he will be able to find out for himself whether my contention is self-evidently absurd or not. My tests give me the following figures: 2-valve tuner, 3 mA at 12 volts, 2-valve amplifier, first valve 2 mA at 60 volts, last valve 4 mA at 120 volts. I am quite willing to leave the quality of reproduction also to any of Mr. Turner's tests.

If after test Mr. Turner still will not agree that distortionless reproduction can be achieved with this low wattage, I should be very interested to know on what tests he bases his contention. If it is possible later to arrange a test, it seems to me that it should take place in my district, a difficult spot on the South Coast, and not in London, in order to obtain a comparison under not too easy conditions. I should prefer, however, that Mr. Turner tests the apparatus for himself.

It will be obvious that before I can consent to any independent test I must obtain, if not the co-operation at least the consent, of the manufacturers.

Interested.

February 19th, 1927.

Electricity Supply Tariffs.

I have been very interested, on my return from South Africa, in seeing the article by Prof. Cramp on "Electricity Supply Tariffs," as it confirms my article, "The Revival of an Old Tariff," in your issue of July 2nd, 1926.

My firm's order book shows an increase in the use of the two-rate system of charging all over the world, and it seems to me that this system will be an absolute necessity if the valley which most stations show in their load curves during the night hours is to be filled up with water heating, as I firmly believe it will be.

Prof. Cramp gives a testimonial to the ingenuity of Swiss inventors in having produced "a wonderful series of automatic time switches." I should like to show him that England is in no sense backward in this direction, having a world-wide reputation second to none for this class of apparatus.

I hope that when he is next in town he can spare time to give me a call, when I shall be very happy to show him a few of our "marvels."

Ernest E. Sharp,
Director, Venner Time Switches, Ltd.

London, *February 14th*, 1927.

Kiosk-type Sub-stations.

I am fully aware of the principal reasons for substituting the above type of sub-station for the brick-built type of e.h.p. systems, but why lower the standard of safety as embodied in the design of most of the modern sub-station switchgear?

It is no use blaming the manufacturers for introducing cheap switchgear into the design of these kiosks; rather should this rest on the users who encourage them to supply it, for after all they are the persons who have to handle it in service and who should know what constitutes a safe and sound engineering job.

In power stations of to-day, and under much more ideal conditions, the design of e.h.p. switchgear is such as to reduce to a minimum the possibility of accidental contact with live metal, and I consider that those whose duty it is to install and operate e.h.p. switchgear in outdoor kiosks should see to it that the operator is amply protected.

I have recently had occasion to draw up a specification for the interior requirements of a 6,600-volt kiosk, and knowing the possible conditions under which a person may have to operate the switchgear, I could only come to one conclusion, namely, that of specifying totally enclosed, metal-clad, drop-down type units.

This type of switchgear costs a little more, but has many advantages for this class of sub-station over an ordinary oil switch and bare isolating links, and is well worth the extra cost involved—if only from the point of view of safety.

The primary object of introducing kiosk sub-stations was to economise on land and buildings, both as regards the cost and obtaining of suitable sites, and not to expose persons to danger by cheap arrangements of switchgear.

Why not start and cut down the expense of the transformer?

I will go one further than "P.M.W.," and instead of suggesting additions to the open-type switchgear, I would suggest to the manufacturers that they scrap the present design of the e.h.p. chamber and substitute gear of the totally enclosed type, which can be made very compact and safe, and at least offers an equivalent protection to that obtaining in well-designed sub-stations or power stations.

The remedy is in the hands of the users, and any economy they wish to make in respect of the cost of sub-station equipment should be consistent with safety and efficiency, particularly with regard to e.h.p. switchgear.

P. Wardle.

Walsall, *February 26th*, 1927.

With reference to the letter by "P.M.W." on the above subject, which appeared in your issue of February 25th, 1927, I should like to express my full agreement with his general conclusions.

At the same time, I feel that it is necessary to draw your attention to the fact that one manufacturer of kiosk sub-stations—*viz.*, The General Electric Co., Ltd.—has been quoting for and supplying kiosks for several years, which do embody every essential precaution to adequately protect a visiting attendant from the danger of accidental contact with e.h.p. live metal.

It is essential in kiosk design to construct the switchgear in a manner which fully complies with H.O. regulations, and in order to do this, proper attention to the enclosure of the h.p. isolators is perhaps the most important point.

In the General Electric Co.'s standard design, whether for single incoming-feeder equipments, ring-main, or other feeder requirements, the isolating links are enclosed in independent cells or cubicles for each individual feeder or transformer circuit. These cells have separate lock-up doors inside the main doors of the kiosks.

After opening the isolator links, their covering doors can be closed and locked, so that the attendant can clean or inspect the oil switch and transformer in perfect security without any risk of slipping, or of being blown by high winds, into accidental contact with live metal.

Alternatively, completely enclosed "armourclad" draw-out h.p. switchgear may be sometimes employed, this being housed inside the kiosk. The leaflet enclosed herewith gives a reproduction of the illustration of a G.E.C. kiosk which was printed on page 1009 of your issue of December 17th, 1926, and which clearly shows the inner door construction.

Herbert J. Coates.

Birmingham, *February 26th*, 1927.

The Earthing of Portable Domestic Appliances.

In the Electrical Review for February 25th, I read with interest the letter written by "A.M.I.E.E." regarding the earthing of all electrical appliances, which I think is a necessity; but as there is no law compelling contractors to take the steps required for safety, they are bound by the low prices they have to quote (to stand any chance whatever) to put in only what they are compelled to provide. I have the greatest admiration for the Institution of Electrical Engineers, and I think if that body laid this matter before the Home Office it would receive all-round satisfaction, because every contractor would be compelled to see that all appliances were earthed, and all corporations would be compelled to examine that earth and see that it was satisfactory; further, it would tend to help contractors to give estimates with the satisfaction of knowing that all other contractors were compelled to do the same. It is a matter that needs fostering for the consumers' safety, and while the majority of consumers are ignorant of its importance, the majority of contractors are neglectful.

Joshua Rose.

Bacup, *February 25th*, 1927.

The Salaries of Engineers.

Surely your correspondent, "Another Poor Blighter," is aware that the question of engineers' salaries will never ruffle the placid minds of the Council of the I.E.E. Obviously these gentlemen are quite satisfied with their salaries, and consider it somewhat vulgar for the lesser fry to mention such a sordid subject.

All other bodies which profess to look after the interests of engineers seem to be very keen on improving their social status without thinking of the possibility of obtaining increased salaries to keep up such social status as they already have.

I quite agree with your correspondent's remarks in connection with the post mentioned, but this is by no means an isolated instance. One has only to scan the "Situations Vacant" columns in the electrical Press to gain ample proof of this.

It is high time that the I.E.E. Council should bestir itself and take up the question of fixing minimum salaries for electrical engineers. If this august body *will not* move in the matter, anybody who will seriously take up this question of salaries, neglecting social status, will, I am sure, receive ample support from the rank and file.

Yet Another Poor Blighter.

February 25th, 1927.

River Water—or Cooling Towers?

Owing to illness I have only just seen Mr. Waite's most interesting article and the ensuing correspondence, or I should certainly have had something to say on the matter at an earlier date.

I quite agree with his general argument and with his contention that, things being as they are, reliable test results are the only criterion to go by. Also I have every reason to have absolute faith in the accuracy of his test figures. But it is easy to recognise what machines have formed the basis of his argument, and I do not think it is right to employ test results on medium-powered turbines more than 10 years old to settle a 1927 problem. From actual test results on two types of machines of larger output, recently set to work, I think that he has very considerably overestimated the defect from the theoretical in the really modern machine. The gain in steam consumption on different types of large modern turbines at 0.9-in. Hg, compared with 1.8-in. Hg, we find to be 6.0 per cent. as an average figure at full load compared with Mr. Waite's 4.0 per cent., an improvement of 50 per cent., which may conceivably influence the argument.

E. Fawssett.

Riding Mill, Northumberland,
February 23rd, 1927.

Extra-High-Pressure Cable Discharges.

I was recently informed of two instances of a curious phenomenon connected with super-pressure cables. It would appear that the cable in question had been tested with high-voltage direct current, and after the test this cable was discharged and all three cores were then permanently connected to earth at one end of the line only. Some hours afterwards a potential had apparently built up on the cores at the other end of the line, and a man proceeding to work on the cable received a severe shock.

The case of a cable building up in potential after a temporary discharge is, of course, well known. The theory of dielectric absorption and resistance which accounts for this does not, however, offer any satisfactory explanation when one end of the cable remains connected to earth.

I find it difficult to accept my information, and I should like to know if any of your readers can recall similar occurrences and can put forward any theory to account for same.

D. P. Sayers.

Blackburn, *February 23rd*, 1927.

A Handicap to Electrical Progress.

Mr. Ivan Fawcett in his letter to you of February 11th registers amusement, and, to do him justice, does it very well, but it shall be said of him, as of someone else whose name escapes me, "nihil tetigit."

I live in Rome and reside in the suburb of Cloaca Maxima. The electricity supply authorities in that particular neighbourhood have had £3 of my money for the last 14 years. They had it from me at a time why my credit was good, and for reasons best known to themselves. You see, they are not commercial. They have done nothing to my meter for 14 years except read it. I pay very little for what power I use, and don't worry, as I know that they are not business people in the ordinary intention of the term.

I think it would be a great mistake to complain.

F. Curius Dentatus.

February 21st, 1927.

A Metering Problem.

At a certain factory taking a supply at 415 V, 3-phase, 50 cycles, the energy was measured by an "Aron" 3-phase meter, in conjunction with a "Reason" mercury max-demand indicator, this combination working from the usual current and potential transformers. The supply company recently removed the transformers, and installed a "Sangamo" 3-phase meter, with its own transformers, but connected the "Aron" meter in with it; with the result that neither meter reads an amount anywhere near the previous reading (when the "Aron" meter was running off its own transformers), and there was also a difference between the "Sangamo" and "Aron" of approximately 4,000 kWh in a little over a week. Thereupon the company installed a portable meter (also *on the same transformers*), to check (?) the other two. No two of the three meters read alike. The company now claims that the "Aron" meter has *never* read correctly, and proposes "averaging" its presumed loss (I do not know how), on the "Sangamo" meter's reading, which is considerably higher than the "Aron" meter has ever been.

In my opinion, it is utterly impossible to connect three totally different meters to a set of current and potential transformers which have been designed to operate one particular meter. The load is a 250-kW motor-convertor (Peebles), and about 32-kVA of induction motors and a heater. There are no unbalanced conditions.

E. H. K. P.

February 20th, 1927.

"Do It With Electricity."

In view of the ever-increasing activities of the E.D.A., and kindred organisations, to further the sale and use of things electrical, a little commentary based on the observations of a "looker-on" who sees *much*, if not *most*, of the game, may be helpful, if not pleasant, reading.

In a nutshell a very large volume of valuable electrical business is passing out of the hands of the electrical trade, whilst their various associations of contractors, wholesalers, and manufacturers sit wasting time round their conference tables in solemn conclave denouncing their satellite associations for *doing*, or *not* doing, "this, that or the other"; instead of sitting up and taking notice of what is actually going on under their very noses.

In the first place, I notice that contractors, wholesalers, power undertakings, and even manufacturers, absolutely neglect the biggest potential field to which they should address their activities, *viz.*, the *industrial* field, which is over-ripe for *more* and *more* electrical labour-saving tools and appliances.

Take a glance at the window displays of the average electrical contractor, wholesaler, and supply authority. You observe there all sorts of frills and fancies; expensive fittings and gadgets, to tempt the money from the already strained pockets of the more affluent householder; but there is utter absence of any of the ever-growing array of labour-saving tools, &c., that are the potential life-blood of industry, whether it be the individual artisan or the larger works and contracting organisations.

Let us take a few examples:—

(1) *The Portable Electric Drill.*—This tool in various forms and sizes, has entered into the daily life of practically every branch of industry; the demand is daily increasing, and thousands are being supplied weekly, yet what do we find? Scarcely *one per cent.* of the electrical drills sold are handled by electrical contractors or wholesalers; but they have made a nice steady and profitable turnover for others who have seen the market and have created, stimulated, and met the demand! Even the motor accessory wholesale houses are selling literally thousands of electric drills (apart from other electrical gear) which would never have been allowed to get into their hands if the electrical trade had kept in advance of electrical progress and had cultivated the markets that should be theirs, by heritage, if not by right.

There is scarcely a laborious manual operation for which an appropriate time-saving electrical equivalent is not available. The writer is associated with an enterprising young firm that scours the world's markets for electric labour-saving tools and appliances and puts the cream before the potential users.

(2) "*Electric Hammers*" that can cut through brick and concrete at the rate of an inch a minute, *30 times as fast as hand drilling*, and can be operated from an ordinary lighting point. Now this is an ideal electrical contractor's tool, and is in use by a number of wide-awake contractors; but the average contractor thinks £40 or £50 a big outlay. So is the too-heavy wages-bill for the more laborious method.

(3) Electric hand-saws for ripping or cross-cutting timber up to 3¾ in. thick.

(4) An electric hand-planer does away with jack planing, &c.

(5) An electric portable sanding machine for smoothing-off wood work.

(6) A portable electric mortising machine.

(7) Portable electric cloth-cutting machines for cutting out thick layers of various fabrics.

(8) An electro-hydraulic car-washing plant which reduces washing costs by two-thirds.

(9) Portable and universal electric grinders.

(10) Universal electric sawing, sanding, and grinding machines.

(11) Portable electric screwdrivers and nut-setters.

(12) Portable electric valve grinders, and so on. . . .

These are but a few of the electrical industrial appliances that we are handling every day and in increasing volume. They are not "novelties," but "necessities" to the many thousands of firms and persons who are using them on their daily production.

The economic conditions arising out of bloody and bloodless warfare have made these things essential to cope with competition. As wages increase, so must the "man-hours" per job be decreased to make the job pay. The domestic load is, we know, a most important factor in the power station,

but it is the industrial load which makes for the prosperity of the nation.

The biggest culprits in ignoring the vast possibilities of portable electrical industrial tools and appliances are the electricity supply authorities. Let us consider, for a moment, the wasted opportunities of housing schemes.

If the supply authorities made a point of running in their mains to the housing scheme sites *before* the foundations were got out, I believe that the labour costs of erection could be reduced by 50 or 60 per cent., by utilising electricity to speed up work that is at present done by hand. This would affect such operations as excavating; loading and unloading materials; concrete and mortar mixing; elevating materials to upper storeys; sawing, planing and sandpapering; cutting away walls, &c.; electrically melting plumbers' metal; soldering; screwing up woodwork; giving artificial light morning and night in winter time, to permit full working time or overtime; spray painting to supersede the old-fashioned brush methods; boring and drilling, and so on.

Electricity is used on building operations all over the States and Canada and many other of our go-ahead Colonies. It is also widely employed in London and various other cities. The supply *has* to be fed into the houses in any case, and it seems a great pity, therefore, that the supply authorities should miss such an opportunity to derive some revenue from their mains *before* the limited and less profitable domestic load is imposed.

We talked things over the other day with one of our leading building contractors who had displayed interest in our portable electric tools. He said that, as things were, these useful appliances could not be used *on the job*, as current was never available until the buildings were ready for occupation; so his employment of these tools was restricted to his workshop. When we suggested that he could overcome the lack of vision and enterprise of the supply authority by having portable generating plant, he at once gave us *carte blanche* to supply a generating set, on wheels, that he could ship from job to job on a lorry.

The moral is that this builder was so impressed with the value of portable electric tools from his limited experience in his workshop, that he was prepared to spend some hundreds of pounds to enable him to extend their use to the *job*.

The power undertakings, the wholesalers, and electrical contractors (especially the latter) must wake up to the possibilities of lightening labour, they must use their knowledge and endeavours to educate the tradesman to the use of portable electric tools, and not be content to sit behind their counter and wait for inquiries. They must *go out* and *make* the inquiries and *place the goods*.

The writer's experience is, that the average "man in the street" to-day (even the schoolboy) has a sounder technical knowledge than many of the self-styled electrical contractors, &c.

My parting advice to the electrical industry, as a whole, is: "Look to your laurels," and do not consider it beneath your dignity to read, mark and *learn* everything that you can possibly absorb on matters electrical, especially in relation to all things appertaining to *production*.

Therein lies one certain road to a healthier tone of the "profit and loss" account.

I shall only be too pleased to help all or any who are interested in the vital problem of applying electricity to profit in the workshop or on the job.

A. E. Long

(*General Sales Manager*, B.E.N. Patents, Ltd.)

London, *February 21st*, 1927.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

21,673. "Telephone systems." Standard Telephones and Cables, Ltd. (L. Polinkowsky and W. Hatton). August 29th, 1925. (Cognate application 28,052/25.) (265,251.)

22,413. "Dynamo-electric machine and winding therefor." W. H. Powell. September 8th, 1925. (265,255.)

24,726. "Electric fuses." R. H. D. Barklie. October 5th, 1925. (265,263.)

26,263. "Electrical jack and plug connectors, particularly for use in telephone systems." Automatic Telephone Manufacturing Co., Ltd., and C. R. Woodland. October 20th, 1925. (265,269.)

27,525. "Electric heaters." O. L. Peard and A. F. Harrison. November 2nd, 1925. (265,279.)

27,593. "Electric switches." F. McElroy. November 3rd, 1925. (Cognate application 12,532/26.) (265,284.)

27,656. "X-ray tubes and the like." C. L. Long, V. E. Pullin, and C. Croxson. November 3rd, 1925. (265,288.)

27,739. "Gaseous conduction electric lamps." British Thomson-Houston Co., Ltd. November 7th, 1924. (242,647.)

27,765. "Electrolytic deposition of cadmium." E. C. R. Marks (Grasselli Chemical Co.). November 4th, 1925. (265,292.)

27,952. "Adjusting devices for radio tuning apparatus." A. H. Curtis, B. Jones, and Igranic Electric Co., Ltd. November 6th, 1925. (265,300.)

27,954. "Inductance coils, transformers, and the like." G. W. Melland. November 6th, 1925. (265,301.)

27,985. "Electric synchronising systems." British Thomson-Houston Co., Ltd. (General Electric Co.). November 6th, 1925. (265,902.)

28,443. "Protective devices for electrical apparatus." Siemens Bros. Co., Ltd., E. A. Petithory, and E. R. Garrod. November 11th, 1925. (265,310.)

28,544. "Device for eliminating natural oscillations arising in electric circuits, chiefly for eliminating the effect of strays in wireless apparatus." L. Levy. November 15th, 1924. (243,003.)

28,616. "High-ratio reduction gear for application to the tuning controls of wireless telegraphic apparatus and the like." G. W. Parr. November 13th, 1925. (265,312.)

28,978. "Ignition apparatus for internal-combustion engines." S. Woodhead. November 17th, 1925. (265,316.)

30,487. "Generator charging systems for electric batteries, particularly for use with radio apparatus." Igranic Electric Co., Ltd., and S. R. Wright. December 2nd, 1925. (265,328.)

30,704. "Controllers for electric motors." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). December 4th, 1925. (265,330.)

31,244. "Police signalling systems." G. Longfield-Beasley. December 10th, 1925. (265,338.)

31,251. "Telephone receivers." C. W. Mills. December 10th, 1925. (265,339.)

31,582. "Indicator for use with internal-combustion engines to test the sparking plugs." H. W. Smith. December 15th, 1925. (265,345.)

1926.

594. "Variable electrical resistances." F. L. Cheers. January 8th, 1926. (265,356.)

1,202. "Electric switchgear." British Thomson-Houston Co., Ltd., and H. Trencham. January 15th, 1926. (265,360.)

2,320. "Carrier for supporting an accumulator, battery, or like device on a motor-cycle or the like." N. J. Patchett and R. A. Stone. January 27th, 1926. (265,366.)

2,798. "Electric liquid-containing radiators." G. Roveglia. February 1st, 1926. (265,371.)

4,610. "Earth device for wireless and other electrical purposes." T. Nichols. February 17th, 1926. (265,389.)

5,178. "Crystal detectors for wireless apparatus." Partridges, Ltd., and H. Mills. February 23rd, 1926. (265,395.)

5,399. "Locking devices operated electrically from a distance." V. Booth. February 25th, 1926. (265,396.)

6,691. "Mercury-vapour apparatus." Hewittic Soc. Anon. March 14th, 1925. (249,121.)

7,512. "Electric signalling apparatus for indicating the positions of electric switches or the like." International General Electric Co., Inc. March 27th, 1925. (249,853.)

8,524. "Metallic-vapour tubes functioning as switches for alternating current." Siemens & Halske Akt. Ges. September 11th, 1925. (258,218.)

11,187. "Electrical tools." Chicago Pneumatic Tool Co. May 5th, 1925. (251,975.)

14,436. "Electric heating apparatus for liquids." K. F. Henneman and P. Kerkhoven. June 10th, 1925. (Addition to 235,513.) (253,525.)

15,028. "Electric power transmission systems." British Thomson-Houston Co., Ltd. June 18th, 1925. (253,910.)

18,856. "Loading coils." Siemens & Halske Akt. Ges. September 12th, 1925. (258,232.)

19,124. "Automatic control apparatus or relay actuated by fluid pressure." Creed & Co., Ltd., F. G. Creed, and A. Orling. November 5th, 1925. (Divided application on 256,285.) (265,071.)

19,187. "Electrodes for electric furnaces." Norske Aktieselskab for Elektrokemisk Industri. September 19th, 1925. (258,560.)

19,598. "Crystal detectors for wireless signalling." E. P. Murray. August 9th, 1926. (265,463.)

20,644. "Crystal wireless detector of the cartridge type." A. W. Griffin. August 21st, 1926. (265,469.)

20,921. "Wired radio broadcasting system." Wired Radio, Inc. August 25th, 1925. (257,611.)

21,673. "Sliding collectors for electric current." J. F. de Tovaros. September 2nd, 1926. (265,477.)

21,795. "Oscillation generators and the like." Telefunken Ges. für Drahtlose Telegraphie. September 11th, 1925. (258,257.)

21,956. "Loud-speaking telephones and loud-speakers." Friho Manufacturing Co., Ltd. (F. Holmann Akt.-Ges für Elektro-Technik-Medizin-Optik). September 6th, 1926. (265,478.)

21,992. "Hydrotherapeutic appliances." E. Havard. February 10th, 1926. (265,479.)

22,394. "Geared transmissions for the driving of dynamos effecting the lighting of trains." A. J. Makower and P. A. H. Mossay. September 18th, 1925. (258,579.)

22,512. "Electromagnetic sound reproducer." Brandes Laboratories, Inc. March 5th, 1926. (265,483.)

22,797. "Electrically-driven timepieces." M. A. Juilkrat. September 15th, 1926. (265,485.)

23,812. "Electrical protective arrangements." Metropolitan-Vickers Electrical Co., Ltd. September 26th, 1925. (258,904.)

24,666. "Protecting device for electric detonators." H. L. Grant. October 19th, 1925. (259,945.)

24,693. "Telephone apparatus." H. Kuchenmeister. October 13th, 1925. (259,947.)

25,437. "Surface wiring for electric distributing systems." Liverpool Electric Cable Co., Ltd., and T. H. Tweedle. October 12th, 1926. (265,500.)

26,197. "Generation of electrical oscillations." Dr. A. Esau. November 10th, 1925. (261,350.)

27,225. "Sound-reproducing devices." Lee de Forest, Ltd. October 31st. 1925. (260,624.)

29,284. "Manufacture of filaments for electric incandescent lamps." General Electric Co., Ltd. July 10th, 1926. (265,113.)

32,020. "Portable electric lamps for miners." J. G. Daloz. March 9th, 1926. (Divided application on 259,902.) (265,522.)

32,541. "Vapour rectifiers." International General Electric Co., Inc. December 31st, 1925. (263,813.)

33,058. "Electrical time-lag devices." British Thomson-Houston Co., Ltd (General Electric Co.). November 6th, 1925. (Divided application on 265,949.) (265,523.)

1927.

239. "Electric motor convertor sub stations." T. W. Ross, C. Ryder, and Metropolitan-Vickers Electrical Co., Ltd. November 17th, 1925. (Divided application on 264,961.) (265,117.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 23rd :—

L.E.C. (lettering and design). No. 474,577. Class 13. Electric junction boxes and casing for surface wiring.—Liverpool Electric Cable Co., Ltd.

Bonfix. No. 475,614. Class 13. Electrical junction boxes and fittings therefor.—Sefton-Fiddian Leage & Co., Bush Lane House, Cannon Street, E.C.4

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABRAM (Wigan).—Housing scheme (40), Bickershaw site, for the U.D.C.; surveyor.

AYRSHIRE.—New Town Hall at Largs, to cost £7,000; burgh surveyor.

BARNSLEY.—Two hotels, for the Barnsley Brewery Co., additional 163 houses, for the T.C.; borough engineer.

BASINGSTOKE.—Alterations, Mount Sanatorium; Hampshire C.C.

BATLEY.—Extensions to Technical College; Walter Hanstock and Son, Batley.

BEXLEY.—Additional housing scheme (230), for the U.D.C.; surveyor.

BLACKPOOL.—Central 'bus station near Talbot Road Station (to hold 500 'buses); borough engineer.

BO'NESS.—Joiners' and machine shops for Messrs. Thomson and Balfour, timber merchants; the manager.

BRISTOL.—Baptist Church (£10,000); for trustees, St. George's Baptist Church.

BURY ST. EDMUNDS.—Electric light installation, institution, for the B.G.; S. E. Day, borough electrical engineer.

CARLISLE.—Offices, Bank Street, for the Ocean Accident and Guarantee Corporation, Ltd.; H. E. Ayris, architect, 68, Lowther Street.

CHATHAM.—Extensions and electric lighting, Court House; Kent C.C.

CHERITON (Kent).—Kinema, for Bernard Miles, 113, Sandgate Road, Folkestone.

CHESTERFIELD.—Hotel (£15,000), Hollingwood, for the Chesterfield Brewery Co., Ltd.; Clayton & Rignall, architects.

CHESTER-LE-STREET.—Housing scheme (280); surveyor to U.D.C.

CLITHEROE.—Housing scheme (60); borough surveyor.

COVENTRY.—Extensions, Earlsdon Schools (£11,129), for the Borough E.C.; director of education.

COWLEY (Oxford).—Housing scheme (436), for Headington R.D.C.; W. Page Webb, architect, 23, High Street, New Headington, Oxford.

CROYDON.—Extension of postal sorting office, East Croydon; Office of Works. Billiard hall and shops, 89-99, High Street; Marcus Estates, Ltd. Showrooms and workshop, Leslie Park Road; Rees & Partners, 44, Park Lane.

DUKINFIELD.—Houses (44), for the T.C.; Marshall & Sons, builders, Ashton-under-Lyne.

DUNDEE.—Proposed conversion of Belmont Castle into Home of Rest (electric lighting); city engineer. New hotel, to cost £50,000 (electric light and radiators); secretary, Rock Villa Hotel, Ltd., Dundee.

EGHAM (Surrey).—Housing scheme (-10), for Mrs. Willson, president of the Women's Engineering Society.

ERITH.—Tuberculosis dispensary; Kent C.C.

GLASGOW.—Warehouses, shops, and offices at Renfield Street and Drury Street, for Upsons, Ltd., 7, Great Dover Street, London; the manager. New offices and addition to workshop at St. Rollox West Mineral Depôt; Fleming Bros., 65, Bath Street.

HAILSHAM (Sussex).—Additional 72 houses, for the R.D.C.; surveyor.

HALESOWEN.—Grammar school extensions (£20,000), for the governors; the clerk.

HILLINGDON.—Secondary school for Middlesex Education Committee; Mr. W. S. Try, of Cowley.

HULL.—Re-erection of factory, Wincolmlee, for Chambers and Fargus, oil cake manufacturers (several thousand pounds).

IRISH FREE STATE (Dublin).—Motor omnibus garage at Summerhill, for the Dublin United Tramways Co.

(Dundalk, Co. Louth).—Additions to railway station for the Great Northern Railway of Ireland; Engineer's Office, Amiens Street, Dublin.

KIRKBY-IN-ASHFIELD.—Housing scheme (68), The Park, for the U.D.C.; L. Dodsley, architect, Public Offices.

KIRTLINGTON (Oxford).—Cement works, for the Oxford and Shipton Cement Co., Ltd.

LEAMINGTON.—Sewage scheme (£88,000); borough engineer.

LEEDS.—Erection of Trustees' Hall at Bardsey, near Leeds; Eric Vernon Wimpenny, architect, Wood Garth, Bardsey, near Leeds.

LONDON (West Ham, E.).—Extensions to Fyfield Schools (£14,850), for the Borough E.C.; education architect.

(E.C.).—New buildings, 7 & 8, King Street, and 25-26, Ironmonger Lane; Mr. W. Waterhouse. Rebuilding part of 78, Upper Thames Street; Gunton & Gunton. Buildings at 97-99, Cheapside, and 31-33, Lawrence Lane; G. E. Wallis & Sons, Ltd.

(Islington, N.).—Extension scheme, Royal Free Hospital, Essex Road (£200,000); governors.

(Wood Green, N.).—Proposed secondary school, Hampton Road; Middlesex Education Committee.

(St. John's Wood, N.W.).—Park Road improvement scheme (£52,000); Marylebone borough engineer.

(St. Pancras, N.W.).—Building in Hampstead Road; Messrs. Carreras.

(Lewisham, S.E.).—Nurses' home for Board of Guardians; Douglas Matthews, Son & Ridley, architects.

(Kensington, S.W.).—Rebuilding premises in Ball Street and Young Street; John Barker & Co., Ltd. Reconstruction scheme, North Terrace and Thurloe Mews; Mr. F. G. Selby, architect.

(Westminster, S.W.).—Shops in Rochester Row; Messrs. Robertsons, Ltd., 217, Knightsbridge. New building for Odhams Press, 12-16, Wilson Street, Long Acre; Francis Chambers & Son. Tenements, Willow Street; city engineer.

(Brentford, W.).—Transformer house, Great West Road; C. & S. Construction Co. Extensions, Reynard Mills, Windmill Road; Messrs. Charles Fox, Ltd. Store and distributing station, Great West Road; Cement Marketing Co., Ltd.

MAIDSTONE.—Houses (82), for the T.C.; R. Corben & Son, builders.

MEREDIN.—100 houses, Castle Bromwich and elsewhere; R.D.C. surveyor.

NUNEATON.—Additional housing scheme (70 or 80), for the T.C.; borough surveyor.

OAKHILL (Staffs.).—Billiard hall and assembly rooms, Trentham Road; Beckett & Bloore, architects.

SALFORD.—Proposed exhibition hall, kinemas, skating rink, underground motor garage, &c., Cross Lane district, for a London syndicate (£1,000,000); city engineer.

SANDWICH.—Extensions, Grammar School; Kent Education Committee.

SEACOMBE (Liverpool).—Re-erection of Gandy Belt Works, Wheatland Lane, electrically equipped, for Messrs. Gandy (many thousand pounds).

SEAHAM HARBOUR.—Café, bakery and dance hall, North Railway Street; Messrs. W. & T. R. Milburn, for Messrs. Snowden Bros.

SMETHWICK.—Additional 108 houses, Warley, for the T.C.; Roland Fletcher, borough engineer.

SOUTHEND-ON-SEA.—Town hall and offices, for the T.C.; Professor Adshead, architect.

SURBITON.—Extensions to Council offices, with lighting and heating (£5,450), for the U.D.C.; surveyor.

SUTTON-IN-ASHFIELD.—Housing scheme (100), for the U.D.C.; Warner & Bocock, architects, Mansfield Road.

TAVISTOCK.—Sanatorium, Kelly College (approximately £5,000); headmaster of college.

TEDDINGTON.—Municipal buildings, for the U.D.C.; surveyor.

THORNTON HEATH.—Improvements, Infirmary, Mayday Road; Croydon Board of Guardians.

TRURO.—Additions to Museum buildings for the Royal Institution of Cornwall; Cowell, Drewitt & Wheatley, Mansion House, architects.

TYNEMOUTH.—Extensions, printing works, Charlotte Street; J. W. Moore, Ltd.

WIGAN.—Additional 108 houses, Gidlow site, for the T.C.; R. B. Donald, borough engineer.

WIRRAL (Cheshire).—Nurses' home for Wirral Board of Guardians; Finchett, Lancaster & Archer, architects, 13, Hoghton Street, Southport.

WISBECH.—Theatre, for H. Bancroft.

WORCESTER.—Houses (118), for the T.C.; G. Smith, builder, Birmingham.

WREXHAM.—Houses (54), Acton Park, for the T.C.; Francis Roberts & Son, builders, Acrefair.

The

Electrical Review

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THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

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Contents:

	PAGE
Industrial Psychology	373
Aerial Navigation Lights	374
Faults in Flexibles	374
The Truth About Electric Cooking	374
The Birmingham Frequency Problem	374
Theatre Lighting (*illus.*)	375
Agricultural Electrical Machinery, by R. Borlase Matthews (*illus.*) (*concluded*)	377
Sag Calculations for Power Transmission Lines, by William T. Taylor (*concluded*)	379
Improved Electric Tramcars (*illus.*)	381
London Transport	383
The Brazilian Market	383
Legal	383
Parliamentary News	384
Business and Industrial Notes	385
Lighting and Power Notes	389
Tramway and Railway Notes	391
Telegraph and Telephone Notes	391
Radio Notes	392
Contract Information	392
Forthcoming Events	394
Notes	394
Our Personal Column	396
Financial Section—	
New Companies Registered	397
Official Returns of Electrical Companies	398
City Notes	398
Stocks and Shares	401
The British Industries Fair—IV. (*illus.*)	403
The "Ideal Home" Exhibition (*illus.*)	408
Illuminating Engineering (*illus.*)	409
Correspondence—	
The "H"-Type of Cable	412
Extra-High-Pressure Transmission	413
The Earthing of Portable Domestic Appliances	413
Kiosk-Type Sub-stations	413
A Metering Problem	414
A Knotty Problem	414
Power Supply for Wireless Sets	414
What is it to Drive?	415
The Salaries of Engineers	415
Published Specifications	415
Trade-Mark Applications	415
New Work for Contractors	416

Industrial Psychology.

THE National Institute of Industrial Psychology, whose report for 1926 is briefly abstracted elsewhere in this issue, has now for six years been carrying on work which is constantly increasing in scope and importance. The president is the Earl of Balfour, K.G., and on the council are enrolled many men of the highest eminence in science, commerce, and industry.

It may seem strange that only in modern times has the importance of the study of the human mind attained to even partial recognition, although the injunction: "Know thyself!" is classic, and the aphorism: "The proper study of mankind is man" is almost proverbial. But the fact is that only in modern times has scientific method been brought to bear upon this subject, which is, moreover, one of exceptional difficulty owing to the impossibility of precise measurement of mental qualities and characteristics—and accurate measurement is the very soul of science. Nevertheless, during this century immense progress has been made, and experimental methods have been developed to a degree that enables conclusions to be reached with a large measure of certainty and to command the confidence of the onlooker. Almost as important as the examination of mentality is the subject of "motion study" in particular occupations; but the latter is rather a mechanical question relating to the body of the worker, and of general application, whilst the former relates to the characteristics of the individual mind without regard to its mortal shell—the contrast between physical and psychic.

"Industrial psychology" is a branch of the larger subject which is of extreme practical importance, for by its intelligent application, with the aid of motion study, the efficiency of the worker can be greatly improved, his happiness and comfort can be secured, and his remuneration economically increased whilst fatigue is minimised. All these factors are of great weight in these days when continuity of output and minimum cost of production are essential to cope with foreign competition, whilst continuity of employment and maximum remuneration are necessary to the maintenance of peace in industry.

We believe that the work of the Institute deserves the warm and practical support of every firm engaged in industry and of every social worker. The more

rapidly its operations can be extended, the sooner will they bear fruit. We are glad to see that it is gaining in appreciation and that its resources are growing; but still its work is conducted on a scale absurdly small in comparison with the vast and fertile field that awaits the tilling, and we hope that donations and subscriptions will flow into its funds at an ever-increasing rate. It should be remembered, too, that its experts are at the service of those who seek advice on the reorganisation of their manufacturing processes, the staffing of their works, and the improvement of working conditions, at moderate fees. It is incorporated as a scientific association not for profit; in its own way it fills a similar position to the National Physical Laboratory, and in due time we hope to see a National Psychology Laboratory come into existence.

Aerial Navigation Lights.

Illuminating engineers have been much concerned with the best methods of lighting streets, the dominant consideration nowadays being the safe guidance of traffic, and for many years the design of coast and ships' lights has been a specialised subject, but in the present century the new problem of lighting the "highways of the air" has arisen. An interesting review of recent work in this field was presented in a paper recently read by Mr. H. N. Green before the Illuminating Engineering Society. The author confined himself to aerodrome lights, but this in itself is now quite a big subject. Considerable ingenuity has been expended on the lighting of landing places, the design of beacons, the arrangement of boundary-lights, &c., and many different forms of lamps are being pressed into service. In remote spots where electricity is not available, acetylene is commonly used for beacons, but the flexibility of electric lighting is well illustrated by the diversity of appliances used. It is common knowledge that electric gasfilled lamps of very high power have been employed for this work, but in many districts the neon light, owing to its unmistakable colour and capacity for quick-flashing, is even more useful. The neon beacon at the Croydon Aerodrome seems to have proved signally successful, and the installation of neon tubes to mark out the landing area is also under consideration. Mr. Green devoted a section of his paper to the problem of flying in fog. At present, pilots do not attempt flight when the visibility is unduly low, but they may be unexpectedly caught in dense fog, or mist. In this case other electrical devices, such as the "leader cable" and directional wireless, come to their aid.

Faults in Flexibles.

In view of the rapid increase in the use of portable electrical appliances in the household, it is surprising that no progress is made towards eliminating a trouble which, though no great matter in itself, must prove irksome to the non-technical persons who constitute the vast majority of users—namely, breakdown of the flexible leads, which happens all too often.

Within our own experience, with a variety of portable apparatus, the faults have been confined entirely to the parts of the flexible subject to frequent bending—*e.g.*, where they are attached to plugs, fires, &c.—and are mainly due to fatigue of the fine stranded wires, resulting in brittleness and eventual fracture, or short circuit due to the broken ends. The inclusion of three steel wires in the strands mentioned by a correspondent some time ago should be beneficial, not, we think, on the score of strength, with which we have no fault to find, but because their relative stiffness prevents the flex from bending at so sharp an angle, and thus distributes the distress over a greater length of the flex.

Material improvement might easily be effected in the same direction by easing the curvature of the entry into plugs, &c. In some cases apparently no thought has been given to the matter at all; the flex enters and is tightly clamped in a hole with sharp edges, concentrating the distress on a length of, say, a quarter of an inch, and inviting early trouble. By attention to such points we have found it easy to reduce faults in flexibles to a trifling number; and faults of other descriptions are rare indeed. Incidentally, stout flexible with plenty of cotton lapping is more durable than thin stuff.

The education of the housewife in effecting simple repairs of this kind, which is one of the aims of the Electrical Association for Women, is a very laudable purpose; but prevention still remains better than cure, and this is a weak point to which, we think, manufacturers might with advantage devote much more attention than they do.

The Truth About Electric Cooking.

In its latest publication (E.D.A.661) the British Electrical Development Association rebuts some rather absurd accusations which have been made against electric ovens as used by bakers and confectioners. For instance, a periodical supporting gas interests recently alleged that there was a movement among Swiss users of electric baking ovens to revert to gas owing to the production of ozone by the elements, which flavoured the food. It is pointed out that a glowing element cannot possibly generate ozone, apart from the fact that in all up-to-date ovens the elements are totally enclosed. The Association quotes a letter to the Electrical Review from a firm of bakers in which the "ozone" *canard* is ridiculed. Further evidence is a statement by the Association of Swiss Master Bakers and Confectioners (representing 5,300 bakers out of a total of 6,000) to the effect that in Zurich alone 30 per cent. of the ovens are electric, and that in 15 years' time 4,000 ovens out of 6,000 in use in Switzerland will be electrified. But perhaps this Association has not yet heard of the "movement" before-mentioned; nor, apparently, have the Swiss supply authorities. Is it possible that the "movement" originated in the befumed imagination of a gas enthusiast? And does this enthusiast want it both ways: non-ventilating electric fires and ventilating electric ovens?

The Birmingham Frequency Problem.

In our "Notes" to-day we reproduce an interesting statement from the *Birmingham Post*, from which it will be seen that the new power station which the Corporation of Birmingham is about to erect is to contain generating plant of 25 cycles frequency. We do not wish to read into this announcement more than is justified; but it is undoubtedly of great significance.

It has been repeatedly emphasised, in and out of Parliament, that if the frequency is to be standardised, the change must be made at the earliest possible moment; the longer it is delayed, the higher will be the cost. The erection of a new power station of capital importance with a frequency of 25 cycles implies that the change in the Birmingham area is indefinitely postponed. Mr. R. A. Chattock and his Committee are to be congratulated on carrying their point—that to spend millions on the conversion would be a waste of money—and we have no doubt that their worries are immensely lightened by this decision.

The suggestion that when the plant attains the end of its economic life it will be an inexpensive matter to replace it with machines of the standard frequency is beside the point. The real difficulty of conversion is met not in the power station, but in the distribution system and on consumers' premises—a very different matter.

As precedent is of great influence in public affairs, we may safely conclude that while the many minor examples of non-standard frequency may undergo standardisation, the big systems operating at 25 and 40 cycles will be left in peace for a time.

Theatre Lighting.

The new complete electric-lighting installation for both the auditorium and stage at the Alhambra Theatre, London, involves some novel features in the remote control of the auditorium lighting from the stage.

THE recent completion of the new stage-lighting installation at the Alhambra Theatre, London, was the final stage of a scheme for rewiring the whole of the building which was commenced a few years back. The old installation, 100-V, 3-wire, was considerably out of balance, and the way in which the old wiring was run rendered it impracticable to effect a reasonable balance of the load. It was equally impracticable to change over the old work on to the outers at 200 V, as the existing wiring was too old to stand the higher pressure, and no intermission of performances and rehearsals could be entertained. It was therefore decided to install modern systems at 200 V, involving the use of high c.p. units for both the auditorium and the stage.

Three main lighting groups serve for the general lighting of the auditorium. Two of these consist of fittings fixed in alternative positions over the seats on the various tiers, and are supplied from entirely independent intake mains housed in separate fireproof chambers at the front of the house (Leicester Square). The third lighting group is made up of decorative totally-enclosed hexagon opal fittings arranged in front of the tiers. By suitable dimming arrangements, very effective lighting is obtained, and with the whole lighting "on," the result is particularly pleasing; some idea of this may be gained from fig. 1.

Although the third lighting group is also supplied from the front of the house, it is controlled for switching and dimming from the stage, the equipment involving some novel features. In order to overcome the difficulty brought about by the L.C.C. Regulation prohibiting circuits from the auditorium passing through the proscenium wall, an ingenious system of electro-mechanical operation has been adopted. The dimming apparatus, designed by the Watford Electric and Mfg. Co., Ltd., and involving the movement of a metal arm for short-circuiting, or otherwise, a number of carbon resistance brushes, is operated by specially designed switches, the essential movements of which are rigidly attached to, but insulated from, the armatures of plunger relays operated from the stage. Fig. 2 shows the remote-control relay switches, the relay and switch portions of which are wholly and separately enclosed. Fig. 3 shows the Watford dimming equipment. The speed with which the resistance is either inserted or withdrawn is adjustable by means of an eddy-current disk brake. Pilot lamps to the circuits remotely controlled from the stage are fixed in an iron box, with a glass cover, let into the proscenium wall in a convenient position for the switchboard operator. In addition to the stage control, two-way and intermediate switching for the third group is provided on the auditoroum ground floor, from where it can at any time be switched on full in a case of emergency.

The dimmers for the general-lighting groups are so arranged that normally the lamps are at about half-light, thus leaving sufficient illumination in the auditorium during performances for the lighting of the gangways. Additional switches provide for further resistance during kinematograph trade shows, when a greater degree of darkening of the auditorium is required. The decorative lighting is dimmed right out while the performance turns are on.



Fig. 1.—Alhambra Auditorium Lighting.

The L.C.C.'s approval is required when it is desired to light any part of the auditorium by the stage current, and the only fitting which is supplied in this way is the large centre fitting suspended from the dome. It is interesting to note that this "Sun Burner," fig. 4, is an old converted gas fitting, and is now equipped with eight 1,000-W gasfilled lamps.

For circulation and cleaning during the day, certain places, such as the staircases and exits, require artificial light, and a group of pilot and exit lights is separately wired and switched for these positions.

Another group provides for other positions where artificial light is only wanted on dark days, the lamps being separately wired and switched as sub-pilots. As it is essential that during performances there should be no possibility of these lights being left out, special switching arrangements are provided. An emergency switch also permits the sub-pilots to be used when required during the day. The exit and pilot lights are wired up to two-way and intermediate switches so that they can be controlled from the stage door and all floors of the auditorium. A large number of lights are

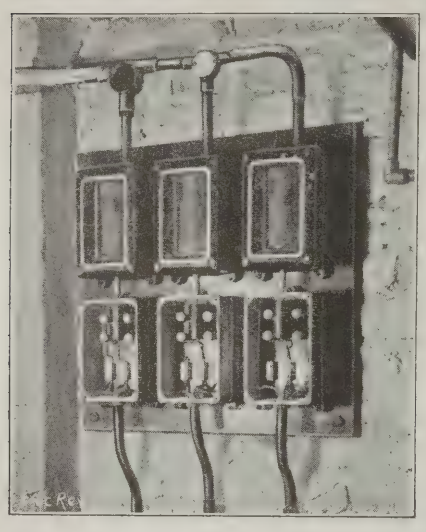


Fig. 2.—Remote Control Relay-Switches.

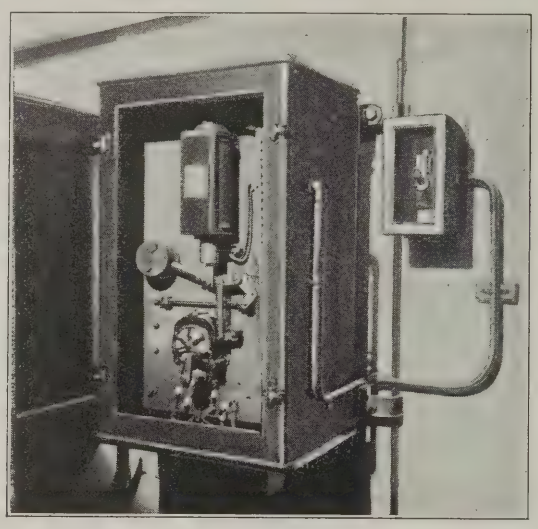


Fig. 3.—Light-Dimming Apparatus.

also provided in the basement, and a separate circuit serves for power and heating. In addition, an entirely separate supply cable serves for lighting and heating in the dressing rooms, boiler house, and workshops. The new auditorium scheme embraces some 258 points and a total loading of 25 kW, as against 550 points and 35 kW in the old installation. The wiring is run in screwed conduit throughout.

For the stage lighting, battens of the magazine type have been employed, replacing many of the open type previously in use, and the resulting improvement in illumination and in the attractive colour effects now obtainable is most marked. The battens are of a special design to secure strength, rigidity, and durability, and employ specially constructed wiring troughs to give easy access to the wiring and lampholders. It is interesting to note that the wiring for the battens is taken right up to the grid and not to the flies, thus affording greater clearance and means of access. All the branch circuits from the control board to the battens are brought to ironclad connection boxes on the grid. These serve as link boxes only, one to each batten, and are designed along the lines of the P.O. telephone link boxes.

The loading of the battens and float is 46 kW. The main battens are 42 ft. long, each carrying 33 white lamps, 17 reds, 17 blues, 16 ambers, and 1 pilot. An additional batten about to be added at the back of the stage is specially designed for tilting, so as to throw the light either in front of or behind a scenic drop. This will bring the total loading of the battens and float up to 52 kW.

Arrangements are made by the provision of a main change-over switch and links, so that in the event of the supply failing on the Charing Cross Electric Supply Co.'s theatre main, current can be quickly obtained from the company's network main.

The relative merits of metallic and liquid resistance dimmers had to be considered in respect of the space available, the provision and ventilation of a fireproof chamber, regulating capacity and cost. It was found that to meet the conditions of limited space and the very fine grading necessary, metallic dimmers would be much more costly than liquid ones, and the latter were decided upon. A few metallic dimmers are, however, used for groups of lights which are regulated "right out" or "right in," as required, without check. The liquid dimmers and arc resistances are housed in a specially constructed fireproof chamber two floors below the stage. Very great difficulties were encountered in conveying the large number of tracker wires from the dimmer regulators on the control gallery to the pots, and the highly satisfactory manner in which these have been overcome is evidenced by the ease with which the regulators are operated. Every dimming circuit has a pilot lamp arranged above the regulating wheel, indicating to the operator the degree of dimming.

The switchboard for the stage installation, which is arranged on a specially constructed control gallery above the stage floor, is in three sections, the operating board, the fuseboard, and the return board. The whole of the fuses for the stage lighting are brought to the middle section, fig. 5 right, thus avoiding the great inconvenience previously experienced by fuses being situated in remote and inconvenient positions. The fuses for any section are clearly indicated and can be easily and quickly identified for replacement, resulting in great economy of time over what was previously possible.

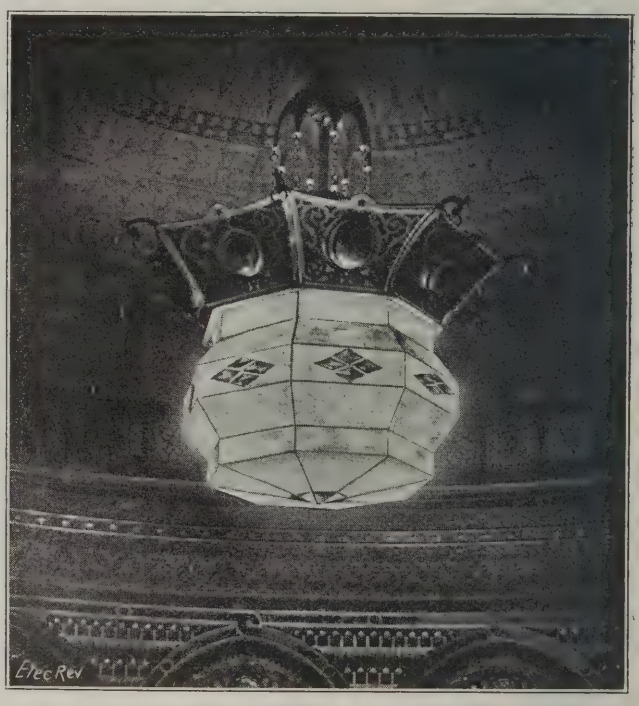


Fig. 4.—Auditorium Fitting, 8,000 c.p.

The operating board, fig. 5 left, is arranged on the negative or earthed side of the system, thereby minimising the risk of accidental shock to the operator. A s.p. knife switch, in addition to a link fuse for each circuit, is provided on this board. On the positive or return board, fig. 6, are installed electrically operated contactors. These are governed by ordinary s.p. tumbler switches on the operating board, the system being arranged so that a master switch and contactor may be operated to put the whole of the lighting "on" or "off" circuit. The necessary

equipment for operating the dimmers is accommodated by a separate board facing the main operating switchgear; the end of this is shown in fig. 5. Pilot lights for the various circuits are arranged over the dimmer controls so that the lighting effect may be observed by the operator.



Fig. 5.—Operating Switchboard.



Fig. 6.—Positive Switchboard.

It may be of interest to record that over 25 miles of wire was used on the stage installation.

The whole of the reconstruction work was carried out without a single interruption in the usual programme of three performances daily and morning rehearsals, and the final change-over to the new 200-V system was made without a hitch of any kind.

The whole of the electrical work in both the auditorium and the stage installations was carried out to the plans and specifications of the consulting engineer, Mr. H. D. Wilkinson, M.I.E.E., to whom we are indebted for permission to view the apparatus, and much of the detail work in connection with the stage installation was developed by Mr. Wilkinson's colleague, Mr. P. S. Tasker. The contractors for the auditorium scheme were Messrs. Duncan Watson & Co., Ltd., and for the stage work Messrs. Tyler & Freeman.

Agricultural Electrical Machinery.

A comparative review of the exhibits at the 1927 Paris Agricultural Exhibition with those of previous years, and machines employed in other countries, depicting some items of special interest to engineers at home.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

(*Concluded from page* 333.)

There was one rather complicated-looking portable agricultural motor, the "Record." Incorporated with this machine is a pump, a circular saw (with a sliding table), and a train of gears with four projecting spindles which provide successively lower speeds for any pulley that may be placed on any one of them. A special winch pulley is provided for the last spindle, so that a rope may be wound round it for haulage purposes, like a crab winch. Altogether this equipment gives a choice of speeds of 50, 75, 100, 150, 200, 400, 600, and 800 r.p.m.

An improvement in the construction of the lighter portable motors is the provision of both stretcher handles and two wheels. The framing is usually so arranged that when it is set down upon its four supporting feet the wheels are just off the ground, which naturally improves the stability of the machine. French manufacturers do not yet seem to have grasped the importance of advocating drip-proof or protected motors for farm use, as is the general practice in Germany and Scandinavia. A tough-rubber-sheathed cable was employed generally for the portable motors. In one case, that of the Thomson-Houston Co., the cable was protected with a leather covering.

Most of the portable motors were provided with cable reels; from these the motors are temporarily disconnected while the cable is paid out to the required length. A plug on a short lead connected to the motor is then placed into a receptacle on the side of the cable drum to which the inner end of the cable is connected. Three-pin plugs are generally employed, with a central earthing pin.

For some time it has been the practice to fix the motor starters directly on to the motors intended for agricultural use. A detail improvement that was noticed was that the starters for the larger "Law" machines were built with curved casings, so that they might be fitted in any position on the cylindrical carcase of the motor. Several firms are now manufacturing a portable platform on which any standard electric motor can be fixed. This is fitted with barrow wheels and also tubular stretcher handles. Above or alongside the motor a shaft fitted with five pulleys of different diameters is mounted (on a pair of A frames, in the case of overhead pulleys).

Legendre Frères showed a portable motor without a chassis, fitted with two convenient carrying handles and a worm reduction gear. The spindle of the worm

wheel was connected to a flexible shaft, the latter being directly attached to the machine to be driven.

While French manufacturers are at present concentrating on the portable wheel-barrow type of farm motor, it should be borne in mind that Germany and Scandinavia have passed through this phase. Nowadays, in those regions, it is becoming the common practice to employ a large number of individual motors. This means more capital invested in motors, but less

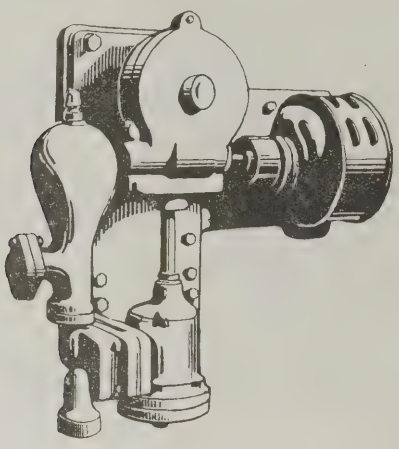


Fig. 9.—Electric Deep-Well Pump.

time wasted in adjusting portable machines and, after all, it is in the total cost per annum that the farmer is interested.

A very compact ball-bearing "Dupuis" threshing machine, which only requires a 3-h.p. electric motor to drive it, was on view. Generally, there were not so many electrically driven threshing machines shown this year.

Several milking machines were exhibited, though there was nothing new, except the "Delort" portable electric vacuum pump, which was mounted under a cover on a truck. One of the "Hinman" portable electric vacuum pumps was also shown. This is new to Europe, though it has been used in America for some time. Both these pumps appeal to the tenant farmer, for they avoid the erecting of permanent piping and shafting in the cow byres.

Most of the electrically driven cream separators were operated by a round belt drive, kept at the correct tension by a jockey pulley. However, the "Persoons" electrically driven separator had the motor directly connected. The machine was also arranged to drive a churn by means of an extensible tubular shaft. In the case of the "Melotte" directly driven electrical separator, a pulley was also fitted to drive a churn by means of a flat belt. Undoubtedly the directly connected electric drive will eventually become the standard, as it is difficult to keep the machines so clean when they have exposed belt drives, apart from the slight danger to the fingers in the use of such a drive.

Saw benches with bascule or tilting tables are still very popular. They are certainly most convenient, for logs can be sawn very much more easily and safely in a swinging V-shaped holder than on a table; yet for other work a table is imperative.

Two windmill electric generators were displayed, but there was no special novelty in their construction. The interest lay rather in the fact that evidently Frenchmen are toying with this method of "getting current for nothing."

A large range of electrically operated water pumps was shown. The high-pressure form is apparently rapidly coming into favour. A number of interesting types of deep-well pumps were on view, in particular the "Japy," a very neat design, fig. 9. The great majority of these pumps only employ fractional horse-power motors, as they depend upon the volume pumped by working steadily nearly all through the twenty-four hours of the day.

The Société Générale Agricole showed a very neat mercury-cum-weight gravity-control mechanism for stopping and starting a pump motor according to the water level. The same firm also exhibited an ingenious wood-turning lathe. This consisted of a standard breast drill arranged for clamping on a turned rod, the latter serving as the lathe bed. Several ingenious attachments result in its becoming an almost universal lathe, a circular saw bench, or various drilling devices.

The French farmer's wife is a confirmed user of washing machines. These are of a very simple character, consisting of a perforated galvanised drum, which is revolved, first one way and then the other, in a bath, fitted with a cover, fig. 10. The bath is usually heated with a charcoal, wood, or coke fire. Several new electric drives were on view this year. The difficulty to be overcome is that a considerable reduction in speed is required, coupled with a reversal of the washing drum, every few revolutions. The price of a complete electrically driven machine, without a wringer, but including the stove, is about £20. These machines are of much rougher finish than the American type that is usual on the British market; however, the first cost is very much less—about one-half.

In conclusion, it may be remarked that the exhibition gave an indication of a considerable advance in general agricultural machinery and also in the electric driving of the same. Undoubtedly attention will soon

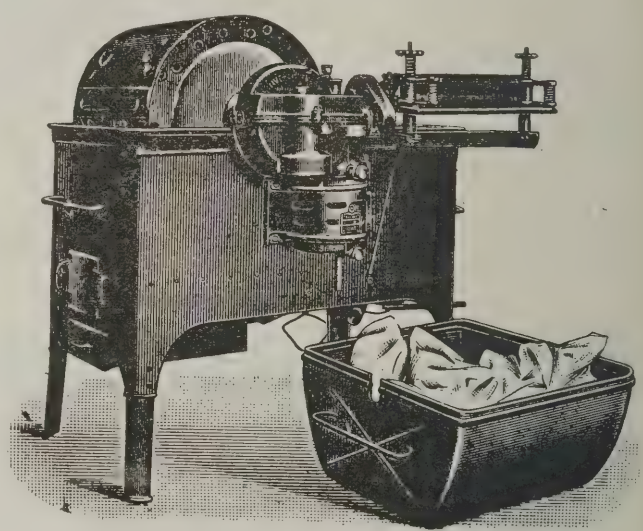


Fig. 10.—A French Electric Washer.

be paid to the design of farm machinery so that it will operate at a few selected speeds (as has already been done in Germany) that best suit motor driving and reduce the number of speed reductions required. The exhibition as a whole was certainly of a most interesting character.

Electro-Farming.

The paper on this subject which was read by Mr. R. Borlase Matthews before the I.E.E. in London last year has since been given at 11 Centres and Sub-Centres, with stereoscopic lantern slides and kinematograph films. On each occasion the contents were brought up to date. At Cardiff, on February 22nd, the paper was discussed at a joint meeting of the Western Centre and the South Wales Institute of Engineers; in the discussion Sir Iltydd Thomas stated that a considerable number of Welsh farmers near Cardiff were taking a supply of electricity from the South Wales Power Co. At Swansea, on the following day, when the lecture was repeated, Mr. C. T. Allan described his successful experiments with electro-culture at Llantwit Fadre, and Mr. Percy Player, who stated that he had used electricity on his farm near Swansea for 20 years, emphasised the necessity of adopting electric ploughing.

Sag Calculations for Power Transmission Lines.

A consideration of the requirements for Overhead Conductors under varying working conditions due to changes in temperature, wind pressure, ice covering, &c.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

(*Concluded from page* 336.)

For the determination of sags and tensions under the different temperature and loading conditions, L_o and L_t are the desired lengths required. The desired sag values D_1 and D_t are given in Table V. These values have been "rounded off" to the first decimal point, and are well within practical accuracy—more so than the possible inaccuracies of *constants* often used, and those inaccuracies made by the man in overalls (the lineman).

Example.—Suppose a 0.10 sq. in. (0.357 in. diam.) bare hard-drawn solid copper conductor is to be erected on a 400-ft. span in such a way that the tension (when loaded to the British Electricity Commissioners' specified loading) shall not exceed 26,550 lb./sq. in. at +22 deg. F., and let it be desired to find the sag and tension for:—

(1) Conductor at +22 deg. F. with ice and wind, as specified by the E.C.;
(2) conductor at 0 deg. F. with ice and wind, as specified by the E.C.;
(3) conductor in still air at 60 deg. F.;
(4) conductor in still air at 100 deg. F.;
(5) conductor in still air at 120 deg. F.

Constants.—$A = 0.10$ sq. in., $D = 0.357$ in., $d = 0.5$ in., $w = 0.386$ lb., $w_{11} = 0.917$ lb., $w_{111} = 0.905$ lb., $W = 1.288$ lb., $E = 18{,}000{,}000$ lb./sq. in., $\alpha = 0.0000093$ per deg. F., $P = 2{,}655$ lb., $l = 400$ ft.

Then, in terms of the allowable tension P, the sag for conductor at datum deg. F. with half an inch radial ice coating and 8 lb. wind at right angles to the line, from the general equation, is—

$$D = 400^2 \times 1{\cdot}288 \;\; 8 \times 2{,}655 = 9{\cdot}7 \text{ ft.}$$

(*see Table II*)

and the length of conductor under this condition is—

$$L = 400 + 8 \times 9{\cdot}7^2 / 3 \times 400 = 400{\cdot}63 \text{ ft.}$$

(*see Table III*)

but the length when all tension has been removed is—

$$L_o = 400{\cdot}63 \;\; (1 + 2{,}655 / {\cdot}10 \times 18{,}000{,}000) = 400{\cdot}04 \text{ ft.}$$

(*see Table IV*)

and, under this condition, for a rise in temperature of 100° F., the length of conductor in the span is—

$$L = 400{\cdot}04 \; (1 + {\cdot}0000093 \times 100) = 400{\cdot}42 \text{ ft.}$$

Hence, by simplifying and transposing the lengths, for the bare conductor in still air, we have—

$$3 \times 400{\cdot}42 \times 400^3 \times {\cdot}386 \;\; 64 \times {\cdot}10 \times 18{,}000{,}000 = 257{\cdot}6,$$

and

$$D_t^3 - \tfrac{3}{8} \times 400 \; (400{\cdot}42 - 400) \; D_t = D_t^3 - 63 \; D_t$$

or

$$(D_t^3 - 63 \; D_t) - 257{\cdot}6 = 0$$

$$D_t = 9{\cdot}46 \text{ ft.} \qquad (\textit{see Table V})$$

and the corresponding tension is—

$$P_t = 400^2 \times {\cdot}386 / 8 \times 9{\cdot}46 = 814 \text{ lb.}$$

For the different temperature and loading conditions we have the following data:—

Loaded, at 22° F.		—	Temperature without ice and wind loads.			
			0° F.	60° F.	100° F.	120° F.
L_1	400·12	L_t	400·04	400·27	400·42	400·49
$\frac{3 l^3 W L_1}{64 AE}$	859	$\frac{3 l^3 w L_t}{64 AE}$	257·36	257·5	257·6	257·65
$D_1^3 - \frac{3}{8} l (L_1 - l) D_1$	$D_1^3 - 18{\cdot}3 \; D_1$	$D_t^3 - \frac{3}{8} l (L_t - l) D_t$	$D_t^3 - 6 \; D_t$	$D_t^3 - 40{\cdot}5 \; D_t$	$D_t^3 - 63 \; D_t$	$D_t^3 - 73{\cdot}5 \; D_t$
D_1	10·15	D_t	6·7	8·41	9·46	9·94
P_1	2,538	P_t	1,150	907	814	776

That is—	(*Tension in lb.*) P	(*Sag in Feet.*) D_r	D_v
At zero °F. with ice and wind loads	2,655	9·7	6·9
At 22° F. with ice and wind loads	2,538	10·15	7·2
At zero °F. without ice and wind loads	1,150	—	6·7
At 60° F. without ice and wind loads	907	—	8·41
At 100° F. without ice and wind loads	814	—	9·46
At 120° F. without ice and wind loads	776	—	9·94

(D_r = plane of resultant; D_v = vertical plane); *see column 11, Table I.*

NOTE:—We thus see that, for this example, the maximum effective (*vertical*) sag occurs at the highest temperature.

TABLE V.—Sag Span Values at different Temperatures and Loadings for Hard-drawn Solid Copper Conductors.

Calculated from the parabolic equation— $[D^3 - \frac{3}{8} l (L_1 - l) D] - 3 L_1 l^3 W/64 AE = 0$ *for 22° F.*

and

$[D^3 - \frac{3}{8} l (L_t - l) D] - 3 I_t w/64 AE = 0$ *for other temperatures.*

A.	t	Span in Feet = l.									
		100	200	300	400	500	600	700	800	900	1,000
·01453	22	2·56	9·80	21·9	38·8	60·6	87·2	118·7	154·9	195·9	242·0
	40	1·17	8·47	21·0	38·7	59·2	85·8	117·3	153·9	194·4	240·3
	60	1·36	8·67	21·2	38·9	59·4	86·0	117·5	154·0	194·6	240·9
	100	1·75	9·07	28·6	39·3	59·2	86·4	117·9	154·1	195·0	241·2
	120	1·95	9·27	21·8	39·5	60·0	86·6	118·1	154·2	195·1	241·4
·01619	22	2·24	8·47	18·8	33·2	51·8	74·4	100·0	131·9	167·8	219·6
	40	0·73	7·00	17·0	32·8	50·2	73·0	98·7	130·5	166·4	218·2
	60	0·95	7·19	17·2	33·0	50·4	73·2	98·3	130·7	166·5	218·4
	100	1·38	7·58	17·6	33·4	50·8	73·5	99·1	131·0	166·9	218·7
	120	1·61	7·78	17·8	33·6	51·0	73·7	99·3	131·2	167·0	218·8
·01815	22	2·11	8·13	18·2	32·3	50·4	72·8	98·2	128·7	163·0	201·0
	40	0·51	6·72	16·8	30·8	49·0	71·2	96·6	127·2	161·5	199·6
	60	0·77	6·94	17·1	31·0	49·2	71·5	96·8	127·3	161·7	199·8
	100	1·31	7·40	17·5	31·5	49·6	71·9	97·3	128·8	161·1	200·2
	120	1·57	7·62	17·7	31·7	49·9	72·1	97·5	128·0	162·3	200·4
·02061	22	1·91	7·39	16·5	29·2	45·5	65·4	88·9	116·2	146·8	181·3
	40	0·50	5·82	14·9	27·5	43·8	63·8	87·4	114·6	145·3	179·7
	60	0·70	6·05	15·1	27·7	44·1	64·0	87·6	114·9	145·6	179·7
	100	1·11	6·51	15·6	27·8	44·5	64·5	88·1	115·4	146·1	180·4
	120	1·31	6·74	15·8	28·4	44·8	64·7	88·3	115·6	146·3	180·7
·02164	22	1·85	7·11	15·9	28·1	43·8	62·9	86·2	111·9	141·5	174·5
	40	0·48	5·47	14·2	26·4	42·2	61·5	84·7	110·5	140·1	173·2
	60	0·67	5·72	14·4	26·7	42·4	61·7	84·9	110·7	140·3	173·4
	100	1·07	6·20	14·9	27·1	42·9	62·1	85·3	111·1	140·7	173·7
	120	1·26	6·43	15·2	27·4	43·1	62·3	85·5	111·2	140·9	173·0
·025	22	1·65	6·36	14·1	24·9	39·0	56·1	74·8	99·7	124·6	155·4
	40	0·38	4·56	12·4	23·2	37·3	54·5	73·2	98·1	123·0	153·8
	60	0·55	4·88	12·7	23·5	37·4	54·7	73·4	98·3	123·2	154·0
	100	0·90	5·51	13·3	24·1	37·7	55·2	73·8	98·7	123·6	154·4
	120	1·08	5·83	13·6	24·4	37·8	55·4	74·1	98·9	123·8	154·6
·02688	22	1·57	6·04	13·4	23·6	36·9	53·0	72·0	94·0	120·2	146·7
	40	0·35	4·19	11·6	21·8	35·1	51·3	70·3	92·3	118·4	145·0
	60	0·51	4·48	11·8	22·1	35·3	51·6	70·5	92·5	118·6	145·2
	100	0·81	5·05	12·4	22·6	35·8	52·6	71·0	93·0	119·1	145·6
	120	1·01	5·31	12·7	22·9	36·1	52·3	71·2	93·2	119·3	145·9
·02926	22	1·46	5·77	12·6	22·6	35·2	49·8	67·6	86·5	111·5	137·7
	40	0·32	3·67	10·6	20·2	32·7	47·9	65·8	84·6	109·7	135·9
	60	0·49	4·01	10·9	20·5	33·0	48·2	66·1	84·9	110·0	136·7
	100	0·83	4·68	11·5	21·2	33·5	48·4	66·6	85·5	110·5	136·2
	120	0·99	5·02	11·9	21·5	33·8	49·0	66·9	85·7	110·8	136·3
·03269	22	1·35	5·20	11·6	20·5	32·5	46·6	62·2	81·0	102·6	126·5
	40	0·30	3·12	9·7	18·8	30·5	44·9	60·4	79·2	102·7	124·6
	60	0·46	3·46	10·0	19·1	30·8	45·2	60·7	79·5	100·9	125·8
	100	0·69	4·14	10·6	19·7	31·3	45·7	61·2	80·0	101·5	125·3
	120	0·85	4·48	11·0	20·0	31·6	46·0	61·5	80·3	101·7	125·6
·03631	22	1·18	4·86	10·5	18·4	28·6	41·1	55·7	72·5	91·2	115·0
	40	0·28	2·62	7·8	16·2	26·4	39·0	53·6	70·4	89·1	112·9
	60	0·40	2·99	8·3	16·6	26·8	39·3	54·0	70·7	89·4	113·2
	100	0·64	3·72	9·2	17·3	27·4	39·9	54·6	71·4	90·1	113·9
	120	0·76	4·09	9·7	17·6	27·8	40·3	54·9	71·7	90·4	114·2
·05	22	0·96	3·90	8·6	15·1	23·5	34·5	46·0	59·7	75·4	91·7
	40	0·26	1·84	6·5	12·9	21·2	31·4	43·1	57·0	73·0	89·3
	60	0·37	2·21	6·8	13·3	21·5	31·7	43·4	57·3	73·3	89·6
	100	0·58	2·92	7·6	14·0	22·3	32·4	44·0	57·9	73·6	90·1
	120	0·69	3·31	7·9	14·3	22·6	32·7	44·3	58·5	73·9	90·3
·075	22	0·79	3·06	7·1	11·8	18·3	26·1	35·4	46·1	58·3	71·8
	40	0·26	1·31	4·8	9·7	16·0	23·7	33·1	43·7	55·8	69·3
	60	0·37	1·67	5·2	10·1	16·4	24·2	33·7	44·2	56·3	69·7
	100	0·58	2·39	5·9	10·9	17·4	25·1	34·2	45·1	57·3	70·8
	120	0·69	2·75	6·3	11·3	17·6	25·6	34·9	45·6	57·8	71·2
·10	22	0·68	2·68	5·8	10·2	15·6	22·3	30·2	39·4	49·7	61·6
	40	0·26	1·30	4·2	8·3	13·5	20·0	27·8	36·8	47·0	58·7
	60	0·37	1·66	4·6	8·5	13·9	20·4	28·3	37·1	47·5	59·4
	100	0·58	2·38	5·3	9·5	14·7	21·2	29·2	38·7	48·8	60·8
	120	0·69	2·74	5·6	9·9	15·1	21·6	29·7	39·0	49·4	61·5
·125	22	0·61	2·35	5·2	9·07	14·1	20·0	27·1	35·6	44·6	54·9
	40	0·26	1·16	3·6	7·09	11·6	17·0	24·3	32·9	42·0	52·4
	60	0·37	1·50	4·0	7·54	12·1	17·7	24·9	33·5	42·7	53·1
	100	0·58	2·18	4·8	8·45	13·2	18·9	26·2	34·8	43·8	54·4
	120	0·69	2·53	5·2	8·90	13·7	19·6	26·8	35·4	44·5	55·0
·15	22	0·57	2·19	4·8	8·5	13·1	18·6	25·2	32·7	41·1	50·8
	40	0·28	1·16	3·5	6·9	11·2	16·4	22·8	30·1	38·3	47·5
	60	0·40	1·50	3·9	7·3	11·7	16·8	23·4	30·8	39·2	48·6
	100	0·64	2·18	4·7	8·2	12·8	18·6	24·8	32·3	41·1	50·3
	120	0·76	2·52	5·1	8·7	13·3	19·0	25·5	33·0	42·0	51·1
·175	22	0·52	2·12	4·6	8·1	12·5	17·7	24·0	31·6	39·3	48·4
	40	0·29	1·30	3·6	6·7	10·7	15·7	22·0	29·6	37·3	45·4
	60	0·41	1·61	3·9	7·1	11·3	16·4	22·7	30·1	38·0	46·3
	100	0·59	2·22	4·6	8·0	12·3	17·7	23·9	31·8	39·2	48·1
	120	0·77	2·53	5·0	8·4	12·9	18·3	24·6	32·2	39·9	49·0

Improved Electric Tramcars.

Two new cars built for experimental service on the North London system of the Metropolitan Electric Tramways, Ltd., their features being light weight, high acceleration, smooth running and comfort.

FOR some considerable time close attention has been devoted by the tramway companies associated with the London "Underground" group to the improvement of car design. On the system of the London United Tramways, Ltd., 70 cars have been equipped with modern light-weight motors having specially designed characteristics for rapid acceleration, and 110 cars with improved brakes; 45 cars of the Metropolitan Electric Tramways, Ltd., are now being fitted with new motors, which are an advance on even those of the L.U.T., Ltd. In addition, a number of cars have been fitted with specially well sprung moquette-covered transverse seats, and the interiors of the cars have been repainted and provided with white ceilings, which, together with improved lighting, has added to the attractiveness of the service afforded.



Fig. 1.—New M.E.T. Electric Tramcar.

It is interesting to note that this example has been followed by other London and provincial undertakings, whilst a questionnaire, by means of leaflets in the cars asking for opinions or suggestions, resulted in many thousands of replies being received, indicating public approval and appreciation.

To obtain full advantage of further improvements, the M.E.T., Ltd., has designed and built at its Hendon works a new car known as "The Bluebell," and to exclude any influence of conventions of existing tramcar design, the interesting step was taken of asking the London General Omnibus Co. to design and build a tramcar body at its Chiswick works. The design was based on comfort, even at the expense of reducing the carrying capacity, and the experience gained with the new cars should be of considerable value.

The M.E.T. "Bluebell."

This car's leading features, in comparison with the existing standard type of double-deck top-covered car, with cross seating, are set out in Table I.

The body is of light-weight construction, composed chiefly of steel channel filled with wood (ash); the platforms used by passengers are level with the main floor of the car, only the driver's compartment being at a lower level, and there are only two steps between the ground and the body floor (the same number as on N.S.-type omnibuses). The staircases have been designed to allow of passengers alighting at the front end whilst others are boarding at the rear end, thus avoiding obstruction. The interior is as free as possible from all mouldings or corners liable to collect dirt, and stainless steel is used for all hand railing and hand-grip stanchions. In the top saloon, each window opens by vertical slide of the balanced type operated individually by passengers.

Transverse moquette-covered seats are fited in the lower saloon with short longitudinal seats at each end in order to provide for standing passengers without obstruction, and a considerable area of platform is available for the same purpose. In the top saloon, transverse spring seats covered with a leather substitute are fitted; the flooring in the lower saloon is of grey rubber.



Built by M.E.T., Ltd. Built by L.G.O. Co.

Figs. 2 and 3.—Front Views of New Cars.

Table I.—The M.E.T. Car.

	New car.	Existing type.
Length over buffers ...	36 ft. 4 in.	34 ft. 8 in.
Maximum width ...	7 ft.	7 ft.
Width inside lower saloon	6 ft. 4 in.	6 ft. 0½ in.
Height, lower saloon ...	6 ft. 3 in.	6 ft. 0½ in.
Height overall from rail	15 ft. 2 in.	15 ft. 5¾ in.
Height of car floor from rail	2 ft. 5 in.	2 ft. 9½ in.
Weight of body with equipment	6 tons	10 tons 11 cwt.
Total weight unloaded ...	12 tons 5 cwt.	16 tons 11 cwt.
Seating capacity, lower saloon	27	27
Seating capacity, upper saloon	44	46
Total carrying capacity, including standing ...	105	85

The driver stands in an enclosed partition with semi-vestibule front, mirrors being situated so as to give him a clear view of the front and rear doorways.

The electrical control is on the contactor system with master controllers and interlocks, of the B.T.-H. Co.'s make, the contactor gear being situated in a convenient compartment on the platform. Air brakes acting on the track and wheels, with emergency cocks at each end of the car for use by conductor or passengers in case of need, act in conjunction with air-blast sanders, and hand brakes are also fitted, operated by a wheel in the motorman's cabin.

The trucks are of the low-wheel bogie type, the driving wheels being 28 in. in diameter instead of the usual 31¾ in. All axle boxes are equipped with roller bearings and the motor armature shafts with ball and roller bearings. The motors are of light weight, rated at 50 h.p. each, two motors being fitted; they weigh 35 lb. per rated h.p., compared with 56 lb. for the older motors, and they give smooth and rapid acceleration, taking full advantage of their large overload capacity.

Folding doors and steps working in unison at each entrance are operated by the motorman manually through a system of ball-bearing rods and levers. Special attention has been given to lighting, which is carried out by means of opal-glass bulbs in suitable fittings. The lighting switches and fuses are enclosed in a small cupboard, and headlights are fitted with special reflectors designed to be effective in foggy weather.

The L.G.O.C. Car.

The car built by the London General Omnibus Co. was at attempt to evolve a tramcar on modern omnibus practice. In many respects it is similar to the vehicle described above, so that only those features wherein it differs will be mentioned. Some of its main dimensions are shown in Table II. The electrical controller is of the camshaft type acting in combination with a line switch, of the Metropolitan-Vickers make. Brakes, sanders, trucks, and motors (though of different make) are identical.

Table II.—The L.G.O.C. Car.

Length over buffers	36 ft. 0 in.
Width, lower deck	6 ft. 9 in.
Height	14 ft. 10 in.
Width of main door openings	3 ft. 10 in.
Width of emergency door openings	1 ft. 6½ in.
Number of seats, lower deck	28
Number of seats, upper deck	36
Total weight, unladen ...	12 tons

All vertical pillars are ash, with steel flitches of 14 S.W.G. inserted, gusseted to the main chassis frame, which is a Z section pressing of nickel steel. The body in its entirety is carried upon this chassis frame.

The motorman's compartment is totally separated from the main lower saloon by a sliding door, but not enclosed. The controls are within easy reach, and include a Peters air brake valve and a Peacock emergency hand-brake lever.

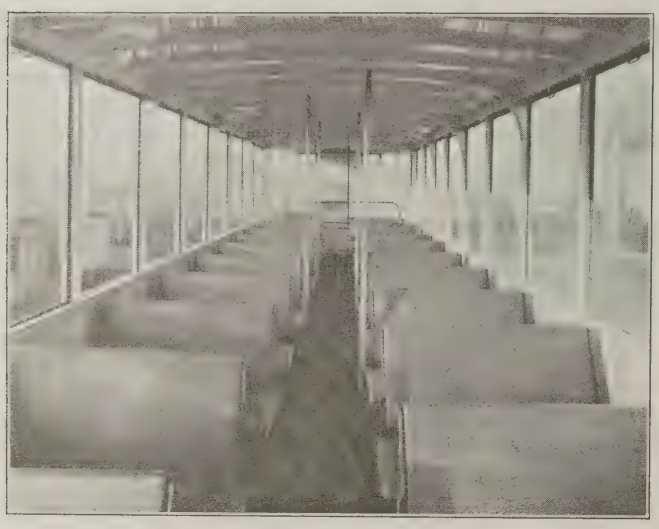


Fig. 4.—Upper Deck, M.E.T. Car.



Fig. 5.—Upper Deck, L.G.O.C. Car.

Double sliding windows are fitted in the upper saloon, provision having been made for excluding draughts when travelling in either direction. A light aluminium metal domed roof is incorporated, reinforced with a steel structure in the centre for carrying the trolley pole collector; trap doors and a "cat walk" are also fitted.

Semi-bucket seats are arranged transversely and longitudinally, the seats and backs being spring filled and upholstered in moquette.

For interior lighting small white opaque bulbs are employed in conjunction with white reflectors. The interior paint is white enamel, and electric bell pushes are fitted at regular intervals.

Two double folding doors form the main entrances, with two small doorways at the other corners for use in emergency, the normal operation being to board and alight at the rear end as in the case of ordinary cars. Steps of a very ingenious design, operated by a removable lever, have been devised to serve two purposes: not only does the step tread rise into a vertical position when folded so as to prevent "hangers on" when the door is closed, but the vertical riser of the steps moves to a horizontal position in order to close the open floor space (when the door is closed) and serves as a portion of the platform.

London Transport.

Report of the London and Home Counties Traffic Advisory Committee.

LAST week the report of the Advisory Committee on the inquiry held in October, 1926, with respect to the travelling facilities to and from South-East London, was issued (H.M. Stationery Office, price 1s. net).

The area concerned comprises seven Metropolitan boroughs, covering 27,934 acres, with a population of 1,098,621 in 1921, when 250,000 persons had to travel into or out of the area every day. A map is included, showing the railways and tramway and omnibus routes in the area; all but one of the railway lines are now electric, there being 140 miles of surface electric railway in the area, and 48 stations. Only 1½ miles of underground "Tube" electric railway is included in the seven boroughs. The L.C.C. electric tramways operate along 46½ miles of street, and 1,492 omnibuses are in service.

During the war nine railway stations were permanently closed, and owing to the competition of tramways and omnibuses the company held that there was little demand for railway facilities within about four miles of Charing Cross. Complaints of overcrowding at rush hours were made, with especial reference to London Bridge station. The local authorities urged the need for new tube railways in the area.

The Committee concludes that main-line trains should not stop at stations within three miles of their termini, except at junctions. The congestion at rush hours has increased since the war owing to changed conditions of employment, resulting in the majority of workers starting and stopping work at about the same time. The electrification of the suburban lines has helped, and will further help, to relieve the situation, and the action of the Southern Railway Company is warmly commended; the consideration of additional underground railways should be deferred until the Company's plans are completed, but the extension of the Bakerloo line in a south-easterly direction is worthy of examination. Fares should be regulated by co-operative action in such a way as to attract long-distance passengers to the railways. Owing to the existing congestion in the northern part of the area, no addition should be made to the numbers of tramcars and omnibuses operating there. The question of linking the East London Railway with the Southern Railway, to enable through trains to be run between the Metropolitan and Southern Railways, should be immediately considered; this would necessitate the provision of a fly-over junction between Whitechapel Junction and Aldgate, recommended in the Committee's report on travelling facilities to and from East London, which would effect a great improvement.

Finally, the Committee again emphasises the necessity for bringing all forms of public passenger transport in London under unified control; inquiries with this end in view are being made by a sub-committee.

The report is accompanied by a number of appendices giving statistics, fares, &c.

The Brazilian Market.

Commercial Secretary's Report.

A report upon the economic and financial conditions in Brazil (dated October, 1926) has been forwarded to the Department of Overseas Trade by Mr. E. Hambloch, Commercial Secretary at Rio de Janeiro (Stationery Office, 1s. 6d. net). In the course of a general survey, Mr. Hambloch says that guerilla warfare, restriction of capital, a sudden rise in the exchange, and a number of other causes combined to make the year ended September last an uneasy one for commercial circles. The position is, however, not viewed pessimistically, for Brazil has great recuperative powers and its purchasing power continues to increase. The latter would expand more rapidly if transport facilities were improved. There is probably no country in the world with such vast potential wealth, but for the full development of the country's resources by private enterprise, the moral and sympathetic support of the authorities and more settled policy are necessary. Foreign capital is required, and any impression that it is not welcome should be dispelled.

Competition in Electrical Supplies.

The United States retained its place as the premier exporter to Brazil during 1925, and the margin between its share of the trade and that of Great Britain widened, although both countries' totals increased. Germany was again third with an appreciably increased share. Taking the Dominions into account, the British Empire, as a whole, was the leading supplier. While actual detailed figures for 1925 were not available, Mr. Hambloch says that it is believed that the exportation of American material to Brazil increased. British manufacturers have to face severe competition in the cases of electrical copper wires and cables, electrical apparatus, dynamos, motors and transformers. German exporters are also very active in the same directions, while Belgian competition is mainly felt in the case of cables. The Americans have large stocks of a very wide range of electrical articles in the principal centres.

Electrical Developments.

During the period under review, a number of small local hydro-electric installations were made, but the only new one worthy of note is that at Cubatao (between Santos and Sao Paulo), which was inaugurated in October last by the Sao Paulo Tramway, Light and Power Co., Ltd. The initial plant consists of two 40,000-h.p. sets; the station is designed for 80,000-kW ultimate capacity. This installation brings the aggregate developed hydro-electric power in the state of Sao Paulo to 250,000 h.p.; Rio de Janeiro has 165,000 h.p., Minas Geraes 52,000 h.p., and Bahia 20,000 h.p. The total development in Brazil is estimated at 500,000 h.p. out of a total available of 9,000,000 h.p.

In March, 1926, a British company obtained the contract for the electrification of 73 km. of the Oeste de Minas Railway. The work is in progress, and this is the first length of railway line to be electrified under the administration of the Federal Government. Nothing has been done in connection with the projected electrification of the Central Railway.

With regard to radio-telegraphy, in April, 1926, the Cia. Radiotelegraphica Brasileira (working under Marconi patents) inaugurated a high-power station at Sepetiba (near Rio de Janeiro), with 12 steel towers, 250 m. in height. There is a receiving station at Jacarépagua (near Rio).

Up to December, 1924, licences had been granted for 2,469 broadcasting receiving sets, and in 1925 a further 1,070 licences were issued, making 3,539. The annual charge for licences is 20 milreis (about 12s.).

Rubber.

In 1925 the exportation of rubber increased, and prices reached a higher level than has been attained for many years. The total in 1925 was 23,537 tons, and the average value was £214 18s. a ton; in the preceding year, while the exportation was not far behind (21,568 tons), the value per ton was only £91. The Ministry of Agriculture has declared that the organisation and systematisation of the exploitation of Brazilian rubber are necessary, but no guidance has been given as to the methods to be adopted.

Legal.

Swedish General Electric, Ltd.'s Patent Application.

THE Swedish General Electric, Ltd., holders of a patent granted to H. K. Schrager for "improvements in alternating current commutator motors," applied to Mr. Justice Tomlin in the Chancery Division on March 1st for an extension of the patent on the ground that by reason of the war they had suffered loss or damage.

Mr. Stafford Cripps supported the application, which was opposed by Mr. Trevor Watson on behalf of the General Electric Co., Ltd., and Mr. McEwan on behalf of Witton-James, Ltd.

Mr. CRIPPS said the patent dealt with an expensive and very novel machine, and, roughly, the reason given for the application was that it could not be marketed during the war in this country because, the machine having no war uses, nobody could take it up, and it was not until after the war that proper attention could be devoted to it. It was a motor that did away with all gearing, and it was not the sort of machine that could be sold straight away. There was a special design for different kinds of installations. Four years was a comparatively short time to develop such an article, but had there been no war the advertising matter sent out would have developed a market here in 1915 or 1916.

Mr. TREVOR WATSON said no explanation had been given why no licence was granted to work the patent here until 1920, when one was granted to the British Thomson-Houston Co., Ltd. The applicants were not engaged on work of national importance during the war, and there was no evidence that they had suffered loss or damage. There was no established trade here in the motor before the war, and they had not reached the point, when war broke out, at which they might confidently have expected to build up a trade. In the words of the section of the Act there was no "loss of opportunity of dealing in or developing the invention," a contention which was only open to applicants who could show that they were engaged in work of national importance. Before 1914, instead of developing the English market, the applicants chose to develop the foreign market. They were content to do nothing during the war, and there was no reason to suppose that they suffered any loss except through their own fault. Everything went to show that if the applicants had made an effort in this country to establish the manufacture and sale of this motor in any way comparable to the effort they made in foreign countries, they would have had no reason to complain of loss or damage resulting from the war.

Mr. MCEWAN associated himself with this statement of the case for the opposition.

Affidavit evidence was read, and after Mr. Cripps had replied, his Lordship gave judgment.

He said the applicants did not do anything before the war to develop the patent in this country, although they developed it abroad, and he must come to the conclusion on the evidence that if the invention had not established itself in the market here before the war it would not be likely to establish itself here during the war. It was a machine of some complication, and could only be applied to existing installations with substantial alterations. It was expensive to make, and was not applicable directly to war purposes. In those circumstances the company's campaign to establish it during the war did not produce any results, and it was not until 1920 that the applicants took it up again, and then they granted a licence to the British Thomson-Houston Co. to manufacture it. The real point was whether, the company not having chosen to develop the patent here before the war, and being handicapped when they sought to do so during the war, there was loss or damage caused by the war. He was satisfied that the course which the applicants took resulted to their disadvantage, but his conclusion was that he ought not to regard that course of conduct as disabling them from seeking relief if they proved that they suffered because of the war. He therefore proposed to give one year's extension of the patent, to date from that day.

Indictment of Cory Bros., Ltd., Quashed.

At Cardiff, on February 28th, Mr. Justice Finlay quashed the indictment against Messrs. Cory Bros., Ltd., upon an allegation of causing the death of a collier by setting a man-trap in the form of an electrically-charged fence. His Lordship held that a corporation could not be indicted for either felony or misdemeanour.

The case against three of the company's officials was, however, proceeded with. The defendants were Thomas Hardie, shift engineer, Temple Davies, power station engineer, and Robert Illingworth, electrical engineer. The evidence at the original proceedings was repeated. This was to the effect that to prevent the continuance of pilfering of coal supplies from the company's power house, a wire fence was erected and made "alive" during certain hours. The defendants were stated to be responsible for its erection and charging. Evidence was given by a man who was with John at the time of his death to the effect that they were not stealing, or endeavouring to steal, coal.

Sir Bernard Spilsbury (Home Office) said that John's death was due to heart failure caused by the passage of an electric current. The extent of the shock depended largely upon the conditions existing; he had known two cases of death from shocks at voltages of 65 and 46.

One of the defendants, R. Illingworth, said that it was only intended to give raiders a "tingle." He did not think that the fence was dangerous; he himself had touched it without feeling any effect.

The hearing was concluded on March 3rd, when after hearing further evidence by the defendants the jury returned a verdict of "Not guilty," and the accused were discharged.

H.M. Inspector of Factories v. Barr & Stroud, Ltd.

In the Justiciary Appeal Court, Edinburgh, on March 1st, counsel were heard in an appeal by H.M. Inspector of Factories, Glasgow, against a decision of Sheriff-Substitute Dods finding a complaint against Barr & Stroud, Ltd., engineers, Glasgow, not proven. The complaint was that the respondents failed to keep a certain horizontal milling machine in their works securely fenced. No accident was known to have occurred at the particular machine involved.

The Court affirmed the original decision, and awarded the respondents 10 guineas expenses.

Infringement of Grid Leak Patent.

The Times reports that a fine of £20 and an order to pay 30 guineas costs were imposed at West London Police Court on March 1st on Alfred Sacks, wireless dealer, Fulham, who was summoned for selling grid leaks to which the false description of "Lissen" was applied.

Mr. H. D. Roome, prosecuting for Lissen, Ltd., stated that they were the patentees of the "Lissen" grid leak. Lately they became aware of the fact that spurious grid leaks bearing their name were being sold at wireless shops. On four different occasions purchases were made at the defendant's shop of Lissen grid leaks, and these, on examination, were found to bear the name "Lissen grid leaks," but were, in fact, spurious, differing in certain important details from the genuine article.

The defendant stated that he purchased the grid leaks in good faith from a man at Brixton, and when he found they were not genuine "Lissen" grid leaks, he requested the man to take them away. Apparently the man must have left some behind, and these were innocently sold by an assistant

Dublin Workmen's Compensation Case.

In the Dublin Circuit Court, before Judge Davitt, last week, Mrs. Mary Slowey, Dublin, claimed compensation from the Dublin City Commissioners in respect of the death of her husband, Michael Slowey.

Mr. W. J. Gleeson, B.L., for the applicant, said that the deceased man was employed on January 17th, 1921, in the electric lighting department of the Corporation of Dublin. While at work he came into contact with a "live" electric wire, and received a severe shock, from which he suffered certain injuries. He was a patient in hospital for some time, but was able to resume work. Later on he developed tubercular disease in the left wrist. The disease spread through his body and he died. The Commissioners had agreed to pay £100 to the applicant, in addition to her costs and expenses.

Judge Davitt made the award accordingly.

B.T.H. Patents in the Irish Free State.

In the High Court, Dublin, before Mr. Justice Meredith, last week, in the case of the British Thomson-Houston Co., Ltd., *v.* Litton & Co., Ltd., Dublin, an application was made to discharge an order of the Master of the High Court, giving liberty to serve a third-party notice on Messrs. Grammont, a French manufacturing firm. The action was brought to restrain the defendants from, as alleged, infringing patents connected with electric lamps, and for damages.

Mr. Justice Meredith, in giving judgment, referred to the grounds urged by the plaintiffs and Messrs. Grammont, on which he was asked to discharge the order, and held that the Master had jurisdiction to make the order *ex-parte*, that the contract to indemnify was a contract to be performed within the jurisdiction, and that the defendants *primâ facie* had claim to be indemnified, though the question whether the claim was sustainable or not was one which would have to be decided in the action. He refused the application to discharge the Master's order, and gave the costs of the plaintiff's motion against the plaintiffs, and reserved the costs of Messrs. Grammont's motion.

British Thomson-Houston Co., Ltd., v. Metropolitan-Vickers Electrical Co., Ltd.

The hearing was commenced in the House of Lords on March 7th, before Lords Dunedin, Sumner, and Blanesburgh, of an appeal arising out of the alleged infringement by the appellants of the respondents' patent 9644 of 1912. Mr. Justice P. O. Lawrence found, after a long inquiry, that the letters patent had been infringed by the appellants, but that they were invalid. In the Court of Appeal, the Master of the Rolls and Lords Justices Warrington and Sargant reversed his decision as to validity, expressing the opinion that the patent was valid and had been infringed. It was against this judgment that the British Thomson-Houston Co. appealed to the House of Lords, contending that the judgment of Mr. Justice Lawrence upon the question of validity was right and should be restored. The respondents maintained that Mr. Justice Lawrence was in error upon the issue of validity, while the Judges in the Court of Appeal were right in fact and law.

The appellants, in their attack upon the validity of the patent, rely upon a prior specification of Tesla, United States, number 459,772, dated September, 1891. There appeared for the appellants Sir Arthur Colefax, K.C., Mr. W. Trevor Watson, K.C., and Mr. Bernard Sandeman, and for the respondents Sir Duncan Kerly, K.C., Mr. J. Whitehead, K.C., Mr. J. M. McEwen, and Mr. J. Mould. The patent in dispute is that granted in 1912 to Emanuel Rosenberg for an invention of improvements relating to synchronous dynamo-electric machines, and the appellants say that in view of Tesla's specification Rosenberg's is not novel.

The arguments extended to considerable length, and the hearing was adjourned.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Private Bills.

The Yorkshire Electric Power Bill has been read a second time, and the North Metropolitan Electric Power Supply Bill has been read a third time, in the House of Lords.

Radio for Aircraft.

On March 2nd Mr. Day asked the Secretary of State for Air if the experiments that had taken place for short-wave radio-telephony between aircraft in flight and air stations had been successful; and whether that system of transmission would be shortly introduced into the air services.

Sir S. Hoare said that the system of transmission referred to was already in use in the Royal Air Force, and the possibilities of its extension were continually kept in view.

High-Power Broadcasting.

On March 1st, Lieut.-Commander Kenworthy asked the Postmaster-General whether the British Broadcasting Corporation had decided on its policy with regard to the building of high-power stations in order to provide alternative programmes all over the country; if so, how far the work had progressed; whether he had been consulted as to that policy; and, if so, what had been the Government opinion expressed.

Sir W. Mitchell-Thomson said that the present position was that the British Broadcasting Corporation was arranging to carry out certain experiments, and when those were concluded it might be in a position to submit proposals.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

The official report dated March 7th records the opening of demonstration houses at Glasgow (Minard Road), Chesterfield, Leicester and Birmingham. The following places are opening demonstration houses in the course of a week or two:—Peterborough, Ipswich, Bermondsey, Birmingham, Potteries District, Chorlton, Paisley, and Derby. Last week exhibitions were opened at Dumfries and Bingley. A former Lady Mayoress of Manchester (Mrs. Simon) was to open the Chorlton house on Tuesday last. The Prestwich house is being visited by 300 people a day; 899 visitors attended the Aberdeen house during the first nine days; and 5,144 people visited the Minard Road, Glasgow, house during the first five days. The house at Brent, organised by the Hendon Circle, recorded an attendance of 8,000. Good business is being reported from all quarters as a result of the demonstration houses. Contractors in Manchester and Stockport are distributing competition booklets among patients in the local hospitals.

On February 25th an all-electric home exhibition was opened at Bingley. It was conceived by the Electricity De-



The Bingley Electrical Exhibition.

partment of the Urban District Council (engineer: Mr. P. Clegg) and loyally supported by the local contractors and their employés, who did all the necessary work voluntarily. Seven "rooms" were erected at the Drill Hall; these were furnished by local firms, and the remainder of the hall was loaned to manufacturers for display and demonstration purposes. The exhibition, which remains open until to-morrow (Saturday), has attracted a great deal of public interest; a number of orders have been received, and many inquiries have been made. We reproduce herewith a photograph of the display taken by a local photographer, Mr. G. Tillett.

The Sunderland Corporation Electricity Department has been lent a house by a local builder and has thoroughly equipped it with electrical appliances. A local company has furnished the dwelling in a tasteful manner. The house was opened to the public on March 1st, and is to remain open for a month. The exhibition has been well advertised in the local Press.

An all-electric house in the Crescent, North Road, Durham, arranged by the County of Durham Electrical Power Distribution Co., Ltd., was formally opened by the Mayor and Mayoress of Durham on Tuesday last week. Mr. W. F. T. Pinkney, of the company, received the guests, who were addressed by the Mayor on the advantages of electricity in the home. The house was open all the week and was visited by a large number of people.

Wages in the Engineering Industry.

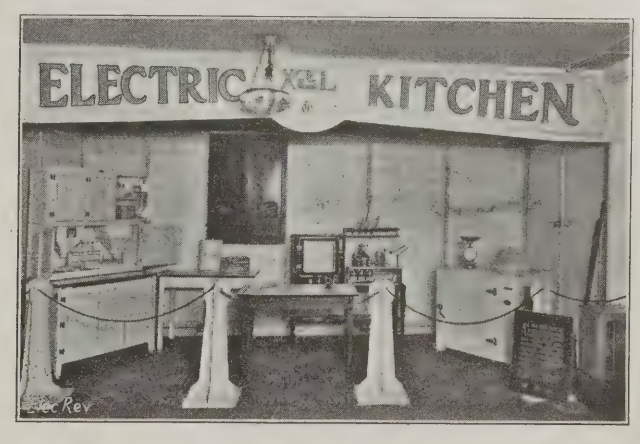
We recently reported that the London District Joint Committee of the trade unions connected with the engineering industry had recommended a claim for an all-round increase of about 12s. per week in the wages of their members. The matter is now being considered by the Committee's constituents, and a meeting is to be held on March 14th, at which their opinions will be expressed. In the meantime notice has been given of a meeting at York on March 24th, at which the question of a national increase will be discussed by representatives of the engineering trade unions.

Unemployment.

The number of unemployed upon the books of the Employment Exchanges on February 21st was 1,196,100. This was 74,117 fewer than on February 14th, but 70,340 more than on February 22nd, 1926.

Electric Kitchen in a Shop.

In connection with a special household shopping week which they recently held, Messrs. George Henry Lee and Co., Ltd., of Liverpool, constructed in their premises a model electric kitchen, in which were given daily demonstrations of cooking by electricity. This kitchen was equipped with an H.810 "Xcel" electric cooker, manufactured by the Auto-



Electric Cooking in a Department Store.

matic Telephone Manufacturing Co., Ltd, whilst a comprehensive range of electric fires, irons, kettles, and other "Xcel" electric appliances was displayed. As may be seen from the illustration, the kitchen was very realistically arranged.

The Timber Market.

Our Timber Trade Correspondent reports that timber consumption, on the whole, in the U.K. is not moving as quickly as anticipated in the early weeks of the year. Stocks of building, joinery, and general woods are ample at present rates of consumption, which shows an improvement compared with a year ago, but cannot be described as good. Spot prices are not up in proportion to shippers' ideas. The hardwoods also are not yet moving very quickly into consumption; good grade mahogany, however, is selling well, but cabinet and furniture manufacturers are only buying hardwoods from hand to mouth. This hold-off policy may not prove the right one if continued for too long, as the demand for timber, both for general purposes and furniture and other fancy work will grow with the progress in general trade, and prices, no doubt, will increase in sympathy.

Irish Free State Electrical Imports.

The returns just to hand show that the imports of electrical goods, excluding machinery, into the Irish Free State attained a value of £40,934 during January last, as compared with £52,407 in January, 1926.

New Zealand's Preference for British Goods.

The New Zealand Government, which has been placing heavy orders in Britain recently for electrical, railway, and other plant, is again in the market for six electric locomotives, large quantities of locomotive workshop machinery, and material for the electrification of the railway tunnel between the Port of Lyttelton and Christchurch. The New Zealand High Commissioner, Sir James Parr, has just received the details of these requirements, with the authority to obtain tenders from British manufacturers. In the aggregate the orders will run into a very considerable sum of money. The workshop material includes about 40 electric drills, welding plant, mechanical hammers, lathes, bull-dozers, four electric cranes, and many other machines. In addition to the above, the New Zealand Public Works Department, through the High Commissioner, is seeking to place orders for electrical equipment for a new sub-station at Lyttelton (from which the electrification of the Lyttelton tunnel will be operated). The same Department is also in the market for four 500-kVA transformers for the Waikaremoana (Hawke's Bay) power scheme, and four 15,000-kVA, seven 1,000-kVA, and eleven 750-kVA transformers for the Arapuni (Wellington) scheme. Manufacturers can obtain full particulars of all these requirements from the High Commissioner for New Zealand, 415, Strand, W.C.2.

Price Reductions.

Increased production and improved manufacture have enabled the London Electric Wire Co. & Smiths, Ltd., to reduce the price of its "Lewcos" screens and bases for inductance coils and radio transformers.

Industrial Electric Cooking Equipment.

The General Electric Co., Ltd., has opened a showroom at Magnet House devoted entirely to industrial electric cooking equipment, in which there is a comprehensive display of "Magnet" apparatus designed and built for installation in hotel kitchens, restaurants, canteens, bakeries, &c. The showroom includes the following exhibits: Roasting ovens, double-oven ranges, compartment roasting ovens, cabinet roasting ovens, ship's galley ranges, bread-baking ovens, pastry ovens,



G.E.C. Industrial Cooking Showroom.

steaming ovens, dough-nut cookers, grillers, fish fryers, grilling and cooking plates, boiling tables, stock pots and soup boilers, vegetable boilers, bainmaries, hot cupboards, urns and water boilers. The apparatus displayed in this showroom is representative of similar equipments which have been built and supplied by the General Electric Co., and are in use all over the world, having been installed on board ship and also in hotels, hospitals, and canteens. A view of the showroom accompanies this note.

New French Company.

A new company has been formed in Paris (50, Rue de Lisbonne) with a capital of 9½ million francs, and the title La Société d'Electricité de Lille et de sa Banlieue, to extend the electricity supply facilities in the Lille district.

A Southport Development Booklet.

The Southport Electricity Department (engineer: Mr. E. Moxon) has produced an illustrated booklet dealing with the advantages of electric cooking and the facilities which the Department provides. A number of cookers are illustrated and particulars are given of the charges for the hire of these, and photographs of the showrooms and lecture theatre are reproduced. Two circulars, one in rhyme, are being sent out with the booklet to consumers in Southport. One of these circulars deals in a comprehensive way with domestic electricity. A cookery exhibition is at present being held at the showrooms.

Recent Contracts.

Among the orders recently received by Messrs. Cecil Hodges & Co., Ltd., Dalston, are one for the lighting control switchgear, including the stage and projecting room switchboards, in the new Astoria Theatre, Charing Cross Road; and one for the extension of the switchboard at the Stationery Office depôt, Harrow, placed by the Office of Works.

The Anglo-Argentine General Electric Co., Ltd., has recently secured an order for the whole of the lamps required for the offices of *La Prensa*, the prominent Buenos Aires newspaper. The lamps are of the "Osram" brand.

Local Exhibitions.

Maidstone.—The illustration which accompanies this note depicts one of the stands arranged by Messrs. E. A. Gardner and Sons, Ltd., Maidstone, at the electrical exhibition recently held in that town. Messrs. Gardner are electrical contractors,



Messrs. Gardner's Stand at Maidstone.

but they also have a special branch, and showroom, for the retailing of electrical supplies. The stand illustrated displayed the products of a number of leading manufacturers; another stand was devoted to "Standard" appliances.

Basingstoke.—An electrical exhibition was opened at the Town Hall on February 24th by the Mayoress (Mrs. C. Bowman), supported by the Mayor (Alderman Bowman), Sir Alfred Holbrook, M.P., Mr. F. Swarbrick, and Mr. V. W. Dale (E.D.A.). The Mayor, in his opening remarks, briefly outlined the history of the undertaking, and paid a tribute to Mr. Swarbrick's energy and enthusiasm. In declaring the exhibition open, the Mayoress said that the electrically-fitted rooms clearly demonstrated how electricity could brighten the home and lighten the labours of the home-makers. Sir Alfred Holbrook, M.P., and Mr. V. W. Dale also spoke. The exhibition consisted of a suite of three rooms, dining-room, lounge, and bedroom, tastefully furnished by Messrs. Moody & Co., and electrically equipped by the Credenda Conduits Co., Ltd. In addition, there was a separate exhibit of electric sewing machines, "Creda" cookers and fires. Mrs. Mole, assisted by Miss Swarbrick, gave a series of lectures and demonstrations throughout the exhibition. Prior to the opening of the exhibition, the Mayor started up the new 600-kW Diesel plant (Mirrlees-Bickerton) at the generating station in Brook Street.

Cardiff.—A house designed on the lines of the E.D.A.-E.L.M.A. prize house by Messrs. Edwards & Jones, Cardiff, was opened recently at Cardiff Drill Hall. It was erected by Messrs. G. L. Ward & Co., Cardiff, and consists of a lounge, dining-room, two bedrooms, bathroom, lavatory, garage and scullery, all of which are electrically equipped. The exhibition is under the auspices of the *Western Mail*, and the house has been equipped by Messrs. David Morgan, in co-operation with Messrs. Ward. The appliances on view are representative of a number of the leading electrical companies.

Dumfries.—Mrs. O'Brien, wife of the Provost, opened, on March 1st at St. George's Hall, Dumfries, an electrical exhibition organised by the local electrical contractors under the chairmanship of Mr. W. Johnston, burgh electrical engineer. Among the exhibitors are Metro-Vick Supplies, Ltd., the British Thomson-Houston Co., Ltd., the General Electric Co., Ltd., Belling & Co., Ackroyd & Best, Souter & Co., Ltd., the Edison Swan Electric Co., Ltd., Siemens & English Electric Lamp Co., Ltd., the Chloride Electrical Storage Co., Ltd., the Hotpoint Electrical Appliance Co., Ltd., and the Singer Sewing Machine Co. Messrs. R. Barbour and Sons, drapers, have fitted up a shop window with special and Sons, drapers, have fitted up a model shop window with special lighting.

Indian Electrical Imports.

The official returns show that the value of the electrical equipment imported into India during December last was 34,00,000 rupees, as compared with 23,26,500 rupees in December, 1925.

The Co-ordination of Government Contracts.

The Parliamentary Correspondent of the *Daily Telegraph* states that last session the Estimates Committee of the House of Commons made the valuable recommendation that a Co-ordination of Contracts Committee should be established for the purpose of arranging for the bulk purchase of supplies for a series of Government departments instead of each department continuing to place its own contracts. This recommendation, designed in the interests of economy, will shortly bear fruit, as it is understood that the Admiralty, the War Office, and the Air Ministry have now agreed to appoint representatives on the Committee. In addition, the Office of Works and the Post Office—departments which have heavy contracts—will participate, whilst the Treasury will naturally take a hand

Trade Announcements.

Medway's Safety Lift Co., Ltd., states that its telephone number has been changed to: Hop 4767-9.

Owing to their premises having been sold, Messrs. Hubber and Son, electrical engineers, of 85 & 86, South Street, Exeter, are selling their stock-in-trade, plant, &c., by auction on March 21st.

The Walsall Hardware Manufacturing Co., Ltd., last week opened a new store at Castle Warehouse, Nottingham, which will contain a full range of "Walsall" specialities, conduits, ironclad switch- and fuse-gear, &c., and will be under the personal direction of Mr. F. H. Blaxley.

The telephone number of Messrs. E. N. Hunter & Co., 68, Victoria Street, S.W.1, is now "Victoria 0259."

Mr. T. J. Stobart, 316, Ivydale Road, S.E.15, has been appointed sole representative in the British Isles for the Canadian directories of the Fraser Publishing Co., Montreal. The metal products (automotive, electrical, hardware, radio, machinery industries, &c.) directory of this series has just been published.

Mr. J. E. Fenton, wireless and electrical engineer, has removed to 44-46, Canmore Street, Dunfermline.

New Catalogues and Lists.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.—Three illustrated and priced pamphlets dealing, respectively, with "mass" type batteries for long slow discharges; h.t. radio "mass" type batteries; and "Monobloc" automobile batteries.

The Cambridge Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.—An illustrated pamphlet advertising the "Cambridge" dial thermometer.

The Electrical Equipment & Carbon Co., Ltd., Bank Buildings, 109-111, New Oxford Street, W.C.1.—Price List S.C.7, dealing with "Siemens" carbons for kinematograph projection; and List M8, containing details and prices of "Elin" d.c. and a.c. motors.

Messrs. Elliott Bros. (London), Ltd., Century Works, Lewisham, S.E.13.—Catalogue sections containing illustrated descriptions of some new portable testing sets and the "Elliott" cable-core temperature indicator.

Messrs. J. H. Tucker & Co., Ltd., King's Road, Tyseley, Birmingham.—A series of booklets, pamphlets, and folders illustrating and describing ironclad switch- and fuse-gear, tumbler switches, switchplates, and other "Tucker" products.

Messrs. Hans Renold, Ltd., Burnage Works, Didsbury, Manchester.—An illustrated brochure dealing with the company's chains and chain drives for power transmission.

The B.E.N. Patents, Ltd., 96-100, Victoria Street, S.W.1.—An illustrated folder advertising the "B.E.N.-Myers" hydraulic car-washing plant. Priced.

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.—A folder containing illustrations and prices of electric light pendants, shade fittings, and lanterns.

Messrs. Allen-Liversidge, Ltd., Victoria Station House, S.W.1.—Catalogue E.W. Section 1 and E.W. Pamphlet 7 dealing exhaustively with "Pontelec" electric welding equipment (Buckley, Saunders & Co., Ltd.) and welding supplies, including rivet heaters. Fully illustrated.

Siemens & English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, E.C.4.—Catalogue No. 164, containing illustrated particulars and prices of bowl fittings, "Silvaray," "Silvalux," and "Moonstone" glassware, alabaster bowls and other lighting fittings. Also March price sheet of electrical accessories, fittings, and appliances.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—March calendar-blotter advertising the company's "20B" cooker for hiring schemes.

The D.P. Battery Co., Ltd., Bakewell, Derbyshire.—A booklet illustrating and describing applications of "Kathanode" batteries for locomotives in power stations and works.

The Hart Accumulator Co., Ltd., Stratford, E.15.—March calendar-blotter advertising the company's batteries; also three new showcards advertising the company's motor-car starting and lighting batteries.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet 4,383, illustrating several examples of bakelite mouldings as produced by the company.

Pope's Electric Lamp Co., Ltd., 5, Arthur Street, New Oxford Street, W.C.2.—March calendar-blotter advertising "Elasta" lamps.

Falconbridge & Co., Cefco Works, Beck Street, Nottingham.—A priced and illustrated catalogue of fan regulators, dimmers, arc resistances, curtain controllers, &c.

Hopkinson Induction Motors, Willesden Lane, North Acton, W.3.—March stock list of single- and three-phase motors.

Bankruptcy Proceedings.

D. T. Donovan and H. A. Langlois, trading as the London Electrical Co., 119, St. Mary Street, Cardiff, formerly 124, Queen Street, Cardiff.—The adjourned public examination of these debtors was held recently at Cardiff. The statement of affairs showed a deficiency of £1,025. Debtor Langlois said he had been in business as an electrical engineer since 1921, having £50 capital when he commenced. In May, 1926, debtor Donovan joined him as a partner. He put £50 into the partnership when he joined. An accountant prepared a statement which showed a net profit for 12 months of £1,086 and a balance sheet showed stock in hand at £400. It was proposed to form a limited company with £2,000 capital, and premises were taken in St. Mary Street. Debtor Langlois agreed that in the last seven months between trading losses and private drawings their loss amounted to £986. An order was made for a statement showing goods received and payments made between certain dates, and the examination was further adjourned.

G. R. Sims, Hartlepool Street, Thornley, Durham, motor and electrical engineer.—The public examination of this debtor was held on March 1st, at Durham. The statement of affairs showed ranking liabilities of £421, and there was a deficiency of £296. Debtor attributed his failure to the mining dispute. It appeared that he commenced business in 1924 and was successful until the beginning of the dispute, after which he had to sell some of his stock at a loss. The examination was adjourned.

A. H. Richardson (Radio Supplies), wireless manufacturer, 4, Rose Hill, and Wellingborough Road, Finedon, Northants.—First meeting held March 8th, at the Official Receiver's Office, The Parade, Northampton; public examination, April 1st, at the County Hall, Northampton.

A. E. S. Challener, wireless engineer, 277, St. Sepulchre Gate, Doncaster.—Last day for proofs for dividend, March 16th. Trustee, Mr. L. J. Clegg, Official Receiver's Offices, 14, Figtree Lane, Sheffield.

J. N. Davenport and L. A. Hackett (Davenport, Hackett and Co.), electrical engineers and contractors, 36, Spring Gardens, and Albert Mill, Albert Street, Manchester.—Second and final dividend of 3s. 2 9/50d. in the £, payable March 15th, at 21, Spring Gardens, Manchester.

G. E. Grainger (Grainger & Co.), wireless engineer, 38, Market Street, Ashby-de-la-Zouch.—Receiving order made February 28th; on debtor's own petition.

G. Turner (Radio Supply Co.), electrician and wireless dealer, 34, Mesnes Street, Wigan.—First and final dividend of 3s. 10¾d. in the £, payable March 18th, at the offices of the Official Receiver, 11, Dale Street, Liverpool.

Company Liquidations.

Neutron, Ltd., Sicilian House, Southampton Row, W.C.—The first meetings of creditors and shareholders of this company were held on March 3rd, at Carey Street, a compulsory winding up order having been made on February 15th at the instance of a creditor. The Official Receiver reported that the company was registered on May 3rd, 1924, with a nominal capital of £500, and its primary object was to acquire the assets and business of William Bennison and T. E. de Vries, who were then dealing in the "Neutron" crystal. By an agreement dated June 30th, 1924, the company acquired from them the goodwill and assets of their business. The company undertook to pay all debts and liabilities of the vendors up to an agreed sum of £100. The purchase consideration was fixed at £394, which was satisfied by the issue of fully-paid shares. Mr. W. Wolsey, a director, had stated that shortly after the incorporation of the company an agreement was entered into with the firm of V. Zeitlin & Sons, by which the latter became sole distributors for Great Britain and Ireland of "Neutron" crystals. They transacted a considerable volume of business with the company, and, according to Wolsey, had paid sums amounting to approximately £45,000. There were agreements with other firms for distributing the "Neutron" and other crystals, and the position in regard to those would be required to be considered by the liquidator when appointed. There had been several issues of debentures, but inasmuch as certain of them were issued within three months of the commencement of the winding up for a past consideration they would appear to be void. A number of judgments were obtained against the company, and, as further capital could not be obtained, the directors, on January 18th last, decided to put the company into voluntary liquidation. On the same day Bennison, under the powers contained in his debentures, appointed a receiver on his behalf. On February 21st, however, the latter wrote to the Official Receiver, on behalf of Bennison, to the effect that he was retiring from the receivership and he had since handed over the estate to the Official Receiver. A receiver, appointed on February 7th by P. G. Marr & Co., Ltd., holders of debentures for £3,150, had not taken any action, with the result that the Official Receiver was in possession of the assets. No statement of the company's affairs had been lodged, but the unsecured

liabilities were estimated at £6,311, in addition to which there was a sum of £3,450 claimed to be due in respect of debentures. With regard to the assets, the book debts were estimated at £500. The Official Receiver had realised £65, and there was a balance of about £127 on the receiver's account, which was, however, subject to his remuneration and solicitor's costs. The chief assets of the company appeared to be goodwill. So far as could be ascertained at the present time about £20,000 had been expended by the company in advertising. The remaining assets consisted of crystals, wireless parts, tins, cartons, &c., and they were of small value unless the goodwill were bought. Two offers had been received for the goodwill, trade marks and stock, the higher of which amounted to £600. Wolsey attributed the failure of the company to excessive advertising. In Bennison's opinion the failure was due to excessive advertising and insufficient working capital to enable orders to be executed. The company had also kept a large and expensive staff, and had incurred losses in connection with the manufacture of and experimenting with radio sets. A liquidator was nominated.

Paragon Electric Welding Co., Ltd.—Winding up voluntarily. Liquidator, Mr. A. J. Francis, 25, Llanishen Street, Cardiff. A meeting of creditors was held at Merthyr House, Cardiff, on March 7th. Particulars of claims to the liquidator by March 31st.

Cinema Apparatus Co., Ltd.—Winding up voluntarily. Liquidator, Mr. F. Wheatcroft, 105, Market Street, Manchester. A meeting of creditors was held at the Liquidator's offices on March 9th. Particulars of claims by April 2nd.

Sterling Accessories, Ltd.—A meeting of members is called for April 6th, at the offices of Messrs. Thorpe & Pearson, 5, John Street, Bedford Row, W.C., to hear an account of the winding up from the liquidator, Mr. W. B. Pearson.

Autoveyors, Ltd.—Winding up voluntarily. Liquidator, Mr. E. W. Dilley, 84, Victoria Street, S.W. Meeting of creditors at 84, Victoria Street, S.W., March 15th.

Private Arrangements.

W. H. Taylor, radio engineer, 106, Bridge Street, Warrington.—A meeting of creditors was held recently, at the offices of Mr. J. Willett, solicitor, Warrington, when a statement of affairs was submitted which disclosed liabilities of £929, of which £529 was due to unsecured creditors, and the debtor's mother was a creditor for £400. The assets were valued at £151 net, leaving a deficiency of £778. It was reported that the debtor commenced in a small way after the war, and four years ago took the present premises. At that time he had no capital of his own, but borrowed £400 from his mother. Details as to the trading were not available, but the debtor stated that the turnover had been as high as £50 per week, and as low as £12 weekly. He attributed his present position to the long illness and subsequent death of his wife. It was decided that, subject to the debtor's mother withdrawing her claim, the estate should be dealt with under a deed of assignment in favour of Mr. P. S. Booth, Exchange Chambers, 2, Bixteth Street, Liverpool, as trustee, together with a committee of inspection consisting of Mr. W. Draper (Messrs. H. E. Beardsall, Ltd.), Mr. S. Lockwood, and Mr. J. F. Warburton. The following are creditors:—

	£		£
O'Brien, R. A., Ltd. ...	95	Bush House	50
Beardsall, W. B., & Co., Ltd.	60	Wood, E., Ltd.	30
		Bankers	28
Mullard Wireless Service Co., Ltd.	62	Mackay & Co., Ltd. ...	25
		B.N.B. Wireless, Ltd. ...	20

C. W. Page and T. K. Garrard, trading as the Southern Sales Co., Rye, Sussex, motor accessory dealers and electrical and wireless factors.—A committee of inspection, appointed at a meeting of creditors, recommends the adoption of a proposal whereby the business will be formed into a limited company and the claims of the present trading creditors secured by a first mortgage debenture.

Herbert Thomas Ellis, Earsham Street, Bungay, Suffolk, wireless and electrical engineer, &c.—A meeting of creditors was held on March 2nd, at the offices of Messrs. Harman and Gowen, 7, Queen Street, Norwich. A statement of affairs was presented which showed liabilities of £943, and assets of £305, leaving a deficiency of £638. Mr. Gowen reported that the debtor commenced business about five years ago with a capital of £400 or £500. He had kept a day book and cash book. No trading figures were available at the meeting. Mr. Gowen added that in consequence of pressure by creditors a deed of assignment had been executed in his favour on February 25th. The debtor had no offer to make, and attributed his position to bad trade and bad debts. The creditors decided that the deed of assignment should be confirmed, and that the trustee should make an immediate endeavour to sell the business as a going concern. The following are creditors:—

	£		£
Shell-Mex, Ltd.	100	Brown Bros.	25
S.D.H. Mfg. Co.	141	Harmsworth, Ltd. ...	40

Dissolutions of Partnership.

H. Van Leemputten & Beneu, manufacturers of wireless and gramophone cabinets, 157a, Stanhope Street, Euston Road, N.W.—Messrs. H. Van Leemputten and P. Deneu have dissolved partnership. Mr. Leemputten will attend to debts and continue the business in his own name.

Springvale Electrical Co., electrical engineers, Springvale Works, Masbro Road, West Kensington, W.—Mr. G. H. Armitage and Mr. D. Heaton have dissolved partnership. Mr. Armitage will attend to debts and continue the business.

Social Events.

Bad weather did not prevent the gathering together of a very large audience consisting of members of the London office staff and friends of W. T. Henley's Telegraph Works Co., Ltd., at a performance given by Henley's Dramatic Club on Saturday evening last, at the Cripplegate Theatre. Ian Hay's domestic comedy, "The Sport of Kings," was the piece presented, and the high standard of excellence for which the club is known was well maintained, if not surpassed. The audience was very appreciative, and we may add our own congratulations. Mr. Frank J. Bettley as Amos Purdie, J.P., was a marked success, and Miss Hilda Starbuck as his daughter Katie was charmingly natural and free. Messrs. A. V. Burnett and W. G. Turner filled prominent positions with ability. Miss Irene Bradbrook had an inconspicuous part to play as Mrs. Purdie, but she did it well. Indeed, everybody contributed his or her share in providing a most enjoyable evening.

The staff of the Bury Electricity Department held its annual dinner on February 28th, at the Royal Hotel, Bury. Mr. J. G. Potts, the borough electrical engineer, presided, and among those present were the chairman of the Electricity Committee (Councillor Evans), Messrs. J. Stephenson (resident engineer), J. Murray (works superintendent), S. J. Watson (Salford), Councillor J. Pilling, and Mr. J. Renshaw (Fleetwood). The dinner was followed by a concert.

On February 26th the Seecol Social and Sports Club (Strand Electric and Engineering Co., Ltd.) held a fancy dress dance at Hana's Studios, W. There was an excellent variety of costumes, and eight prizes were given by the directors. Music was provided by the Revels Dance Orchestra.

The Indoor Games Section of the G.E.C. Social and Athletic Club held a successful dance at the Lecture Room, Magnet House, on February 18th, arranged by Mr. H. J. Fisher, the hon. secretary of the section.

The Outdoor Section of the Osram-G.E.C. Lamp Works Social and Athletic Club held the sixth dance of the season at the Osram Works on February 19th, when over 300 members and their friends spent a most enjoyable evening.

The annual staff dinner of the Reliance Telephone Co., Ltd., was held at Anderton's Hotel, Fleet Street, on February 26th. Mr. E. Silbermann, managing director, presided, and in responding to the toast of "The Directors," proposed by Mr. W. T. Ashton, A.M.I.E.E., he referred to the growth of the company, and the excellent spirit of good fellowship and loyalty which prevailed amongst the employés. A concert followed, and the evening was brought to a close. A vote of thanks for those responsible for the arrangements was proposed by Mr. A. V. Cannon, sales manager.

New Showrooms and Offices.

The Barking Urban District Council has applied to the Electricity Commissioners for sanction to a loan of £4,000 for the provision of showrooms and offices for the Electricity Department.

The Accrington Corporation's electricity showrooms, in Burnley Road, were to be opened this week. During the past year the costs of running electric houses have been collected with a view to helping prospective tenants of all-electric houses.

Book Notices.

An illustrated folder has been issued by the Edison Swan Electric Co., Ltd., London, to show the way to construct an interesting crystal set l.f. amplifier, called the "R.C. Twosome." The circuit employs two valves (R.C.2 and P.V.2) with a resistance capacity coupling unit. A transformer is used to couple the crystal set with the first valve. The circuit is certainly exceedingly simple, and can be put together quickly at a low cost. The design is not to increase the range of the crystal set with which it is incorporated, but to amplify the signals received so as to operate a loud speaker. The simple operations of building the set are very clearly explained in the instruction folder (complete with blue-print) which is issued free.

Messrs. Adam Hilger, Ltd., have issued a booklet dealing with developments in spectrography, &c., during the year ended June 30th last. This contains particulars of new instruments devised by the company and a digest of the literature of the subject published during the year. It also embodies a list of orders obtained by the company from all parts of the world.

"Doubling Our Coal Power" is the title of a pamphlet by Mr. A. Allport, who has made a close study of fuel economy for upwards of 15 years; he holds, and claims to prove, that low-temperature carbonisation is to-day a commercial proposition, and has issued this pamphlet at his own expense to set out the advantages of the "Coalite" process. (Wadsworth & Co., Keighley, price 6d.)

"Notes on Electricity and Service Electrical Apparatus as Applied to 1926 Artillery." London: H.M. Stationery Office. Price 2s. net.

"Controllers for Electric Motors," by H. D. James. Pp. vi+522; figs. 444. London: Chapman & Hall, Ltd. Price 21s. net.

"Mesures Electriques," by J. Granier. Pp. 200; figs. 85. Paris: Armand Colin. Price 9 fr.

Registered Electrical Contractors.

The following applications for registration were accepted by the Executive Committee of the National Register of Electric Installation Contractors on March 4th :—

Grotecke, K., Heaton Chapel, Stockport.
Coates & Co., Harrogate.
Lyons, W. H., Manchester.
Lea Bros., Birmingham.
Cooper, C., & Co. (London), Ltd., South Kensington.
Cooper, W. R., Redcar.
Keep & Roebuck, Sheffield.
Shawcross, J. T., Old Trafford, Manchester.
Morement & Bridges, Calne.
Hammond & King, Nottingham.
Elliott, R. H., Newbiggin-by-Sea.

For Sale.

The Crittall Manufacturing Co., Ltd., has for disposal several surplus generating sets. Nottingham Corporation Electricity Department invites offers for surplus generating plant, &c., at the St. Anns and North Wilford power stations. Barking U.D.C. Electricity Department has for disposal boilers, feed pumps and generating sets. The superintending engineer, Coastal District R.A.F., invites offers for one 44-kVA Siemens alternator, one turbine pump, two 440-V a.c., and one 220-V d.c., motors and one 10-kW Siemens generator, all lying at the Leuchars Aerodrome, Scotland. (See our advertisement pages to-day.)

Prices of Raw Materials.

Messrs. James Forster & Co., reporting on March 5th, stated :—"Closing prices of lead yesterday were £28 17s. 6d. for March, and £29 5s. for June, a rise on the week of 12s. 6d. per ton. . . . There is a slow but steady improvement in demand from all branches of the trade in this country, even cable manufacturers absorbing slightly larger quantities than heretofore. Increased activity is reported from the Continent, where Germany and Russia have been buying considerable quantities. In the United States also firmer conditions prevail. . . . Supplies here are still ample. . . . Reviewing the position as a whole, we can see no reason to anticipate other than continued firm markets with higher prices."

The following prices are only general, and they may vary according to quantities and other circumstances :—

CHEMICALS, &c.		Price Mar. 8th.	Fortnight's inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£13 10s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3¼d. to 3½d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ...	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots...	per ton.	£107 to £112	...
b ,, Wire	per lb.	1/6 to 2/-	...
b ,, Sheet	,,	1/3 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£274	£3 inc.
Grade II	,, ,,	£190	£3 inc.
Grade III...	,, ,,	£98	£2 inc.
c Brass (rolled metal 2" to 12" basis)	per lb.	9⅝d.	...
c ,, Tubes (solid drawn) ...	,,	11½d. to 11¾d.	...
c ,, Wire, basis	,,	9⅝d.	...
c Copper Tubes (solid drawn) ...	,,	1/0½	...
c ,, Bars (best selected) ...	per ton.	£86	...
c ,, Sheet	,,	£86	...
c ,, Rod	,,	£86	...
d ,, (Electrolytic) Bars ...	,,	£63 2s. 6d.	52/6 inc.
d ,, ,, Sheets ...	,,	£144 10s.	...
d ,, ,, Wire Rods ...	,,	£73 2s. 6d.	32/6 dec.
d ,, ,, H.C. Wire	per lb.	9¼d.	¼d. inc.
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
n German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	8/-	...
h India-rubber, Para fine	,,	1/6	2½d. inc.
l Iron Pig (Cleveland No. 3.) ...	per ton.	122/6	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£29 15s.	5s. inc.
g Mercury	per bot.	£17 15s. to £18	10s. inc.
e Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large ...	,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2¾	...
p ,, ,, wire...	,,	1/3½	¼d. dec.
o Platinum	per oz.	£23	...
d Silicium Bronze Wire	per lb.	10¾d.	¼d. dec.
r Steel, Magnet, in bars	,,	7½d.	...
n Tin, Block (English)	per ton.	£310 to £311	£3 to £3 10s. inc.
n ,, Wire, Nos. 1 to 16	per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications. Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co,. Ltd
g James & Shakespeare.
h Edward Hill & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Lighting and Power Notes.

Aldershot.—New Plant.—As the result of a further interview with the Electricity Commissioners, the borough electrical engineer has been asked to submit to them for consideration a scheme for the installation of new plant at the electricity works. It is proposed to install two internal-combustion engines of 600 h.p. each, together with generators, auxiliaries, switchgear, and necessary interconnecting cables, at an approximate cost of £16,000.

Alsager.—Inauguration of Supply.—The formal inauguration of the supply of electricty for the district took place on February 26th, the chairman of the Urban District Council switching on the supply, which is provided by the Electricity Distribution of North Wales and District, Ltd.

Barnes.—Electricity in Small Houses.—The Housing Committee of the L.C.C. has recommended that electricity be installed for lighting, cooking, heating and domestic purposes in 57 houses on the Castelnau housing estate, and that 599 houses be wired for lighting only. The Urban District Council will lay the cables on the whole of the estate and provide the necessary services free of charge to the L.C.C., but the latter will undertake the wiring of the houses. The charges will be 4d. per kWh for lighting, with an alternative tariff of 2½ per cent. of the ratable value of the premises per quarter, plus ½d. per kWh during the summer months and 1d. per kWh during the winter months for electricity consumed. The cost of the scheme to the L.C.C. will be £1,082 for wiring the 57 houses for lighting, cooking and heating, and £6,887 for wiring 599 houses for lighting only.

Basingstoke.—Extension of Supply.—The Town Council is applying for a Special Order authorising it to supply electricity within the area of the Rural District Council. The estimated cost of the extension is £20,020.

Opposition to Bill.—The Council has also decided to oppose the Wessex Electricity Bill.

Bicester.—Electricity Supply.—The Urban District Council has consented to an application by Messrs. Cooper & Hanns for a Special Order to supply electricity to the town. The maximum prices proposed are 1s. per kWh for lighting, 4d. per kWh for power, and 6d. per kWh for public lighting.

Bridport.—Inquiry.—An inquiry was opened on February 25th by Col. T. C. Ekin, for the Electricity Commissioners, relative to a proposal by the Town Council to carry out an electricity scheme. Opposition was made by the Rural District Council, which sought to include a time limit in which the work should be carried out, the Manufacturers' Association, which ask for the insertion of a clause safeguarding the rates, and by the local gas company.

Burnley.—Mains Extensions.—The Corporation is to carry out extensions to feeders and distributing cables, at a cost of £5,000.

Clitheroe.—Inauguration of Supply.—The power station was to be opened on Wednesday last. The Corporation has undertaken to wire houses and to charge slightly in excess of the standard charge per kWh until the cost of wiring is met.

Continental.—France.—A group has been formed in the Senate to do all in its power to further the exploitation of the country's numerous waterfalls. This group will keep before it the idea of the electrification of railways, the employment of electricity in all the domains where it is feasible, and the speeding-up of the construction of the necessary power stations.

The Paris-Orleans Railway Co. has placed a contract for the establishment of a h.p. transmission line between the hydro-electric station at Eguzon and a transformer station at Maregis. The line is to be capable of transmitting electricity at a pressure of 220,000 V, but at first the pressure will be limited to 150,000 V.

Switzerland.—A scheme is under consideration for the erection of a large hydro-electric power station to utilise the water power of the Rivers Inn and Spols in the Lower Engadine. It is estimated that by the construction of three dams, a total of 230,000 h.p. can be made available.

Belgium.—A new central electricity station has recently been completed in Ghent, the plant comprising two 10,000-kW steam turbo generators. The old station, which has a capacity of 3,000 kW, is being converted into a transformer station.

Derby.—Electricity Extensions.—The Corporation proposes to borrow £83,500 for the following electricity extensions :—Mains, £45,000; transformers, £10,000; motors, £3,000; boiler house plant, £25,500.

Edinburgh.—Electricity Extensions.—At the Dean of Guild Court on March 3rd, plans were passed for the erection at the Corporation's power station at Portobello of a turbine house and a switch house, part of an extension scheme which will cost about £200,000. The new turbine house will contain two 25,000-kW turbo-alternators. Plans for additions to

the pump house have already been passed and an application for permission to extend the boiler house will come before the Dean of Guild Court soon. The extensions are being pushed on with a view to an additional supply of electricity being made available by the winter of 1928.

Harrogate.—Year's Working.—The accounts of the Corporation electricity undertaking (engineer, Mr. G. Wilkinson) for the year ended March 31st last, show a total income of £52,690, as compared with £49,450 in the preceding year. Working expenses amounted to £28,965, as against £25,121, leaving a gross profit of £23,725 (£24,329). Capital charges absorbed £10,277, and there was a net surplus of £13,448, as compared with £11,343 in 1924-25. The capital expenditure during the year amounted to £24,436, the chief item being £14,560 for machinery. The sales of electrical energy increased from 3,782,411 to 4,495,011 kWh, and the maximum supply demanded from 2,397 to 2,793 kW.

Horsham.—Opposition to Order.—The Urban District Council is to oppose an application for an Order by the Electric Supply Corporation, Ltd., to supply electricity in areas adjoining the Council's area, which are included in an extension scheme contemplated by the Council.

Japan.—Electrical Development.—Work has commenced on the construction of a steam power plant for the I.G.R. which will have a capacity of 60,000 kW. The cost is estimated at 5,000,000 yen.

The Lugawa Denryoku K.K. is to utilise the Azuma river for generating electricity, and the first section of its scheme provides for the erection of a power station at Matsudani with a capacity of 22,700 kW.

The new power station of the Tokyo Denryoku K.K., at Tajima-machi, Kanagawa-ken, has recently been completed. Two 35,000-kW sets have been installed.

Kirkham.—Electricity Supply.—There has been a favourable response to the *questionnaire* sent out by the Urban District Council regarding the probable demand for electricity in the area, and it has been decided to apply for an Order to proceed with the scheme. It has not yet been decided whether the Council will carry out the scheme itself or place it in the hands of the Preston Town Council.

Leeds.—Loan Sanctioned.—The Corporation Electricity Committee has obtained sanction to the borrowing of £95,000 for services.

Liverpool.—Electricity Charges.—The Corporation Electricity Department will introduce from March 31st a new scale of charges for combined business and private premises, being a fixed quarterly charge of 7 per cent. on the ratable value with a minimum assessment of £18, plus ½d. per kWh for electricity consumed in Liverpool, Bootle, and Litherland, and ¾d. per kWh in Waterloo and Gt. Crosby.

Llandudno.—Supply for Small Houses.—In all future municipal housing schemes, the Council has decided that provision shall be made for electric wiring.

Lytham-St. Annes.—Loan.—The Town Council is applying for sanction to borrow £5,000 for the purchase of electrical apparatus to be let out on hire.

Manchester.—Progress during January.—During the month of January the Corporation electricity undertaking showed an increase in connections of 1,885 kW, bringing the total to 301,934 kW; and the number of applications received for supply, including consumers for additional supplies, was 916, representing a total of 3,624 kW. The number of hired cookers connected increased by 97, bringing the total actually on circuit to 2,788. Applications for the hire of cookers totalled 129. A new 7,500-kVA, 33,000/6,600-V transformer was put into commission at Oldham Road sub-station, and one 500-kVA transformer was installed at Connolly's (Blackley), Ltd., sub-station in place of two 125-kVA transformers.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Stoke-on-Trent.—Multi-part tariff for domestic consumers: 5s. per room per quarter, plus 1d. per kWh for the first 1,000 kWh per quarter, ¾d. per kWh for the next 1,000, and ½d. per kWh for all energy consumed in excess of this amount.

Preesall.—Lighting: 8d. per kWh.

Birkenhead.—The 10 per cent. increase made in September last to be withdrawn.

Grantham.—*The Urban Electric Supply Co., Ltd.*—Lighting: From 10d. to 9d. per kWh; the increase made in the charges for power and heating owing to the coal dispute is to be discontinued.

Wallasey.—Lighting reduced to 4½d. per kWh, and in addition a discount of 5 per cent., for prompt payment of accounts to consumers on lighting, heating, cooking, and small power tariffs. No increase was made to this class of consumer during the coal dispute.

Hampstead.—The flat rate for lighting reduced from 4d. to 3½d. per kWh, the charges for cooking, heating, and power to remain as at present, *viz.*, 1d. per kWh. Mr. J. Leadbeater, borough electrical engineer, states that this is the lowest flat rate charge in the London and Home Counties area, and one of the lowest in the country.

Southampton.—The increase of 20 per cent. for lighting, heating, cooking and power, made owing to the higher cost of coal, is to be withdrawn.

Reigate.—New Plant.—The Town Council has applied for consent to install an additional generating set with a capacity of from 800 to 1,000 kW, at an estimated cost of £20,000, plus £1,000 for foundations. Inquiries are also to be made as to the possibility of a supply of electricity in bulk, and the terms.

Sandbach.—Inauguration of Supply.—An electricity supply for the district was formally inaugurated by the chairman of the Urban District Council on February 26th. Electricity is obtained from the Electricity Distribution of North Wales and District, Ltd.

Sheffield.—Inquiry.—An inquiry was held by the Electricity Commissioners at Sheffield recently concerning the claims of rival undertakings to supply Cudworth, near Barnsley, with electricity. The Electrical Distribution of Yorkshire, Ltd., applied for statutory powers to supply Cudworth and Billingley. The Carlton Main Colliery Co. is already supplying electricity in Cudworth, where the Power Company is also supplying a number of consumers. For the Distribution Co. it was stated that it had not been successful in obtaining the consent of the Cudworth Urban Council, and it asked that such consent be dispensed with. The Colliery Co. had three pits, and at Frickley a generating station had been erected, linked up with the other two pits. It was the obvious intention of the colliery company to compete with the power company without incurring any of the statutory restrictions and obligations which the allied companies would be under if they obtained the Order. Mr. W. B. Woodhouse, engineer and manager of the Distribution Co., suggested that the colliery company took steps regarding supply after it knew of the impending application of the Distribution Co. He contended that it would be safer for the people to get a supply from the Distribution Co. because it would be subject to Government control and the prices regulated by the Electricity Commissioners. For the Cudworth Council, Col. Raley said that all through the prices charged by the colliery company had been lower than those of the Distribution Co., and the latter did not make any definite terms until the Council was morally and legally bound to the colliery company, whose terms were cheaper. The Commissioners will give their decision in due course.

Sidmouth.—Electricity Supply.—It was reported at the February meeting of the Urban District Council that the Electricity Committee hoped to be able to announce a reduction in the price of current at the next meeting, to come into operation as from March 31st. The Committee recommended the Council to adjourn *sine die* the proposed provision of a new generating set at the electricity works at an estimated cost of £3,500, as it was felt that the expenditure for standby plant was not justifiable at present.

Southend-on-Sea.—New Power Station.—At a meeting of the Town Council on March 7th, it was decided to apply for sanction to erect a new power station at Hole Haven, on Canvey Island, at an estimated cost of £649,000. The station will have a capacity of 25,000 kW.

South Shields.—Electrical Progress.—The electrical engineer reports that under the assisted wiring scheme 983 additional consumers were connected during the December quarter. Electricity sold totalled 212,053 kWh, and the revenue obtained was £5,750. Since the inception of the scheme a total revenue of £17,398 has been obtained from this source.

Special Orders.—Application has been made to the Electricity Commissioners by Basingstoke Corporation for a Special Order authorising it to extend its area of electricity supply so as to include certain parishes in the rural districts of Basingstoke, Kingsclere, and Whitchurch.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising Messrs. E. H. Leach and W. H. Phillips to supply electricity in the borough of Tenby; Major C. H. B. Prescott-Westcar to supply in the urban district of Axminster, the borough of Chard, and part of the rural districts of Axminster and Chard; the Tilbury Urban District Council to supply electricity in its area, and for the amendment of the Romford and District Electric Lighting Order, 1913; and the Crowborough District Gas and Electricity Co., to raise additional capital for electricity purposes.

Stoke-on-Trent.—Change-over.—At a recent meeting of the Corporation Electricity Committee the engineer reported upon the change over of supply to consumers in the centre of Tunstall, and was instructed to carry out the work over a period of three years at an estimated cost of £6,000.

Supply to Uttoxeter.—The Committee has received a letter from Mr. W. C. C. Hawtyne, consulting engineer to the Uttoxeter Urban District Council with regard to a supply of electricity, and the Committee has informed him that the Corporation would give a supply at the city boundary provided the Council would erect the necessary line to take supply thereat.

Loans Sanctioned.—The Corporation Electricity Committee has received sanction to loans totalling £23,100 for mains, services, and sub-station plant.

Torpoint.—Electricity Supply.—It was reported at a meeting of the Urban District Council on March 3rd that representatives of the Torpoint Electricity Supply Co., Ltd., had attended a private meeting of the Council and made definite proposals with a view to securing the withdrawal of the

Council's application and asking for its support to the company's application. Contingent upon this, the company offered a reduction in the price of electricity, which it promised to obtain from Plymouth as soon as it was economically possible, and also made proposals regarding the removal of the overhead wires in Fore Street. The Council had been given a definite assurance that if it supported the application of the company the cable would be laid across the River Tamar from Plymouth within three years of the date of the Order.

Wallasey.—Electricity Extensions.—The Corporation has prepared a scheme for extensions to the electricity works involving the expenditure of £150,000. The scheme includes the installation of a new 12,500-kW turbo-alternator and two boilers, thus doubling the capacity of the station. Tenders will shortly be invited for the supply of new plant.

Wirksworth.—Street Lighting.—The Urban District Council has accepted an offer by the Derbyshire and Nottinghamshire Electric Power Co., to pay the cost of converting the street lamps on the route of the cables, and maintain and light them at a cost to the Council of £3 10s. per lamp per annum. The agreement is for a period of three years.

Worthing.—Street Lighting.—The Corporation is to convert the existing street lamps from gas to electric lighting, and all the 60-watt lamps are to be replaced by lamps of 100 watts. The total cost of the scheme is £4,000.

Tramway and Railway Notes.

Continental.—Belgium.—The Chamber, by 73 votes to 61, has decided to abandon the proposed underground railway, linking up the north and south stations in Brussels.—*Reuter* (Brussels).

Germany.—Work is well in hand on the electrification of the railway between Munich and Rosenheim, Bavaria. Electric trains are already in operation on part of the line, which is expected to be completed by May next.

Austria.—The electrification of the last section of the State railway between Innsbruck and Bregenz—that between Feldkirch and Bregenz—has recently been completed.

Spain.—A concession has been granted for the construction of an electric tramway to connect the Granada-La Zubia railway with Monachil.

Switzerland.—Last week a new line was opened at Zurich on the left bank of the lake. For years this section of railway has given trouble to both the town authorities and the Federal Railways, as Zurich has grown so rapidly and has so spread out, that the line which formerly ran outside the city, passed inside it and cut through no fewer than twelve streets. In order to avoid the danger of such a state of affairs, the city voted 20 millions of francs, and the Federal Railways 30 millions, towards the cost of a new line. This is at last finished, and is, of course, electric. Special attention has had to be given to the tunnels, one of which passes under the bed of the River Sihl, and has been specially lined to ensure its being perfectly watertight. This Wiedikon tunnel is 507 metres long, the Ulmberg one is 260 metres, and the Willishofen tunnel is 903 metres. A new station has been built at Enge.

Halifax.—Track Renewals.—The Tramways Committee has recommended the renewal of the tramway track from Ratten Clough to Causeway Foot, at an estimated cost of £3,467.

Japan.—Tokio.—The first underground railway which is being constructed by the Tokio Underground Railway Co., Ltd., is expected to be completed by the end of this month, and work on the construction of the second line will be commenced shortly.

Railway Electrification.—It is understood that the Kurihara Kido K.K. at Wakayagimachi, Migagi-ken, intends to electrify its railway at an estimated cost of 550,000 yen.

A scheme is in hand for the formation of a company, with a capital of 250,000,000 yen, for the construction of a rapid transit electric railway between Osaka and Tokio.

Plans are being prepared for the electrification of 337 miles of the following Government lines:—Tokaido Line, Atami-Numazu, 13 miles; Numazu-Akashi, 300 miles; Tabata-Omiya, 14 miles; and Kobubunju-Hachioji, 10 miles. According to *Commerce Reports*, the Tokaido line extensions consist of two separate projects which, when completed, will form one continuous line. The first extension from Atami to Numazu will link the former with the Tokaido main line at Numazu. The 300-mile stretch between Numazu and Akashi is perhaps the most important project yet contemplated, since it includes the electrification of one of the heaviest traffic railway divisions in the empire. That portion of the Tokaido system now electrified, together with the proposed extension, will serve 16 prominent towns and cities. Three of the most important sea ports are situated within its limits, as well as the largest manufacturing centres.

Liverpool.—New Cars.—The Ministry of Transport has sanctioned the borrowing by the Corporation of £74,000 for the provision of new tramcars.

Newcastle-on-Tyne.—New Route.—The Corporation Transport Committee has recommended the laying of a tramway track across the new high-level bridge over the Tyne, now in course of construction, to form another connection between Northumberland and Durham. The estimated cost is £19,000, plus £3,000 for equipment.

Telegraph and Telephone Notes.

"Beam" Radio-Telegraphy.—Australian Service Tests.—On March 7th, Post Office authorities commenced re-testing "beam" wireless communication between the Marconi Company's stations at Grimsby and Skegness and the Australian stations near Melbourne.

Bolivia.—New Radio Station.—Congress has granted 30,000 bolivianos for the erection of a wireless station at Magdalena, the capital of the Province of Iténez. The province has a population of only 95,000, or just over 0.5 per square mile.—*Reuter's Trade Service* (La Paz).

France.—Radio-Telephony.—The Algiers Chamber of Commerce recently discussed the subject of wireless telephony between France and Algeria. After considering the conclusions arrived at by the Constantine Chamber of Commerce, the Algiers Chamber declared that it was of the opinion that wireless telephone communication between France and Algeria would offer the greatest advantages, particularly in intensifying the relations between the two countries and in relieving the cables. The Chamber expressed the wish that the French Post, Telegraph and Telephone Administration should study a plan for the establishment of wireless telephony between France and Algeria.—*Reuter's Trade Service* (Paris).

Germany.—Berlin-New York Telegraphy.—After a lapse of twelve years, Germany can once more telegraph direct to the United States, for on March 4th the newly-laid Emden-Azores cable was officially declared to be in service by the Minister of Posts and Telegraphs, Dr. Schaetzle, at a banquet in Berlin to celebrate the occasion. Soon after war broke out, all German cable lines to the United States were cut by the Allies, and ever since telegrams from Germany to the United States have had to be transmitted through foreign cable companies. The new cable of the German Atlantic Telegraph Co. runs as far as the Azores, where it connects with the lines of the Western Union and the Commercial Cable Companies, so that messages can now be sent direct from Emden to New York.—*Reuter* (Berlin).

League of Nations.—Proposed Radio Station.—At the 44th session of the League of Nations Council, which commenced at Geneva, Switzerland, on March 7th, a proposal to build a special wireless station to enable the League to communicate with all Governments in emergency was to be discussed. The *Daily Mail* understands that the chief objection to the project is the cost.

Russia.—Automatic Telephony.—The Nizhni-Novgorod telephone works has begun to manufacture automatic telephone apparatus. This apparatus will be installed by the Commissariat of Posts and Telegraphs on its new system.—*Reuter's Trade Service* (Moscow).

South America.—Telephone Statistics.—The extent and growth of the telephone lines of the two companies which operate in Buenos Aires and in neighbouring provinces, such as Buenos Aires, Santa Fé, and Cordoba, may be estimated from the following statistics recorded in Messrs. Tornquist and Co.'s recent report:—

Companies.	No. of offices.	Number of Apparatus. Capital and suburbs.	Interior.	Total.
United R. Plate Telephone Co.	336	106.128	51.892	158.020
Soc. Co-operativa Telefónica	26	6.609	1.026	7.635
Total, 1926 ...	362	112.737	52.918	165.655
Total, 1925 ...	334	104.895	45.390	150.285

The United River Plate Telephone Co. is constantly extending its radius of action. The increase in the number of apparatus in 12 months was more than 15,000, equivalent to 10 per cent.

The Telephone Service.—Statistics.—Official figures show that there were 1,510,775 telephones in use in Great Britain and Northern Ireland up to December 31st, 1926, made up of 1,477,003 Post Office telephones, 21,736 in the Hull, Guernsey and Jersey systems, and 12,036 private stations connected

with the Post Office system. The total represents an average of 34 telephones for every 1,000 inhabitants in the area.

Automatic Exchanges.—The comprehensive programme of automatic telephone conversion which is being carried out this year by the Post Office provides for installations in 12 provincial towns (making, with the 35 already equipped, 47 in all) and for four installations in London. Holborn and Bishopsgate will be the first London exchanges to be converted, and later in the year Sloane and Western exchanges will follow. In the provinces the work has already begun; Harrogate was "cut over" on February 26th, and Sheffield's installation on March 5th. At intervals the change will be made at Halifax, Hanley, Wakefield, Exeter, Nottingham, Colwyn Bay, Burnley, Brighton, Leicester, and Southport.

Transatlantic Telephony.—New Receiving Station.—Work at the transatlantic wireless telephony receiving station at Kemback, near Cupar, is progressing. The land line linking the station with the local post office has been completed, and in the power house four dynamos, as well as the engines for driving them, have been placed in position, and the large control board and switchboard have been fitted up. Two types of receiving apparatus, one of American and one of British make, are in course of being built at the receiving hut. Dr. Baillie, of the Bell Telephone Co., New York, is in charge of the installation of the American receiving apparatus.

Germany's Application.—The German Post Office has asked the British Post Office whether, in view of the good results attending the experiments in telephony between Frankfort and New York, *via* London, it will be possible to include Germany in the transatlantic telephone service. The British Post Office has not yet replied.—*Reuter* (Berlin).

Radio Notes.

Amateur Broadcasting.—Manchester Station.—Mr. J. E. Kemp, chairman of the Manchester Branch of the Wireless League, is one of the chief members of the Manchester Radio Scientific Society, which recently opened a new transmitting station with call sign 2HD. Mr. Kemp has stated that the Society is a purely scientific body experimenting by unorthodox methods. *The Times* reports him as follows:—"We are merely a research station with about 80 members, affiliated to the Association of Radio Societies, and our area extends to Preston on the north, Crewe on the south, and the West Riding of Yorkshire on the east. We are giving experimental transmissions to our members on a wave-length of 440 metres on Sunday afternoons, using 10 watts. All who contributed to the programme did so voluntarily, and all the money subscribed by members goes in material for the upkeep of the station and for research work." The matter has been raised in the House of Commons, and it is understood that the Postmaster-General has cancelled the licence granted to 2HD, and has issued a new licence which, it is stated, will make further concerts such as those broadcast in the past impossible, but a *Daily Mail* reporter has been told that the Society intends to continue broadcasting and will risk the consequences.

Canada.—Licences.—Listeners who "dodge" the dollar licence fee are liable to visits by Dominion Government inspectors, accompanied by Royal Canadian mounted policemen who may ask to see the receipt for the fee, says *World Radio*. Commander Edwards, of the Radio Branch, has ordered a drive in Toronto, Ottawa, Montreal, Halifax, and Victoria to round up the fee "dodgers," who are estimated to number nearly two hundred thousand. The maximum fine is £10 and costs, but the usual fine for a first offence is £1 and costs. Of the estimated 350,000 owners of radio receiving sets in Canada only 168,000 have taken out licences.

Wave-lengths.—Under the arrangements with the United States Department of Commerce, Canada is supposed to use 17 wave-lengths, six exclusive and eleven jointly with United States stations.

China.—Regulations.—Radio broadcasting has been officially recognised in Manchuria and regulations for its control established; at present the facilities are very limited. The North-Eastern Wireless Long-Distance Telephone Service, an official Chinese bureau in Mukden controlling Chinese wireless communication in Manchuria, which is erecting a broadcasting station in the three eastern provinces, has promulgated regulations which, *Commerce Reports* says, will govern broadcasting and the importation, sale, and installation of receiving sets and parts in Manchuria.

Paraguay.—New Station.—When a receiving and broadcasting station at Asunción was approaching completion its range was found to be only 180 kilometres, and, as this is insufficient, another transmitter of greater power has been ordered and will soon be installed. The country (200,000 square miles in area) is generally flat, and of the whole population (approaching 1,000,000) only 8 per cent. are tribal Indians. A radio club has already been formed with a considerable membership. Messages are received from Buenos Aires, Rosario, Sao Paulo, Rio de Janeiro, and other stations in Argentina and Brazil.—*Reuter's Trade Service* (Asunción).

Rumania.—New Company.—A Rumanian company is to be established which will monopolise broadcasting and the manufacture of radio apparatus, and possibly telephone and telegraph apparatus. The International Radio Broadcasting Commission of Geneva has allotted a wave-length of 236.2 metres to Bucharest, says *Commerce Reports*, but the local director of radio communication has requested permission to use a wave-length of 460.5 metres.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Adwick-le-Street.—March 21st. Urban District Council. Cables, boxes, pillars, and necessary materials and apparatus for a distribution network scheme. (March 4th.)

Ashford.—March 14th. Electricity Department. Two electrically-driven centrifugal pumps (capacity 30,000 gal. per hour). (February 25th.)

Australia.—Melbourne.—April 26th. Postmaster-General's Department. Telephone switches. (B.X. 3254.)* Instrument cords. (B.X. 3255.)*
April 12th. Cord-type switchboards. (B.X. 3280.)*
May 17th. Resistances and Reactances. (B.X. 3307.)*
May 23rd. State Electricity Commission. Switchgear and accessories. (B.X. 3285.)*

Ayr.—March 23rd. Ayrshire Education Authority. Electric lighting and central heating of new primary school at Irvine. Plans with Master of Works, Education Offices.

Brecon.—March 16th. Electricity Department. Generating plant and switchgear, battery of accumulators and connections, underground and overhead lines. (February 25th.)

Dumfries.—March 16th. Dumfriesshire Unionist Association. Electric lighting and heating installation at headquarters building. Messrs. J. Barbour & Bowie, architects, 27, Castle Street, Dumfries.

Edinburgh.—March 21st. Electricity Department. Twelve months' supply of cables, box frames and covers, house service fuse boxes and fuseboards, meters and meter boards. (March 4th.)

Erith.—March 24th. Electricity Department. H.p. and l.p. underground cables, joint boxes, &c. (See this issue.)

Hamilton.—County of Lanark District Committee of the Middle Ward. Electric lighting installation in connection with the erection of 190 houses. Mr. P. C. Smith, District Offices, Hamilton.

Hazell Grove and Bramhall.—March 23rd. Urban District Council. One oil circuit breaker and kiosk and seven 20-kW transformers and kiosks, cables and two e.h.p. substation switchgear panels. (March 4th.)

Ilford.—March 22nd. One 500-kW rotary convertor, with transformer, switchgear, &c. (March 4th.)

India.—March 22nd. India Store Department. Two 250-kW Diesel-engine alternator sets, with switchgear, transformer, &c. (February 18th.) 30,000 oil insulators. (March 4th.)

DELHI.—March 17th. India Store Department. Oil-engine-driven generator sets with switchboard. (B.X. 3264.)*

Kettering.—March 23rd. Electricity Department. E.h.p. and l.p. armoured cables and one 1,000-kVA transformer. (March 4th.)

London.—BERMONDSEY.—March 16th. Board of Guardians. Six months' supply of electric lamps. Mr. H. H. Reeve, clerk to the Guardians, 283, Tooley Street, S.E.

ISLINGTON.—March 19th. Board of Guardians. Electrical supplies for 6 months. Mr. A. King, clerk, Guardians' Offices, St. John's Road, Upper Holloway, N.19.

Manchester. — March 18th. Electricity Committee. Three 500-kVA and two 250-kVA static transformers. (March 4th.)

Plympton St. Mary.—March 31st. Urban District Council. H.p. cables, underground and overhead mains, h.p. and l.p. switchgear, transformers and transformer kiosks. (See this issue.)

New Zealand. — WELLINGTON.—May 31st. Public Works Department. 50-kVA transformers for the Waikaremoana electric power scheme. (B.X. 3294.)* 50-kVA transformer for Arapuni scheme. (B.X. 3293.)*

June 7th. Railway sub-station equipment, Lake Coleridge electric power scheme. (B.X. 3295.)*

May 4th. General Post Office, Stores Division. Sub-station protectors. (B.X. 3286.)*

June 13th. New Zealand Railways. Machine tools, workshop equipment and overhead electric travelling cranes. (A.X. 4344.)*

June 6th. Six electric locomotives. (A.X. 4355.)* Overhead equipment for the Christchurch-Lyttelton electrification scheme. (B.X. 3301.)*

Oldham.—March 26th. Electricity Department. One 80-ton electric travelling crane. (March 4th.)

Rhondda.—March 26th. Electricity Department. Twelve months' supply a.c. ordinary and prepayment meters, mains and house service material. (February 25th.)

Roumania.—BUKAREST.—April 2nd. 600,000 porcelain insulators. (B.X. 3314.)*

Salford.—March 14th. Tramways Department. Electric lamps, steel tires, m.i. castings, &c. General Manager, 32, Blackfriars Street.

South Elmsall.—March 19th. Electric lighting installation at Westfield Lane Council School. Education Department, County Hall, Wakefield.

Southend-on-Sea.—April 9th. Light Railways and Electricity Department. Remote-controlled rotary convertors. (See this issue.)

Torquay.—March 16th. Electricity Department. One 6,000-kW turbo-alternator, with surface condenser and auxiliary plant. (February 25th.)

Tynemouth.—March 14th. Electricity Department. Three 250-kVA and one 500-kVA transformers. (March 4th.)

Walthamstow.—March 23rd. Electricity Department. L.p. cables and v.i.r. wires for 12 months. (See this issue.)

Warrington.—March 14th. Electricity Department. Motors and transformers. (February 25th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Electricity Committee. Accepted:—
Cable (£6,800).—W. T. Henley's Telegraph Works Co., Ltd.; Macintosh Cable Co., Ltd. (£846).

Bury.—Town Council. Accepted:—
Boiler, stoker and economiser, Chamber Hall Power Station.—Clarke, Chapman & Co.
Electrically-driven pump for the baths.—Royles, Ltd.

Bradford.—Tramways Committee. Accepted:—
Ten miles of copper trolley wire (£922).—T. Bolton and Sons, Ltd.

Canterbury.—City Council. Accepted:—
Motor convertor (£2,591).—Bruce Peebles & Co., Ltd.
Feeder cables (£2,497).—Standard Telephones & Cables, Ltd.

Chelmsford.—Town Council. Accepted:—
Pumping installation at the swimming bath (£377), including an automatic motor float.—Electric Supply Corporation, Ltd.

Cheltenham.—Highways Committee. Accepted:—
Electric light fittings for 12 months.—Edison Swan Electric Co., Ltd.

Colchester.—Town Council. Accepted:—
Pipework at the new electricity station (£8,970).—J. Spencer, Ltd.

Dumfries.—Town Council. Accepted:—
Storage battery (£2,890).—D.P. Battery Co., Ltd.

Elvington, near Dover.—
Electric lighting of 102 houses.—Mr. Gordon C. Lent, Dover.

Glasgow.—Gas Committee. Recommended:—
Extension of electric cable from Tennant Street to Dalmarnock gasworks (£336).—A. Anderson & Co.
Special Acts Committee. Accepted:—
Electric light installation, St. Rollox Registration Offices —John Wright.

Tramways Committee. Accepted:—
D.c.c. wire.—Enfield Cable Works, Ltd.; British Insulated Cables, Ltd.; and W. T. Henley's Telegraph Works Co., Ltd.

Hitchin.—Rural Council. Accepted:—
Laying services on the Knebworth housing site, wiring houses and supplying and fixing fittings with five lights per house (£7 10s. per house, inclusive).—Stevenage Electric Light Co.

London.—LONDON COUNTY COUNCIL.—Education Committee. Installation of electric lighting at the trade school for girls in Barrett Street, Marylebone:—

E. Wender. (Recommended.)	**£947**
Alpha Manufacturing and Electrical Co., Ltd.	995
Anderson, Angell & Co.	1,062
J. F. Prendergast	1,095
L. G. Tate & Co., Ltd.	1,098
Alex. Hawkins & Sons	1,157
Richard Hunt & Co., Ltd.	1,167
J. Briggs & Co.	1,241
Pinching & Walton	1,362

Installation of electric lighting at Crondall Street school, Shoreditch:—

Bailey & Incledon, Ltd. (Recommended.)	**£480**
Anderson, Angell & Co.	529
Alpha Manufacturing & Electrical Co., Ltd. ...	550
A. Hawkins & Son	619
City Electrical Co.	623
Pinching & Walton	624
A. Meckhonik	637
L. G. Tate & Co., Ltd.	647
Smith & Hammond, Ltd.	655
Gaillard, Robinson & Co.	661
R. Hunt & Co., Ltd.	674
General Electrical Maintenance Co.	983

Electrical installation at the county secondary school, Eltham:—

Alpha Manufacturing and Electrical Co., Ltd. (Recommended.)	**£1,140**
Anderson, Angell & Co.	1,162
L. G. Tate & Co., Ltd.	1,250
E. E. Dyne	1,290
Alex. Hawkins & Sons	1,390
Woolwich Metropolitan Borough Council ...	1,687

GREAT WESTERN RAILWAY CO. Accepted:—
One 2-ton petrol-electric crane for Newport.—Ransomes and Rapier, Ltd.
Electrically-driven pumps for Landore.—F. Pearn and Co., Ltd.

ADMIRALTY.—
2-pint kettle hot plates.—Edison Swan Electric Co., Ltd.

ISLINGTON.—Borough Council. Accepted:—
Electric lamps for 12 months.—Edison Swan Electric Co., Ltd.

METROPOLITAN ASYLUMS BOARD.—Works Committee.
The following tenders were received for the installation of electric lighting at Millfields:—

South-Western Electrical Co.	£805
Alpha Mfg. & Electrical Co., Ltd.	835
Smith & Hammond, Ltd.	837
Read & Partners, Ltd.	881
A. Higginbotham & Sons	899
H. J. Galliers	937
R. Whipp & Co.	940
Sabine & Co.	1,047
T. Clarke & Co., Ltd.	1,050
C. J. Drake & Co.	1,078
Phillips & Dart	1,086
A. Dean & Co., Ltd.	1,099
J. Briggs & Co.	1,119
A. Cozens	1,144
Brightside Foundry & Engineering Co., Ltd.	1,200
C. F. Williams	1,237
Page & Miles, Ltd.	1,325
General Electrical Maintenance Co.	3,860

SOUTHERN RAILWAY.—
Six months' contract for electric lamps.—Metro-Vick Supplies, Ltd.

Manchester.—Electricity Committee. Accepted:—
Twelve months' supply of motor-starting switches.—Metropolitan-Vickers Electrical Co., Ltd.
Electric motors.—F. & A. Parkinson, Ltd.; Electromotors, Ltd.
450 street lanterns.—Cable Accessories Co., Ltd.
12,000 yd. 3-in. weldless-steel tubes.—British Mannesmann Tube Co., Ltd.; Bromford Tube Co., Ltd.
Circulating-water pumps.—Mather & Platt, Ltd.
L.p. circulating-water and steam pipes.—Aiton & Co., Ltd.
Four circulating-water pump suction valves.—J. Blakeborough & Sons, Ltd.

Northampton.—Northampton Corporation. Accepted:—
Electric wiring of Gipsy Lane housing estate (230 houses).—Lowke & Sons, Ltd.

Prestwick.—Ayrshire Education Committee. Accepted:—
Installing electric light at Prestwick school extensions (£242).—W. Ross, Ayr.

South Africa.—Johannesburg.—Municipal Council. Accepted:—
8 miles 6,600-V cable (£12,838).—British Insulated Cables, Ltd.
½ mile ditto (£385).—British General Electric Co., Ltd.
—*S.A. Mining and Engineering Journal.*

South Shields.—Housing Committee. Recommended:—
Wiring 204 houses on the Cleadon Park estate (£5 14s. per non-parlour house, £6 4s. per parlour house, and £5 4s. per bungalow).—Moore & Oliver, Birtley.

Torquay.—Electricity Committee. Accepted:—
Railway siding and coal-handling plant at Newton Abbot power station (£19,500).—Ed. Bennis & Co., Ltd.
Six transformers (£613).—Hackbridge Cable Co., Ltd.

Wimbledon.—Electricity Committee. Accepted:—
Twenty-six 100-kVA transformers (£2,222) and six 200-kVA ditto (£730).—Hackbridge Electric Construction Co., Ltd. Two 500-kVA ditto (£628) and two 750-kVA ditto (£790).—Bruce Peebles & Co., Ltd. One 1,155-kVA ditto (£575).—British Electric Transformer Co., Ltd.
H.p. switchgear equipments (£2,000).—Brush Electrical Engineering Co., Ltd. L.p. ditto (£2,552).—G. Ellison.
Extensions to switchboards at generating station and two sub-stations (£3,867).—A. Reyrolle & Co., Ltd.

Health Committee. Recommended:—
Refrigerator at isolation hospital (£55).—Electrolux, Ltd.

Forthcoming Events.

Women's Engineering Society.—Friday, March 11th. 26, George Street, Hanover Square, W. 6.30 p.m. "The Electrification of Rural Districts." Dr. J. Purves.

Junior Institution of Engineers.—Friday, March 11th. 39, Victoria Street. 7.30 p.m. "Cupolas." Mr. J. Wolstenholme.

Birmingham Electric Club.—Friday, March 11th. Grosvenor Hotel. 7 p.m. Annual dinner.

Royal Society of Arts.—Monday, March 14th. 8 p.m. Cantor Lecture. "Some Industrial Applications of Electrothermics," by Mr. G. I. Finch.

Paisley Association of Electrical Engineers.—Tuesday, March 15th. Town Hall, Paisley. 7.30 p.m. "Apprentice Papers."

National Association of Supervising Electricians (Birmingham District Centre).—Tuesday, March 15th. Grand Hotel, Birmingham. 7.15 p.m. "Rotary Convertors." Mr. H. C. E. Jacoby.

Institution of Electrical Engineers.—Thursday, March 17th. London. 6 p.m. Faraday lecture, "What is Electricity?" Prof. W. M. Thornton.

London Students' Section.—Friday, March 18th. Imperial Hotel, Russell Square, W.C., 7.15 p.m. Annual dinner.

(North-Eastern Centre).—Monday, March 14th. Armstrong College, Newcastle-upon-Tyne. 7 p.m. "The Stability of Large Power Systems." Mr. F. H. Clough.

(Western Centre).—Monday, March 14th. Exeter. "Home Lighting." Mr. R. B. Mitchell.

(Sheffield Sub-Centre).—Wednesday, March 16th. Royal Victoria Hotel, Sheffield. 7.45 p.m. Address by the President, and smoking concert.

(South-Midland Centre (Wireless Section)).—Wednesday, March 16th. University, Birmingham. 7 p.m. "Characteristics of Audio-frequency Amplifiers used in Telephonic Repeaters." Mr. C. Robinson.

(South-Midland Students' Section).—Friday, March 18th. Annual joint meeting.

British Electrical Development Association.—Thursday, March 17th. Savoy Hotel. Annual dinner.
Friday, March 18th.—Royal Society of Arts. 7.30 p.m. "Refrigeration." Mr. N. E. Barber.

Edinburgh Electrical Society.—Thursday, March 17th. Royal Scottish Society of Art, 117, George Street. 8 p.m. "Ventilation." Mr. E. N. Beavis.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Wire or strip suitable for the manufacture of thermal time lag devices.

Notes.

Late Legal.

Wareham Electric Supply Co., Ltd.—The petition of Mr. W. E. Weston for the compulsory winding up of this company again came before Mr. Justice Eve on March 8th; it was supported by creditors. The company asked for a further fortnight's adjournment, and this was granted.

Electrical Association for Women.

On February 25th, Metro-Vick Supplies, Ltd., entertained a party of the Birmingham Branch of the Electrical Association for Women, which visited the British Industries Fair. A demonstration of electric cooking and various types of electric domestic appliances was given, as well as a very interesting lecture by Mr. Edinborough, of the above company.

At the invitation of the British Thomson-Houston Co., Ltd., a party of the Manchester District Branch of the Association visited the company's King Street, Manchester, showrooms on March 4th, when an interesting programme included a demonstration of electric cookers and a short lecture on "How your house is wired," in addition to a demonstration of the "R.K." loud speaker and an exhibition of kinematograph films showing the making of the "Mazda" lamp.

The inaugural meeting for the formation of the South Wales and Monmouthshire Branch will be held at the City Hall, Cardiff, on Thursday, March 24th, at 6.30 p.m. The Lady Mayoress will preside.

Appointments Vacant.

Chief clerk (£400) for the Sunderland Electricity Department. Assistant mains engineer for the Bedford Corporation Electricity Department. Meter engineer for the Rangoon Electric Tramway and Supply Co., Ltd. Engineering assistant for the Borough of Wallasey Electricity Department. Electrical engineer to superintend overhead h.p. line erection for the Crediton U.D.C. (See our advertisement pages to-day.)

Artificial Light as an Aid to Aerial Navigation.

A paper on the above subject was read by Mr. H. N. Green (Royal Aircraft Establishment, Farnborough), at the meeting of the Illuminating Engineering Society on February 22nd. The first point considered was the location of the beacon. It was generally preferable to select a site on ground only slightly above the average level of the surrounding country, and to mount the beacon on a tower of sufficient height to clear ground mists. The chief features of such a light should be a distinctive character; it should be reliable in operation and require little attention, and should have a maximum range for a given power consumption.

Distinctiveness was, in practice, usually attained by flashing at regular intervals, the optical system rotating so that a series of beams rotated across the sky. This method was usually preferable to flashing the actual filament, for in the case of the very powerful gasfilled lamps used for this work, an appreciable time was required for the filament to cool. (This point was demonstrated by Mr. Green with the aid of one of the largest gasfilled projection lamps yet manufactured.) Distinctiveness might also be based on colour: the strontium beacon invented by Mr. Toulmin Smith and Capt. Davis utilised an oxy-acetylene flame, with an endless chain running through a bath of strontium chloride, which imparted a bright orange colour to the flame. It had, however, been replaced by the electric neon beacon which, besides having an unmistakable colour, could be flashed with great rapidity.

In the next section of the paper the author discussed the distribution of light and attainable beam-candlepower, after which the lighting of the Croydon-Lympne air-route was described. The neon beacon erected at Croydon utilised 8 kW at 5,500 V, and had a total horizontal candlepower of approxi-

mately 13,700. Flashing mechanism was included on the low-voltage side, and the beacon had a character consisting of a 2-second flash followed by a ½-second eclipse. The official range was given as 45 miles, but in clear weather the light had been seen by pilots from the French side of the channel.

The illumination of an aerodrome to facilitate landing was carried out with floodlight projectors, and Mr. Green presented a very striking photograph illustrating the effect produced. Another device illustrated was the arrangement of lights to form an arrow, giving to pilots information regarding the direction and strength of the wind. The paper concluded with an interesting discussion of the problem of flying during fog. Flying was not at present attempted when visibility was very bad, but there was always a chance of a pilot being caught in a fog. In this case he derived material assistance from the "leader cable" carrying a low-frequency alternating current, which marked out the route into the aerodrome. Once he could pick up the course of the cable by means of the instruments on the aeroplane he could safely guide himself to the landing ground, where he received the assistance of the special lights. The lights employed at Croydon for this purpose would probably consist of neon tubes at intervals down the landing course, suitably protected in cast-iron boxes embedded in concrete. When above the fog-level the pilot could often locate the landing place by the local illumination of the fog by the lights below.

Marconi Radio Apparatus.

The accompanying illustrations show two somewhat unusual forms of radio apparatus. Fig. 1 is a reproduction of a telegraph and telephone set for submarines; the power of the transmitter is 1.5 kW, and it has a c.w. telegraphy range of 300 miles and a telephony range of 100 miles. The valve to be seen in the panel on the left-hand side is the telephone modulator, and alterations in tuning are made by means of the plugs and sockets indicated at the top of the picture.

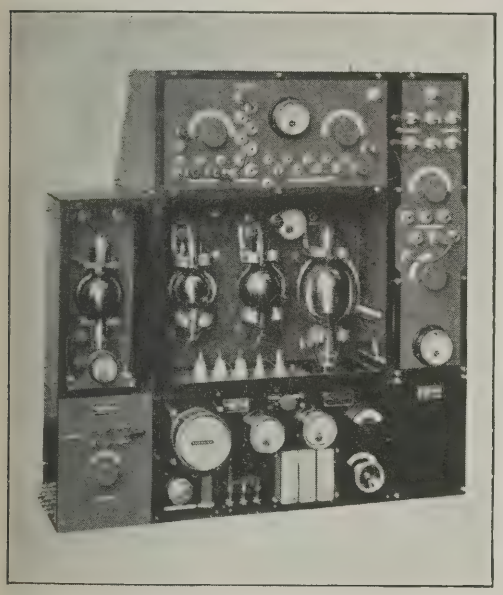


Fig. 1.—A Submarine Radio Set.

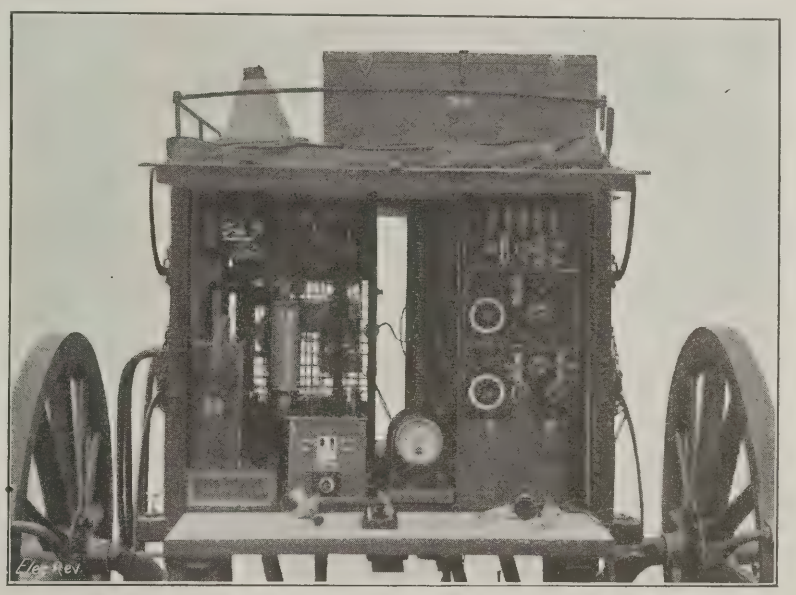


Fig. 2.—An Army Field Radio Outfit.

Fig. 2 also shows a combined set, which has a telephone range of 70 miles when 200-ft. high aerial masts are used, and a c.w. telegraph range of 200 miles. It is of the UC1 0.5-kW type, mounted on a cart for field use, the power for the transmitter being obtained from a generator driven by a petrol engine, which is usually carried on a second cart. The 5-valve receiver with two tuning units is on the right.

Arrangements are being made by Imperial Airways, Ltd., for the construction of new wireless stations to serve the Imperial air route to India, says *The Times*. The aeroplanes employed on the service will be within reach of Continental stations throughout their flight to Egypt, and the new stations are being erected between Cairo and Karachi to enable messages to be sent or received at any time during the journey. The aeroplanes are being fitted with the latest design of Marconi aircraft equipment of 150-watt telegraph and telephone transmitters and receivers, which will operate over a range of from 300 to 400 miles. A generator will be used which will give power for the navigation lights, the illumination of the cabins of the aeroplane, and the working of the wireless apparatus. In the event of a descent having to be made at an isolated spot it will be possible to communicate with one of the stations, as the aeroplane will have a battery charged by the wind-driven generator during flight, to meet such an emergency. There are already wireless stations along the route, but it is intended that those now being erected shall be of a more permanent character, and they are being equipped by the Marconi Company. Arrangements have been made through the Air Ministry for their erection, and when they are completed the chain of wireless stations from Egypt to India will be Heliopolis, Ismailia, Gaza, Rutbah Wells, Ramadi, Baghdad, Shiabah (Basra), Bushire, Bandar Abbas, Charbar, and Karachi.

A number of Antarctic whalers have been fitted this season with Marconi wireless-telephone apparatus, which has enabled them to spread further afield and to adopt tactics which would be impossible without this means of inter-communication; by means of a simple system of code words, the vital information in any message can be kept secret from any other ships that may be within range. The Marconi ½-kW telephone sets fitted to all the ships of the Southern Whaling and Sealing Co., Ltd., and to other whaling fleets, have been specially designed for this class of work; they are operated by a stout lever which can be easily manipulated, even when the hands are heavily gloved, and the apparatus is enclosed in a steel case which renders it practically undamageable. Reception is by loud-speaker, so that there is no need to remove head coverings in order to use the telephone. One ship has heard another 2,000 miles away, but normally communication is maintained between whalers and with the whaling station at Stroemness, South Georgia, up to distances of 750 miles. In addition, a number of Antarctic whalers are this season fitted with Marconi direction-finders specially arranged for these small craft. In regions close to the magnetic pole, where much of the whaling is done, the wireless direction-finder, which is entirely independent of the earth's magnetism, has been found invaluable to the whaling vessels.

The Electricity (Supply) Act, 1926.

The "Memorandum on the Provisions of the Act," briefly mentioned in our last issue (H.M. Stationery Office, price 3d. net), has been prepared by the Electricity Commissioners for the information and assistance of authorised undertakers; it is in effect an abridged translation of the phraseology of the Act into plain language, grouping the various matters dealt with under appropriate headings, with marginal references to the scattered Sections from which the particulars are derived. By this means the provisions are brought into proper perspective, and a coherent impression of the powers, duties, and obligations of the Central Electricity Board, the owners of stations, authorised undertakers, joint electricity authorities, and power companies respectively can be readily obtained; but the Memorandum does not purport to give an interpretation of the provisions of the Act.

Anyone who is concerned with the working of the Act in any way, or who desires to make a quick survey of its contents, will do well to procure a copy of the pamphlet.

Educational.

Northampton Polytechnic Institute.—A course of four lectures on "Power Station Chemistry" will be given by Mr. W. S. Patterson on Friday evenings, commencing March 18th, at 7.15 p.m. Admission free. (See our advertisement pages to-day.)

The Raising of a Coal Bunker After Subsidence.

On Monday last a paper was read before the Society of Engineers (Inc.) by Mr. M. E. Gerard, M.Soc.C.E. (France), describing how a bunker, weighing 1,600 tons, and designed to hold 1,250 tons of coal, was raised to its original level, after a settlement of 7 ft. at one end, and was successfully reinstated upon new foundations. Temporary trestles of ferro-concrete were erected, from which to lift the structure by means of twenty-four 150-ton hydraulic jacks. An elaborate arrangement of packing was devised to enable the jacks to travel up step by step as the bunker was raised. Lifting proceeded according to a carefully arranged programme. A large number of men were engaged in the process—one man to each jack, and others to pack up under the bunker as it was raised. Each man had to be trained for his special work, and great discipline had to be observed during the operation. After the bunker had been raised to its original position the new founda-

tions were completed with new columns built up to meet the stumps of the old columns. The raised bunker has now been in full work for about three years.

Birmingham and Electricity Development.

The following appeared in the *Birmingham Post* of March 4th :—When the proposals for a unified electricity scheme were first outlined it was foreseen that a rigid application at the outset of a uniform periodicity must involve serious disturbance of trade in those districts where existing systems were not in accord with the chosen standard. The consensus of opinion was in favour of the 50 frequency which has been adopted in the larger proportion of undertakings under the independent development of the past. In the Birmingham area a 25 frequency applies, and it is stated by experts who are in the best position to judge, that to alter it at once to a 50 frequency would involve a direct outlay of millions of money and heavy losses through interruption of trade. It is evident that the representations made on this aspect of the Government's scheme have impressed those authorities who started with the premise that a uniform frequency was an indispensable principle, and who still hold that view.

The surrender of this position must not be inferred from the announcement made in Birmingham the other night that assent has been given to the perpetuation of the 25 frequency in the great generating station at Hams Hall which Birmingham is about to add to its equipment. The Electricity Commissioners have their hands too full with the problem of development in other parts of the Kingdom to give attention to the Midlands yet awhile. Far-sighted plans have been made in Birmingham, for the progress of the electrification of industry and other services. If the rate of development is to be maintained, the equipment of the Hams Hall station must be put in hand forthwith, or the municipality will find itself without adequate resources for the prosecution of its plans within the next year or two. It is in these circumstances that assent has been given to the installation of plant being proceeded with. No decision has been arrived at with regard to the larger question of unification. As has been pointed out before, there is no imperative reason why differential frequencies should not still exist side by side as they have in the past. If unification is the ultimate aim, the conversion to standard of those local systems which do not now conform to it may be accomplished at far less expense and inconvenience as existing plants reach the end of their economic life. The equipment of Hams Hall and its connections on a 25 periodicity would not conflict with such a policy, and this consideration has probably carried a good deal of weight with the central authority.

The Birmingham electricity supply is now stretching out into the coalfield across the north-eastern borders of the municipality. A seven miles line carries the current to the new pit, which is to be sunk at Hurley. In co-operating in the work of colliery development the department has entered upon a new and pregnant sphere.

National Institute of Industrial Psychology.

The annual report of this Institute for the year 1926 was presented at the annual meeting of members on Wednesday last week; it shows an increased revenue from investigations, and an increase of membership from 665 to 984—49 per cent. In every direction the activities of the Institute have expanded to an unprecedented degree. Twenty-two investigations for private firms were carried out, besides many shorter surveys, with great satisfaction to the clients, as well as to their employés, who cordially recognise the benefits that they derive from the work. The rapidly growing demands on the educational and clerical work of the Institute have necessitated an addition to the staff of 25 per cent., and increased accommodation is urgently needed. Many instances of increased output, economy of space, and improved working conditions in factories and offices are cited, resulting from the Institute's recommendations. New tests in connection with vocational selection have been devised, and favourable reports have been received. An experiment in vocational guidance which has been in progress for some years has been continued, and 600 children have been examined and advised as to the work they are fitted for; many of these cases have been followed up, to observe the results, which have proved very satisfactory. Various special researches are also in progress. The income was £11,519, and the expenditure £11,399. The appeal fund amounted to £18,054, and donations and subscriptions to £2,571.

Institute of Wireless Technology.

At the February meeting of the Institute a paper entitled "A New Loud-speaker" was read by Mr. H. W. Gambrell, A.M.I.E.E., and was followed by a demonstration of the R-K loud-speaker; reproduction was of very high quality, particularly in the lower frequencies, and it was obvious that this instrument was a great advance in loud-speaker design.

Royal Institution.

On Tuesday, March 15th, at 5.15 p.m., Dr. G. Shearer begins a course of two lectures on "X-rays and the Chemical Molecule"; on Thursday, March 17th, at the same hour, Dr. Guild delivers the first of two lectures on "Colour Measurement"; and on Saturday, March 19th, at three o'clock, Sir Ernest Rutherford will commence a course of four lectures on the "Alpha Rays and Atomic Structure." The Friday evening discourse on March 25th will be delivered by Dr. C. T. R. Wilson on "Thunderclouds."

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The staff of the Sun Electrical Co., Ltd., and a number of guests, met at a dinner at the Hotel Cecil on Friday last to celebrate the completion of 25 years in a managerial capacity by Mr. A. G. Beaver. Mr. J. J. Rawlings (director) presided in the absence, through ill-health, of the chairman (Mr. R. Tweedy Smith), and read a letter from the latter expressing his great regret at being unable to attend. In proposing the health of the guest of the evening, Mr. Rawlings said that Mr. Beaver joined the Sun Company at its inception 28 years ago, being appointed general manager in 1902. In 1921 he was made managing director, a position which he still held. The speaker paid a tribute to Mr. Beaver's energy, consistency, and calmness, which had brought the company to its present proud position in the electrical industry. He made special reference to Mr. Beaver's activities in Association work. As a token of his co-directors' esteem, he asked Mr. Beaver to



L. C. Smith.] [*London*

Mr. A. G. Beaver.

Managing Director of the Sun Electrical Co., Ltd.

accept an inscribed gold cigarette case for himself and a travelling bag for Mrs. Beaver. Replying to the toast, Mr. Beaver said that during the period in which he had been with the company he had received loyal support from his fellow directors and the whole of the staff. He held that the way to succeed in business was to enjoy it, and he had enjoyed every moment of his time with the Sun Company. There were few directorates which had remained the same so long as that of the company. In a humorous speech, Mr. W. R. Rawlings (director) proposed the toast of the company and conducted his listeners upon an imaginary tour of the premises. The health of "The Staff" was proposed by Mr. Beaver, who said that no one could deal with such a toast with better knowledge than himself. He referred to the long service of many of the staff and paid special tribute to the work of the secretary (Mr. W. J. Rogers), Miss Dewdney, Miss Tickner, and Mr. Weeks. He then made presentations to Messrs. Weeks, Rogers, and Owen, and Miss Tickner, in recognition of their 21 years' service with the company. A special, personal, presentation was made to Miss Dewdney, Mr. Beaver's secretary. Brief acknowledgments were made by the recipients, Mr. Rogers, Junr., replying for his father, who was absent through ill-health. The toast was replied to by Mr. D. M. Fraser, manager of the Leeds branch of the company. After the speeches there was a dance, which the 200 or so guests thoroughly enjoyed.

At a recent meeting of the Blackburn Town Council, it was stated that the electrical engineer (Mr. P. P. WHEELWRIGHT) had asked for a re-consideration of his salary. The Town Clerk was instructed to obtain copies of a return from other electricity undertakings, together with copies of the statistical report on salaries paid to electrical engineers, for consideration at a special meeting.

The Southport Town Council has adopted a recommendation by the Electricity Committee to pay the electrical engineer (Mr. E. MOXON) a salary of £1,550 a year as from April 1st next.

On the unanimous recommendation of the Electricity Committee the Southport Town Council, at a meeting held on March 1st, appointed Mr. W. T. GANN to the position of deputy borough electrical engineer.

A recommendation that the salary of Mr. SEDDON, engineer and manager of the Edinburgh electricity department, should be increased from £1,200 to £1,300, was lost by 31 votes to 25, at a Town Council meeting last week.

The Dover Town Council has increased the salary of Mr. E. H. BOND, general manager of the tramways, from £400 to £425 per annum, as from April 1st next.

Mr. H. A. UTTLEY, M.Sc., M.Inst.C.E., has been appointed resident civil engineer for the Barton Station extensions of the Manchester Electricity Department, in place of Mr. D. E. Laing, who has resigned. Mr. A. HEATON, of the Finance Staff, has been appointed assistant financial controller to fill the vacancy caused by the death of Mr. B. Bennison.

Mr. W. T. TALLENT-BATEMAN having accepted the position of manager for South Africa for Messrs. Ferguson, Pailin, Ltd., left Bombay in December last, where, for the last three years he has been manager for India, Burma, and Ceylon for the company. His address in future will be: c/o Messrs. Ferguson, Pailin, Ltd., P.O. Box 737, Liberal Life Building, Burg Street, Cape Town.

In appreciation of his 25 years' service as manager of the Cheltenham and District Light Railway Co., Mr. H. J. MCCORMICK was recently presented by some of the leading townspeople with a silver gilt loving cup. The presentation was made by the Mayor (Ald. C. H. Margrett), who also presented a turquoise cross to Mrs. McCormick.

Mr. F. W. PURSE, borough electrical engineer of West Ham, has been elected president of the West Ham Rotary Club for the ensuing year.

Mr. P. K. TURNER, head of the Research Department of Burndept Wireless, Ltd., is joining Messrs. Alfred Graham, Ltd., makers of the well-known "Amplion" loud-speaker, as assistant chief engineer. Mr. Turner made his acquaintance with "wireless" in 1911, with Mr. H. Grindell Matthews, and in 1913 he owned, and gave instruction in, the "Irish School of Wireless" in Dublin. During the war he was a wireless officer in the R.F.C. and the R.A.F., arriving at the head of No. 2 Wireless School; afterwards he joined Messrs. Iliffe and Sons, and was editor of the *Wireless Trader*, and of *Experimental Wireless*, until he went to Burndept's in December, 1925.

Obituary.—SENOR M. P. SANTANO.—The death is reported from Madrid of Señor Don Miguel Perez Santano, a well-known Spanish telegraph engineer, and the inventor of many improvements in telegraphy.

MR. W. LEAF.—We regret to record the death of Mr. Walter Leaf, who, in addition to his position of pre-eminence in the banking and business world, was prominently associated with London electricity supply companies. For many years he was chairman of the St. James' and Pall Mall Electric Light Co., Ltd., and deputy chairman of the Central Electric Supply Co., Ltd. He was also a director of the London Power Co. He was 75 years of age.

MR. A. F. HILLS.—The death of Mr. Arnold Frank Hills, of Thames Ironworks and Shipbuilding fame, in his seventieth year is an event which revives many memories of days gone by in the engineering and shipbuilding world. We know of no more striking example in the industrial world of the "triumph of mind over matter," as *The Times* describes the remarkable way in which he overcame his physical disabilities. In his University days he was a notable athlete, but later a serious illness left him "a hopeless cripple, tied to his bed-chair, unable to move a limb without help." Yet though permanently in this state of physical helplessness, his mind remained vigorous and active, and he devoted his thought to the affairs of the business, its serious problems, the well-being of the company's employés, and so on. He struggled hard to continue the activities of the Thames Ironworks Co., and for some years an electrical manufacturing department was conducted, but eventually he had to close the works down. He was a man of strong convictions and original and independent in his attitude towards industrial problems—he was one of the first to try profit sharing—but we name him here especially for the gallant struggle that he made and for the example of fortitude that should be an inspiration to others who chafe under far less serious disabilities.

MR. A. E. COTTERELL.—The death occurred on March 3rd of Mr. Arthur E. Cotterell, of 34, Manorway, Beckenham, who was until his retirement assistant provincial superintendent for the Midlands of the National Telephone Co. He was in his 62nd year.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies. Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Hertfordshire Rubber Co., Ltd.—Private company. Registered March 3rd. Capital, £15,000 in £1 shares. Objects: To carry on the business of manufacturers of or dealers in rubber and rubber goods and products, rubber substitutes, waste rubber, ebonite, vulcanite and any other plastic substances or compounds made therefrom, &c. The subscribers (each with one share) are:—Joan Peachey, 9, Hetley House, Hetley Road, W.12, stenographer; V. Deighton, 97, Junction Road, Highgate, N.19, solicitor's clerk. The first directors are J. Entwistle (permanent) and others to be appointed by the subscribers. Qualification of first directors, 1 share; of other directors, 250 shares. Solicitors: Arthur Blackman, Hailey & Co., Capel House, New Broad Street, E.C.2.

H. J. Bartlett (Hove), Ltd.—Private company. Registered March 2nd. Capital, £2,000 in £1 shares. Objects: To acquire the business of an electrical engineer and contractor now carried on by H. J. Bartlett at 12, Cross Street, Hove. The permanent directors are:—H. J. Bartlett, 12, Cross Street, Hove; E. L. B C. G. Whitcher, 58, Lansdowne Place, Hove. Qualification, 100 shares. Remuneration as fixed by the company. Manager: H. J. Bartlett. Solicitors: Cockburn, Gostling & Co., 61, Church Road, Hove.

Light-o'-Day Electric Lamp Co. (1927), Ltd.—Private company. Registered March 1st. Capital, £5,000 in 2,000 participating preference shares of £1 and 60,000 ordinary shares of 1s. each. Objects: To acquire the business of applying to electric lamps a lac known as "Oriona Lac," and to adopt an agreement with C. H. Stone. The subscribers (each with one ordinary share) are:—G. E. Byers, 318a, Euston Road, N.W.1, consulting mining engineer; F. H. Edwards, 76, Cheapside, E.C., solicitor. The first directors are:—G. E. Byers, F. H. Edwards, R. P. Wilson, S. Crowther-Smith, and A. C. Peebles. Qualification, £100. Remuneration, £50 each per annum and 7½ per cent. of the net profits in any year after paying the fixed preference dividend of 10 per cent., divided between them. Solicitor: F. Harold Edwards, 76, Cheapside, E.C.2. Registered office: 318a, Euston Road, N.W.1.

Vacuum Lamp Co., Ltd.—Private company. Registered March 3rd. Capital, £500 in £1 shares. Objects: To carry on the business of importers and exporters of and dealers in electric lamps, and wireless and electrical accessories. The first directors are:—Paula Weinmann (Russian, of English origin) and David Weinmann (Swiss), 285, Old Street, E.C. Qualification, 50 shares. Solicitor: V. A. Lyons, 16-17, Devonshire Square, E.C. Registered office: 285, Old Street, E.C.

Transporting Machinery and Engineering Co., Ltd.—Private company. Registered March 3rd. Capital, £25,000 in £1 shares. Objects: To carry on the business of mechanical, electrical, civil, marine, motor and general engineers, contractors, designers and manufacturers of labour-saving and other machinery and appliances, &c. The subscribers (each with one share) are:—S. J. Sulston, 32, Deal Road, S.W.17, incorporated secretary; R. Keedwell, 51, Stembridge Road, Anerley, S.E.20, law clerk. The first directors are not named. Solicitors: Churchill, Clapham & Co., 1, Broad Street Place, E.C. Registered office: Stanley House, Dean Stanley Street, Westminster, S.W.1.

North-Western Wireless Company and Wallasey Motor Exchange, Ltd.—Private company. Registered March 3rd. Capital, £2,500 in £1 shares (1,250 7½ per cent. cumulative preference and 1,250 ordinary). Objects: To acquire the business of radio engineers and manufacturers and motor dealers now carried on by J. H. Guest Cochran at 18, Rullerton Road, Wallasey, as the "North-Western Wireless Company and Wallasey Motor Exchange." The first directors are:—J. H. G. Cochran (permanent), 14, Rullerton Road, Wallasey, Ches.; W. C. Davis, 14, Rullerton Road, Wallasey, Ches. The said J. H. G. Cochran shall be managing director and chairman so long as he holds 100 ordinary shares. Qualification of directors, £1. Remuneration as fixed by the company. Registered office: 18, Rullerton Road, Wallasey, Ches.

Express Magneto (Repairs) and Electrical Co., Ltd.—Private company. Registered March 3rd. Capital, £2,000 in 500 ordinary and 1,500 6 per cent. cumulative preference shares of £1 each. Objects: To acquire the business carried on at Goldcroft, Yeovil, Somerset, as the "Express Magneto" (Repairs) and Electrical Company," and to carry on the business of electrical, wireless and general engineers, manufacturers and repairers of and dealers in electrical and radio apparatus, motors, motor cycles, &c. The first directors are:—J. J. Davis, Milborne Port, Somerset; L. G. Wheeler, Rose Cottage, Yeovil Marsh, Somerset; A. C. Balchin, West Coker Road, Yeovil, Somerset (all permanent, subject to each holding £100 shares). Secretary: A. H. W. Chinnock. Solicitor: A. King, Westminster Bank Chambers, Bridgwater, Somerset. Registered office: Goldcroft, Yeovil, Somerset.

Flexible Electric Cords, Ltd.—Private company. Registered February 24th. Capital £1,000 in £1 shares. To carry on the business of electrical engineers, manufacturers of wireless cables, and other apparatus connected with wireless telegraphy, manufacturers of, agents for and dealers in flexible electric cords, electric wire manufacturers, &c. The first directors are:—C. V. Matthews, 172a, Lea Road, Wolverhampton, solicitor; F. Kniveton, Astley House, 138, Southbury Road, Enfield Town, N., electrical engineer. Qualification, one share. Solicitor: C. V. Matthews, 172a, Lea Road, Wolverhampton. Registered office: Queensway, Ponders End, Middlesex.

Anderson & Stuart, Ltd.—Private company. Registered February 25th. Capital £1,000 in 250 10 per cent. preference and 750 ordinary shares of £1 each. Objects: To carry on the business of installers and suppliers of materials, apparatus and appliances for wireless telephonic, telegraphic and other telephonic, electrical, magnetic, galvanic, mechanical, and other apparatus and appliances, &c. The permanent directors are:—G. A. Anderson (chairman), 31, Greencroft Gardens, Hampstead, N.W.6 (director and secretary of Gil-Ray Trading Corporation, Ltd.); Eleanor M. Stuart, 21, Milton Road, Weston-super-Mare, Somerset; A. C. Gilmour, 42, Bacon Lane, Roe Green, Kingsbury, N.W.9 (director of Gil-Ray Trading Corporation, Ltd.). Qualification, £50 shares. Secretary: A. C. Gilmour. Solicitors: Baxter & Co., 12, Victoria Street, S.W.1. Registered office: Sicilian House, Sicilian Avenue, W.C.1.

Gillan Radio-Electric, Ltd.—Private company. Registered February 28th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of and wholesale and retail dealers in wireless apparatus and component parts, &c. The first directors are:—W. Greenwood, 40, Hertford Avenue, East Sheen, Surrey; Mrs. Janet M. Greenwood, 40, Hertford Avenue, East Sheen, Surrey. Qualification, £10 shares. Solicitors and registered office: Reid, Sharman & Co., 36, Bedford Row, W.C.1.

Amalgamated Lamp Companies (Great Britain), Ltd.—Private company. Registered February 28th. Capital, £600 in £1 shares (300 5 per cent. cumulative preference and 300 ordinary). Objects: To carry on business as agents and factors for electrical equipment and similar goods, &c. The directors are:—Miss G. M. Cuthbert, 85, Alexandra Road, Hampstead, N.W.8; H. Feneron, Rosslyn, Wraysbury Road, Staines, electrical agent (both permanent, subject to each holding 300 preference or ordinary shares). Solicitor: E. V. Miles, 30, Theobalds Road, Bedford Row, W.C. Registered office: 14, Moorgate Chambers, Finsbury Pavement, E.C.2.

Midways Electric, Ltd.—Private company. Registered February 28th. Capital, £500 in 400 7 per cent. cumulative preference and 100 ordinary shares of £1 each. Objects: To acquire the business of electrical engineers and contractors now carried on by W. E. Burton as "Midways Electric," at 10, Gees Court, Oxford Street, W. The subscribers (each with one share) are:—G. T. Heard, 23, Harewood Road, Colliers Wood, S.W.19, solicitor's managing clerk; F. G. Buckland, 49, Lavender Avenue, Mitcham, Surrey, solicitor's clerk. The directors are: W. E. Burton and R. P. Atwood. Solicitors: Perowne & Co., 7, Great James Street, W.C.1.

Takato & Co., Ltd.—Particulars of this company were filed on March 1st. The capital is 3,000,000 yen in 50-yen shares. The company was incorporated in Tokio on July 26th, 1925, to carry on the business of sellers, agents, and transporters of electrical, steam, hydraulic, gas and oil machinery, apparatus and instruments, iron, steel, and all other metals, &c. The British address is 282, Dashwood House, 69, Old Broad Street, E.C., where R. H. Webb and A. E. Danvers are authorised to accept service of process and notices on behalf of the company.

Official Returns of Electrical Companies.

Neutron, Ltd.—H. Hackett, 448, Strand, W.C.2, ceased to act as receiver or manager on February 21st, 1927.

Re-Echo Radio Co., Ltd.—C. H. Whatley, 6-7, Charing Cross Chambers, Duke Street, Adelphi, W.C.2, ceased to act as receiver or manager on February 21st, 1927.

Eunice Wireless Cabinet Works, Ltd.—Issue on February 21st, 1927, of £200 debentures, part of a series.

Cark and District Electricity Co., Ltd.—Particulars filed of £1,000 debentures authorised February 4th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Newton Brothers (Derby), Ltd.—Particulars filed of £75,000 debentures authorised January 1st and covered by trust deed dated February 14th, 1927, charged on land and buildings in Alfreton Road, Derby, and fixed plant and the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £30,000. Trustees: Midland Bank Executor and Trustee Co., Ltd.

Cleveland and Durham Electric Power, Ltd.—Satisfaction to the extent of £11,300 on various dates between February 4th, 1926, and February 19th, 1927, of debentures secured by trust deed dated October 6th, 1913, and supplemental trust deed dated December 31st, 1918, securing £250,000.

Radio Accessories, Ltd.—Debenture dated February 10th, 1927, to secure all sums of money as may be owing to the chargees on June 30th, 1929, or on such earlier date as the principal moneys become due under the debentures on the balance of the company's loan and current account with the chargees or in respect of loan and current accounts due by the company to such chargees or in any other manner whatsoever, charged on the company's undertaking and property, present and future, including any uncalled capital. Holders: Burndept Wireless, Ltd., Eastnor House, Blackheath, S.E.3.

Attaix, Ltd.—Satisfaction in full on February 1st, 1927, of debentures dated February 10th and July 2nd, 1926, each securing all moneys not exceeding £500.

S. Kalisky (Aldgate), Ltd.—Debenture dated February 1st, 1927, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: S. Kalisky, Ltd., 43, Bidder Street, E.

Nox Electric Lamp Co., Ltd. (189,377).—Capital, £2,000 in £1 shares. Return dated December 31st, 1926. 502 shares taken up. £2 paid. £500 considered as paid. Mortgages and charges: Debenture for £662 13s. 4d.

Walker, MacEwen & Co., Ltd.—E. L. Holford, of 41, Nightingale Lane, Wanstead, E.11, ceased to act as receiver on February 8th, 1927.

City Notes.

Marconi's Wireless Telegraph Co., Ltd.

The report of the committee appointed to investigate the company's affairs was issued last week. The directors' report for 1926 was published a day or two later, and as this embraces the committee's recommendations, it will be sufficient to deal with the directors' statement. It is shown that although over £3,000,000 was taken from reserves in 1923 and 1924 for the purpose of writing down sundry assets, it was found in May last year that further heavy writing down was necessary. To ensure that this operation would be final, Sir Gilbert Garnsey and the company's auditors, Messrs. Cooper Bros. & Co., were asked to investigate the company's affairs. Their report shows that after taking into account the trading profit, less the preference dividend, for 1925, additional provisions should be made to the extent of £2,766,168 in respect of:—Advances to associated companies, which have become bad (£1,059,623); writing down of share holdings in associated companies (£772,623); obsolescence of plant due to the adoption of the "beam" system (£373,856); further reserve to meet depreciation of the company's holdings in foreign currencies, &c. (£275,690); and provision for claims and expenses arising out of the Argentine law suit (£237,955). Following these recommendations, the directors have decided to write down patents and patent rights to £1, and to transfer the balance to general reserve. After transferring the balance of the general reserve and the credit balance from 1924, making

together £1,140,374, there remains a deficiency of £1,625,794. Following the Committee's advice, the directors have decided to recommend a reduction of 10s. per share in the ordinary capital (*i.e.*, from £2,374,954 to £1,187,477). The capital will subsequently be restored to £4,000,000 by the creation of 3,250,092 new shares of 10s. each. If these recommendations are approved, the directors will be able to recommend a dividend out of the profits of 1926 when the accounts are available. During the last two years the policy of the management has been to wind up all non-wireless companies which had no reasonable chance of earning profits; to reorganise those companies which had profit-earning possibilities with a view to their disposal; to concentrate the manufacture and sale of broadcasting material in one company; to construct "beam" stations and modernise existing stations; to secure from the Government a general licence to establish telegraph services throughout the world; and to improve relations with Government departments. At the beginning of 1925 the company had interests in 56 other companies. Twelve of these had no connection with the wireless business, and nine of them have been liquidated, while the other three have been reorganised for disposal, and are either making a small profit or balancing their accounts. Five other companies were dormant, and have since been wound up. Three companies making broadcasting apparatus have been amalgamated, and last year made a substantial profit. The company's claim against the Government for the use of patents during the war has not yet been settled; progress has been made in arbitration regarding this matter. During the past four years the company's net revenue from patent royalties has shown a satisfactory increase. The "beam" system is being continually improved and developed. The Canadian station has been handed over; the Australian station has passed tests satisfactorily; and it is hoped to open the South African and Indian services during the next three months, and the North and South American services during the coming summer. These services should all prove remunerative to the company. The report proceeds to review other developments, and mentions the formation of an Egyptian subsidiary to conduct radiotelegraphic services between Egypt and other countries; the inauguration of further services by the Portuguese company; the contract for the administration by the company of the Peruvian postal and telegraphic services; a similar arrangement in Bolivia; a contract for the erection of radio stations in Venezuela; and the development of a system of *fac simile* transmission. Improvement in the company's relations with Government departments is reported, and mention is made of the general licence received in 1925 to establish services with all extra-European countries and Austria, Bulgaria, Denmark, Finland, Greece, Portugal, Russia, Spain, Sweden, Switzerland, Turkey and Jugo-Slavia. Senatore Marconi has expressed a desire to be relieved of his work as chairman of the company to permit him to devote more time to the technical side. It is accordingly proposed to accede to this desire, and to appoint Senatore Marconi president of the company. The following gentlemen have been invited to join the board:—Lord Inverforth, P.C., Major-General Sir Frederick Sykes, G.B.E., M.P., Lord Wester Wemyss, G.C.B., Sir Charles C. Barrie, K.B.E., and Mr. F. R. S. Balfour, D.L., and it is suggested that Lord St. Davids shall be appointed chairman. The following directors have intimated their willingness to resign:—Mr. H. W. Allen, Sir Frederick J. Barthorpe, Lord Herschell, Sir Wm. Slingo, and Mr. S. St. J. Steadman. The necessary resolutions for the reduction and subsequent increase of the capital and for the appointment of Senatore Marconi as president will be submitted at the annual meeting to be held on March 15th.

The directors point out that although the authorised capital is to be raised to £4,000,000, there is no intention of making any new issue until the development of the company's business warrants it.

Midland Counties Electric Supply Co., Ltd.

The annual meeting was held on March 1st. Mr. G. Balfour, M.P. (chairman), who presided, said that when they reviewed the difficulties with which they were faced during the year, in common with all concerned with public services, they could be satisfied with the results that had been obtained. The aggregate number of miles run by the tramway cars and motor-buses during the year was practically the same as in the previous year, but the number of passengers decreased, some unremunerative services having been cancelled. Better results would be obtained if only a reasonable number of vehicles were allowed to run; the public would still be properly catered for, and the business would be remunerative. They hoped by degrees to make the transport branch a paying one; it represented about 12 per cent. of the company's resources. In the supply of electricity steady progress had been maintained, although full benefit had been denied them on account of the industrial troubles. The amount of energy sold had increased by 22 per cent. to 73,565,000 kWh, and 2,709 consumers had been added, making a total of 11,366. The connected load of the various operating companies had increased by 13,480 kW to 67,720 kW; the maximum load had risen to 28,640 kW. Arrangements were being made for the installation of another 12,000-kW turbo-alternator with the necessary boiler plant, &c., at the Spondon station, and additional boiler plant at the Avon station. In a few months the work of connecting the Avon, Hinckley and Spondon stations by 33,000-V lines would be completed. The lines would be in duplicate and 53 miles long. During the year 92 miles of h.p. lines and 64 miles of l.p. cables had been installed, making the respective totals 430 and 250 miles. Supplies of electricity were inaugurated in three urban districts and 19 parishes during the year and bulk supplies to Coventry, Mansfield and Newark were commenced. The company was now supplying in three boroughs, 22 urban districts, and 50 parishes in rural districts, in addition to bulk supplies to five local authorities. The Leicestershire and Warwickshire Company's Bill received the Royal Assent in June last, and Special Orders were obtained by the Derbyshire and Notts. Company for Shardlow and Bakewell. A Special Order was also obtained by the Leamington and Warwick Electrical Co. for the areas south of Warwick. As soon as lines were extended Special Orders were applied for, and four applications were now being considered. Mr. Balfour expressed the company's intention to do what it could to facilitate the operation of the new Electricity (Supply) Act. He doubted whether the Act would effect the anticipated economy; it was not its effect upon the companies but upon the public and the policy involved, which he believed to be wrong. After referring to the success of the issue of preference shares during the year, he said that the results during the first two months of the current year had justified their best expectations.

London and Suburban Traction Co., Ltd.

The annual meeting was held last week, Lord Ashfield (chairman) presiding. In presenting the report (*vide* our last issue, p. 356), the chairman pointed out that the company's income was derived from three sources—tramways, motor-omnibuses, and electricity supply. Although their tramway investments at £1,658,000 represented 75 per cent. of the whole, they had received nothing from that source for 1926. Until the tramways could be restored to a state of moderate prosperity, the shareholders were not likely to receive a return upon their investments. The traffic receipts of the combined tramways had fallen by £20,000. The Metropolitan Electric Tramways failed, by £3,844, to meet its bare working expenses. The company's lease expired in 1930, and it had intimated to the Middlesex County Council that unless there was a drastic change in the circumstances under which tramways operated it could not entertain a renewal of the lease. Since 1922 the competition of motor-'buses had increased by 437 per cent. He (the chairman) hoped that before the expiry of the lease practical steps would have been taken to relieve the tramways of that wasteful and injurious competition. Such improvements as there were during the year occurred on the Uxbridge Road route of the London United Tramways system and the development of housing in the area served by the South Metropolitan Electric Tramways. The Ministry of Transport had restricted the number of omnibuses on the Uxbridge Road, and the L.U.T. had consequently been able to improve its stock and provide a good service for the public, which was duly appreciated. By the adoption of similar methods on other routes, both the companies and the public would secure advantages. The tramways laboured under onerous burdens which should be shared by their competitors. If the Government honoured its pledge to relieve the tramways from wasteful and uneconomic competition he had no doubt that they would again achieve prosperity. The report and accounts were adopted.

Scottish Power Co., Ltd.

The annual meeting was held in Edinburgh on February 28th. Mr. G. Balfour, M.P., who presided, said that the trading results for the past year were satisfactory in view of the circumstances. For the first four months of the year the demand showed a 10 per cent. increase, but then the coal dispute supervened. Their total receipts had nevertheless risen from £117,332 to £133,184; that result was due partly to normal progress in domestic and small power supplies, and to a greater degree to temporary arrangements with collieries for supplies. The operating costs were substantially increased, but owing to their policy of early securing options upon colliery stocks, they had not had to fall back on foreign coal, which was inferior and high-priced. The nature and extent of the company's load, apart from normal expansion, justified their confidence that the improvement in trade which was anticipated would immediately be reflected in the trading results. A Special Order had been obtained during the year, and the company was therefore now able to give lighting as well as power supplies throughout the whole area, with the exception of one or two small burghs which already had their own undertakings. Arrangements had been made to link up with the Fife Electric Power Co., and the construction of the trunk line was now proceeding and would be completed shortly. The company had made similar arrangements with the Grampian Co. The purchase for £93,860 of the Alloa undertaking by the Scottish Central Co. would prove a satisfactory addition to the company's assets. An issue of capital was to be made to repay the money borrowed for this and other purposes. As the authorised capital was already fully issued, the shareholders would be asked later in the year to sanction an increase. The chairman made brief reference to the Electricity (Supply) Act, 1926, and then reviewed the financial results, which were summarised in our issue of February 25th (p. 313).

North Metropolitan Electric Power Supply Co.

Presiding at the annual meeting last week, Sir James Devonshire, K.B.E. (chairman) said that the company, to a considerable extent, had escaped the effects of the industrial depression, although the output and revenue had been affected. No increase had been made in the charges to their 30,000 domestic consumers on account of the coal dispute. Other matters which had an effect upon the revenue, as compared with 1925, were the closing of the British Empire Exhibition and the reduction of the rates for energy supplied to the Metropolitan Electric Tramways. Notwithstanding this, the same dividend had been paid upon a larger capital. The total expenditure of the company had been brought to £3,100,000 by the expenditure during the year of over £500,000, chiefly upon mains and sub-stations. The demand for electricity from the public was as great as ever, but it was small at present compared with what it would become in the near future when electricity was adopted for all domestic purposes. Already there was a tendency in that direction, and that would be encouraged by a method of charge consisting of a fixed rate to cover standing charges combined with a low "unit" rate. Although the balance from working was £25,000 lower, they had been able to declare the same dividends and carry an increased amount forward. Referring to the construction of the Brimsdown station, the chairman said that the initial installation would consist of two 25,000-kW sets, but the ultimate capacity would be 150,000 kW. During the construction period the debenture interest would be paid by the Construction Company out of revenue. As soon as the station commenced operation a rental would be paid by the Power Company to the Construction Company, and this would, generally speaking, meet the latter's debenture interest and sinking fund. The report and accounts were approved.

Underground Electric Railways Co. of London, Ltd.

The report for the year ended December 31st last shows traffic receipts amounting to £804,113, to which are added miscellaneous receipts of £5,975, making £810,088—an increase of £69,643, as compared with 1925. The net receipts at £749,301 were £71,235 higher. After deducting interest and adding £145,959 brought forward there was a balance of £241,054. From this £8,929 is deducted for the payment of 8,929 ordinary shares in accordance with the scheme for the reorganisation of the capital, and the cost of this scheme, £11,000, leaving £221,125. It is proposed to pay a dividend of 1½ per cent. on the ordinary shares, which will leave £145,092 to be carried forward. Reference is made to the reorganisation, and it is noted that the capital of the company now consists of 5,068,878 ordinary shares of £1 each. The investments were increased during the year by purchases of London General Omnibus and North Metropolitan ordinary shares. The results of the subsidiary companies are reviewed (*vide* Electrical Review, February 25th, p. 311), and the deaths of Lord Stuart of Wortley, and the resignation of Lord George Hamilton are recorded. During the year Brig.-Gen. A. M. Asquith, D.S.O., and Messrs. S. B. Joel, G. Leith, C.B.E., and E. R. Peacock were appointed to the board. The meeting is to be held on March 15th.

Mather & Platt, Ltd.

Mr. L. E. Mather (chairman) presided at the annual meeting on February 28th, and in presenting the report pointed out that the past year's profit was only slightly below the average for the two preceding years. Having regard to the troublesome times which had been experienced, they were thankful that such success had been attained. The directors had no hesitation in recommending the same dividend and bonus as for 1925. During the year the number of employés had been kept constant, and the output per man-hour had been maintained. The volume of orders was materially affected by the coal dispute and some were taken with a very small margin of profit, but they were not pessimistic. There were signs of revival in the cotton trade, and the collieries were beginning to make inquiries for electrical and pumping plant. Municipal contracts for extensions to electricity and pumping stations continued to be placed, but there was keen competition. Overseas trade had been disappointing, with one or two exceptions, but that was all the more reason for anticipating better times. Their French company had done well. Machinery was being supplied to Russia, and all payments had been made as they fell due. They were prepared to take further contracts on a similar basis, but the existing economic and political situation in Russia made it difficult to obtain further business on satisfactory terms.

Electrical Distribution of Yorkshire, Ltd.

The annual meeting was held in Leeds on March 1st. Mr. R. W. Wickham (chairman) presided, and in moving the adoption of the report and accounts (Elec. Rev., February 25th, p. 312) said that in spite of an increase of £12,000 in the cost of energy, through the coal dispute, they had made further reductions in their prices, had met new capital charges amounting to £17,000, had added £10,000 to the reserve fund, and had increased the balance carried forward by £1,500—a very gratifying result. The company was now the authorised distributor under 36 Electricity Orders covering an area of 960 square miles. When the company's outstanding applications had been dealt with, a supply of electricity for lighting purposes would be available in practically the whole of the industrial area of Yorkshire south of the River Wharfe. That marked the end of their original scheme, and they had broken new ground by making an application in respect of Ripon and district. There had been a steady growth in the use of electricity for street lighting, and the company now had agreements with a number of local authorities. The greatest development which had occurred during the year was in the direction of domestic supplies; the majority of the houses now being built were being wired for electric lighting, and provision was usually made for other apparatus. That development had been encouraged by the introduction of a two-part tariff. The board had under consideration a wiring scheme by which the installation would be paid for by a small addition to the price of energy. Supply to new housing estates through prepayment meters was growing. To meet those developments more capital was required, and in a few days the shareholders would be offered an issue of 300,000 new shares. Those shares would be offered in the proportion of three to every five held, and the price would be 25s. Mr. Wickham did not anticipate that the new Electricity Act would have any adverse effect upon the company.

Liverpool Overhead Railway Co.

The traffic receipts for the past year amounted to £83,997, and miscellaneous receipts to £5,289, making £89,286. Against this were charged working expenses £87,749, renewal fund £5,000, and contingent fund £400, leaving a deficit of £3,864. After meeting debenture interest this deficit is increased to £10,619, but against it are placed balance of compensation under the Railways Act, 1921, and the balance brought forward from 1925, reducing it to £3,069. The number of passengers carried fell from 7,896,572 to 7,006,230. There is stated to be little hope of material improvement in the company's prospects until trade revives. The report records the death of Col. H. Concanon and the resignation (on account of the pressure of official duties) of the Lord Mayor, Mr. H. C. Bowring. Their places on the board have been filled by Messrs. E. B. Orme and G. T. Phizackerley. The company's general manager and engineer, Mr. E. J. Neachell, has resigned owing to ill-health, and Mr. W. T. D. Grundy has been appointed to the position.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted:—

Auckland Electric Power Board.—£250,000 5 per cent. water power conversion and general extension purposes debentures, Nos. 1 to 2,500 (£100) bearer.

Madras Electric Supply Corporation.—110,000 ordinary shares of £1 each, fully paid, Nos. 326,801 to 436,800.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Adelaide Electric Supply Co., Ltd.—250,000 new 6½ per cent. "C" cumulative preference shares of £1 each, partly paid and fully paid, Nos. 500,001 to 750,000 (ex dividend).

North Metropolitan Electric Power Supply Co.—850,000 ordinary shares of £1 each, fully paid, Nos. 1 to 850,000 (ex dividend).

Torquay Tramways Co., Ltd.

In the course of his speech at the recent annual meeting, the chairman (Mr. H. T. Barnett) said that up to July last matters looked very bad, but from that month onwards there was a marked recovery, and by the end of the year the traffic revenue was greater than that of 1925. The company had come to an arrangement with its omnibus competitors upon the Torbay road, which had resulted in improvement for both parties. The Babbacombe Cliff Light Railway was opened on April 1st, and the results had exceeded all expectations. Their subsidiary, the Devon General Omnibus and Touring Co., Ltd., had maintained its progress. It was not, however, intended that that company should declare a dividend on its ordinary capital until the reserve fund had been built up.

Isle of Thanet Electric Supply Co., Ltd.

The report for the year ended December 31st last shows a revenue of £151,167 and net income of £59,778. After meeting debenture interest and sinking fund and transferring £25,000 to reserve, and crediting interest (£519) and the balance brought forward (£3,504), there remains £23,800. The preference dividend is paid and one of 3 per cent. declared on the ordinary shares, leaving £3,460 to be carried forward. Although the coal dispute adversely affected the receipts, they were £13,176 in advance of the 1925 figure, while the expenses rose by £5,650. In March, 1926, an issue of 72,000 preference shares of £1 each was fully taken up by existing shareholders. The meeting was to be held on Wednesday last.

Mansfield and District Tramways, Ltd.

The profit for the past year was £5,039, and to this is added £1,148 brought forward, making £6,187. A balance of £2,608 remains after meeting loan and debenture interest, and £4,011 is taken from the contingency reserve, making £6,620. Of this £6,605 is put to debenture stock redemption funds, leaving £15 to be carried forward. In 1925 the preference dividend was paid and the ordinary shares received 5

per cent. The adverse result is, of course, due to the coal dispute, and the directors state that some time must elapse before conditions become normal.

Cambridge Electric Supply Co., Ltd.

The accounts for the past year show a profit of £35,361, to which is added £5,097 brought forward, making £40,458. After meeting debenture interest and taxation and transferring £10,000 to depreciation fund, £10,000 to reserve, and £1,500 to pension fund, there remains a balance of £11,905. It is proposed to pay a dividend of 7 per cent., leaving £4,905 to be carried forward. During the year a new Babcock & Wilcox boiler was installed, and the total capital expenditure was £22,283.

Llanelly and District Electric Supply Co., Ltd.

The profit for the last year, including £998 brought forward, was £31,546. After meeting debenture interest, &c., and allocating £2,500 to renewals reserve, the preference dividend is paid and £1,189 is carried forward. For 1925 a dividend of 5 per cent. was paid on the ordinary shares; last year the undertaking was very badly affected by the coal dispute, the net profit falling from £23,302 to £14,691. An improvement is recorded for the first two months of the current year.

The Mackay Companies.

The report for the year ended December 31st last shows a total income of $4,922,811 and an expenditure of $296,640, leaving a surplus of $4,626,171, which is added to the surplus brought forward, making $6,771,512. After paying dividends of 4 per cent. on the preferred and 7 per cent. on the common shares, a surplus of $2,160,401 remains. The investments stand at $92,883,716.

Clarke, Chapman & Co., Ltd.

The net profit for the past year was £13,453 (as compared with £33,194 in 1925) and after providing for maintenance charges, depreciation, &c., and adding £2,192 brought forward, there remains £8,135. The directors recommend the payment of the final dividend on the preference shares, but are unable to declare an ordinary dividend. For 1925 the dividend was 5 per cent. A balance of £3,246 is carried forward.

Galashiels and District Electric Supply Co., Ltd.

At the annual meeting on March 4th it was reported that there had been a steady expansion of business, and it would be necessary to extend the power station. The Special Order applied for should be ratified by Parliament within the next few days. It was proposed to increase the share capital from £100,000 to £200,000.

Westminster Electric Supply Corporation, Ltd.

The directors recommend a final dividend at the rate of £5 16s. per cent. upon the ordinary capital as increased by the recent bonus issue. The total dividend represents a return of 14.7 per cent., as compared with 15 per cent. last year.

British Insulated Cables, Ltd.

The directors recommend the payment of a final dividend of 10 per cent. on the ordinary shares, making 15 per cent. for the year. This is paid upon a capital increased in 1925 from £1,000,000 to £1,333,333. £285,000 is allocated to depreciation and reserve, and £271,000 is to be carried forward.

Charing Cross Electricity Supply Co., Ltd.

The directors recommend a final dividend on the ordinary shares of the West End Undertakings at the rate of 9 9/16d. per share. This, with the interim dividend already distributed, makes up the standard dividend for the year, in accordance with the London Electricity (No. 2) Act, 1925.

Vickers, Ltd.

The directors announce the payment of the final dividends upon the 5 per cent. preferred stock (less tax), the 5 per cent. preference shares (less tax), and 2½ per cent. upon the cumulative preference shares (free of tax).

Bournemouth and Poole Electricity Supply Co., Ltd.

The directors recommend the payment of a final dividend of 5½ per cent. upon the ordinary shares, making 10 per cent. for the year, together with a bonus of 4 per cent. free of tax. Last year's distribution was similar.

St. Maurice Power Co.

The total income for the past year was $1,031,379, as compared with $807,000 for 1925. After meeting expenses, rentals, and interest, $170,000 was transferred to reserve, and a balance of $627 was added to surplus, making $983.

Danish Company.

The *Nordisk Kabelfabrik*, Copenhagen, reports net profits of 1,578,000 kr. for 1926, and has declared a dividend at the rate of 5 per cent., as in each of the two previous years.

Globe Telegraph and Trust Co., Ltd.

A quarterly dividend of 2½ per cent. has been declared on the ordinary shares.

Reduction of Capital.

X-RAYS LIMITED AND REDUCED.—A petition for confirming the reduction of the capital of the company from £75,000 to £24,265, has been presented to the High Court, and will be heard in London on March 22nd.

Richmond (Surrey) Electric Light and Power Co., Ltd.

A final dividend of 5 per cent., making 9 per cent. for the year, is recommended on the ordinary shares. Last year the old ordinary shares received 10 per cent.

Northern Mexico Power and Development Co.

A dividend of 1 per cent. has been declared on the common stock and a quarterly dividend of 1¾ per cent. upon the preference stock.

Brazilian Traction, Light and Power Co., Ltd.

A quarterly dividend of 1½ per cent. has been declared on the cumulative preference shares.

Coatbridge and Airdrie Electric Supply Co., Ltd.

The directors recommend a dividend of 9 per cent. on the ordinary shares for the past year.

Western Telegraph Co., Ltd.

The directors have declared the second quarterly interim dividend of 5s. per share, free of tax.

Newcastle and District Electric Lighting Co., Ltd.

The directors recommend a dividend of 7 per cent. for the past year.

W. Canning & Co., Ltd.

A dividend of 10 per cent. and a bonus of 6d. per share are recommended on the ordinary shares for the past year.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets are in a fairly cheerful frame of mind. The Chinese trouble has faded into the background as a factor of disturbance to any markets except the few that are intimately connected with it. The people who, a month ago, were talking "dearer money" have changed their key, and investment stocks show general strength. A recovery in the rubber share market stands out conspicuously.

Reference was made here last week to the growing inclination on the part of holders of London electricity supply shares, to exchange the latter for shares in the big power undertakings. With nothing much to look forward to in the way of possible price appreciation, and with the knowledge of a common 7 per cent. dividend level to be reached after the end of 1931, the proprietor of the London companies' shares is asking whether he cannot obtain wider scope for dividend and profit in the power concerns. No doubt the proprietary of the average London company is composed mainly of investors pure and simple—people who, to use the Stock Exchange phrase, will never sell their shares until they are dead. Their investments are secure, were never more so, in the older electricity supply companies, and this is all they ask. But there are other shareholders who require a more extended prospect, and who turn to the power companies as offering what they, the investors, seek. Several of such shares are quoted in our weekly lists, but it may be of some service to set out in a separate table the principal provincial stocks and shares quoted in the Stock Exchange lists:—

Share.	Divd. %	Price.	Yield. £ s. d.
Clyde Valley ordinary	8	30/-	5 6 8
Do. first preference ...	6	22/-	5 9 1
Do. second preference	8	27/6	5 16 5
Co. Durham Electric Power Dis. debenture	5	87½	5 14 3
Elec. Dis. Yorkshire	8	31/3	5 2 5
Kent Electric Power debenture	4½	80½	5 11 10
Lancashire Elec. Light & Power ordinary	7½	24/6	6 2 5
Do. first preference ...	6	26/6	4 10 7
Do. second preference	7	26/6	5 5 8
Midland Counties Elec. ordinary	6	22/-	5 9 1
Newcastle-on-Tyne Elec. ord. ...	7	22/-	6 7 3
Scottish Power ordinary	8	25/-	6 8 0
Shropshire, Worcs. & Staffs. "A"	8	27/6	5 16 5
Do. "B"	6	23/6	5 2 2
Do. preference	6	22/-	5 9 1
South Wales Power preference	6½	17/6	7 8 7
Do. debenture	6	100½	5 19 5
Yorkshire Electric ordinary ...	8	29/6	5 8 6
Do. preference ...	6	23/-	5 4 4
Do. debenture ...	5½	101	5 9 0

The dividend on Lancashire Electric first preference is paid tax free and the company's 7 per cent. preference carry participating rights.

While the list of London electricity supply shares remains very firm as to its prices, the provincial group shows increasing strength. There are small rises in Clyde Valley, Midland Counties, Newcastle-on-Tyne and Lancashire Light and Power. Amongst the supply companies, Bournemouth and Poole has declared a final dividend of 5½ per cent., less tax, making 10 per cent., plus a bonus of 4 per cent., tax free, the same as last year. The price of the shares is unchanged at 60s. 9d. Isle of Thanet Electric Supply has raised its dividend by ½ per cent. to 3 per cent., and the figures in the report tell of satisfactory progress. The price of the ordinary shares is 16s.; the 6 per cent. preference are quoted at a guinea. The Richmond (Surrey) Electric Light and Power final dividend of 5 per cent. makes 9 per cent. for the year on the ordinary shares, standing at 30s. 9d.

The Westminster Electric final dividend for 1926 is declared on the capital as increased by the new shares issued at the end of last year through capitalisation of the company's reserves. The dividend is 5.8 per cent. on the whole capital, and makes 8.8 per cent. for the full year. This is equal to 14.7 per cent. on the capital before the latter was increased, and it goes against 15 per cent. paid for 1925. The yield on the shares at the current price of 25s. 6d. is £7 2s. 6d. per cent. now, but, as observed previously, our yield-table is calculated upon the 7 per cent. dividend that will obtain from the beginning of 1932. That this austere method is recognised as being strictly, if not mathematically correct, would seem reasonable to assume in view of the fact that no protest has reached us on the point.

Tube Railway stocks are slightly better on the week, Underground Electric Railways of London £1 shares firmed up to 16s. The company's report, published a few days ago, shows that the Associated Equipment Company enabled the payment of the maiden dividend of 1½ per cent. upon Underground £1 shares. The Associated Equipment contributed £60,000 to the Common Fund, and the dividend on the Underground shares took £76,000. The London & Suburban Traction is the Cinderella of the combine, the company paying nothing to the pool. At the meeting last week, the chairman said that what they needed was a little more fair play: the tramways stood at a disadvantage by having to carry workmen passengers at cheap fares, while its competitors were not subject to the same terms. The shares are a little better at 7s.

United River Plate Telephones are 2s. 6d. down after their big rise, said to be due to American buying for control purposes. International Automatic Telephone deferred, after their dip to 40s., have recovered to 43s. The ordinary have risen to 44s. 6d. Cable stocks present no features of interest. Globe ordinary shed 5s. to 18½. Westerns are unaffected by declaration of the usual quarterly dividend of 5s. per share net. Anglo-American deferred is ⅛ lower at 23⅞.

Foreign traction varieties are better. Anglo-Argentine Tramways preference, of both classes, have made further headway. Brrazilian Tractions went 3½ higher under buying pressure from Brussels, Montreal, and New York. The preferred are up to 116½. Mexican Utilities hold most of the substantial rises recently acquired. The Tramways firsts gained two points to 71½, and the seconds rose to 50½. In the Colonial stocks, British Columbia Electrics are heavy, the deferred going back to 154½, a 3½ points decline. City Services preferred have dropped 4 to 90½. An offer is being made, of 2½ million francs, in 7 per cent. bonds at 97½, by the Société des Forces Electriques de la Vallée de Gavarnie.

The recommendations of the Marconi Board are out at last. They have been so thoroughly canvassed in the Press that their detailed examination here might look out-of-date when these notes appear. Two main points are the proposal to reduce the nominal share value to 10s., by writing off 10s. per share, and the expression of opinion that such action will lead to an early return of Marconis to the dividend list. The English Shareholders' Committee adopted the unusual course of issuing a statement of its own on the eve of the company's announcement. At the moment, it looks as if two camps existed, and that between the two lies more than one gulf. Shareholders will probably be well advised to support the Marconi directors. To job backwards is useless. The future holds promise of success after the bitter lessons of the past. The price of the shares has gone back to 15s., but the writing-off of deadweight capital will make no difference to the market price of Marconi shares. Under reorganised conditions, the Marconi Company should rapidly regain much of the lost ground.

Johnson & Phillips are again the weak spot in the electrical equipment section. The shares are 2s. 6d. lower, following upon a similar drop in the previous week, and the only assumption advanced in explanation is that the dividend may prove disappointing. The announcement is due next month, and will compare with 2s. a year ago. In November, the interim dividend was 1s. per share. British Aluminiums are 9d. better at 47s. Edison 5 per cent. debenture is a point higher at 85. The company's 5½ per cent. second debenture stands at 81.

Babcocks are steady. Vickers have gained a trifle and Armstrongs went up a little upon rumours, denied though these were, that some kind of working agreement might be reached by the two undertakings. A feature in the Miscellaneous Market is a spurt in rubber shares. The produce hardened in price, and the share list responded with an all-round improvement in values, accompanied by a mild outburst of business activity.

Share List of Electrical Companies.

	Nom. £	Dividend. 1924.	1925.	Price Mar. 7 1927.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	14	14	60/9	—	4 12 0
Brompton Ordinary	1	10	10	25/-	—	5 12 0
Charing Cross Ordinary	1	15	15	25/6	—	5 9 10
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	12	12	25/-	—	5 12 0
City of London	1	15	15	2⅞	—	... ...
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4
Clyde Valley	1	8	8	30/-	+6d	5 6 8
County of London	1	15	15	27/6	—	5 1 10
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/3	—	6 2 0
do. 7% Pref.	1	6	7	28/-	—	6 1 9
Elec. Supply Corporation	1	10	10	30/6	—	6 11 9
Kensington Ordinary	1	15	15	24/6	—	5 14 3
Lancs. Light and Power	1	7½	7½	24/6	+6d	6 2 5
London Electric	1	10	10	24/-	—	5 17 8
do. do. 6% Pref.	5	6	6	5⅛	—	5 10 4
Metropolitan	1	11	11	25/6	—	5 9 10
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	22/-	+6d	5 9 1
Newcastle-on-Tyne Ordinary	1	7	7	22/-	+9d	6 7 3
do. 5% Pref.	1	5	5	17/6	—	5 14 8
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	25/6	+6d	5 9 10
South London	1	15	15	24/6	—	6 8 0
South Metropolitan Pref.	1	7	7	1¼ xd	—	6 8 0
Urban Ordinary	1	4	7	25/6	+6d	5 9 10
do. 6 % Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	25 6	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	+8d	7 6 4
Yorkshire Elec.	1	8	8	29/6xd	—	5 8 4
Home Rails.						
Central London Ord. Assented	Stock	4	4	70 xd	—	5 14 4
Metropolitan	,,	5	5	63½ xd	—	4 14 6
do. District	,,	8½	8½	59½	—	5 18 8
Underground Electric	£1	Nil	Nil	16/-	+6d	1 17 6
do. do. Income	Bonds	6	6	10xd	—	5 18 10
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	100	—	6 0 0
do. Def.	,,	1½	1½	23⅞	—⅛	6 6 0
Automatic Telephone	1	8	10	53/3	—	8 15 0
Chili Telephone	5	5	6	6½	—	4 12 4
Cuba Sub. Ord.	10	5	5	7	—	7 5 6
Eastern Extension	10	10	10	17⅝	—	*5 13 4
Eastern Tel. Ord.	Stock	10	10	172½	—	*5 16 0
Globe Tel. and T. Ord.	10	10	10	18½	—½	*5 8 1
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	22	20	26¾	—	7 10 0
Indo-European	25	8½	10	46½	—	*5 7 6
Marconi	1	10	Nil	15/-	—1/16	... ...
Marconi-Marine	1	10	7½	1⅛	—	6 13 4
Oriental Telephone Ord.	1	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	5	8	8	8⅜	—⅛	*4 11 5
Western Telegraph	10	10	10	17	—	*5 17 8
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3⅜	+1/16	8 12 6
do. do. 2nd Pref.	5	6	6	3⅛	+⅛	9 8 2
do. do. 5% Deb.	Stock	5	5	71½	—	7 0 0
British Electric Traction Ord.	,,	7	8	145½	—	5 10 0
do. do. 6% Pref.	,,	6	6	109	—	5 10 1
Brazil Traction	100	4	5	128	+3½	4 13 6
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	96/-	136/9	116½	—4	*5 7 6
do. do. Deferred	,,	129/5	8	154	—3½	*5 4 0
do. do. Deb.	,,	4¼	4¼	81½	—	5 4 4
London & Sub. Trac. 5% Pref.	1	2½	Nil	7/-	+6d	Nil
London United Tram. Deb.	Stock	4	4	49½	—	8 1 8
Mexico Trams, 5% Bonds	—	5	5	71½	+2	6 19 10
Mexican Light Common	100	Nil	Nil	43	+1	Nil
do. Pref.	100	Nil	Nil	96½	+1	Nil
do. 1st Bonds	—	5	5	70½	—	7 1 10
Yorkshire (West Riding)	1	5	—	8/9	—1/3	... ...
Manufacturing Companies.						
Babcock & Wilcox	1	12	13	52/6	—	4 19 1
British Aluminium Ord.	1	5	10	47/-	+9d	4 5 1
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	1	15	15	68/9	—	4 7 3
Brush Ord.	1	10	10	28 3	—	7 1 7
Callenders	1	15	15	8½	—	4 5 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	85	+1	5 17 8
Electric Construction	1	10	10	31/3	—	6 8 0
Enfield Cable Pref.	1	7½	7½	1¼	—	6 6 4
English Electric	1	5	Nil	13 9	—9d	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 1
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	5	7½	31/-	—	4 16 9
Henley	1	16	20	89/3	—	4 9 8
do. 4½% Pref.	5	4½	4½	4½ xd	—	5 6 0
India-Rubber	1	5	5	1	—	*5 0 0
Johnson & Phillips	1	10	17½	2½	—⅛	6 10 1
Met.-Vickers Ord.	1	8	8	28/3	—	5 13 3
do. Pref.	2	8	8	2⅝	—	6 18 4
Siemens Ord.	1	7½	7½	29/6	—	5 1 8
Telegraph Construction	12	20	10	29⅜	—	*4 0 8

* Dividends paid free of Income Tax

The British Industries Fair.—IV.

Proceedings and Exhibits at Birmingham.

THE Fair closed on Friday last amid expressions of satisfaction from the bulk of the exhibitors. The actual business done was substantially in advance of that of previous years, and inquiries which should bring forth fruit in due season were numerous. Our Birmingham correspondent states that, as a result of this year's experience, it is probable that the accommodation at Castle Bromwich will be further increased by next year. It is thought that another building will be erected between the existing buildings "A" and "B," which are at present connected by a long corridor in which serious congestion has taken place.

While it is very difficult to gauge with a high degree of accuracy the extent of the business done, it may be worth while to record the official estimate. This places the value of orders actually obtained at £4,000,000, while the business which is likely to accrue during the next twelve months as the result of the Fair is put at between eighteen and twenty millions. According to the same official source, the branches in which the bulk of the business was done included switchgear, internal-combustion engines, colliery plant, lamp shades, and boiler and engine room plant.

Our own impressions, gathered from exhaustive inquiries at the electrical stands, confirm the optimism thus officially expressed. While, of course, actual figures were not disclosed, practically every company interviewed was pleased with results, and satisfied that its efforts had not been wasted.

One of the leading electrical companies stated that the volume of orders for all departments was satisfactory, the majority being for the home market. There were several important foreign orders and inquiries. Excellent results were reported by a well-known company which makes electric fires; 50 fires were sold in one day, there being many oversea buyers. One switchgear company reported orders from India, and another received promising inquiries from Canada. Another company manufacturing electric fires and other appliances, which is a regular exhibitor at the Fair, considered that this was the best year so far as it was concerned. An electric vehicle firm noted as an interesting point that many small firms made inquiries regarding its products. One of the smaller companies dealing with domestic appliances said that it had done far better than it had hoped to do. A number of good orders and sound inquiries regarding water-heating apparatus were received by another London company of electrical manufacturers. Some makers of electric heating and cooking apparatus said that, although the volume of orders was not very large, a number of inquiries had been received which appeared certain to bring in business from entirely new directions. The foregoing are typical replies to questions put to the exhibitors. Only one firm seemed dissatisfied with results so far as orders were concerned, but even in this case it was admitted that many useful "contacts" had been made.

We are convinced that the Electrical Section of the Fair, at least, has been a success, and we call for the co-operation of British electrical manufacturers in ensuring a continuance of that success.

The Department of Overseas Trade announced last week that the Government intended to repeat its grant of £25,000 for publicity purposes in connection with next year's Fair.

About 90 per cent. of this year's exhibitors have notified their desire to show again next year, and in many cases increased space is required.

THE BIRMINGHAM SECTION.

An Electrical Luncheon.

On March 3rd there was a further concourse of electrical visitors at the Fair. They included delegations from the Incorporated Municipal Electrical Association, the British Electrical Development Association, the Provincial Electric Supply Committee of the United Kingdom, and the Electrical Association for Women. The delegates took lunch at the invitation of the Fair Council.

Mr. T. R. Martin (chairman of the Fair Management Committee), who presided, pointed out that the Fair had doubled its size inside two years.

Mr. W. C. P. Tapper (borough electrical engineer, Stepney) observed, in reply to the toast of "The Visitors," that the electrical industry had suffered less than many trades during the period of depression. It was busily engaged in re-organising itself in view of the operations of the new Electricity Board. That re-organisation should result in rapid progress, and the electrical industry was hoping to carry the other industries of the country along with it.

Lady Brooks, President of the Midlands Branch of the Electrical Association for Women, said it was the hope of women that they could indirectly help the electrical industry enormously.

The toast "The Electrical Industry," was proposed by Ald. W. Walker, of Manchester (a member of the new Central Electricity Board), who said he only hoped that the forecast of politicians, that within a short period everybody in the country, in towns, or remote villages, would have at his disposal electricity without any trouble, would be realised.

Mr. R. A. Chattock, city electrical engineer, Birmingham, replying, suggested that the various associations in the electrical industry should get together and see to it that at next year's Fair, all electrical wares and developments were shown in one building. The effect of that would be to stimulate buying for the home and the export markets. The electrical industry had been marking time, but was now desirous of going ahead.

Mr. J. W. Beauchamp, director of the British Electrical Development Association, pointed out that whether we got electricity at a very cheap rate or not, would depend more than anything else on the amount the public consumed.

W. McGeoch & Co., Ltd.

Upon this stand there appeared a very varied selection of lighting fittings and switchgear. Among the former were ships' fittings of all kinds, including navigation lamps and indicators; there were also standards, pendants, &c., for the home. Self-aligning porcelain-handled fuses were shown as well as battery-charging boards, distribution boards, knife switches, lampholders, plugs and sockets, and ironclad switchgear, including colliery types.

R. A. Lister & Co., Ltd.

Two small lighting sets were shown by this company rated at 1 kW and 1½ kW respectively. In both cases the prime movers were the company's standard petrol engines, and the switchboards formed an integral part of the set. The engine is of the 4-stroke pattern equipped with automatic lubrication, and is claimed to have a very low fuel consumption—2.25 pints of petrol per b.h.p.-hour on full load. The dynamo is a 4-pole protected-type machine. It is shunt wound for battery charging and is also provided with powerful series starting windings to enable the plant to be started by means of the battery. The rating is a conservative one.

Thos. J. Digby Illuminating Engineering Co., Ltd.

The principal exhibit of this company was the artificial daylight apparatus. The "Trulyte" system is made up into special units for colour matching, photography or ordinary lighting purposes. Another device shown was a combination spot light employing a 400-W tubular projector lamp. The device is fitted with a set of lenses for giving spots of varying size and intensity.

Cambridge Instrument Co., Ltd.

In addition to the large and representative selection which was shown on its own stand, various "Cambridge" temperature-measuring and engineering instruments were in operation on other stands in various parts of the exhibition. For example, in connection with the John Thompson water-tube boiler, there was a panel of "Cambridge" instruments, comprising an index thermometer for measuring the temperature of the exit gases, a draught gauge and an illuminated CO_2 indicator, all with 13-in. dials. The last instrument was exhibited publicly in actual operation for the first time. It was connected up to a working Cochran boiler mounted on the stand of Messrs. Cochran & Co. (Annan), Ltd. The indicator possesses many novel features which greatly facilitate the work of the stoker. The actual figure representing the CO_2 percentage is illuminated by a white light, while the pointer, in line with it, is illuminated by a green light if the percentage is increasing, and by a red light if it is decreasing. A "Cambridge" thread recorder, working in conjunction with the above CO_2 apparatus, was shown on the company's own stand. This stand bore a large and varied selection of instruments. The dissolved oxygen recorder shown recorded the percentage of oxygen on a chart calibrated in cu. cm. per litre of water. The full scale deflection on the chart corresponds to one cubic centimetre of oxygen per litre. The apparatus may be arranged to operate an alarm. The CO_2 and CO indicator which was shown is electrical in principle, and contains no chemical absorbents or fragile glass work. The apparatus is robust and needs little attention. It comprises a CO meter panel connected to an indicator, together with a CO_2 meter, soot filter, and bubbler-aspirator. The Cambridge" dial gauges, also exhibited, are convenient, robust, and moderately-priced indicators for the measurement of draught or pressure up to 60 in. of water. They can be arranged to indicate directly the difference in pressure between two points. The exhibit also included draught and pressure recorders (for ranges up to 60 in. of water) and pressure and vacuum recorders with circular charts 9½ in. in diameter (for ranges up to 1,000 lb. per sq. in.). One of the pressure recorders was in operation, showing the pressure of the steam in the exhibition power plant. The temperature-measuring instruments included various patterns of the firm's "Easy-to-Read" dial thermometers, which are suitable for steam plant, refrigerating plant, &c., in marine and land installations. These thermometers are of the vapour-pressure type, and an important feature of the design is that changes in the temperature of the indicator or of the flexible tubing do not affect the accuracy of the readings. This enables the instrument to be installed at some distance from the place where the temperature is being measured. Electrical distance thermometers formed an important part of the exhibit. Indicating, recording, and combined indicating and recording outfits are made. A portable resistance pyrometer outfit; thermo-electric pyrometers; stator and rotor temperature measuring outfits; radiation and optical pyrometers; a disappearing filament pyrometer; and many other instruments were displayed.

H. H. Vivian & Co., Ltd.

This company exhibited bus-bars, condenser tubes, and high-conductivity copper strip, tape, and sections for electrical purposes.

E. Brook, Ltd.

Chief among the exhibits of this firm was a 30-h.p. motor in half section, showing all internal parts, including slip-rings, and a 5-h.p. motor on a revolving base. The latter machine had both end plates removed in order to expose the internal parts, especially the windings. Other exhibits included the rotor of a 75-h.p. motor on ball-bearings, a showroom motor, a loom motor, a buffing motor on stand, squirrel cage motors, slip ring motors, three starters with automatic features, parts of slip rings, brush gear, rotor bars, ball and roller bearings, slide rails, pulleys, &c.

C. H. Parsons, Ltd.

Once again this company presented a very comprehensive display of its switches, electric lamp holders and accessories, in addition to one or two new lines. These included a 2-pin, 10-A switch plug, a 3-pin, 10-A switch plug with earthing device, a shock-proof switch plug, and a range of flush-type switches in iron boxes. All of these were of excellent construction and finish.

Allen-Liversidge, Ltd.

In addition to a great deal of oxy-acetylene equipment, this company showed examples of "Pontelec" welding apparatus (made by Messrs. Buckley, Saunders & Co., Ltd.). These included spot, seam, and butt types of various sizes. One machine was a 3-kW butt welder, designed for the cable industry, and it is capable of dealing with wires up to large gauges in copper, brass, or steel. Samples were shown of work carried out by a spot welder for the treatment of aeroplane wings, and other samples displayed the results of the use of a flash welder which can deal with angles and sections of steel, such as casements. The spot welders have water-cooled electrodes and an automatic trip control switch by which the current is only allowed to remain on during the short period required for the weld. Numerous photographs of welders and welded products appeared on the stand.

Heenan & Froude, Ltd.

Various types of apparatus for power station work were exhibited by this firm, noticeable amongst which was the "Heenan" patent stationary cooler, which can be put to numerous uses, such as an air purifier or cooler, water or oil cooler, humidifier, or dehumidifier. Other exhibits included a stationary air filter, enclosed-circuit air coolers, and the Heenan "K" type water cooler.

J. A. H. Hunt.

On this stand was exhibited a complete range of new models of decorative house lighting fixtures. These have been designed and manufactured especially for the present demand for better-class materials at reasonable prices. There were also shown some examples of wrought iron units for the exterior lighting of public buildings, &c., and several illuminated signs.

Pritchett & Gold & E.P.S. Co., Ltd.

This company exhibited a few of its different types of accumulators for country house and central station work, and also various types of train-lighting accumulators. These demonstrated the patent anti-splash lids, special grids, and other features. A complete stationary battery was erected on the stand for the purpose of showing the construction. Component parts and a number of small accumulators for special purposes, such as wireless, were also exhibited.

Carron Company.

A large selection of its electric fires and irons was displayed by this company, but the principal electrical appliance shown was a baking oven. This is a two-compartment oven, each compartment having a 6-kW loading, and a baking space measuring 3 ft. 2 in. by 2 ft. 10 in. by 11½ in. The appliance is constructed of cast-iron and sheet steel, double-cased and lagged. The baking sole-plate of each deck is formed of cast-iron frames with firebrick tiles bedded down with fireclay. The bottom elements are fixed under the soles but not in contact with them. The top and bottom elements are controlled by three-heat "Diamond H" snap switches. Provision is made for a steam jet. Two domestic cookers were also on view. The smaller has a total loading of 6,750 W, which includes a 1,600-W and a 1,750-W boiling plates, and a 1,600-W grill. The boiling plates can be of the open-coil or the solid types. The oven space measures 14 in. by 13½ in. by 12½ in. The construction is of cast-iron and mild steel, double-cased and lagged. The other cooker was similar in construction but larger, having a total loading of 8,200 W and three boiling rings. In this case the oven space is 16 in. in each direction. All the elements of both cookers are fitted with three-heat controls.

J. H. Tucker & Co., Ltd.

This company again showed a most comprehensive range of its varied manufactures. Among these was a new double-pole ironclad switch incorporating a quick-make, quick-break positive action. It is designed on sound mechanical lines, and the switch is rated at 15 A, 250 V, or 10 A, 500 V, and independent tests have demonstrated that it is capable of breaking 50 per cent. overload at 50 per cent. excess pressure. A combined switch and fuse is also available with similar switch action (fig. 14). An interesting feature is the provision for adaptors, which provide facilities for the use of screwed con-

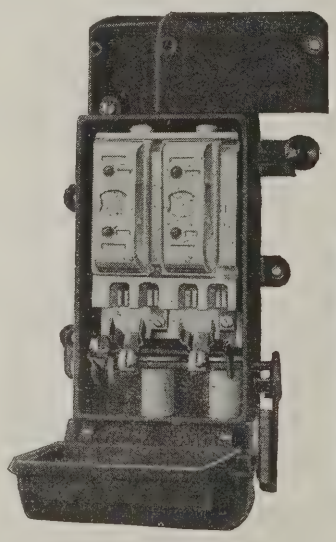


Fig. 14.—A New Tucker Switch-Fuse.

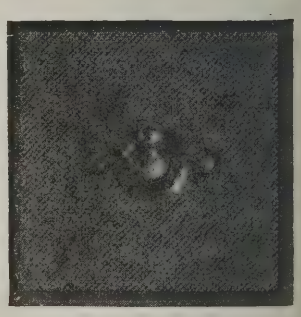


Fig. 15.—A "Telacite" Switch Plate.

duit. There was a new ironclad cut-out which is rated at 15 A, 250 V, or 10 A, 500 V, the efficiency of which is claimed to be of very high order, adequately complying with the short-circuit tests laid down by the I.E.E. The fuse handles are of the non-reversible, self-aligning type, fitted with a permanently fixed asbestos tube. The contacts are substantially made in phosphor bronze. A novelty in switchplates was shown. These were of moulded "Telacite," a material which is especially

suitable for the purpose. A novel method of fixing the plate to the switch dispenses with the need for switch rings. The surface of the plates is finely cross-cut, giving an attractive matt finish (fig. 15). As an "all insulated" plate, it has distinct advantages over glass, or other fragile material. The finish of the plate is dark brown. Adjustable grid boxes were shown in a variety of ways, and fitted with various accessories. Steel corner adjustment pins are now provided instead of brass, and the plates are secured by rings or corner fixing screws. Large quantities of these boxes have been recently used on important wiring contracts. Another new line was a quick-make, quick-break pear switch, the action of which is similar to the well-known "Tucker" push-bar lampholder. Since the last Fair was held, Messrs. J. H. Tucker & Co. have largely developed the heavy duty quick-make, quick-break switch, which was an outstanding feature of their exhibits a year ago. It is now available not only in 5-A and 15-A ordinary flat types, but also in semi-recessed, earthing types, locked covers, switch sockets, flush switches and practically in all types and patterns. A 5-A switch of this new type has successfully broken a load of 33 A at 250 V. Fuseboards and distribution boards in iron and teak cases in a wide variety of types, Home Office, channel, solid block, &c., and knife switches, power fuses, and gear for switchboard mounting up to 1,000 A formed an interesting display of the heavier products. Ironclad switches and combined switch-fuses, double- and triple-pole, up to 100 A were shown in several types, and there were also on view house service fuse boxes, ceiling roses, plugs and sockets, lampholders, switchplates, &c.

Rainsford & Lynes, Ltd.

The principal exhibits on this stand were Phillips's patent "Supersize" fittings for electric lighting, which are this company's latest product. These are constructed along rather original lines. A simple and ingenious arrangement of the stem of both the pendant and the wall brackets allows them

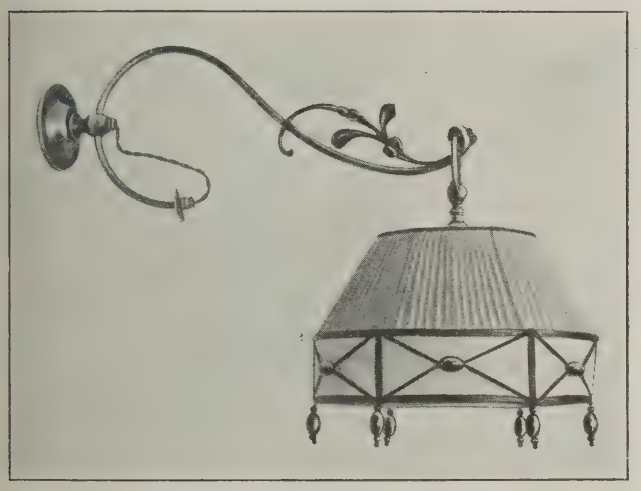


Fig. 16.—A "Supersize" Lighting Bracket.

a rise and fall movement, and also gives the wall brackets a lateral movement of 180 deg. This arrangement can be seen in fig. 16. The rise and fall movement puts no strain on the flex and requires no balance weight, so that shades of any weight or design can be used. The design of both the pendant and the wall bracket are very good.

Hart Accumulator Co., Ltd.

On the stand of this company was displayed a representative collection of products of interest to all classes of users of electrical storage batteries. For low-tension wireless circuits there were the types known as "Magno," "Enduro," and "RME." These cells are assembled in specially moulded pressed glass boxes, upon the insides of which are moulded ribs or grooves which extend almost to the bottom of the box, between which the plates themselves rest. This design obviates the need for bottom blocks, and the absence of these provides a larger space for the collection of deposit from the plates, as also for a greater volume of electrolyte. As an additional safeguard, these particular cells are equipped with corrugated sheet ebonite separators. The "RME" type is intended primarily for use with valves requiring considerable current. The general finish resembles that of the "Magno" and "Enduro" types, whilst the accumulator is also provided with connectors, manufactured from an alloy of non-corrodible metal, suitable for connecting several cells together when a battery is required consisting of a number of these cells. The "MEZ" type of ebonite accumulator is specially suitable for tropical climates in which the atmospheric conditions may make the use of celluloid batteries inadvisable. "Hart" high-tension accumulators were also exhibited. The container consists of a moulded glass box which is provided with grooved bottom rests into which the plates fit. The lid is of ebonite, sealed to the cell with a special compound, and when assembled into batteries the cells are connected to each other by connectors made from a non-corrodible alloy, which also serve as points of contact with a wander lead fitted with clip terminals. Both the positive and negative plates are covered with sheets of perforated ebonite, which completely envelop the plates, thus preventing any dislodging of the active material from the grid structures. Other exhibits included batteries for private house lighting, central station work, yacht lighting, &c.

Hewittic Electric Co., Ltd.

The d.c. supply for the Fair was converted from the Birmingham 5,000-V, 25-cycle supply by a mercury-arc rectifier equipment made by this company, upon the Corporation's stand. This had a capacity of 460 kW, and comprised a 280-kW equipment feeding into the outers, and a 180-kW equipment feeding into the inners of the three-wire d.c. system. This arrangement illustrated two types of equipment, as supplied for boosting (feeding across the outers) or for feeding into a three-wire system, and dealing with the out-of-balance load (inners). One of the developments which have taken place in connection with rectifiers has been in the means of voltage regulation. This used to be obtained by means of tapped auto-transformers controlled by tapping switches, the latter being operated either by a handwheel from the front of the cubicle, or by a motor, controlled by a pressure relay. This means is still employed, and gives every satisfaction, but on the larger units the company has adopted the use of an induction regulator controlling the primary supply into the step-down transformer which feeds the rectifier sets, as this method becomes then more

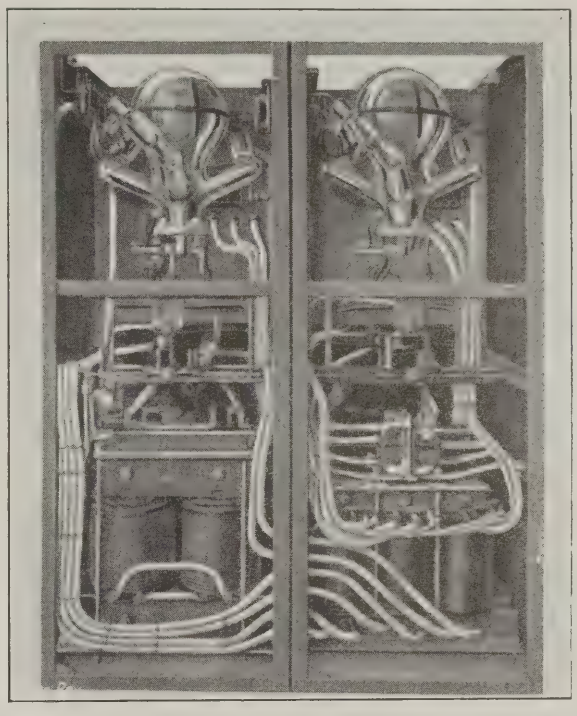


Fig. 17.—Hewittic Mercury-vapour Rectifier Cubicles.

economical, besides offering a finer means of regulation. While the rectifier first entered the field in connection with small sub-stations, it is now being used extensively for capacities up to 1,500 kW, and the company has a 2,000-kW sub-station which has been running for more than 12 months. The chief characteristic of the rectifier as a convertor lies in the fact that the plant is static, and it is simple and almost inherently automatic. It requires a minimum of attendance, and if it is desired to make it absolutely automatic either by means of pressure and current control, time switch, or remote control, the gear necessary entails a very small number of relays. Fig. 17 is a rear view of two typical light and power cubicles. On the company's stand various other products were exhibited. Among these were "Service Light" lamps for industrial lighting. These are divided into two kinds. Lamps with long tubes are used for normal workshop lighting, while silica lamps are employed for yard lighting and lofty buildings. "Service Light" is quite characteristic, giving a thoroughly diffused glareless light which, it is claimed, offers the nearest approach to daylight obtainable from a commercial illuminant. This results from the fact that the light is emitted not from a point source, but from a surface of considerable area. The lamps are also very efficient from the current consumption point of view; for long-tube lamps it is $\frac{1}{3}$ W per c.p., and for silica lamps it is $\frac{1}{4}$ W per c.p. All the lamps start automatically on the closing of the switch controlling their circuit. Owing to the high actinic value of mercury-vapour light, it is used by all the leading photographers for studio work, printing, enlarging, &c. Typical photographic outfits were displayed. The mercury-vapour light is also very rich in ultra-violet rays. The company exhibited the Hewitt-Levick "Ulviarc" lamp for radio-therapeutics, water sterilisation, testing of dyes,

treating of leather, and other purposes, as well as other medical lamps for similar purposes. Other exhibits were cabinets for testing purposes, a small water steriliser, and small rectifiers for battery-charging purposes.

John Harper & Co., Ltd.

Castings for electrical machinery were shown on this stand, a special display being made of castings for switchgear and instruments.

Imperial Engineering Co., Ltd.

This company had a comprehensive exhibit of its electrical appliances for domestic use. Noticeable amongst them was the "Imperial Senior" electric iron, which embodies a number of improvements. It is heavily nickel-plated, and the element is of high quality hard mica, wound with nichrome ribbon. The thumb rest is of green erinoid. Another appliance shown was the "Carlton" electric heater. This is an artistically-designed heater of the portable type, there being three elements with a four-sided sloping reflector. It is made of solid copper, highly polished, and mounted on a cast-iron pedestal. Four types of electric fire were also shown. Conspicuous amongst these was the "Midland" design, which is a handsome cast-iron front fire with a polished nickel-plated bowl, 12 in. in diameter, the element being of the spiral type. It is made in three loadings, and can be supplied with either oxydised copper or oxydised silver finish. Other exhibits on this stand included "Imperial" immersion heaters, and the "Imperial" toaster, which is made for all voltages.

Runbaken Magneto Co.

On this stand was exhibited, amongst other things, apparatus specially designed for automobile electrical repairs. One exhibit was a starter battery test meter. This is constructed on the principle that to form an opinion as to the state of a cell without first dismantling it, it is necessary to subject it to a heavy rate of discharge and a simultaneous voltage test, the voltage under these conditions varying in relation to the current discharging; an undue voltage drop during discharge can be taken as a positive indication of serious trouble. Thus it is possible to isolate a particular cell as defective. With this instrument a load up to 250 A can be applied at the time of testing, and a small inspection lamp is provided which, in addition to lighting up the face of the meter, gives an indication of the state of the cell. The meter, which indicates both volts and amperes, is of the moving coil type, and robust in construction. The prongs are of hardened nickel steel and are readily renewable. Another interesting exhibit was the "Runbaken" spotlight and portable lamp, which was recently described in this journal.

Rawlplug Co., Ltd.

The principal exhibit of this company was a comprehensive range of "Rawlplugs," which are too well known to require describing here. Every size, ranging from ½ in. to 4 in., was shown, together with the accompanying "Rawldrill." A more recent line exhibited was the "Rawlplug" bolt anchor, an invention which enables exceedingly strong fixings to be obtained for bolts in practically any kind of hard material. It is constructed from specially chilled iron in combination with lead, and is so formed that when fixed in position upon the head of a bolt, the chilled iron section forms a series of struts between the bolt-head and the walls of the hole, the result being that it is impossible to withdraw the bolt until the walls of the hole itself actually break away or the bolt fractures. In actual tests a ½-in. diameter bolt used in conjunction with a bolt anchor sunk in concrete has withstood a pull of about 3½ tons. It is unaffected by atmospheric conditions, and can be safely fixed under water when necessary. Another new line shown was "Durofix." This is a new kind of adhesive possessing the property of resistance to both heat and water; it is ready for instant use without first warming. It is strongly adhesive, and, since it is colourless, invisible joins can be made with it.

Jackson Electric Stove Co., Ltd.

This company had a display of eight electric cookers, ranging from the "No. 18" model with a maximum loading of 2.8 kW, to the "No. 24" model with a maximum loading of 8 kW, and capable of catering for 10 to 14 persons. All these models are designed on the same principles, the only difference being in the size, and the addition of certain accessories. The chief point of interest is the boiling plate, to which the makers attach considerable importance. This is of the "fully-protected" type, for which a patent has just been granted. A channel-shaped reflector of aluminium alloy carries the fireclay supporting pieces, and these, together with specially shaped fireclay end blocks, are held together by removable rods, which serve also to support the element in position under the cooker hob plate. The heating spirals are laid in slots in the fireclay blocks, and, to prevent sagging between these supports, fireclay rods are threaded through the spirals. Over the top of the element is fitted an inverted shallow metal tray, which provides full protection against spilt liquids and foodstuffs coming into contact with the spirals. These protecting covers are attached to the cooker hob, and access to the element can only be obtained from the underside by raising the hinged hob plate. All the metal parts of the element, with the exception of the terminal nuts and bolts, are of rust-proof, non-corroding alloys. Other interesting exhibits on this stand included electric wash boilers (which are supplied with the "Perco-Wash" spraying device), bath water heaters, hot water tanks arranged with a continuous low loading and with or without boost or thermostatic control, breakfast cookers, fires, kettles, &c.

Berry's Electric, Ltd.

This year the company had two separate stands. One of these was covered in to provide semi-darkness, in which a number of "Magicoal" fires could be seen to the best advantage. The other stand was mainly devoted to switchgear. A prominent feature was a "Viking" ironclad switchboard; this type of board has open access to the bus-bars and can easily be extended. There were also examples of interlocked foolproof circuit breakers and fuses, including a 3-pole, 200-A pattern. Switches of the "Firimine" and "Firadanac" type were shown; as their names imply, these are designed for colliery use. A section of the stand was given up to "McLary" cookers," the manufacture of which the company is undertaking. In this type of cooker the oven elements are plugged in, while the hot plates are removable bodily, being also of plug-in design. Other points are a separate socket for an iron, a door thermometer and three-heat snap switches for all the elements. The exhibit also included instruments by Messrs. Nalder Bros. & Thompson, Ltd.

Hendon Electric Lamp Co., Ltd.

Examples of "Hendon" lamps, lampholders, and switches were shown, among the apparatus being the "Unique" shade carrier. This is designed to replace the ordinary shade ring which with many types of fittings is very difficult to manipulate. The carrier consists of two rings, between which is a strong helical spring. The upper ring actually retains

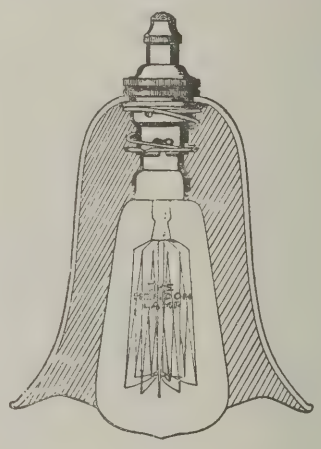


Fig. 18.—The "Unique" Shade Carrier.

the shade in position; a lug on the lower one engages in the lamp slot. For this purpose the slot has to be cut extended the opposite direction. This, of course, necessitates a special form of lampholder which the company provides. It also supplies a special tool by means of which the ordinary pattern of lampholder can be cut in the necessary manner. The carrier is slipped over the lower part of the lampholder, and when the lug on the bottom ring engages in the slot the top ring presses against the shade and is kept in position by the spring. The device is illustrated in fig. 18.

Holden & Hunt.

One of the principal attractions at this stand was the automatic wire-bending machine, which, with the chain welder, was seen making chain direct from wire. This was the No. 2 size, which is capable of forming ordinary and block chain from wire up to 5/16 in. diameter at the rate of 50 links a minute. The bender, which is of massive construction and well proportioned, was driven by a 2-h.p. motor. Another exhibit was the double-headed rivet heater, which has several unique features. The machine is rated at 25 kW and is capable of heating 200 ¾-in. diameter rivets per hour, the time for other sizes being in proportion. In addition to the No. 3 size universal spot welder, there was shown a larger size of spot welder. This was the No. 4 size, which has a rating of 25 kW, and is capable of welding iron and mild steel up to ⅜ in. added thickness on repetition work, or ½ in. added thickness occasionally. The No. 3 size is a 12-kW machine and will weld up to ¼ in. added thickness on repetition welding, or 5/16 in. occasionally in iron and steel. These spot welders are free from any risk of electric shock, and even during the progress of welding all exposed parts can be handled freely. An automatic trip switch of simple design and having a wide range of adjustment is fitted, the renewable contacts being made from non-arcing metal. The heating speed is controlled by means of a four-way regulator, whilst the water-cooled electrodes can be fitted quickly and easily with renewable tips of varying

shapes to meet different requirements. A well-designed example of hand-operated butt welding machine was also displayed. This is intended primarily for heavy jobbing work and is capable of welding up to 1 square inch section. It is rated at 30 kW, and is designed on principles of strength, easy adaptability for undertaking a wide variety of work, and extreme accuracy of alignment under the heavy "upsetting" pressure required. The machine is water-cooled throughout, and the "upsetting" pressure is applied by means of a powerful eccentric cam designed to give the pressure in a direct line with the required "upset" and to prevent any twisting or unbalancing force from acting on the slide. The switch is foot operated, and the heating speed is controlled by means of a three-way regulator. The application of butt welding to light engineering work such as joining lengths of wire together, welding nickel pins to steel shanks for sparking plugs, &c., was illustrated by the No. 2 size wire welder. This machine, which is rated at 4 kW, is very sensitive and efficient, being capable of welding iron and steel (mild or high carbon) up to 5/16 in. diameter, brass and similar alloys up to 3/16 in. diameter, and copper up to ⅛ in. diameter. A heavy cast-iron body completely enclosing the high-pressure parts is carried on a rigid cast-iron stand, the whole being mounted on wheels. A ½-kW bench wire welder was also shown.

Dundee Electrical Repairs Co., Ltd.

This company exhibited a control pillar for d.c. motors, comprising a d.p. isolating switch, two s.p. overload trips, with time-lag device, two s.p. contactors, starting switch and shunt field regulating switch, all mounted on an enamelled slate panel enclosed in a sheet-iron case. The starting switch eliminates pitting and burning of the short circuiting brushes and resistance contacts. This is accomplished by the introduction of a second moving brush capable of carrying the main current. By a simple method, this second moving brush is prevented from carrying any current at those periods when it bridges any two resistance contacts; hence there is no overloading of the brushes and contacts. The starting switch and shunt regulating switch are moved horizontally through a screw and nut, the handles projecting through the right-hand side of case and also that of the isolating switch. Two push buttons are provided on the front of the panel, one for "inching" and the other for stopping. The shunt regulating switch is electrically interlocked, so that the motor will not start up on a weak field.

International Combustion, Ltd., and the Underfeed Stoker Co., Ltd.

Upon this joint stand were several examples of pulverised fuel and other boiling firing equipment. Among these were a model "Raymond mill," complete with cyclone separator, for use in power plants for pulverising coal and for the grinding of many other materials; a "Lopulco" feeder of new design and a section of a "Lopulco" combustion chamber, showing arrangement of the Murray walls; Murray fin-tubes, the fin of one tube being staggered in relation to that of the next tube, and taken up to (wooden) headers; an "Usco" unit pulveriser, in which the fuel is treated by causing the particles of coal to come into contact with each other at a fairly high speed; an "Usco" air heater, consisting of a series of hollow elements inside of which flows the air to be heated, whilst around them flow the flue gases, in a contrary direction; impelled draught furnace fronts, a sort of "half-way house" between hand firing and mechanical stokers; and a "H" stoker with several new features.

Callender's Cable & Construction Co., Ltd.

This stand was arranged to show the company's capabilities in the way of providing apparatus for dealing with power in large quantities as well as in smaller (domestic) quantities. A special feature was made of the "Kaleeco" wiring system, and samples were shown of the special fittings and wire used. Among the principal points of the latter are a special earthing wire laid beneath the metal sheathing, and the entire absence of hygroscopic tapes. Many samples of cable were shown, and a large part of the stand was occupied by typical transformer kiosks, which are made for pressures of from 3 to 11 kV. The l.p. panels were fitted with enclosed fusegear. The bodies are either of cast iron or all steel. Other exhibits were telephone cable, a 33,000-V trifurcating box, house-service boxes, "Fors" accumulators, and "Kalanite" insulating material.

Electric Heating and Hardware, Ltd.

This company exhibited an electric cooker designed along new and improved lines. In this the general wiring system is extremely simple, there being three solid terminals only passing through the lagging. These are protected by distance tubes and insulated from any moisture that may accumulate. The fuse-box is roomy and easily accessible, and all fuses and connections may be examined by sliding down the outside panel, which is secured by a wing nut. The insulation consists of steatite bushes throughout, no mica being used. The heating elements are of special design, being made up of small steatite formers built on racks, or grids. Each element is easily detached and is interchangeable, contact being made direct with bus-bars. Four elements are fitted on either side of the oven, and also two for bottom heat when required. Consequently, the elements cover practically the whole superficial area of the inner body, giving good distribution of heat at any loading.

Hackbridge Electric Construction Co., Ltd.

The principal exhibits on this stand were two large transformers, the first being a 2,000-kVA, three-phase, 50-cycle, 11,000-V oil-immersed self-cooled transformer, and the other a 250-kVA, three-phase, 50-cycle, 6,600-V, oil-immersed, self-contained pattern. Both transformers were of modern design and construction, and embodied many of the latest improvements. Another exhibit was a complete automatic voltage-regulating equipment, comprising switchgear and transformers connected up and operating, the switches being of the contactor type. There was also a display of transformer construction and assembly details, and a noticeable exhibit was the "Hackbridge" tapping switch, which represents a great advance in transformer tapping-switch design. Other plant displayed consisted of a standard tubular tank with rounded ends, and a standard type of mining tank.

Excelsior Shade Manufacturing Co.

This company, which reported good sales during the Fair, had a very comprehensive display of its latest designs in lamp shades. These vary in size from the small shade for a bracket to large and expensive shades for pendants. The fittings are of silk flounce over wire, constructed in the usual manner, while some of the heavier types are made with rings of oak or mahogany to match furniture. Beads and other types of decoration also play a prominent part in the designs.

I. Calvete, Ltd.

This company exhibited at both sections of the Fair. Its Birmingham display comprised ultra-violet apparatus, vibrators, and other electromedical apparatus. Radiant therapy lamps of various types were shown, and there was also an "Icall" blower incorporating a heating element. One novel feature was a combined massage and hair-clipping apparatus, in which the change of function was arranged for by changeable heads upon a flexible shaft.

Camille Espir.

This stand, although small, bore a beautiful display of decorative electrical fittings. These were of several kinds of material, such as "Erinoid," synthetic resin, "Celastoid," and wood, and included standards, pear switches, switch plates, ceiling roses, &c. Emphasis was laid upon the fact that all the electrical fittings for a room, from the switches to the lighting fittings, could be produced in the same design, a very unusual thing.

Thermo Path Co., Ltd.

Examples of the "Merocol" screen fire, described a short time ago in the Electrical Review, were exhibited by this company. These, it will be remembered, are fire screens with a boss-type electric fire which, when not in use, can be covered in with an ornamental plate. Other types of electric fire were also shown, in addition to artistic floor and table standards for electric lighting, the "Windsor" electric oven, &c.

New Conveyor Co., Ltd.

One of this company's exhibits was a foundry sand-recovery plant, shown working. Driven by a 4-h.p. electric motor, this equipment comprises a band passing over two drums, one of which is of the electro-magnetic type made by the Rapid Magnetting Machine Co. This separates out the metallic particles from the sand, which passes to a jigging screen, from beneath which the sand is recovered.

Electrical Power Engineers' Association.

This exhibit drew attention to the beneficent work of the National Joint Board, to which the Association is a party, emphasising the important work of the board, particularly in respect of the training of electrical power engineers. In addition, the educational work of the Association through technical lectures and by articles in its *Journal* was stressed.

Electrical Power Engineering Co. (Birmingham), Ltd.

Motors, lighting plant, and pumps were shown by this company. The lighting set was of the "Warwick" type suitable for small country houses. A battery-charging set was shown, as well as an electric motor provided with "Fabroil" reduction gear.

Tubes, Ltd.

On this stand were exhibited various type of weldless steel tubes, boiler tubes, and steam pipes for high-pressure work, both for marine and power-house use. The boiler tubes are manufactured to meet various naval and marine specifications and requirements.

Young, Osmond & Young, Ltd.

This company again displayed short sections of its "Lightfoot" and "Unity" heating apparatus. This is of the tubular type with low, distributed loadings, the wires being enclosed in metal tubes for mounting along skirting boards, &c.

The "Ideal Home" Exhibition.

A review of the electrical features of this year's show at Olympia, London.

VISITORS to the Ideal Home Exhibition at Olympia, London, this year are finding that it has again surpassed the shows of the previous years in the collection of new methods and ideas for the housewife. Olympia itself is transformed with fresh decorative schemes, and a new mezzanine terrace is found at the end of the main hall. An attractive feature is a scene of rural charm in the new hall where a flower-fringed village stream borders a picturesque group of full-size furnished houses, one of which, a Tudor mansion, is the largest house ever built inside Olympia.

In the main hall a fountain court forms the centrepiece of a display of electrically lit furnished rooms, and the art of landscape gardening again transforms the annexe into a fascinating spectacle of spring. Another feature of interest may be seen in the Hall of British Handicrafts in the gallery, where the operation of a variety of old crafts is shown.

Our Dominions are represented by a great display staged by the Empire Marketing Board in the new hall gallery, where there is also a vast array of exhibits of other British commodities for replenishing the larder.

In connection with the lighting of Olympia this year for the Exhibition, some shades are in use which are believed to be unique in some respects. Fig. 1 is a general view of these.



Fig. 1.—Large Electric Light Shades at Olympia.

There are 20 all told, and they are each 14 ft. in diameter and 16 ft. 6 in. high. Each is constructed on an iron framework, weighing about 3 cwt., which is covered with ordinary good-quality bed sheeting, hand sewn on to the frame work with special twine and copper wire. The outside and inside are dyed and painted respectively, orange and blue, the whole being efficiently fire proofed. The framework was made in sections at the workshops of the makers, Messrs. Walford Art Co., London, and assembled on the site. The shades are each equipped with two or three outside-type 1,000-W fittings, those already installed in the building, so that the illumination from each shade is four or six thousand c.p.

The shades are placed 55 ft. above the floor, measuring from the bottom of the shade. Each is carried by an 8-in. ring, by means of chains, and is suspended by two ¼-in. steel wires from the roof girders. Twenty fittings fixed above the shades illuminate their exterior, and result in a pleasing effect. The contractors for the work were Messrs. William McGeoch and Co., Ltd.

It is encouraging to note that the electrical industry is fairly well represented this year, although it is a pity that the Electrical Development Association has not found it possible to take part in the show as in previous years; on the whole credit is due to the electrical firms for their displays. It is also interesting to note that there is a general spirit of co-operation among the electrical firms in order to more effectively compete with the gas industry, which, by the way, is obviously making very great efforts. A new introduction is that of ultra-violet apparatus, which is not only shown by electrical firms, but is included in some of the general exhibits, of the more luxurious nature, as modern bathroom equipment. There is also the exhibit by the Zoological Society, London, of a working-model section of the new monkey house which is being constructed at the "Zoo." A portion of the cage is roofed with "Vitaglass" to admit the ultra-violet from high-c.p. incandescent "Lamplough"-glass lamps. An electrically heated floor serves to keep the animals warm.

The following is a brief summary of the electrical exhibits:—

Reliance Telephone Co., Ltd.

The wide scope of the telephone and the degree to which it can be used to save labour is clearly demonstrated at this stand, where an all-British display shows that internal telephone communication is no longer the prerogative of offices and large hotels, and that it can be conveniently installed in clubs, flats, nursing homes, and private houses. On the Reliance service telephone system shown, calls can either be made from any floor or room to one central point, or, alternatively, the installation can be arranged so that every instrument can call directly every other instrument without the assistance of a switchboard operator. The Reliance auto-intercommunication system is somewhat similar, but is designed particularly for use in smaller offices, works, banks, hospitals, and so on. The Peel-Conner private automatic exchange telephone systems are represented by a 25-line and a 50-line Peel-Conner P.A.X. exchanges. The design of these allows for the incorporation of such special facilities as executive control, secretary's service, firm-alarm service, conference lines, and general code calls.

Belling & Co.

As might be expected, the outstanding feature of the exhibit by this firm is a comprehensive range of "Belling" electric fires. Included in these is a series of four imitation coal fires which have not yet been marketed. The multi-parabola fire-bar feature, common to the electric fires made by this firm, is being utilised in these new models, but to meet the different design requirements it is being made up in another form. The latest type of boiling plate adopted in the electric cookers by the company may be seen. It is a modification of the makers' "Honeycomb" plate (Electrical Review, November 27th, 1925, p. 846). The fireclay through which the element spirals are threaded is now solid in one piece, and the bottom side of it is drilled so that small portions of the elements are exposed on this side. A feature of the new "Belling" cooker is its stainless-steel linings to the oven. A new model of the makers' cookerette is also exhibited. This is now made up as one unit, and a drop-down door is provided for the grilling chamber under the oven. For cooking demonstration work on this stand an ammeter graduated to show the consumption price per hour is proving attractive.

Francis Polden & Co., Ltd.

This firm is showing a complete Armstrong-Whitworth country-house lighting set of 1½ h.p. This is equipped with a "Wico" magneto, a separate model of which is shown working satisfactorily with water running over it. A recent introduction to the "Creda" cooker is also to be seen here; this is equipped with a white enamelled hob, and it is claimed that the special enamelling used stands up to the heat particularly well. Amongst all manner of lighting fittings, into which a very fine colour scheme is worked, are a number of triple-jointed bracket lamps, suitable for the local lighting of difficult spots, such as is required in dentistry.

Dowsing Radiant Heat Co., Ltd.

A variety of unusual electrical appliances may be seen on this stand. A number of bowl fires permanently and vertically set in cast frames are shown; also a combination of three bowl fires arranged triangularly on a framework, each bowl being arranged for tilting either up or down. An interesting exhibit in connection with electro-medical apparatus is the "Ultradescent." This provides both ultra-violet and heating, being equipped with tungsten filament and heating lamps. It is in the form of a polished-metal shroud for bed treatment. Various types of ultra-violet arc lamps and high-frequency apparatus are also shown.

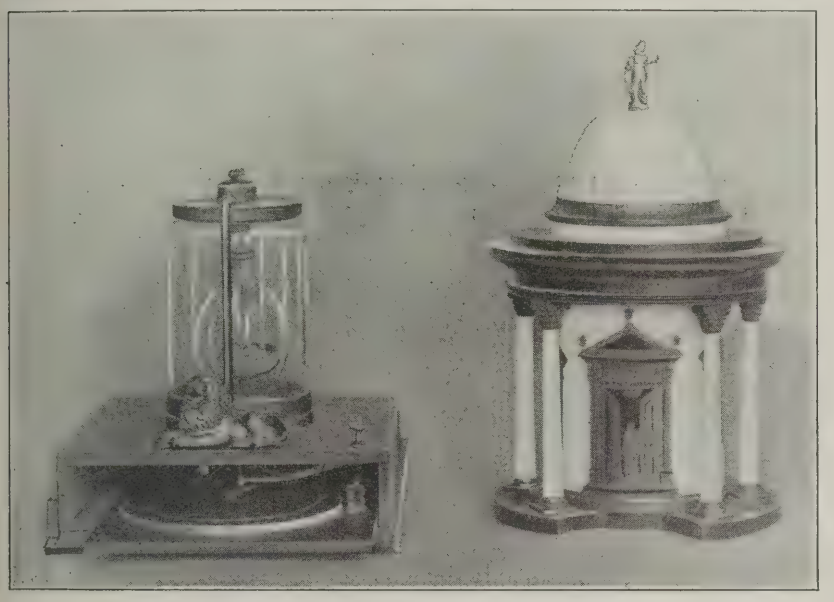
(*To be continued.*)

Illuminating Engineering.

Conditions governing good lighting: some street-lighting problems.

(*Résumé of Proceedings before the* Institution of Electrical Engineers.)

THE ordinary meeting of the Institution of Electrical Engineers on March 3rd was preceded by a demonstration in the Common Room, by Mr. Ll. B. Atkinson, of a very old electro-pneumatic lamp. It consists of a glass vessel (fig. 1) wherein hydrogen gas is generated by the action of acid on zinc: on a lever being depressed, a jet of gas is liberated and simultaneously ignited by a spark from an electrophorus contained in the wood base of the instrument. The whole is housed within a decorated porcelain container (fig. 2) representing a "Temple of Venus," and is in an excellent state of preservation. The device was patented in 1807, and was made in Germany; it has been in the possession of Mr. Atkinson's family for over 100 years, and is an extremely rare specimen of its kind.



Figs. 1 and 2.—An Electro-pneumatic Lamp and Cover (right).

Two papers were presented (one of which is abstracted below), and a discussion followed, during which a draft B.E.S.A. specification for street lighting was outlined. Mr. H. T. Harrison's paper will be summarised in a forthcoming issue. Several different makes of photometer were exhibited.

Illuminating Engineering.—(*Abstract.*)

By John W. T. Walsh, M.A., M.Sc., A.M.I.E.E.

The wide range of subjects, physics and engineering, physiology and psychology, coming within the purview of the illuminating engineer is pointed out. A brief *résumé* of the recent rapid progress in illumination is followed by a description of fundamental principles, in particular the use of the modern conception of luminous flux in illumination calculations.

What is emitted by any source of light is radiant energy in the form of waves capable of being appreciated by our eyes as light. The eye appraises this energy variously according to the wave-length in which it is conveyed, the maximum visual effect being produced at a wave-length of 555 millimicrons. Thus by appropriately weighting each wave-length, the rate of energy emission from a source can be expressed in terms of visual effect, or luminous flux. The lumen is defined as "equal to the flux emitted in unit solid angle* by a uniform point source of one international candle." If a point source of which the luminous intensity is 1 candle in every direction be placed at the centre of a sphere from which there has been removed an area equal to the square of the radius (fig. 3), and if all reflected light be neglected, the light flux which escapes from the opening in the sphere is equal to 1 lumen. If, now, the unit source be replaced by one having a luminous intensity of I candles in every direction lying within the cone shown shaded, the flux emitted within this cone is I lumens, and equally so if the *average* luminous intensity in this cone be I candles. Since the area of the whole surface of a sphere is $4\pi r^2$, the luminous flux emitted by a source is equal to 4πI, where I is the luminous intensity if this is the same in all directions, or the average luminous intensity if the distribution be non-uniform (the practical case). This average luminous intensity in all directions in space is often termed the mean spherical candle-power, so that the luminous flux output in lumens is equal to the mean spherical candle-power multiplied by 4π.

The conception of luminous flux leads to a most convenient definition of illumination: if the luminous intensity of the source be 1 candle and the radius of the sphere 1 foot, the illumination of the interior surface of the sphere (reflected light being neglected) is everywhere equal to 1 foot-candle; but the area of the surface defined by the shaded cone is in this case 1 square foot, and the flux reaching it is 1 lumen; therefore, the illumination of a surface may be defined as the flux density, or flux per unit area, reaching that surface, the foot-candle thus being equal to 1 lumen per square foot.

Values were formerly invariably calculated by means of the inverse-square and cosine laws; now, however, the more usual procedure, at any rate in planning a general lighting system, is to multiply the area to be lighted (A square feet) by the illumination (E foot-candles); the useful flux required is thus AE lumens. A "utilisation factor" U is then applied to convert the "useful" lumens to the lumens actually emitted by the lamps. The value of the factor U ranges from about 0.2 to 0.6 according to the shape of the room to be lighted, the tone of the internal decoration, and the system of lighting employed. The luminous flux output required is thus AE/U and the number and rating of the lamps is chosen accordingly.

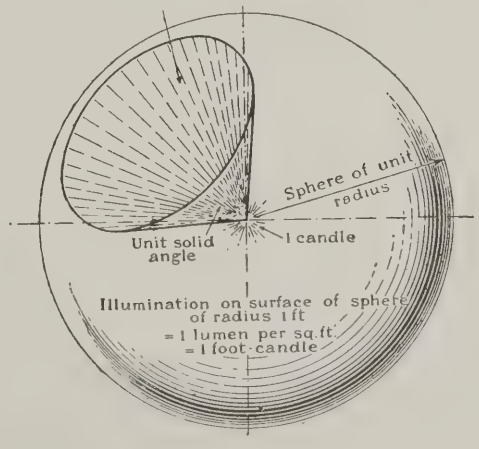


Fig. 3.—Area of Surface of Sphere of Unit Radius = 4π = Total Flux of Light from a Source of Unit m.s.c.p.

The photometric bench used for the measurement of candle-power, *i.e.*, the comparison of the luminous intensities of two sources of light in a fixed direction, is still the basic instrument in light measurement. The photometer head may take many different forms. All depend ultimately upon the capacity of the eye to judge when two contiguous surfaces presented to it are equally bright. The precision with which this judgment can be made governs absolutely the precision of all photometric measurement. The governing factor, then,

* The unit of solid angle, sometimes called the "steradian," is the angle subtended at the centre of a sphere by an area of the spherical surface equal to the square on the radius.

is psychological and not physical and is subject to the limitations of perceptual phenomena. The curve relating the lowest perceptible contrast in percentage ($100\delta B/B$) with absolute brightness for white light (actually the light of a flame lamp) is shown in fig. 4. The governing factor is not the brightness of the field looked at, but the brightness of the image formed on the retina; as the pupil of the eye enlarges at the lower values of field brightness, it would be unsatisfactory to plot values of field brightness as viewed by the eye with the natural pupil. The scale of abscissæ is therefore a scale of field brightness when the eye is covered with an artificial pupil having an area of 1 mm².† In ordinary photometric work the natural pupil is used up to a limit of about 10 mm² (the area of the artificial pupil in the usual Lummer-Brodhun head). A second scale of abscissæ has therefore been added to show the actual field brightness under normal working conditions *assuming an average value for the pupillary aperture at each brightness.* The quantitative effect of colour

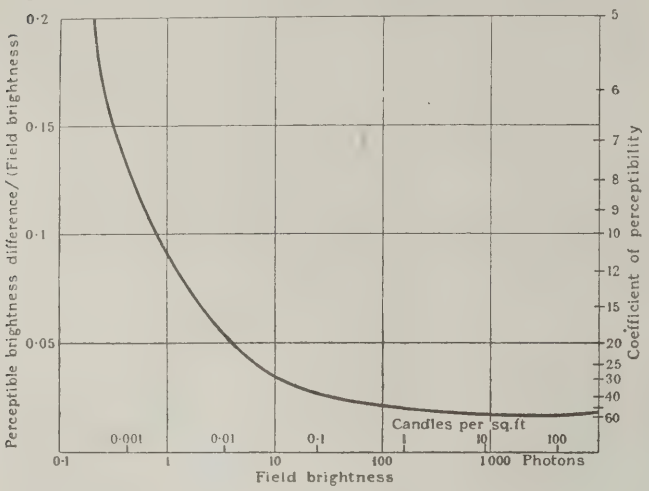


Fig. 4.—Variation of Contrast Sensitivity with Brightness.

difference has not been extensively studied, and no doubt it, like the other factors influencing an equality judgment, must depend markedly on the individual.

Essentially, there is no difference between the head used on a bench for the measurement of luminous intensity and the portable photometer used for illumination measurements. However, one class of illumination measurement demands special consideration; in streets, the light is incident at a small angle with the horizontal, especially at the point of minimum illumination. Large errors are therefore almost inevitable if any attempt be made to measure the illumination of a horizontal plane at this point in the ordinary way. The only satisfactory method of finding the horizontal illumination is to place the test surface so as to face each lamp in turn, and to measure the "normal" illumination due to that lamp in the ordinary way. The horizontal illumination can then be found by multiplying the value so measured by the sine of the angle which the light makes with the horizontal. Since this angle is usually small, the sine of the angle varies approximately as the angle itself, so that an accurate determination of the angle is essential. For street-lighting work, therefore, it is necessary to have, in addition to the photometer, a device for determining the angle which the rays from any light source make with the horizontal. Sometimes such a device is fitted to the photometer itself. In the new Holophane instrument it takes the form of a skeleton telescope and angular scale; when the instrument is levelled, the image of the source is focused on the cross-lines and the angle required is then read on the scale attached to the card-holder. The values of partial horizontal illumination thus calculated for each lamp are added to find the total horizontal illumination.

The brief description (in the paper) of some of the instruments used for the measurement of illumination, and of the errors inherent in this type of measurement, suffice to indicate the order of accuracy attainable in normal practice. With a satisfactory instrument, recently calibrated and carefully used, the precision may probably be put at about 8 to 10 per cent. for field work at normal values of illumination (1 foot-candle and upwards). As the illumination is reduced the precision falls, until for work in illumination of the order of 0.02 foot-candle (the illumination due to the full moon, a value not uncommon in street lighting) a precision better than 25 per cent. can hardly be hoped for.

Conditions Governing Good Lighting.—The factors governing design may be divided broadly into two main classes: the illumination must be *adequate* and the lighting must be *suitable*. The tendency to concentrate on adequacy without similar attention to suitability is a serious mistake: it is an easy matter to draw up a schedule of the illuminations considered necessary for different places or classes of work, and often nearly as easy to draw up a lighting scheme to give this necessary illumination, but careful consideration of the special requirements of each system as regards the placing of the light sources, the use of suitable shades or reflectors, the best scheme of interior decoration and the possible advantage of using light of some special colour, demands much more care, much experience, and constant touch with the rapid developments now taking place in the design of lighting equipment.

(*a*) *Adequacy.*—No excuse, then, is made for passing over "adequacy" in a few lines. Most books on illuminating engineering give tables of foot-candle values recommended for different purposes; in the author's personal opinion, however, the values given in such tables should be regarded as minima. Values double, or even treble, these can be employed with advantage in nearly every case, but always with the proviso that the system is planned with due regard to the principles explained in the paper. Most people will gladly work in daylight, which is often 5 or even 10 times as great as that they consider to be too high in the case of artificial light. The fact is that, generally speaking, the conditions under which daylight is received are immeasurably superior to those to which we are accustomed in the case of artificial lighting. Once again it is a matter of "suitability." The governing factor in determining visibility is not illumination, but brightness; therefore, in general, where the work is normally dark in tone, the illumination should be at least three times that allowed for in the tables of illumination values referred to above.

(*b*) *Freedom from Glare.*—Quantity of light is useless, or even harmful, unless it be properly distributed. The considerations which determine the suitability of any lighting system may be divided as follows:—

(*a*) Freedom from glare and from excessive contrast in the field of view.
(*b*) Adequate, but not excessive, diffusion.
(*c*) Correct colour.
(*d*) Correct proportion of local and general lighting.

Much has been written on the subject of glare, but very little that has materially advanced our knowledge of this complicated phenomenon. Glare is closely related to "ocular adaptation," and the remarkable constancy of the least perceptible brightness difference which, as can be seen from fig. 4, exists for a range of field brightness from 0.3 to 300 candles per square foot, is a striking example of the extremely wide range over which the eye is capable of almost complete adaptation. However, (*a*) values of field brightness often met with under artificial lighting conditions lie outside this range of complete adaptation, and (*b*) adaptation, even within a restricted range of brightness, is very far from instantaneous. The time (several seconds) taken for adaptation of the eye is, at least, a contributory cause of "successive glare," *i.e.*, the reduction of visual efficiency which results from allowing the eyes to view a bright source and so become adapted to a brightness level higher than that of the normal working field. The assumption that, as long as there are no sources of light situated in or close to the normal line of view, the lighting system is free from glare is very far from being correct. The eye almost certainly will wander over the whole room up to a certain angle of elevation. The first rule, therefore, for the avoidance of glare deals with the angle

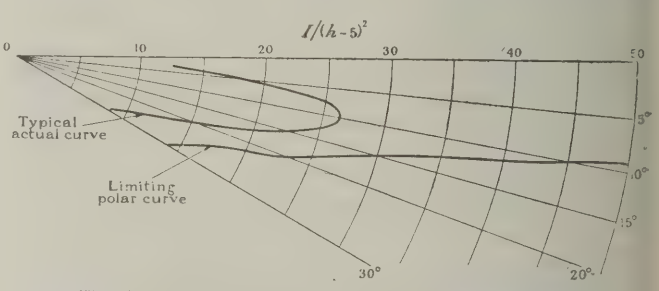


Fig. 5.—Limiting Polar Curve for Street Lighting Fitting.

of cut-off and may be stated thus:—"In any lighting system every light source or other bright surface visible to the eye should have an angular elevation of at least 20 deg., and preferably 30 deg., when viewed from any normal working position."

It has frequently been stated that the limiting brightness tolerable in the field of view is about 3 candles per square inch, and the definition given in the Factory Lighting Committee's report is 5 candles per square inch. Under normal daylight conditions the working illumination is usually much higher than that provided by artificial light, and it may quite well be the fact that to an eye adapted to a working illumination of 20 or 30 foot-candles, a brightness of 3 candles per square inch does not produce any noticeable glare. To the same eye adapted to a working illumination of one-tenth this amount, however, such a brightness in the field of view may produce a very distinct diminution of visual efficiency. The truth is that glare is a continuous phenomenon: it increases with the size as well as with the brightness of the glaring source, and it decreases progressively as this source is removed further and further from the line of fixation; all these conditions being fixed, it decreases as the brightness of the

† A field brightness of 1 candle per m² viewed through a pupil of 1 mm² area gives a retinal illumination of 1 photon.

normal field of view increases. The ideal conditions are those in which there is nothing in the field of view (*i.e.*, less than 30 deg. above the horizontal) brighter than the object requiring attention.

It might be thought that the ideal could easily be achieved by concentrating light on the point of work by means of some local fittings, leaving the remainder of the room in complete darkness, but this is a most undesirable arrangement. When the two fields differ markedly in brightness, the visual efficiency is lower than when both have a brightness equal to the smaller of the two previously employed; thus, when the brightnesses of the two fields are respectively about 7 and 0.3 candles per square foot, the visual efficiency is less than when the brightness of both fields is 0.3 candle per square foot. There must, then, be a further rule that the general level of illumination in the field of view should not be too low in comparison with that of the object requiring attention. The data available on the subject are really insufficient to indicate a figure for the greatest permissible ratio, but it is almost certain that one-twentieth is an outside limit, while one-tenth or even one-fifth is to be preferred. It should not be concluded from the two rules just given that a dead uniformity of brightness is to be aimed at. Moderate contrasts are pleasant; they are in fact the means by which the features in any scene are recognised. If it be allowable to take the contrasts commonly met with in nature as a guide, ratios not exceeding one-tenth are suggested, since the brightness of a grass field is approximately one-tenth that of the sky above it. Absolute uniformity of brightness in the visual field, if attainable, would be most tiring, since the eye would constantly be searching for relaxation and failing to find it. Once again, however, it is necessary to remember the distinction between brightness and illumination.

In every case the fight against glare must be waged with the utmost vigour. To say that surfaces having a brightness of 3 candles per square inch or over must not be tolerated in the normal field of view, may sound like a counsel of perfection to-day. The author ventures to prophesy that in 10 years' time it will be as much a truism as is the statement now that a bare electric lamp should not be visible in any properly lighted room.

(*c*) *Adequate Diffusion.*—The unpleasant effect of the hard shadows cast by a single source of light of small superficial area is familiar to everyone, but an almost complete absence of shadow, although suitable for a few purposes, such as drawing-office work, is most inconvenient for other work, such as sewing, for it is only by means of the shadows cast by the individual threads that the texture of the material can be seen. Each of the three systems, direct, indirect, and semi-indirect, has its own field of usefulness. The brightness of the diffusing material used for the bowls of semi-indirect fittings is generally of the order of 1 to 3 candles per square inch, and it is therefore sometimes concluded that there is no disadvantage in having such fittings within the normal field of view, but this is not the case and such fittings should be hung as high as is permissible.

(*d*) *Suitability of Colour.*—Deliberate colouration of the light involves the sacrifice of some part of the available flux. There is no doubt, however, that for certain purposes a modification of the colour of the light given by the lamps may be of very great advantage.

(*d*) *Correct Proportioning of Local and General Illumination.*—It is sometimes desired to have a very high illumination (of the order of 20 to 50 foot-candles) at the point of work in such fine processes as watchmaking, engraving, &c., and the only solution of the problem is to supplement the general illumination with local lighting. The contrast between the high level of brightness at the point of work and the comparative darkness of the room in general will cause a certain loss of efficiency, but this must be faced; it can be minimised by having the general illumination as high as possible, and in no case less than one-tenth of the illumination provided by the local lighting.

Street Lighting.—It has not yet been decided whether it is more important to illuminate the vertical surfaces of objects in a roadway, or the horizontal surface of the road itself; both are concerned in rendering objects visible to the driver of a vehicle. An object must be seen by contrast with the road surface which forms its background. The brightness of this background is almost certainly variable from one part to another, and the higher the general level of brightness, at least up to a limit of 0.7 candle per square foot (a level much higher than that met with in any street) the more sensitive is the eye to small differences of brightness (see fig. 4), *i.e.*, the smaller the contrast detectable. The conclusion that excellence in street lighting could be achieved by having as high an illumination as possible, with an adequate diversity of brightness so as to ensure a good contrast with objects, whether light or dark, ignores the all-important factor of glare. The following is an attempt to apply such experimental data on glare as we possess to a problem in which glare exercises an almost preponderating influence.

For any source which is of such a size that its maximum linear dimension subtends an angle of less than 3 degs. at the eye, the brightness and the size need not be considered separately, but the glaring effect may be regarded as due simply to the effective candle-power in the direction of view. The glare, then, is governed by the following four factors:—

(*a*) The candle-power in the direction considered.
(*b*) The distance of the source from the point considered.
(*c*) The angle of elevation.
(*d*) The general brightness of the field of view, *i.e.*, in practice, of the street surface.

Since the visibilty of objects depends very largely on the sensitivity of the eye to contrast, take as the criterion of glare the reciprocal of the brightness contrast just perceptible to the eye. This "coefficient of perceptibility" $p = B/(B - B')$, where B and B′ are the brightnesses which can just be distinguished from each other; from fig. 4, the maximum value of p attainable under conditions of "no glare" is about 60 at normal values of brightness. The scale of ordinates on the right of that figure shows how p diminishes as the general field brightness is decreased. The variation of p with the candle-power of the glaring source and its distance from the observer may be expressed by means of a curve showing the relation between p and the illuminatin E produced by the glaring source at the observer's eye. It is necessary to determine the relation between p and the angle α between the lines joining the observer's eye to the glaring source and to the object respectively. A relation may then be found giving p in terms of both α and E; in other words, for constant glare conditions the relation between E and α is fixed. If, further, it be agreed to measure α from the horizontal plane passing through the observer's eye (say, the 5-ft. plane), there is for the fitting a limiting polar curve corresponding to any given mounting, for $\tan \alpha = (h - 5)/d$, where h is the mounting height and d the horizontal distance of the observer from the standard. Further, $E = (I_\alpha \cos \alpha)/d^2$ or, approximately, $E = I_\alpha \alpha^2/(57)^2(h-5)^2$, where α is in degrees. Hence a relation can be found which gives $I_\alpha/(h - 5)^2$ for every value of α. The figures may be put in the form of a polar curve, as has been done in fig. 5, which shows the maximum limiting values of $I/(h - 5)^2$, so that, for a given mounting height, the outer limits of the polar curve are determined for the fitting; alternatively, if the polar curve be fixed, the minimum mounting height may be determined. The above method of limiting the amount of glare must be used in conjunction with a specified street illumination. The figures calculated have all been based on the assumption of a field brightness of not less than 0.07 candle per square foot. Taking the reflection factor of the roadway as of the order of 10 per cent., this means that the average illumination must be at least 0.7 foot-candle. Assuming a round figure of about 9 for the diversity factor, *i.e.*, the ratio of maximum to minimum illumination, this means that the horizontal illumination due to a single lamp midway between the standards must be at least 0.3 foot-candle at the road surface. If the ratio of spacing to height be r, the value of α at the midway point is arc tan $(2/r)$, while the illumination at this point is $(I_\alpha \sin \alpha)/h^2(1+r^2/4)$. This consideration fixes a maximum value of r for a given value of h and a given polar curve.

For example, with a specified minimum illumination of 0.3 foot-candle, fig. 5 shows that the maximum permissible value of r with a mounting height of 15 ft. is about 6.5; with a mounting height of 40 ft., however, r may be nearly as high as 9.

The above treatment of glare in the case of street lighting is novel so far as the author is aware, and, as it was developed in connection with the preparation of a proposed British Standard Specification for Street Lighting, it is an example of an attempt to apply the results of what was primarily a psychological investigation to a practical illuminating engineering problem.

Conclusion.—With the opinion that many modern lighting installations providing an illumination of 3 or 5 foot-candles represent the saturation point, at least so far as load is concerned, the author does not agree. Far higher degrees of illumination will be found advantageous so long as proper care is taken to ensure that the light provided is used in the right way.

It may well be that a proper distribution of the light provided, or a desirable modification of its spectral distribution, may result in a utilisation factor far lower than that commonly attained at the present time. Such an apparently wasteful system may, in reality, be the best when the psychological factors are given due weight in the problem, and there is every indication that the economic value of good lighting is such that even a large increase in lighting costs may be far outweighed by the benefits resulting from increased economic efficiency. It is not too much to say that 90 per cent. of people in this country carry on their work after daylight hours by inadequate illumination and an unsuitable system of lighting. A quadrupled lighting load, properly employed, would result in better health, physically and mentally, and its cost would be trifling compared with the benefits it would confer on every class of the community.

Discussion in London.

Mr. C. C. Paterson opened the discussion by outlining the scope of the British Engineering Standards Association's draft Specification for Street Lighting, which was equally applicable to electric and gas lighting, and referring to the subjective aspect of the subject. The effect on the eye itself was apt to be forgotten, and when considering street lighting the eye was used very near its limit without a factor of safety. The authors of both papers had been very active members of the B.E.S.A. Committee (of which Mr. Paterson was chairman)

that had framed the specification; it had worked for two years with very few data of real value to guide it, but its findings had been unanimous. He appealed to all concerned to read the preface (copies of the draft specification had been handed to all members attending the meeting) carefully, the last paragraph of which was worded as follows:—"There is no doubt in the minds of those responsible for this specification that during the next few years the trend will, and should, be towards higher and better distributed street illumination, and the standards have been set to anticipate the immediate future rather than to stereotype the past." There was at present no criterion to go by in street lighting, no accepted standard, and the Committee had laid down a classification that would not hinder future progress. The mandatory clauses were few and simple, Nos. 8 and 10, which dealt respectively with the classification of installations and the minimum service illumination; all the other clauses had been framed mainly to make the two aforementioned ones practical. The specification was nothing more than a first step, but, if adopted, it would carry the subject forward.

Mr. F. Bailey agreed with the views put forward by Mr. H. T. Harrison in his paper. The City of London's lighting was so good because it had been thoroughly tested and considered; they had had a year's experience of it before it was put into public use. Central suspension of the lamps over the streets was the right method: he had had to alter the design of lamp standards so that when they were knocked down by vehicles they would not fly into pieces, and so that they would know where they would fall, and what they would do when they reached the ground. The quality of the city's lighting was revealed by the number of foreign visitors who came to view it, and their appreciation. England produced the finest plant and did the finest work; a wave of pessimism had spread over the country to which he objected strongly.

Mr. W. J. Jones emphasised the fact that the eye was the final court of appeal. Mr. J. W. T. Walsh's paper teemed with suggestive passages, but with regard to that which implied that a brightness of 3 per cent. would result in glare, care must be exercised when defining the upper limit when diffusing fittings were used; the author had been somewhat adventurous in prophesying the limit of brightness for future fittings, for each installation must be considered on its merits. The speaker looked forward to the time when street lighting would be judged in terms of visibility, and it would not be long, he thought, before such a criterion would be available. "The more light we have amongst us, the happier we will be."

Mr. Leon Gaster was gratified to hear the subject of illuminating engineering discussed before the I.E.E., for it was not so long since he was a "crier in the wilderness." Thanks to the National Physical Laboratory and the scientific research in progress, the subject was now being dealt with in an authoritative manner which would convince the public. He stressed the educational aspect of the matter: there was no justification for anyone to call himself an electrical engineer or architect unless he possessed knowledge of illumination, and illumination engineers had not been able to convince such people that they could help them. Perhaps Mr. J. W. T. Walsh, who was a member of the I.E.E. Council, would draw that body's attention to the need for more illuminating education.

Mr. P. Good was not surprised at the length of time taken by the B.E.S.A. Committee to produce the street lighting specification; valuable help had been rendered by the G.E.C. Research Laboratory and the E.L.M.A. Lighting Service Bureau, and in view of the large amount of work that had been done he thought the Committee had achieved its aim quickly. To put more wires over streets would be a retrograde step. Those concerned with street lighting talked too much about its cost, and it was time they began to talk of its cheapness; three times the present amount of light could be obtained for a very small additional cost. Darkness, dirt, and crime were very closely associated.

Mr. R. C. Fox, speaking as a student, said that totally indirect lighting had a somewhat dismal effect, though it seemed to reduce eyestrain. That the central suspension arrangement was the best form of street lighting was shown by the City of London's installation. It would seem that the side streets merited consideration first, for the illumination of main thoroughfares was contributed to by shop-window light: when the shops closed main-street traffic decreased as people moved homewards through the side streets, thus increasing traffic danger therein due to lack of light. In college he had found a lack of technical instruction on illumination; the subject was inadequately provided for, and most of what he knew about lighting he had had to pick up outside college hours.

Capt. W. J. Liberty was of the opinion that overhead suspension was the ideal method of lighting streets. In Cheapside the number of every motor-car, no matter how fast or slowly it was travelling, could be seen; a pin could be seen on the surface of the road, and one could read a newspaper comfortably. When standards at the roadside were used half the light was wasted on the walls of buildings where it was not wanted. It had been his pleasant duty to distribute the B.E.S.A. specification to town authorities all over England; a conference representative of neighbouring towns had been called by the Sheffield city authorities to urge the official adoption of the specification, which was being given serious consideration everywhere. He hoped that everyone interested in the matter would record his opinion of the specification, so as to assist those responsible for drafting it to form an idea of what was required.

Mr. D. Dixon pointed out that the eye was the final judge, but that which pleased it was not necessarily always good for it. Habit was an important factor, as witnessed the public's general reluctance to employ artificial daylight.

Mr. T. J. Sack thought that Mr. H. T. Harrison's suggested method of suspending street-lighting fittings overhead would prove embarrassing to fire brigades. The present method of allowing motorists to provide their own light on the highways was most uneconomical; it meant that something like 90 million watts were "careering round the country" wastefully. Each car carried its own little lighting system, which cost on an average about £20, representing a total capital investment of about £18,000,000; if that amount of money had been used to build large generating plant, it would have sufficed to provide one light per mile of highway throughout the country.

Mr. J. W. T. Walsh, in reply, remarked that three candles per sq. in. could be intensely glaring. There was a lack of data on glare, but the Department of Scientific and Industrial Research had an investigation on that subject very much in hand, and before long results would become available. Not "the more," but "the better light there is amongst us, the happier we will be." He endorsed what Mr. L. Gaster had said about education and illumination; in the I.E.E. membership examination illumination was at present a part subject only, whereas it should really be made a whole subject. The reason why many people disliked artificial daylight, and characterised it as depressing, was because they did not use enough of it: 20 or 30, even 50, ft.-candles would not be harmful, for they were used to very much higher figures in the case of natural daylight.

Mr. H. T. Harrison, also in reply, explained that the small wires he proposed for overhead street lighting would not be readily visible at a height of 30 ft.; tramway wires were four times as large as those he proposed to employ, and yet people had become accustomed to them. No more obstruction would be caused to fire brigades than was experienced to-day with tramway wires.

Finally, Mr. C. C. Paterson expressed gratification at the manner in which the draft B.E.S.A. Specification for Street Lighting had been received by the meeting, and at the way it was being taken up seriously elsewhere in the country as indicated by Capt. Liberty's remarks.

(To be continued.)

Correspondence.

***Correspondents should forward their communications* as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

The "H" Type of Cable.

I have read with interest the letter by Mr. G. H. Nisbett on page 1074 of your December 31st, 1926, issue, and also the replies thereto published in two subsequent issues. While most of the questions have been covered adequately in this correspondence, there are still one or two points which might be mentioned, and I would appreciate a small amount of space in your columns to take up a few of them.

To begin with, Mr. Nisbett is entirely correct in stating that there is nothing very new about Type "H" cable, which dates back to 1914. I may state that my company has been the pioneer in this field. It has held a licence for this form of cable for the United States since 1913, has been investigating its properties since that time, and has been actively engaged in manufacturing Type "H" cables for the voltage range of 25 kV to 35 kV for the last eight years.

I find difficulty in following some of Mr. Nisbett's arguments. The recent work of Farmer, of the Electrical Testing Laboratories at New York, has shown (*Journal* of A.I.E.E., 1926, p. 454) that the weak points of ordinary belted three-conductor cable when exposed for a long time to high voltage are in the filler spaces and at the surface of the conductor insulation towards the cable centre, these regions giving way and carbonising first, and leading to eventual puncture and complete breakdown. He comes to the conclusion that the long-time breakdown strength of cables in which the stress is radial is 50 per cent. or more of that of the belted type of cable.* Obviously the long-time breakdown strength of a cable with radial stresses is not infinitely high, and the mere use of the Höchstädter metallised surfaces does not eliminate all cable troubles. Still, a device which will so greatly increase the breakdown strength for long-time high voltage, or even give an increase very much smaller than that, seems to be well worth while.

Mr. Nisbett claims that Type "H" cable is larger than the belted type. My company has made large quantities of this type of cable and has a large amount in actual successful service. Its general policy is to make the Type "H" cables at least as small as a comparable belted cable, because it is possible

* As written; apparently it should read "50 per cent. more than that," &c.—Eds.

to use the conductor insulation in a more rational way, and therefore use higher stresses. The alleged mechanical difficulty of cabling together the three conductors without a surrounding belt has been entirely satisfactorily solved by methods we have employed.

The question of relative current-carrying capacities in Type "H" and belted cables does not seem to be entirely clear in the correspondence, possibly because there has been too much generalisation. To draw any conclusion, it is necessary to know how the metal is applied to the insulated conductors, how thick it is, what its thermal resistivity is, and how many adjacent cables there are. Our own policy is normally to use around each of the insulated conductors copper foil about 0.003 in., which is usually specified in this country. We then apply over the three twisted conductors a thin steel foil, so that the metal coating of the conductor insulation is in general in thermal contact with the lead sheath. Using this construction, and in view of the fact that copper has about double the thermal conductivity of aluminium, we find that the temperature rise of the conductors above the lead sheath for a given size of conductor and current is about half as much in a Type "H" cable as in a belted cable. The actual percentage gain in current-carrying capacity is, of course, a function of how large a percentage the rise between conductors and lead is of the total rise of the conductors, which depends upon conditions of installation, number of adjacent cables, &c.

With regard to the relative dielectric losses, there are two points of view. The first is probably the more important, namely, that, due to the better design of the Type "H" cable, the ionisation curve is likely to be flatter, and thus the power factor of Type "H" cable at high voltage will be lower than that of a belted cable. Any such difference is also likely to be accentuated further during service when the cable has been put through temperature cycles, resulting in still further ionisation and high power factor and loss for the belted type of cable.

Neglecting the higher ionisation losses in belted cable, we may, however, consider the relative losses in a Type "H" cable and a belted cable on the basis of equal power factor of insulation. On this basis, we usually find that the loss in the Type "H" cable is slightly higher than that in a belted cable, due to the fact that higher working stresses may be used in the Type "H" cable. However, the main effect of dielectric loss is a reduction in permissible current-carrying capacity due to the heating from dielectric loss, and the excellent thermal characteristics of the Type "H" cable more than compensate for the slightly higher losses therein, resulting in a total temperature rise due to dielectric loss (regardless of conductor losses) less for Type "H" than for a belted cable.

The reason for this is twofold. To begin with, the temperature rise between conductor and lead of a single-conductor cable or of a Type "H" cable is half as much for a given loss in the dielectric as for the same loss in the conductors (Archiv für Elektrotechnik, 1922, Vol. 11, p. 68), while it is approximately the same for both types of losses for a belted cable. Furthermore, as stated above, the thermal resistance between the conductors and lead of a Type "H" cable properly designed is about half of that in the corresponding belted cable. These two facts together mean that the temperature rise between conductors and lead due to dielectric loss for a Type "H" cable is about *one-quarter* that of the belted cable, and the usual effect of this is to make the total temperature rise due to dielectric loss for a Type "H" cable less than that in a belted cable, even neglecting the increase of power factor and loss in the belted cable due to ionisation.

Donald M. Simons,
Development Engineer, Standard Underground Cable Co.

Pittsburgh, Pa., *February 21st*, 1927.

Extra-High-Pressure Transmission.

Mr. A. T. Scott's letter in your issue of February 25th is not by any means a complete answer to mine in the issue of February 7th. He ignores the point I made that two overhead lines at, say, 33,000 volts, can be provided at less than the cost of one underground cable. One might develop this further. It is admitted that a single 33,000-volt cable is not reliable enough. Would two overhead lines be considered adequate? If so, the question is settled. If not, why not have four overhead lines, which will be cheaper than two underground cables? Surely four overhead circuits will be safe, or even three with specially large insulators.

Having in mind recent e.h.p. cable troubles, I deny that overhead construction practice has not kept pace with cable design.

Mr. Scott's statement as to the cleaning of all insulators being necessary eventually is interesting, but I hope inaccurate. In this country we get rain at least once a month, and this means that we have an insulator with half its surface cleaned each month without the help of a cleaning gang. The surface exposed to rain may be made sufficient to resist wet flash-over, assuming the under surface to be so dirty that it is ineffective; such an insulator will not flash over in a fog, even after a long spell of dry weather, during which it has become dirty.

It is known that 3,300-volt and even 6,600-volt insulators never need cleaning in England in open country, even in manufacturing districts, and I have many 33,000-volt insulators which have not been touched for 3½ years. These are in a mixed residential, manufacturing, and agricultural area, and they are only "2-shed." We have had to change some near railways, chemical works, &c., for the "3-shed" type, and none of these has, so far, flashed over. Any real quantitative information which can be obtained on this subject will be welcome, but we hope to be spared qualitative generalities such as those Mr. Scott has provided.

It is interesting to find that Mr. Scott has been misled by my reference to G.P.O. practice, because I purposely followed his indirect form of expression on this point. It shows how desirable it is to adopt downright and forthright methods. I understand that the Post Office has found underground cables unsatisfactory for trunk lines, and declines to put important lines underground whenever they can go overhead. In other words, while Mr. Scott may have been right in advising us to follow its example, he was wrong in imagining its policy to be one of putting important routes underground.

W. Fennell.

Northwich, *February 28th*, 1927.

The Earthing of Portable Domestic Appliances.

I am afraid Mr. Joseph has missed the point of my article. It is not a case of "making too much fuss about the whole business," but rather a matter of giving complete satisfaction to the owner of the installation.

I am all against unnecessary restrictions and regulations; we suffer from a surfeit of them already in the electrical industry. But since most, if not all, of the fatalities in private houses due to electric shock have occurred in bathrooms, it is incumbent on the profession to make the use of electrical appliances in such places as safe as possible, and I think the majority of engineers will agree with me on this point.

As regards rendering portable appliances safe in bathrooms, this usually means earthing, since, with the majority of apparatus, it is impossible to enclose the metallic framework completely with insulating material. This can only be done effectively by using a 3-core flex with a 3-pin earthed plug-socket, because if the ordinary 2-pin plug-socket is used and a separate earthing lead is installed, the latter connection may be forgotten or overlooked when the appliance is plugged in. Therefore, when a plug-socket is to be fixed in a bathroom, it must of necessity be of the 3-pin type, and this is just where the disadvantage and inconvenience to the owner of the installation comes in. If all the other plug-points in the house are of the 2-pin type (and from the point of view of safety there is no reason why they should not be) apparatus used in the bathroom cannot be utilised in the other rooms, and *vice-versa*. Numerous consumers have complained to me of this decided disadvantage. Naturally, they wish to be able to use any particular appliance in any part of the house and not to be restricted to certain rooms.

The only way out of this difficulty, in my opinion, is, as I have suggested, to provide 3-pin plug-sockets at all plug points. Apart from the bathroom, or other situations where a shock to earth is thought to be dangerous, it is not necessary to connect the third socket to earth, although if lead-covered wiring or steel conduit is used it would take very little more labour to make such a connection. If C.T.S. is used for the installation, my method would be to provide 3-pin plug-sockets throughout and only make an earth connection from a convenient water pipe to the socket fixed in the bathroom.

Therefore, in my opinion, the whole thing boils down to this: If no plug is required in the bathroom, 2-pin plug-sockets will suffice throughout the house; but if portable apparatus is to be used in the bathroom (and with the ever-increasing use of electricity it will undoubtedly be wanted in such places in the near future), then 3-pin plug-sockets must be fitted in all the rooms for the purposes of interchangeability.

I am glad "A.M.I.E.E." supports my views. He complains, however, that some supply authorities do not apparently practise what they preach, by not earthing their supply services and meters. I can assure him, nevertheless, that owing to the special nature of such gear, opinion is very much divided on the advisability of earthing this particular class of apparatus.

Reg. H. Rawll, A.M.I.E.E.

Birmingham, *March 1st*, 1927.

Kiosk-type Sub-Stations.

As manufacturers of kiosk-type sub-stations, we were interested in the remarks of your correspondent "P.M.W." on this subject in your issue of February 25th. We have always appreciated the fact that adequate screening of e.h.p. parts is essential, and would refer your correspondent to the article on our design of kiosk in your issue of December 17th, page 1009. The illustration clearly shows that not only has the e.h.p. apparatus been screened from accidental contact from the outside of the kiosk, but the various circuits and apparatus have been partitioned off so that adequate protection is given when working on any section. We do not favour the interlocking of kiosk doors, as this gives a false idea of security. A very elaborate system of interlocking and the earth-

ing of the power transformer, both on the e.h.p. and l.p. sides, would have to be undertaken to give really complete foolproof protection. Totally enclosed metal-clad e.h.p. switchgear has been advocated, but whilst this is good in principle, capital cost in the big majority of cases rules it out. We trust that "P.M.W." will now appreciate that even if our contemporaries have not pleased him, we always give attention to the points he raises.

We will certainly provide our customers with all essential safeguards, but it should be recognised that much is asked and but little paid, for anything in the way of super safety devices sometimes specified and sometimes only suggested as an afterthought.

W. H. Holding.

Manchester, *March 1st*, 1927.

Your correspondent "P.M.W." will perhaps be interested to learn that at least one manufacturer is in a position to meet the conditions laid down by him, at an economic price, by completely immersing not only the automatic switches, but also the isolators (which are of the quick-make-and-break type), bus-bars, current transformers, &c., in oil.

The e.h.p. switchgear is in the same compartment of the kiosk as the transformer, and there is no necessity for the added complication of interlocked doors. The l.p. gear is in a separate compartment entered by a special door at the side.

There is absolutely no risk of accidental contact with the e.h.p. apparatus, and, further, cleaning of bus-bars and isolating switches, together with their insulators, is entirely eliminated; also the gear is unaffected by deleterious atmospheric conditions.

This switchgear has been successfully in service in this country for the past seven years, and is available for the largest capacity systems. The writer would be glad to furnish full details to "P.M.W." or any other engineer interested.

P. Nutter,
Engineer, Coq Switchgear Co.

Newcastle-on-Tyne, *February 26th*, 1927.

A Metering Problem.

It is rather difficult to diagnose the trouble experienced by your correspondent "E.H.K.P.," because, as is almost unavoidable in cases of this nature, all the information necessary to ensure arrival at the correct conclusion is not available. However, the appended remarks may be of some interest.

(1) It would appear that the Supply Authority, being convinced that the Aron meter was registering considerably less energy than was supplied to the consumer, was confronted with the problem of metering the load correctly, and, at the same time, convincing the consumer that the Aron meter readings were hopelessly low.

Presumably, to serve this dual purpose, a carefully calibrated Sangamo equipment was then installed with the Aron meter operating from the same instrument transformers. Admittedly, the introduction of the additional load of the Aron meter would interfere with the fine accuracy of the Sangamo equipment and the Aron meter would not be compensated for the ratio and phase-angle errors of the Sangamo transformers, but the inaccuracies thus introduced would be negligible compared with the difference in reading of 4,000 units—approximately 10 per cent. of the energy consumed by the factory when working at full load for seven 24-hour days. Apparently, therefore, the Supply Authority justified its contention regarding the inaccuracy of the Aron meter.

(2) Although the introduction of the third meter is not explained, probably the consumer would not admit that the Company had proved its case, and the third meter was put in circuit with the other two in order to "make assurance doubly sure." We are told, however, that none of the three meters read alike, but the most important information—namely, the *percentage* inaccuracy of the third meter, taking the Sangamo meter as correct—is not given.

It is quite possible for there to be a considerable difference in the actual readings of two meters, both of which are accurate within prescribed tolerances. Let us assume that, when all three meters were in circuit, the Sangamo meter was 2½ per cent. fast and the third meter 2½ per cent. slow. If the actual units consumed during the test period were 24,000 (approximately half load on the factory for seven 24-hour days), the Sangamo meter would read 24,600 units, and the third meter 23,400 units—an actual difference of 1,200 units. Although both meters would be within the limits prescribed by the B.E.S.A. specification for meters calibrated with their instrument transformers, it is easy to see that, without some explanation, the Company would have difficulty in persuading its client that a difference of over 1,000 units was permissible in the readings of two meters claimed to be accurate.

(3) Provided that the difference in the readings of the two check meters was of an order which could be accounted for by some explanation such as that given above, the Company's proposal to charge the consumer for the period when the Aron meter was in circuit on the basis of the units registered by the Sangamo meter during a similar period would appear to be the fairest method of dealing with the matter, since the Supply Authority could hardly be expected to present the consumer with energy at the rate of 4,000 units per week, even for a short period, and, in addition, bear the expense of the preparation and installation of check outfits. Of course, the most convincing way of demonstrating the inaccuracy of the Aron equipment would have been to have left the complete outfit in circuit and installed the complete Check Sangamo equipment alongside it, but, possibly, conditions on site precluded the adoption of this method.

(4) To guard against troubles of this nature it is very useful for consumers who take a heavy load to install their own meters on the various sub-circuits. The summation of the readings of these meters then serves as a useful check on the Supply Company's meter, and, moreover, the individual meter readings are very valuable for departmental costing purposes.

(5) One method of simplifying the equipment installed in the case under consideration would be to use meters with pressure coils connected directly to the line. Several manufacturers of high-grade polyphase watt-hour meters arrange the pressure coils of their meters suitable for direct connection to voltages up to and including 650 across phases.

Frank Rostron.

Oldham, *March 4th*, 1927.

I read with great interest in your "Correspondence" columns the letter on the subject of "A Metering Problem." I am more than surprised to notice that the test department that is responsible for the accuracy of meters on consumers' circuits appears to treat this subject so lightly. I should like to point out the utter foolishness of connecting two different meters on the same current and potential transformers, when they were designed for their own transformers.

Further, the error was increased by inserting a portable test meter again on the transformers which were already wrongly connected, so obviously the test was useless. The subject of metering is most important for consumer and supply company also.

We all like to know what we are paying for, so the test departments should possess men that know what they are about.

D. M. Duncan.

Walthamstow, *March 4th*, 1927.

A Knotty Problem.

Your correspondent "Perplexed" is like the man who could not choose a suit owing to the tailor showing him too many patterns.

As an experienced electrical contractor, however, I should certainly plump for C.T.S. of the original manufacture. This system is the cheapest and best. It is ideal for wiring buildings already occupied, as it disturbs the place least, takes up very little room, and is quickly installed—hence the cheapness.

If "Perplexed" should be in the Manchester area I should be happy to quote him for his work and assure him that the work will be to his present and lasting satisfaction.

J. H. Fletcher.

Manchester, *March 3rd*, 1927.

Power Supply for Wireless Sets.

I note the further letter from "Interested" in your issue for March 4th, and see therefrom that your correspondent is apparently prepared to go further with the matter of a comparative test.

It will be remembered that your correspondent claimed "equal performance." The first test which I would suggest is a simple aural one. Obviously the sets must be compared on the same loud-speaker, and since their output impedance probably differs this is difficult to arrange. I therefore suggest that the output from each set be switched in turn on to a choke-coupled high-power amplifier of first-class quality, the output of which is applied to a Rice-Kellogg loud-speaker. Should your correspondent agree to carry out the test, I hope that I may be able to obtain permission to use apparatus of this type which I know to be in the possession of Messrs. Burndept. The amplifier in question has a substantially flat response curve between about 40 and 9,000 cycles, and can deal with input swings up to 120 volts or more. If the last valve of "Interested's" set is of higher impedance than that in the set which I propose to try against it, I should of course agree to his using a larger coupling choke in proportion, in order that the frequency response of the amplifier may be the same in either case. In this way it will be simple for both sets to be tested under the same conditions, *viz.*, with an output swing of about 150 volts, which is the maximum undistorted swing obtainable on my set.

Since the test is essentially one of *quality of reproduction*, it is of course essential that it should be carried out quite near to the broadcast station, in order that no questions of strength or selectivity should enter into the test conditions. If "Interested" agrees, I would suggest asking permission of Messrs. Burndept Wireless, Ltd., to carry out the test in their research department. Arrangements would, of course, be made for those who are to judge the quality to listen to the sets with rapid change-over arrangements, and without knowing which set is in operation.

I feel myself fairly confident that the results of trying to obtain output swings of 150 volts with only 120 volts h.p. will definitely convince "Interested" that his claim to equal performance cannot be maintained. If this is not the case, however, it will be necessary to carry out further tests. These

should comprise (1) a measurement test on pure sine-wave input, so as to obtain a frequency response curve of the type given in my original article, and (2) some form of wave-form test at an output of about 150 volts swing. Unfortunately, I do not know where I can obtain the loan of an oscillograph, which would be the simplest method of making this test, but failing this there is a fairly simple method of finding whether there are any strong harmonics, details of which I will give you if you desire them.

It will, of course, be appreciated that "Interested's" claim for equal performance must be interpreted to mean (1) that in spite of its three transformers, his set will reproduce notes in the extreme bass (*i.e.*, down to 30 cycles) as well as the one which I shall produce, and (2) that in spite of its limitation to 120 volts h.p., his set will give no more wave-form distortion than mine, with an output swing of 150 volts in each case.

P. K. Turner.

Blackheath, *March 4th*, 1927.

What is it to Drive?

We are surprised to read in the article under the above heading in your issue of March 4th, that purchasers of motors are recommended to add 20 per cent. to published horse-powers, as machine makers cut the horse-power to a minimum, leaving no safety margin.

This may be necessary when one is purchasing motors from Continental manufacturers, or certain manufacturers in this country who deliberately cut their ratings, but if motors are purchased from reputable firms who not only promise on paper that their motors comply with B.E.S.A. 168 but deliver motors that on test do comply with this specification, then there is no need for the distrust in ratings which your correspondent implies.

On a.c. motors particularly, it is inadvisable to adopt the course he suggests, as otherwise power factors tend to be low when the motors are running on light loads.

The Lancashire Dynamo and Motor Co., Ltd.

G. E. Mason, *Director*.

Manchester, *March 5th*, 1927.

[The "published horse-power" in question is, of course, the rating of the machine that is to be driven by the motor.—Eds. Elec. Rev.]

The Salaries of Engineers.

May I express complete agreement with the remarks on the above subject by your two previous correspondents?

"Yet Another Poor Blighter" suggests that the I.E.E. Council should consider the advisability of fixing minimum salaries for electrical engineers; may I go a step further, and suggest that a little critical self-examination on the part of members who occupy administrative positions in manufacturing companies might go a long way in improving the monetary reward given to members of their technical staffs?

Having in mind the highly critical capabilities of members, displayed at meetings of the I.E.E. on technical subjects, it seems a pity that a discussion has not been raised on electrical engineers' salaries; it would be an amusing, if somewhat pathetic, sight, to see some of the aforementioned administrators endeavouring to explain away the fact that many qualified members of their technical staffs were receiving "salaries" considerably less than hands employed in their workshops, and this in spite of the ever-increasing dividends paid by companies manufacturing electrical equipment.

And Yet One More.

March 4th, 1927.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

16,174. "Thermo-electric generators for energising the filament and plate circuits of wireless receiving sets and the like." H. A. Roberts. March 22nd, 1926. (269,519.)

19,981. "Method of producing high permeability in magnetic material." Standard Telephones and Cables Ltd. (Bell Telephone Laboratories, Inc.). August 8th, 1925. (265,642.)

22,486. "Electric switches." J. C. White. September 9th, 1925. (265,645.)

23,398. "Mechanism for operating electric oil switches or for analogous purposes." J. G. Statter and G. S. Marston. July 12th, 1926. (265,647.)

23,841. "Traffic control lamps." M. J. Raymond. December 30th, 1925. (265,648.)

25,260. "Current rectifiers." L. Levy. October 9th, 1925. (265,652.)

25,277. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. October 9th, 1925. (265,653.)

25,611. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and A. J. Ray. October 13th, 1925. (Addition to 246,550.) (265,657.)

26,498. "Safety apparatus for electrically-driven pumps." Rees Roturbo Manufacturing Co., Ltd., and C. F. Bekenn. October 22nd, 1925. (265,660.)

27,023. "Remote control systems." Coventry Automatic Telephones, Ltd., and J. E. Collyer. October 28th, 1925. (265,661.)

27,048. "Loud-speaking telephonic apparatus." M. Graham and A. Graham (legal representatives of F. A. Graham, deceased). October 28th, 1925. (265,662.)

27,663. "Automatic and semi-automatic telephone systems." Standard Telephones and Cables, Ltd., J. H. E. Baker, A. J. Chanter and W. R. Moscrip. November 3rd, 1925. (265,666.)

27,782. "Telephone systems." Standard Telephones and Cables, Ltd., J. H. E. Baker and J. R. Hardwick. November 4th, 1925. (265,668.)

28,031. "Electrolytic oxidation of organic compounds." C. H. Field. November 7th, 1925 (265,672.)

28,153. "Maximum-demand meters for alternating current." G. F. Shotter and E. W. Hill. November 9th, 1925. (Cognate application 19,016/26.) (265,673.)

28,191. "Grid leaks, variable condensers, and resistances for use in connection with radio apparatus." R. H. Winter and H. C. Daly. November 9th, 1925. (265,676.)

28,216. "Telephone systems." Standard Telephones and Cables, Ltd., J. H. E. Baker and J. R. Hardwick. November 9th, 1925. (265,678.)

28,303. "Electric heating units." L. Satchwell. November 10th, 1925. (265,684.)

28,625. "Amplifier for four-wire connection with heavily loaded lines." J. W. Kirkland (Allegemeine Elektricitäts Ges.). November 13th, 1925. (265,693.)

28,674. "Automatic and semi automatic telephone systems." Standard Telephones and Cables, Ltd., R. A. Moir and G. C. Hartley. November 13th, 1925. (265,695.)

28,779. "Control knobs." P. C. Rushen (Pacent Electric Co., Inc.). November 14th, 1925. (265,698.)

28,968. "Braking of vehicles and more especially of electric tramway and other cars." W. E. Ireland. November 17th, 1925. (265,700.)

29,187. "Crystal receiving sets." H. F. Pattinson, C. T. O'Callaghan and W. C. Waghorne. November 19th, 1925. (265,705.)

29,330. "Manufacture of evacuated vessels such as thermionic valves." General Elctric Co., Ltd., and S. M. Duke. November 20th, 1925. (265,711.)

29,403. "Electric switches." J. B. Tucker. November 21st, 1925. (265,712.)

30,128. "Deviation indicating apparatus for railless vehicles for overhead wire electric traction." Brecknell, Munro & Rogers, Ltd., and A. M. Willis. November 28th, 1925. (265,722.)

30,433. "Electromagnets and solenoids." H. Cooch. December 2nd, 1925. (265,725.)

31,187. "Telephone systems." Siemens Bros. & Co., Ltd., and H. E. Humphries. December 10th, 1925. (265,732.)

31,802. "Holders for electric incandescent lamps." W. E. Grant and M. B. Bean. December 16th, 1925. (265,739.)

31,919. "Dynamo-electric machines." J. A. Kuyser and Metropolitan-Vickers Electrical Co., Ltd. December 17th, 1925. (265,740.)

32,346. "Sockets for receiving and supporting plug-in vacuum tubes." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). December 22nd, 1925. (265,743.)

32,483. "Vapour condensers." H. L. Guy and Metropolitan-Vickers Electrical Co., Ltd. December 23rd, 1925. (265,745.)

1926.

502. "Illuminated signs." E. J. Mathews. January 7th, 1926. (265,751.)

3,796. "Means for containing and connecting electric batteries." H. A. Yoward. February 10th, 1926. (265,773.)

4,263. "Electronic discharge devices." Raytheon Manufacturing Co. March 5th, 1925. (248,721.)

7,032. "Electric lamps." T. J. Digby. March 13th, 1926. (265,801.)

8,433. "Multi-channel telegraphy." F. E. Pernot. August 15th, 1925. (Divided application on 20,528/25.) (265,806.)

8,866. "Intermittently operating electric regulators." Allmanna Svenska Elektriska Aktiebolaget. April 3rd, 1925. (250,257.)

9,441. "Telegraph submarine cable with loading coils." Felten and Guilleaume Carlswerk Akt. Ges. June 11th, 1925. (253,483.)

10,779. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. December 29th, 1925. (263,736.)

11,703. "Means for closing and disinfecting the mouthpieces of telephone transmitters." W. H. Wintle. May 4th, 1926. (265,823.)

12,642. "Process for the electrolytic separation of metallic chromium." R. Appel. May 17th, 1926. (Addition to 259,118.) (265,833.)

14,248. "Inductance coils." M. Barengolz. June 7th, 1926. (265,836.)

14,570. "Illuminated signs." Patent-Treuhand Ges. für Elektrische Gluhlampen. October 31st, 1925. (260,548.)

16,459. "Method of manufacturing hollow conductors." Dr. A. L. Mond (Metallbank und Metallurgische Akt. Ges.). June 30th, 1926. (265,849.)

16,559. "Electron discharge apparatus." British Thomson-Houston Co., Ltd. July 1st, 1925. (254,731.)

18,261. "Protection of supply systems from high voltage surges and the like." Sieverts Kabelverk, M. Sieverts Fabriks Aktiebolag. August 18th, 1925. (257,236.)

20,172. "Control systems for dynamo-electric machinery." Metropolitan-Vickers Electrical Co., Ltd. August 25th, 1925. (257,595.)

21,432. "Electromagnetic operating means." British Thomson-Houston Co., Ltd. August 31st, 1925. (257,632.)

24,238. "Electrical apparatus for heating liquids." Santon, Ltd., and H. C. Sanders. October 1st, 1926. (265,883.)

29,055. "Wireless telegraphy and telephony." Marconi's Wireless Telegraph Co., Ltd. November 18th, 1925. (261,758.)

29,525. "Oil-cooling means for oil-immersed electrical apparatus." Maschinenfabrik Oerlikon. December 2nd, 1925. (262,414.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 2nd. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Supronic. No. 476,822. Class 5. Wire.—L.P.S. Electrical Co., Ltd., Avenue Road, Acton, W.3.

Pyromic. No. 477,406. Class 5. Unwrought and partly wrought metals used in manufactures.—Telegraph Construction and Maintenance Co., Ltd..

S.S. Protos (lettering and design). No. 472,257. All goods in Class 6. No. 472,258. All goods in Class 8. No. 472,259. All goods in Class 13. No. 472,260. All goods in Class 18. No. 472,261. All goods in Class 22.—Siemens-Schuckertwerke Gesellschaft, Berlin. (Haseltine, Lake & Co., 28, Southampton Buildings, W.C.2.)

Paradyne (lettering and design). No. 471,276. Class 8. Radio and electrical apparatus and sound-reproducing instruments.—Paradyne Manufacturing Co., 27, Elgin Road, Seven Kings, Essex.

Silveroid. No. 473,533. Class 8. Instruments and apparatus made from a nickel alloy.—Henry Wiggin & Co., Ltd.

Ton (lettering and Bear design). No. 475,122. Class 8. Parts of apparatus for radio-telegraphy and telephony, but not including electric cells and batteries or goods of a like nature.—C. F. & H. Burton, Bernard Street, Walsall.

Ohmrat Rut. No. 475,205. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—Naamlooze Vennootschap Ramie Union, Enschede, Holland. (J. Martin Blair, Amberley House, Norfolk Street, Strand, W.C.2.)

Macilaphone. No. 476,584. Class 8. Telephone transmitter attachments for muffling sound.—E. McCann, Thanet House, 231, Strand, W.C.2.

Ancahe VI (lettering and design). No. 476,556. Class 8. Electric cables.—Callender's Cable and Construction Co., Ltd

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AYR.—352 houses, for Corporation; burgh surveyor.

AYRSHIRE.—Extension to hosiery manufacturing company's factory at Irvine (£6,500); the manager. Entertainment pavilion, four verandahs, shelters, &c. (£4,000), for Town Council of Saltcoats; burgh surveyor.

BARTON-ON-IRWELL (Manchester). — Hospital, Davyhulme (£92,000), for the B.G.; the clerk.

BECKENHAM.—60 houses, Elmers End estate; Universal Housing Co., Ltd.

BEDDINGTON AND WALLINGTON.—Housing scheme (40), Bute Road estate, for the U.D.C.; S. F. R. Carter, surveyor.

BEXHILL.—Houses, Warwick Road and Cooden Drive; J. E. Maynard, Collington Avenue. Subway, Terminus Road, for Corporation and railway company; R. Robinson and Co.

BIRMINGHAM.—Museum; Corporation Museums Committee.

BLACKPOOL.—Extension of Victoria Hospital (£100,000); J. S. Gibson & Gordon, architects, Old Bond Street, London.

BOLTON.—182 houses, Moorfield estate; A. Braithwaite and Co., Ltd., Leeds. 102 houses, Moorfield estate; J. W. Lee, Ltd., Chorley.

BOURNEMOUTH.—Schools, Moordown, for the managers of St. Walburga's Roman Catholic schools; Preston and Redman, architects.

BRADFORD.—326 houses for Corporation at No. 6 housing scheme (Eccleshill); city architect, Town Hall.

BRIGHTON.—Reconstruction of Richmond Street and Circus Street schools (£20,500), for the borough E.C.; director of education.

BURSLEM.—Electrical installation, New George Hotel; Longden & Venables, architects.

CAMBORNE (Cornwall).—Additional 50 houses, for the U.D.C.; surveyor.

CHELMSFORD.—Additional 50 houses, for the T.C.; borough engineer.

CHISLEHURST.—Factory, offices, &c., Cray Road, for the Crittall Manufacturing Co., Ltd., Braintree.

DALSERF.—Additional 50 houses, for Lanarkshire C.C.; housing architect.

DEAL.—Additional housing scheme (48), for the T.C.; borough surveyor.

DEWSBURY.—Infirmary (£90,000); Infirmary Board.

DUDLEY.—Highway depôt extension, Griffin Street, borough engineer.

DUNDEE.—Two schools, for education authority; master of works.

FORRES.—Reconstruction of mansion, for Sir Alexander Grant, Edinburgh; Mr. Alastair MacDonald, architect, London.

GUILDFORD.—Council offices, with central heating, for the R.D.C.; J. W. Wilton, surveyor, Market Chambers, Onslow Street. Extensions, Haydon Place; Guildford Glass Works.

HAMILTON.—Town planning scheme, including 44 houses; burgh surveyor.

HATFIELD.—Additional 40 houses, for the R.D.C.; A. Sidwell, surveyor.

HIGH WYCOMBE.—Municipal offices, for the R.D.C.; C. H. Wright, architect, 3, Bourbon Street, Aylesbury.

HOLMFIRTH.—Children's ward, Holme Valley Memorial Hospital, with electrical work; P. N. Brown, architect, Hollowgate. Warehouse, Ford Mills; Kirk, Sons and Ridgway, architects, Market Place, Dewsbury.

HONITON.—84 houses, for the R.D.C.; clerk to the Council.

HULL.—Technical college (£150,000); Education Committee.

HUNTINGDON.—Showrooms and offices, for the Hunts., Cambs. and Beds. Electricity Co., Ltd.; Pettits, Ltd., builders.

ILKLEY.—56 houses; borough engineer.

KINGSTON-ON-THAMES.—Additional 58 houses, for the T.C.; borough surveyor. Boys' schools (£41,850), for Surrey E.C.; W. W. Finny, secretary.

LANCASTER.—146 houses, various estates; borough engineer.

LICHFIELD.—Extensions, including assembly hall, dining hall, laboratory, &c., Friary school, for Staffs. E.C.; F. A. Hughes, director of education, Stafford.

LINCOLN.—Extensions (new pavilion), city hospital, for the T.C.; S. C. Baggott, city engineer.

LONAN.—Schools (£13,450), for Isle of Man E.C.; William McArd, builder, Port Erin.

LONDON (Barking, E.).—Wesleyan mission hall (£52,000); Gelder & Kitchen, architects, Hull; Myall Bros., builders, Ilford. 40 houses, Hertford Road; Scriven and Huxtable. Electrification of additional machinery, Barking Town Works; W. Warbe & Co. Sewerage and electric pumping plant; U.D.C. surveyor.

(Becontree, E.).—Synagogue, Becontree Avenue; Hebrew Congregation.

(Ilford, E.).—Modernising lighting on stage, Town Hall; borough engineer. Isolation Hospital extensions; borough engineer. Church, Eastern Avenue; G. Baines and Sons.

(Leyton, E.).—Schools, Canterbury Road (£18,850), for the Borough E.C.; director of education.

(Walthamstow, E.).—36 houses, Forest Road; U.D.C. surveyor.

(Whitechapel, E.).—Roman Catholic central school, Lucas Street; Canon T. J. Ring.

(Highgate, N.).—Extensions, Furnishing Trades Benevolent Association's Homes (£10,000); secretary.

(Cricklewood, N.W.).—Garage and showrooms, Willesden Lane; G. A. Sexton & Son. Boiler house and chimney stack, North Circular Road, for Allen-Liversidge, Ltd.; Heron, Rogers & Pettit.

(Willesden, N.W.).—Extensions for McVitie & Price, Ltd., Waxlow Road; Willard, Son & Ellingham.

(Bermondsey, S.E.).—Motor buildings, Riley Street, for Henry Grant & Co., Ltd.; W. Figg.

(Rotherhithe, S.E.).—Flats, Boss Street, for Courage and Co., Ltd.; F. M. Kirby.

(Wandsworth, S.W.).—Housing scheme (80), for the T.C.; surveyor.

(Wimbledon, S.W.).—Catholic church, Arthur Road; Elkins and Co., Ltd.

MANCHESTER.—College of Technology; Education Committee (competition for designs).

MERTHYR.—Housing schemes for borough architect (300).

MILTON REGIS (Kent).—Municipal offices, for the U.D.C.; surveyor.

NEWRY (Co. Down).—40 houses for the U.D.C. (£11,000).

NEWTON ABBOT.—54 houses at Broadlands Housing Estate, for the U.D.C.

PORTSMOUTH.—Extensions, Grammar School (£20,000), for the governors; the clerk. New R.C. church at Cosham, and central hall; Rt. Rev. W. T. Cotter, St. John's Cathedral.

PUDSEY.—96 houses for Corporation, at Southroyd Park Estate; Basil H. Noble, borough surveyor, Town Hall.

RAMSEY.—Secondary schools, for Isle of Man E.C.; director of education, Douglas.

SEAHAM HARBOUR.—Housing scheme (80), for the U.D.C.; J. B. Abbey, surveyor.

SHEFFIELD.—Café, sale-room, offices and house, Exchange Street and Waingate; Brightside and Carbrook Co-operative Society, Ltd. Market hall (£35,000), near Exchange Street; city architect. 175 houses, Wadsley Hall Estate; Sutton trustees.

SOUTHAMPTON.—Hostel for Seamen; secretary, British Sailors' Society. Additional block, South Stoneham House, Swaythling, for University College; G. Grant, registrar.

SOUTH SHIELDS.—55 houses, Mortimer Road; T. A. Page and Son, architects.

STOKE.—Laboratory, water cooling tower, pump house and reservoir, Michelin Works; Michelin Tyre Co.

STOURBRIDGE.—Wesleyan church (£10,000); Crouch, Butler and Savage, architects, Birmingham.

WOLSTANTON (Staffs.).—Electrical installation, Chelmsford Road; Burslem and District Co-operative Society, Ltd.

The

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For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

Contents:

	PAGE
Electric Street Lighting	417
Standardisation in the United States	418
Edison's Birthday	418
Electricity and Gas at Retford	418
Retford Electricity Supply (*illus.*)	419
Voice-frequency Telegraphy (*illus.*)	421
The "All-Earthed" House, by H. W. Clothier	424
The Charges for Packages, by W. Eric Jackson	425
Legal	426
New Electrical Devices, Fittings and Plant (*illus.*)	427
Electrical Progress in New Zealand	428
Parliamentary News	429
Business and Industrial Notes	429
Lighting and Power Notes	433
Tramway and Railway Notes	435
Telegraph and Telephone Notes	436
Radio Notes	436
Contract Information	437
Forthcoming Events	438
Notes	438
Institution Notes	441
Our Personal Column	442
Financial Section—	
New Companies Registered	442
Official Returns of Electrical Companies	443
City Notes	443
Financial Section - *continued.*	
Stocks and Shares	445
U.S.A. Electrical Exports	447
Indian Electrical Imports	447
The British Industries Fair—V. (*illus.*)	448
Illuminating Engineering (*illus.*) (*concluded*)	450
The Electrical Production of Steam	452
The "Ideal Home" Exhibition (*illus.*) (*continued*)	454
Correspondence—	
The Price of Electricity for Home Use	456
River Water—or Cooling Towers?	456
The "H" Type of Cable	456
Two-Part Prepayment Meters	456
Power Supply for Wireless Sets	457
Portable Domestic Appliances: Earthing and Flexibles	457
Faults in Flexibles	457
A Metering Problem	457
Supply Undertakers' Regulations	458
A Handicap to Electrical Progress	458
Ferranti and Edison	458
The Salaries of Engineers	458
The Birmingham Electric Club	459
Published Specifications	459
Trade-Mark Applications	459
New Work for Contractors	460

Electric Street Lighting.

IT was somewhat of a departure for two such papers as those by Mr. J. W. T. Walsh and Lieut.-Commander Haydn T. Harrison to be presented before the Institution of Electrical Engineers, for the discussion of illumination has taken place mainly before the Illuminating Engineering Society since it came into being about 17 years ago. The fact that it is possible to devote so much attention to illumination, and to attempt standardisation in lighting matters, is due mainly to the pioneering work carried out during those 17 years.

Readers of Mr. Walsh's paper (which was abstracted last week) will perhaps hardly form an adequate idea of the part which this Society has played in developing the subject of illumination, though in Mr. Harrison's paper (an abstract of which will be found elsewhere in this issue) allusion is made to the memorable paper read before it by Mr. A. P. Trotter in 1913, which may be said to contain the genesis of the idea of a specification for street lighting. A feature of the discussion was Mr. C. C. Paterson's contribution, summarising the chief features of the British Standard Specification for Street Lighting, which has been drafted by the B.E.S.A. Sub-Committee. Mr. Paterson again presented a summary of the specification at the meeting of the Illuminating Engineering Society at the G.E.C. Research Laboratories on March 8th, when there was a particularly useful and informative discussion. It was undoubtedly a happy idea to present the specification in draft form for comment by the chief societies interested. Opinion seems generally favourable to the specification, which represents the results of two years' patient work, and is framed on lines not dissimilar to those followed in 1913.

The classification of streets is again based on ascending values of minimum horizontal ("mid-span") illumination, from 0.02 up to 2 ft.-candles. It is true that there can, at present, be very few streets in Class A, with a minimum illumination of 2 ft.-candles, and the inclusion of this class seems soewhat optimistic. but if main thoroughfares could be illuminated to the value indicated in Class B (min. 1 foot-candle), this would be a great advance. It was pointed out that at the time of Mr. Trotter's paper the fundamental idea

of grading streets in terms of minimum horizontal illumination was strongly contested in some quarters, but it is probable that the principle will be widely accepted to-day as the best compromise possible. A good feature is the specification of heights of light sources, with a maximum of 30 ft. and a limiting value of 12 for the spacing ratio. The fixing of heights should be helpful in avoiding glare, and in an appendix a method of determining a coefficient, which is an approximate measure of the effect of the glare on the ability of the user of the road to perceive detail, is outlined. This method is based on the reasoning and formulæ set out in Mr. Walsh's recent paper, and is believed to be a novel treatment of the subject of glare. The problem of framing a clause to limit glare in street lighting is obviously difficult: it was suggested in the discussion that the process would appear somewhat involved to the uninitiated, and it was also urged that the fact that the formula only included candle-power and height, apparently taking no account of the degree to which the source was screened by diffusing glassware, seemed anomalous. Other points raised in the discussion dealt with procedure in testing, and a useful communication from Mr. Colquhoun, public lighting engineer in Sheffield, was presented, dealing with the specification from a practical standpoint. There was general recognition of the great value of the work which the British Engineering Standards Association's Sub-Committee had performed, and the difficulty of its task; no doubt the comments made during the I.E.S. discussion will be helpful in enabling it to deal with any points in the Specification which are still not clear and require elucidation.

Standardisation in the United States.

At the winter convention of the American Institute of Electrical Engineers, which was held at New York City last month, the question of simplifying the voltage ratings in vogue occupied a prominent position in the programme, two entire sessions being devoted to a discussion on this subject, which is reported in the *Electrical World* of February 19th. It was stated by representatives of the big manufacturing companies that special electrical apparatus in use in the United States, valued at from 100 to 200 millions sterling, had cost from 20 to 40 millions more than it would have done if standard apparatus could have been used.

The whole range of rated voltages from the generator (13,200 V) and step-up transformer (132,000 V) through four steps down to the ultimate lamp voltage was mapped out and studied. It appears that the three common lamp voltages of 110, 115, and 120 V must be retained, but the tendency is to regard 115 V as the normal, with 230 V between the outers of d.c. three-wire systems. Where a.c. distribution is used, the voltages may be 115 and 199 or 200. Obviously the low lamp voltage entails difficulties with motors and other devices absorbing large powers, and we may congratulate ourselves on having to a great extent escaped that drawback by our bold adoption of the double voltage many years ago; there remains abundance of scope for further unification of our voltages, which is a very pressing need, but the majority of our systems are operating at declared pressures which, at least, are of the right order.

With regard to the generation and transmission voltages, United States engineers are grappling with a huge problem which will also enter on an acute phase in this country when the Central Electricity Board's operations begin to take effect. For instance, the interchange of power which forms so prominent a feature of the Government scheme involves the use of interchangeable step-up and step-down transformers, in order to transfer energy in either direction at pleasure. On the other hand, this calls for a voltage range of 25 per cent., involving heavy expense, whether it be provided by voltage taps or induction regulators, especially as such changes of voltage will have to be made under load. From the report of the discussion in our contemporary, it appears that there is a general feeling in favour of unification of voltages, as would be expected, but considerable diversity of opinion as to the most desirable schedule of voltage ratings and no little perturbation with regard to the cost of changing existing plant. There is in the United States no central authority, such as our Electricity Commission, to deal with such problems, and whilst individual and unrestricted enterprise has been one of the principal factors in the rapid development of electricity in that country, it appears to render the solution of the standardisation problem more difficult of attainment.

Edison's Birthday.

The eightieth birthday of Mr. T. A. Edison was celebrated on February 11th at a luncheon given in his honour in Newark, N.J., by the "Edison Pioneers"; the report in the *Electrical World* states that a message was read from President Coolidge, acknowledging the debt owed by the world to his energy, courage, industry, and strong will, and Mr. Samuel Insull expressed his pride in having served for nearly half a century in a company bearing the name of Edison. There was a large gathering of men who had been associated with the work of Edison before the year 1886, full members of the club, and of associate members—those who were connected with his work between 1885 and 1900. After the luncheon Mr. and Mrs. Edison held a reception at their home, and it is alleged that "Mr. Edison took the whole day off and was late to work next morning."

On February 11th we published a brief appreciation of his career, and telegraphed to him: "London Electrical Review sends most cordial greetings on your eightieth birthday." Last week-end we were gratified to receive from him the following acknowledgment, dated February 23rd, from his laboratory at Orange, New Jersey:—

"Gentlemen,—

"My friends have helped to make my recent birthday a notable and pleasant one. Your message of congratulation and good-will was received and appreciated, and gives me the opportunity to greet and to thank you for your kind remembrance of the occasion.

"Yours sincerely,
"Thos. A. Edison."

Electricity and Gas at Retford.

We have often pointed out that the generation of gas and electricity jointly offered a prospect of effecting material economy in the consumption of coal. In August, 1924, Mr. J. R. Bradshaw, at that time engineer and manager of the Retford Corporation Gas and Water Works, in our "Correspondence" columns expressed the same view, and stated that on his advice his Corporation had taken steps to obtain powers to generate electricity at the gas works, in conjunction with the gas department; and in our issue of April 3rd, 1925, Mr. G. M. Gill, a well-known gas engineer, discussed the question quantitatively, showing that by the use of waste heat, coke breeze, &c., resulting from gas manufacture, a considerable quantity of electricity could be economically produced.

Mr. Bradshaw's proposition has now been carried into effect, and we publish to-day some particulars of the Retford undertaking. In this case the waste heat is used for driving a 50-kilowatt generating set, whilst the larger sets are driven by gas. As the waste-heat set runs almost continuously, on a high plant load factor, it turns out a relatively large amount of "cheap units."

It will be noticed that the larger sets generate at 6,600 volts, a high pressure for a small undertaking; the inference, we take it, is that it is intended to carry the supply into the surrounding country at an early date. Twenty years ago the supply would almost certainly have been direct current—but we have passed that stage.

Retford Electricity Supply.

A small electricity undertaking designed for working in conjunction with a gas works, utilising the waste heat from the retort house, and embodying some novel self-contained transformer units on the distribution system.

WHAT is believed to be the first electricity supply undertaking in this country to work in conjunction with a gas works, utilising the waste heat from the retort house for generating electricity for public supply, with the two concerns under joint management, has been recently established and put on load at Retford, Nottinghamshire, and will be officially inaugurated on March 21st.

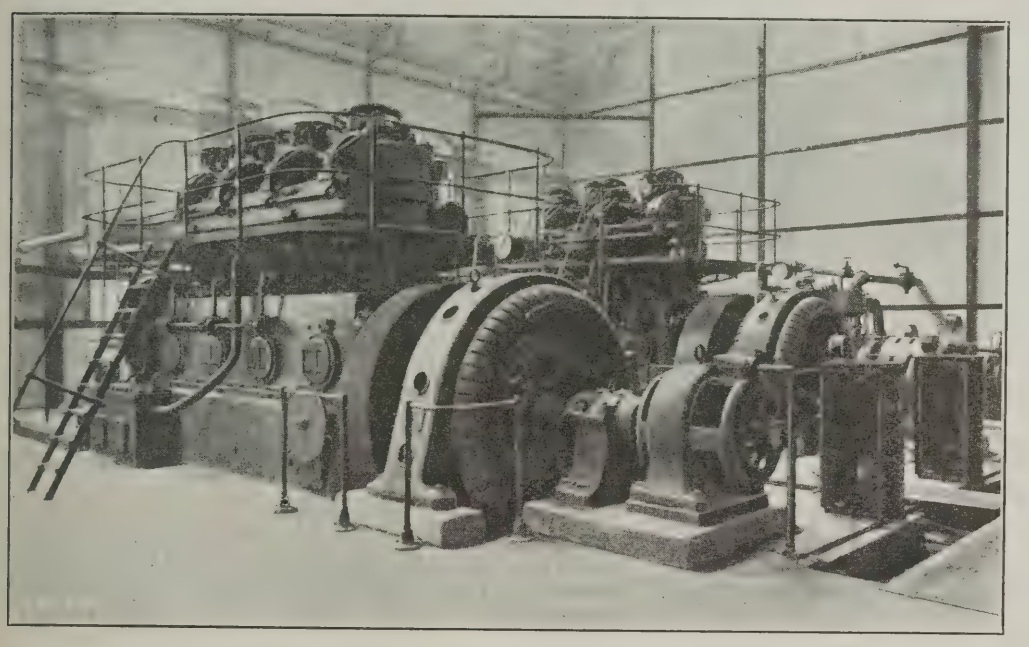


Fig. 1.—Gas-Engine Generating Plant.

A Special Order for the Retford area, 200 sq. miles, was granted to the Corporation last year, and sanction was obtained from the Electricity Commissioners for the construction of a generating station. This has been put down in the gas-works yard. The building is a plain steelwork structure with brick filling and "Asbestolite" roofing.

The main generating plant at present consists of two gas engines, fig. 1, one 4-cylinder, 400 h.p., and the other 3-cylinder, 300 h.p., supplied by the National Gas Engine Co., Ltd., directly coupled to 270- and 200-kW alternators, respectively, 3-phase, 6,600 V, 50 cycles, and the necessary exciters. The alternators were supplied by the Electrical Construction Co., Ltd., the main contractors for the generating plant. The cylinders of the engines are standardised and interchangeable. The machines are supplied with gas direct from the holders. They start on compressed air at 350 lb./sq. in. and are provided with the usual electrical-ignition arrangements. Two compressors, fig. 2, one driven by a small National gas engine and the other electrically driven by a G.E.C. motor, supply the necessary starting air to conveniently arranged bottles. Unusual difficulties were met with when putting down the foundations for the main engines, owing to the existence 10 ft. below the surface of a bed of running sand about 5 ft. 6 in. thick. They were overcome by drilling out 12-in. diameter cores to a depth of 22 ft., and casting piles *in situ*, afterwards placing very heavy concrete beds on the piles and filling in the running-sand space below the beds with liquid or "milk" cement, the latter being pumped into the ground at 300 lb./sq. in. so as to replace the sand. This work was carried out by the Francois Cementation Co., Ltd., and it is said to be the first time that such foundation work has been effected in this country.

The alternators supply direct to a truck-type e.h.p. E.C.C. switchboard, fig. 3, from which the supply is transmitted at the generating pressure.

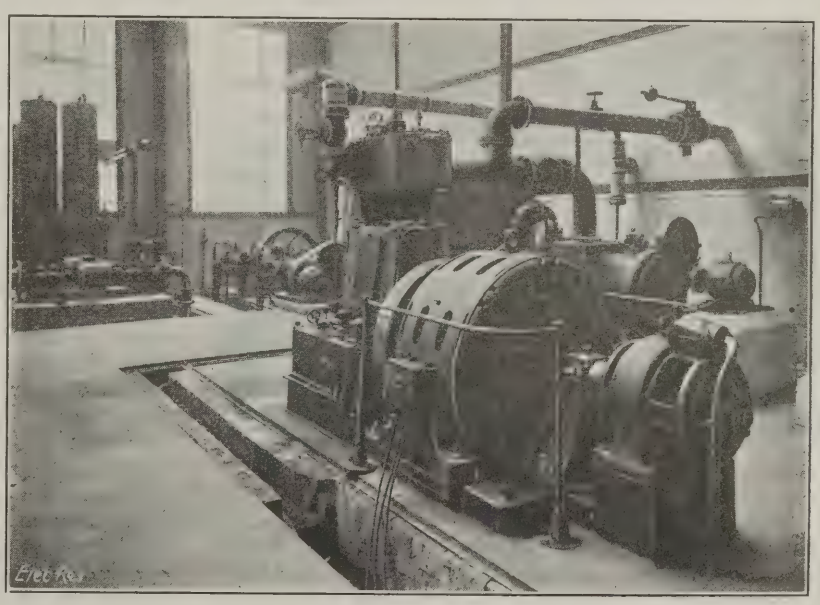


Fig. 2.—Steam Plant and Pumps.

The waste-heat plant consists of a horizontal tubular boiler, supplied by Messrs. Spencer Bonecourt, Ltd., in the retort house, and a small Belliss & Morcom condensing steam engine and auxiliaries, fig. 2, in the

power station. The hot gases are taken from the main flue of the gas plant by means of an electrically driven Sirocco fan and passed through the boiler, and the steam from the boiler is passed through a superheater contained in a chamber near the main flue. The boiler is designed for a working pressure of 120 lb. per sq. in. The feed water is taken from a Spencer Bonecourt vertical waste-heat boiler, fig. 4, which is positioned outside the power house and fed by both the exhaust and the cooling water from the gas engines. This plant also serves effectively as a silencer for the exhaust.

The steam engine is directly coupled to a 50-kW E.C.C. alternator, which generates at 400 V, 3-phase, the pressure of the l.p. supply network. A 2-panel E.C.C. slate switchboard, fig. 3, deals with the l.p. supply from the steam-driven plant. In conjunction with this and a small generating set used in the gas house for supplying power to the stoking machine, a small motor-generator serves as a medium for the interchange of power between the respective works.

The condensate from the steam plant with the cooling water from the gas engines is collected in a hot well, from which it is pumped over a cooling tower, fig. 4, supplied by the Visco Engineering Co., Ltd. From the cooling-tower tank the water is pumped to an overhead storage tank. The make-up water is taken from the town supply. The pumping requirements are dealt with by two double-pump motor-driven sets, fig. 2. In each case the central motor drives two turbine pumps, one for delivery to the cooling tower and one to the storage tank. The pumping equipment was supplied by Messrs. Mather & Platt, Ltd. The engine room is spanned by a 10-ton Morris hand crane.

In connection with the distribution system, some specially designed equipment in the form of distribution units is of particular interest. Each of these comprises all that is necessary for the complete control of a distribution section, taking power from the e.h.p. mains. The principal feature is the cutting out of the usual brick or steel transformer

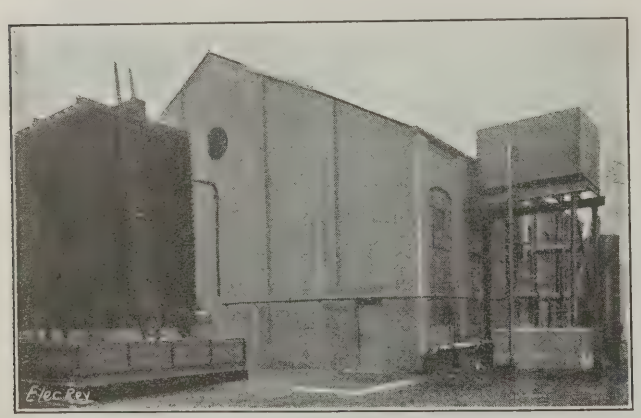


Fig. 4.—Cooling- and Feed-Water Equipment.

chambers, kiosks, and the like, and, by adopting a substantial transformer tank of suitable design, using only one "enclosure," thereby reducing the capital cost considerably, and also the heating losses.

In each case a pillar, containing in its base the necessary e.h.p. trifurcating boxes for both the high- and low-pressure cables, and permanently fixed to the ground, provides for the necessary connections to the unit. The tails from the e.h.p. cables are taken to three well-insulated pockets at the top of the pillar. Similarly with the l.p. cables, but in more recently designed equipment the cable pillar is rather larger, and houses l.p. fuse-link units, thus forming a low-pressure distribution pillar. The l.p. busbars are then connected to four sockets at the top of the corresponding section of the pillar.

The transformer portion of the apparatus is entirely separate from the pillar, and the enclosure is electrically welded throughout. Above the transformer proper, and forming part of the same structure, is a steel chamber accommodating the control apparatus, which is contained in two separate compartments on opposite sides for the division of the two classes of equipment, e.h.p.

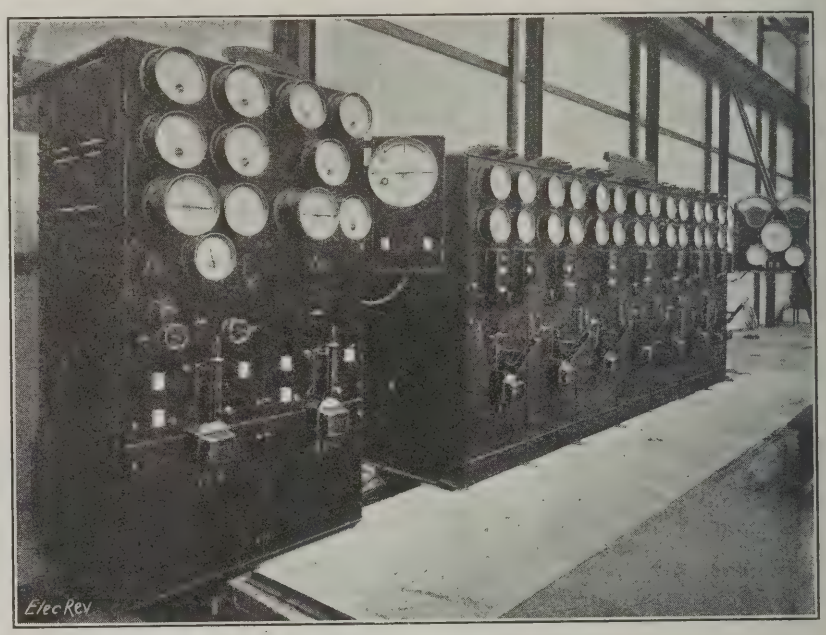


Fig. 3.—E.h.p. and L.p. Switchgear.

and l.p. Separate lock-up doors serve these compartments, the e.h.p. side being further protected by expanded-metal screens suitably interlocked with the switchgear. Corresponding to the sockets provided in the cable pillar, there are connecting plugs on the side of the apparatus chamber, so that there are no cable connections whatever between the two sections, and the transformer, with the control apparatus, can be disconnected very easily from the main. The e.h.p. control gear includes a triple-pole isolating switch in series with three single-pole tetrachloride fuses, one on each phase.

On the l.p. side an ammeter is fitted for each phase and a voltmeter with a three-way switch to give the readings from each phase to neutral. An important feature is the l.p. voltage control. In each phase there are tappings in the l.p. winding connected to regulating switches which can be operated under load; thus the pressure between each phase and neutral can be adjusted independently. Scarcely any flicker can be seen on the voltmeter when these switches are operated. By this arrangement it is possible to deal economically with low load factors, such as are likely to be experienced at Retford, by using small cables even for long runs where the drop at full load would, normally, be too great. The portable portion of the equipment is fitted with roller wheels, and short rails embedded in concrete are provided at the foot of the fixed pillar to facilitate the sliding in or out of position. Suitable flanges at the connection between the fixed and movable parts provide the necessary clamping. In the case of breakdown or other emergency, the transformer can be removed and another wheeled into position, plugged in and made alive, without interfering with the e.h.p. supply, the whole operation being much more quickly performed than changing a transformer in a sub-station.

At present three of these distribution units are installed on the system, two in the town and one in the works, but more will be added as the undertaking is

extended. The works unit is designed so as to be used for either stepping up or down, in order that either the e.h.p. or the l.p. system may be supplied from it.

Fig. 5 shows a 100-kVA distribution unit installed in the Market Place at Retford. The kiosk on the right accommodates three e.h.p. switches, arranged vertically one over the other in separate compartments, with the necessary provision for the lead-in of the cables and the trifurcating boxes, thus providing an e.h.p. distribution point. One of the switches, of course, serves the transformer equipment.

Fig. 6 shows the pillar of one of the more recent designs, which we understand is to be used on the new undertaking which is being carried out at Gainsborough.

The transformer units are interchangeable for any size up to 250 kVA, that is, any size of transformer up to that limit may be served by the same pillar. The contractors responsible for the design and supply of the transformer equipment are Messrs. Foster Engineering Co., Ltd.

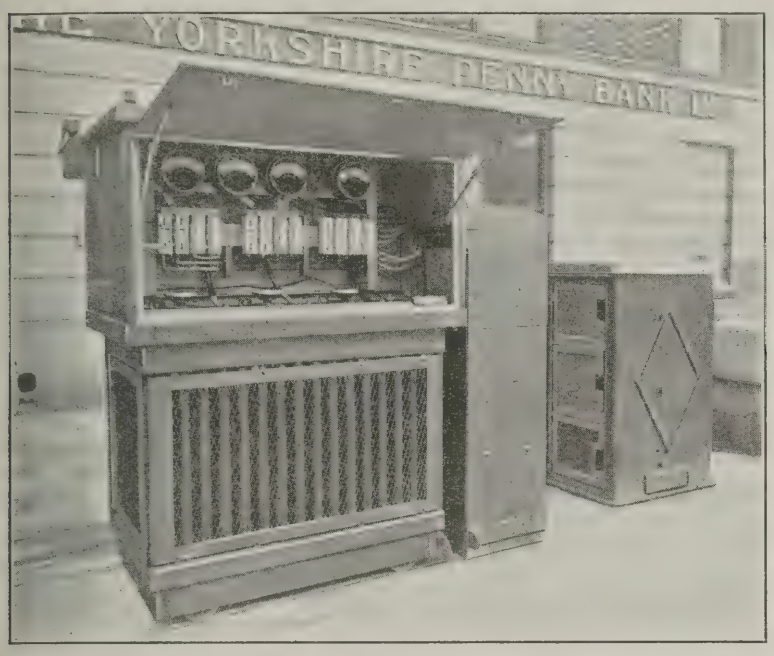


Fig. 5.—100-kVA Distribution Equipment, Retford.

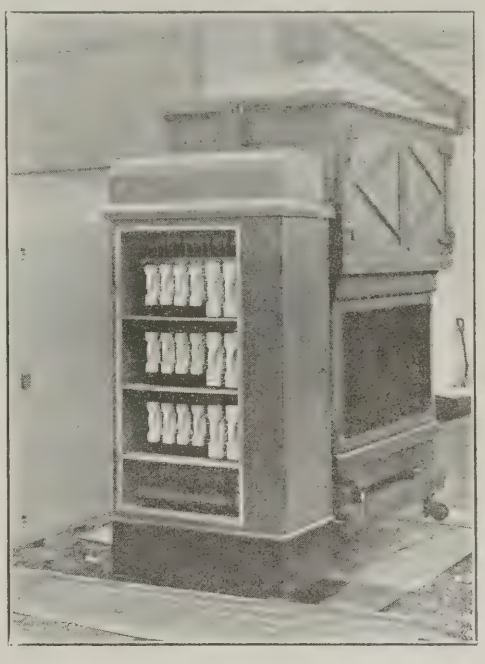


Fig. 6.—Distribution Unit with Pillar Fuses.

The consulting engineers responsible for the whole scheme are Messrs. A. Hugh Seabrook & Partners. Mr. S. O. Pacey, M.I.Mec.E., engineer and manager of the Corporation gas, water and electricity undertakings, supervised a considerable amount of the construction work entailed.

Voice-frequency Telegraphy.

Telegraphy at voice-frequency is a system that promises not only to facilitate operating arrangements, but also to lead to cabling economy; the development of the thermionic-valve repeater has made the method a practical proposition on underground telephone cable networks.

(Communicated.)

THE method of conveying telegraph signals at voice-frequency is sometimes referred to as tone-frequency signalling. It is a development of the method of tuning-fork signalling first tried some 70 years ago, and developed by the French scientist Mercadier towards the close of last century into a multiplex telegraph system having twelve channels of communication, each of which had a Morse key for signalling purposes and a mono-telephone for reception.

The actual signals which passed over the telegraph line came from a number of differently tuned tuning-forks, which were kept vibrating continuously and "making and breaking" connection with a signalling battery at a speed corresponding to their rate of vibration: when a Morse key associated with any particular tuning-fork was held down, the vibrating currents were passed through a transformer on to the line as alternating currents; each tuning-fork was tuned to correspond to the fundamental note of a particular steel diaphragm at the receiving end of the line, each diaphragm being supported on three points and situated above an electro-magnet. The electro-magnets were arranged to receive all the line signals, but the diaphragms responded only to the particular note proper to them; that is to say, to their relative keys at the sending end. Hence, it was practicable to send six different messages at the same time over the line, and for them to be properly sorted out by the mono-telephones. The arrangement proved to be workable, but it had disadvantages that made its adoption at that time quite uneconomical, chief among them being the disturbing noise that it produced on neighbouring telephone lines.

With the advent of the thermionic valve-amplifier, the currents which actuated the mono-telephones could be replaced by much weaker currents and then be augmented at the receiving end to make them suitable for actuating an ordinary telegraph relay, which in turn can actuate printing mechanism. With a valve-oscillator it is much easier to maintain, or to re-adjust,

the rate of vibration required for each channel of the multiplex telegraph line. The rates of oscillation used are kept within the range of the frequency of the human voice, *viz.*, from 300 to 2,000 oscillations a second; the current value on the line is kept to the value approximately of telephone currents, *viz.*, about one milli-ampere; and the voltage at the sending end of the circuit is about one volt. It thus becomes practicable to utilise this system of telegraphy on telephone lines, or cables, and through telephone repeaters. It is this fact that makes the use of voice-frequency telegraphy such an attractive feature at the present time when underground telephone cables containing small-gauge wires are being provided by most Administrations.

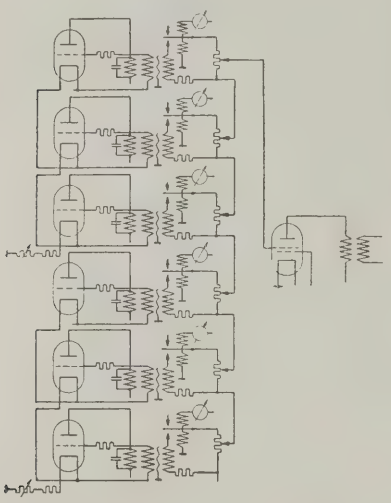


Fig. 1.—Sending Set for Six Frequencies.

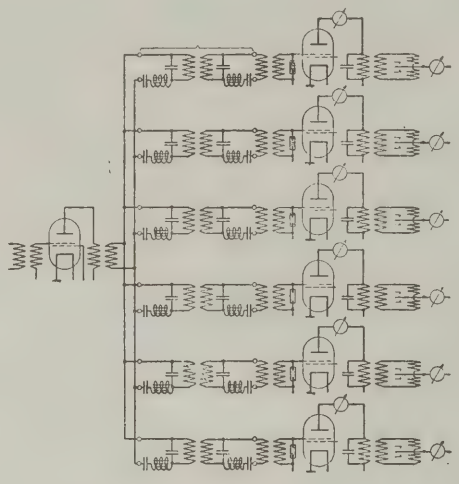


Fig. 2.—Receiving Set for Six Frequencies.

The underground-cable wires for long telegraph circuits of the ordinary type are much larger than those for telephone circuits, being as much as ten times larger in cross section, thus seriously limiting the number of circuits which can be provided in a cable of normal size, and, of course, are very much more costly. The inductive disturbance that may be caused by a modern voice-frequency telegraph system is no more than the cross-talk between ordinary telephone circuits, and is therefore practically negligible from the practical standpoint. The apparatus at telephone repeater stations serves equally well for repeating the voice-frequency signals as for ordinary speech, and there is consequently no need for the attendants at the repeater stations to be telegraphists, or as expert as the staffs at ordinary telegraph repeater stations.

Each frequency can be utilised to work a Wheatstone circuit at 100 words a minute, or a multiplex circuit with four or even more channels. The number of frequencies obtainable depends on the permissible margin between the frequencies, but ten separate channels have been provided and arrangements have been made for even twelve, giving the possibility of 48, or perhaps more, multiplex channels for each pair of telephone wires. Obviously this system can be employed on any circuit that is a practical telephone circuit, and, with some limitations, it can be utilised on circuits which are beyond the limit of commercial speech, by utilising only the lower frequencies.

The voice-frequency method of working is now being developed in Europe and America, and the following detailed information, kindly supplied by Messrs. Siemens & Halske, of Berlin, will indicate the progress that has been made with the system, which has been in daily use on the cables of the German Telephone and Telegraph Administration for several years. Fig. 1 shows the general principle of the arrangement for a sending end providing for six frequencies, *e.g.*, of 400, 638, 877, 1,110, 1,350, and 1,590 periods a second, produced by the valve-oscillators shown. The heating of their filaments is arranged in two sets of three in series, and the frequencies are obtained by adjusting the movable iron cores of the transformers. The amplitude of the frequencies sent out by each of the sending relays is regulated by a potentiometer; the six potentiometers are connected in series and to the grid of the amplifying valve, which passes all signals through a transformer to the line: by this arrangement the opening, or closing, of any of the transmitting relays does not cause any interference with the signals from any of the other transmitting relays. Each frequency produces about 0.2 volt at the sending end of the line, and when all six frequencies are working about one volt is impressed on the sending end. The currents traverse the line and pass through any telephone repeaters that may be necessary on the route in a similar manner to ordinary telephone currents. At the receiving end, fig. 2, the arriving currents pass through a transformer and to the grid of an amplifying valve, thence to six filters connected in parallel, each, of course, being adjusted to receive only the particular frequency corresponding to the particular telegraph communication it is serving. After each filter there is a detector valve which transforms the alternating currents into direct currents. The plate of each valve is connected to a transformer across whose coil is a condenser; thus, when a train of waves arrives at the grid of the valve, a direct current passes through the plate and the primary of the transformer; the secondary coil sends a momentary current through the relay, thus closing the local circuit. On the cessation of the train of waves, the plate-current ceases, causing a momentary reverse current in the secondary coil of the transformer and through the relay, thus opening the local circuit; the

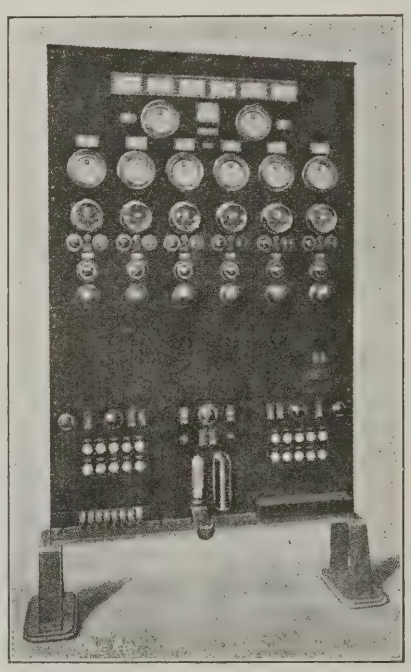


Fig. 3.—Transmitter Board, Six Frequencies.

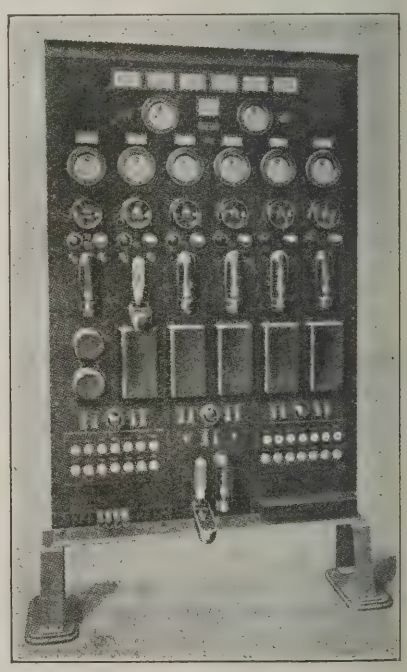


Fig. 4.—Receiver, Six Frequencies.

relay must be adjusted for neutrality, *i.e.*, so that its tongue will remain on either contact when no current is passing through its coils.

The apparatus for the sending end of a six-frequency set is shown in fig. 3: the section is divided into six sets of panels, each set being fitted with similar apparatus and made easily detachable and interchangeable with the others. Each panel of the centre set carries a galvanometer, a relay, an oscillating valve with protecting cover, and arrangements for regulating the frequency and amplitude; also a switch for introducing a suitable resistance in place of the lamp filament when any frequency is out of use; the latter precaution is essential, as the filaments are in two series of three. A control key is provided for actuating the relays when necessary, and a jack for the connection of a telephone for checking the frequencies, or for an amplifying voltmeter for measuring the amplitude of the frequencies. The lower panels are fitted with keys for speaking telephonically with the telegraph office and with the other voice-frequency transmitting station. The latter is usually arranged by superposing a telephone circuit on the two circuits used for the voice-frequency telegraph service. there being one circuit in each direction for a six-frequency service. The amplifying valve which passes all the six frequencies on to the line is situated in the middle of the lowest set of panels and is duplicated, so that should it cease to function, it will be automatically replaced by the reserve valve. On this panel there is also placed an adjustable resistance for regulating the filament current and switches in the filament and plate circuits. Jacks are provided for checking the voltages supplied to the grids by the oscillating valves and the current sent out. The panels to the right and left of the amplifying valve are fitted with fuses for the different circuits, keys for the filament and plate circuits of the oscillating valves, a resistance for the filament circuit, and a reversing key for the measuring instruments. The right-hand key connects the voltmeter at the top of the section to the power leads; the left-hand key connects the ammeter, situated to the right of the voltmeter, in the filament circuits of the oscillating and amplifying valves. In principle this ammeter is also a voltmeter, as it measures the voltage at the terminals of the fixed resistances connected in the filament circuits; it is graduated in amperes. On the upper panel indicators are placed for automatically notifying any faults that may occur; they are in the form of apertures covered by a strip of ground glass behind which are placed small lamps which, when alight, indicate the failure of the voltage for the filament, plate, auxiliary grid, regulating grid, or telegraph. At the same time that the lamp glows, a bell also rings, thus giving both visual and audible signals for attention. Condensers and resistances are placed at the back of the panels for regulating the plate voltage.

The apparatus for the receiving end of a six-frequency set is shown in fig. 4. This section is also divided into six sets of panels similarly fitted with a receiving relay, regulating resistance for the filament current, a measuring instrument to control the current resulting from the reception of a train of waves, two lamp resistances for the relay contacts, detecting valve under a protecting cover, a switch for cutting off the current from the coils of the relay, and a jack for checking the current from the filter by means of a telephone or amplifying voltmeter. Beneath these panels are six other panels supporting the filters for the six frequencies. In the middle of the lower set of panels is placed the receiving amplifying valve and its reserve valve, which comes into operation automatically when necessary, a variable resistance for regulating the filament current of the receiving amplifying valve, three keys for the filament circuits and three keys for the plate circuits, as well as a jack for the control of the unamplified current. The spaces to the right and left are occupied, as on the sending section, with fuses, keys, and switches. The upper panel carries galvanometers for checking the outgoing currents to the Telegraph Offices, as well as the apparatus for verifying the power supply, and the fault indicators. The transformers, both ingoing and outgoing, of the receiving amplifying valve, and the detector transformers are placed at the back of the panel, as well as the regulating resistances and condensers of the power supply circuit.

The speed of signalling on the voice-frequency system is limited by the fact that the frequency band of the receiving filters is limited in width, which is a simple function of the duration of the transitory period of an alternating telegraph signal. Let us suppose that we can accept a duration of the transitory phenomenon equal to t seconds, then the narrowest band of transmission allowable will be given by the equation $\delta f = (0.8 \text{ to } 0.88)\ l/t$; but for greater security in practice we take $\delta f = 1.2\ l/t$. The filters in the system described have a transmission band of 80 periods, the transitory period being 0.015 second. A satisfactory service is possible when the transitory phenomenon is less than the duration of the minimum signal, known in the Morse code as a "dot." One can therefore send 67 dots (or dot spaces) a second, or 4,000 a minute, or 800 letters of the 5-unit code.

In practice it has been shown that on long-distance cables the transitory phenomenon has not prejudiced the security of service on lines exceeding a length of 1,000 kilometres. The transitory period of a signal is defined by the difference of the duration of propagation of the highest and lowest frequencies employed for the transmission of a signal. The band of frequency transmitted has a width of 80 periods. The difference of the duration of propagation is the highest for the band corresponding to the highest carrier frequency. This band is between about 1,600 and 1,680 periods. The duration of propagation of these frequencies on a conductor 0.9 millimetre in diameter and 1,000 kilometres long, is from 0.074 to 0.0763 second, giving a difference of 0.0023 second. As the receiving filters introduce a transitory period of 0.015 second, it is essential that the line should have not more than 0.005 second. This will be reached only by cables having a length of $(0.005 \times 1{,}000/0.0023) = 2{,}200$ km., about.

Static and Hurricanes.

Static, the bane of the radio fan, may prove a valuable warning of storms and hurricanes, according to a study made by the Hydrographic Office of the U.S. Navy. In a study of the value of weather maps in navigation, it was noticed that there was a very definite relation between the state of the atmosphere, as recorded in the data for weather maps broadcast from the naval radio station at Arlington, and static. Later, when the weather maps were broadcast and received by means of the machine invented by Mr. C. Francis Jenkins, wherewith a duplicate of the transmitted map is automatically drawn on the ship, it was found that the receiver could be used to record static. The Jenkins machine is used in connection with a radio compass: the latter is equipped with a loop antenna so that as the loop is rotated, and peals of static in any direction are detected by the receiver, corresponding ink lines are drawn on the paper-covered revolving drum of the Jenkins machine. In the time that it takes the recording pen to travel from one end of the drum to the other, the loop is turned through a complete circle, so that the paper gives a graphic picture of the static in any direction. Such hurricanes as the Miami one develop off Cape Verde several weeks before they hit the United States. It is suggested that a group of radio compass stations would be able to detect these storms as they approach. With three stations, where the lines cross would be the centre of the storm, so that its position could be accurately plotted and sufficient time for warnings and preparation could be allowed.—*Science Service.*

The "All-Earthed" House.

Some Suggestions for the Prevention of Shock from Domestic Electrical Appliances.

By H. W. CLOTHIER, M.I.E.E.

IT seems to me that some of the points in Mr. R. H. Rawll's interesting article on the earthing of portable domestic appliances in your issue of February 11th are so vital that they should be emphasised by further comment. One of the most important things that he says is that plugs and sockets with earthing arrangements embodied in them should be provided at every power point, and I agree very heartily with this as a principle. My own view of the best method of providing for earthing, however, is different from Mr. Rawll's: he advocates the use of three-pin plug sockets, and I find it better to have a metal-enclosed plug in which the outer case is used to make a scraping contact. My objection to the pin for earthing is that it may be damaged, and may therefore cease to make proper contact; in all my experience, on the other hand, I have never known a scraping contact to become unreliable.

In my own opinion, every piece of portable apparatus should be provided with a standard socket as an "inlet" for the current, from which the plug with its flexible cable may be detached. The plug at the other end of the flexible cable is, of course, also detachable from the socket on the wall. It may be called the "outlet," and thus the flexible cable, with the "outlet" plug at one end and the "inlet" plug at the other end, will be standard throughout the house, and may be used conveniently at any power point. Corresponding to the words "inlet" and "outlet" for the two ends, the word "trailet" has been applied by my company to the complete part consisting of the flexible cable and the two end fittings.

One of three possible conditions may obtain when the live conductor touches the frame of the apparatus. The frame may be properly earthed, the earth connection may be faulty, or the frame may not be earthed at all. The effect on a person who happens to be touching some other piece of earthed material will be different under each of these three conditions. In the first case, he may handle the frame of the electrical apparatus with perfect safety and no fear of discomfort; in the second, he will receive a shock, which will be more or less severe according to the amount of resistance in the earth connection; and in the third, he will receive a shock at the full voltage to earth of the supply system. A fatality occurring in domestic service is obviously a very serious matter, and, apart from that, it is also of the greatest importance to avoid all possibility of the frequent occurrence of even minor shocks. This is becoming more and more a subject for close attention, because the extent to which electricity will be used in the future is so much greater than it is now. If the present practice of not having effective earthing everywhere continues, it is certain that many more accidents will happen, and that there may even be fatalities; and it does not seem to me that this serious difficulty can be met by merely prohibiting the use of wall plugs in certain places. This would restrict the use of electricity quite unnecessarily. As Mr. Rawll points out, the things in a house that are earthed are not found only in bathrooms or sculleries; there may be, to name a few, kitcheners, used or disused gas pipes, cistern chains for flushing, wash-basin taps in cloak rooms and nowadays frequently in bedrooms, water radiators and pipes for central heating systems, bell wires, wires for connecting up wireless apparatus, and telephone earth wires. Modern buildings, too, have a great deal of steel work in their construction; one might go so far as to call some houses "metal-clad" as a whole. The network from which the domestic supply is taken is usually earthed on one pole outside the house; and when conductors connected to that pole happen to be in metallic contact with the framework, the latter will necessarily be at earth potential, and it is thus quite impossible to ensure that there will be no "earth," even in a room where the presence of earthed materials might not be suspected. I think we must also face the fact that the voltage may be as high as 260, and that this makes the problem more difficult in this country than in those where something in the neighbourhood of 100 V is used.

The bathroom is only different from other rooms because a person having a bath is likely to be in better contact with earth than in any other part of the house. A case is on record of a girl being electrocuted in a bath when using a hair dryer or vibrator; and it is at least conceivable that a person elsewhere who happened to be handling a piece of electrical apparatus—for example, a kettle with a faulty connection—might, if standing near a central-heating radiator, which would necessarily be earthed, put out a hand and touch the radiator, and thus run almost as great a risk in the drawing- or dining-room as in the bathroom. It seems to me that the obvious remedy is to adopt the practice employed in collieries and factories, that is, to earth the framework of all apparatus everywhere. In other words, it ought to be as unthinkable to have electrical apparatus with its framework unearthed in the house as it is now in industrial places. It may be argued that to provide for this would involve the introduction of a number of new regulations, but surely these regulations would be well warranted if absolute security were obtainable by working to them.

If universal earthing is adopted, the first thing to secure is continuity of the earthing system. This has been recognised already in other connections; for example, so long as 30 years ago concentric single-phase systems with earthed outers had only links, without switches or fuses, on the earthed side, and the prohibition by the I.E.E. Regulations of fuses or unlinked single-pole switches on the earthed side of an installation is well known. It has been argued in a discussion following a fatal accident due to a shock from a lamp-post, that there should be no fuses on the earthed side of any sub-circuit. In a discussion at one of the power conferences in Paris, an American engineer stated that the question of earthing had been considered in the United States, and that a proposal had been made to use a concentric system in which the outer was earthed and connected to the framework of the apparatus. At present, I believe, serious shocks are frequent in the States, notwithstanding the lower voltage commonly used there. There are a large number of washing machines, often in damp basements, and the earth connections of these are frequently much neglected or of poor quality. A bad earth connection is worse

than none at all, because it gives a false sense of security. In addition to this, two metallic parts of the earth circuit exposed in a house might have a difference of potential between them sufficient to cause arcing and possibly even a fire; and obviously a shock could be felt by a person touching both of these points, even though he was quite remote from the electrical apparatus. Effective bonding of the metal work in the earth circuit is therefore essential, and the best way of securing it is to use a bare copper wire leading from the sockets of the wall plugs to the nearest good "earth," such as a cold water pipe, and to clamp it to any cable cleating or other metal work that it may pass in its course. If the earth circuit is reasonably well made at the beginning, there is little fear that an open circuit will develop in it. A simple way of checking its continuity is to use the earthing conductor as a common return for the ordinary electric bell system of the house, coupling one terminal of the remote bell pushes to the end of the earth wire, and the corresponding pole of the battery to the nearest part of the cold water system. An accidental break in the earth wire would then be detected by the failure of the bell to ring, and, this indication having been given, the break could readily be found because the earth wire is on the surface and the connection to the water pipes is visible.

It is obviously essential for securing continuity in the earthing circuit that the connection between the earth wire in the flexible and the apparatus "inlets" and wall "outlets" should be thoroughly dependable. This can be achieved with certainty by the use of the protected plugs and sockets already referred to, in which a tongue in the socket or, alternatively, the entire circumference of the socket, makes a scraping contact all round the casing of the plug. Nothing short of deliberate intention, and the use of some special tool, could so distort this contact as to prevent it from making a proper connection. The earthing contact of the flexible is visible where it is connected to the terminals of the plugs at both ends, and, being locked by a spring washer, it cannot work loose unless it is purposely interfered with. One great advantage of this type is that a sound and permanent earth connection can be made by a wireman of ordinary skill. Another very important point is the making of a good earth connection between the protecting shield of the "inlet" socket on the apparatus and the framework of the apparatus. Sometimes a protrusion formed in the metal of the framework can be used, or the earth connection may simply be soldered or welded to the framework. Where this method is used, or a connection is made by bolts or screws, a thoroughly satisfactory job can be made of it at the maker's works, and the apparatus will be sent out in permanently sound condition.

The shrouded type of plug has the very important advantage that it can be used as a circuit breaker, because the arc, when the circuit is broken, is enclosed in a metal chamber. This being so, very considerable saving can be effected by using plug "outlets" without switches in house installations, or, alternatively, more plug "outlets" can be put in for the same total expenditure. It has been argued that if switches are not used, a meddlesome child may poke something into the socket. A switch at the door is, however, no protection in such a case. It would need to be near the socket, and interlocked with it; and it would certainly have to be a double-pole switch, not a single-pole switch like so many of those on the market, which give the impression of security without the reality, because there may still be a live pole although the switch is off. Even when a double-pole interlocked switch is used, the interlock must be essentially of good mechanism and such that it will not fail during the lifetime of the plug; it must clearly be close enough to prevent the plug from being partly pulled out so as to expose the pins when the switch is on. These requirements make the apparatus very costly if switches are included, and it is obvious that it is far from being as simple as when plugs and sockets are used of such sound construction that switches can be altogether dispensed with. The socket fitting can be recessed deeply into the insulation and the holes made so small that even the tiniest child would have difficulty in poking its fingers into the recess, and safety can thus be secured at least as certainly as with switches. A further useful precaution against danger to children crawling on the floor is to put the sockets out of their reach by fixing them two or three feet above the floor level, which gives a real advantage by actually making them more accessible in ordinary use.

I urge most strongly, finally, that it is right and proper to make our homes as free from discomfort and the possibility of danger as we make our factories, and I submit that this can be done in the way I have suggested without depriving ourselves of the use of electric portable appliances in any part of the house where we may wish to have them.

The Charges for Packages.

Returnable and Non-returnable Crates and Cases.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

THE question of packing charges is one which arises from time to time in every trade, very often leading to bad feeling, and more often than not to useless debits and credits being made. Strangely enough, there have been no authoritative legal decisions upon the question whether a seller can charge a buyer with the price of cases or crates, probably because most large sales of goods are in bulk, and in small sales the packing charges are negligible.

It seems to be a general principle of commercial practice which is recognised by the laws of France and of the United States, that all expenses prior to delivery are to be borne by the seller. This, of course, would include packing charges.

In this country, however, the expenses of delivery are generally borne by the buyer, subject, of course, to any contrary arrangement. The Sale of Goods Act provides that the question whether the seller must send the goods or whether the buyer must come and take them depends on the terms of the contract. If nothing is said, the place of delivery is the seller's premises; that is, the buyer must come and fetch the goods.

The Act, however, also says that "Unless otherwise agreed, the expenses of and incidental to putting the goods into a deliverable state must be borne by the seller." Hence, if the place of delivery is the seller's premises, the packing charges will be negligible in most cases. The goods need only be sufficiently packed so as to be handled by the buyer's carman.

If the goods are sold f.o.r. at the town where the

seller's business is, the goods must be packed sufficiently to enable them to go by rail. In this connection two decisions of the Courts are of interest. It has been held that where there was a sale of a cargo of rice "from the deck," the seller must pay all that is reasonably necessary for the buyer to remove the goods. Thus, harbour and dock dues were payable by the seller. And where wool was sold by weight, the seller was held liable to pay the cost of labour in putting the wool into the buyer's sacks.

If goods are sold on the terms that the seller is to send them per post or rail, the delivery is not complete until the goods have arrived. That is, the buyer will not be bound to pay for the goods if they arrive damaged or get lost in transit. Accordingly, the expense incidental to delivering them at the buyer's premises will fall on the seller. The fact that the buyer pays carriage charges sometimes confuses matters, and it might be argued that delivery in those instances is complete as soon as the goods are put on rail, the seller acting as agent for the buyer. But the trade practice is more often than not to the contrary, and if goods are lost in transit the loss is generally borne by the seller, who claims on the carrier. The fact, then, that carriage charges are borne by the buyer does not seem to alter the general presumption that in such contracts delivery is the buyer's premises.

Accordingly, packing material sufficient to protect the goods in transit is the seller's liability. This does not mean that he sells the package to the buyer. The sale is for goods, the package is only an incident in delivery. If the seller chooses to deliver by his own van, he need not pack the goods at all. The packing material is only the seller's means of making delivery, and the buyer cannot claim to keep it if the seller indicates his wish to have it back.

Accordingly, any statement on the invoice that the case is returnable, or any charge made for it, will be sufficient to tell the buyer that he must not keep the empty case. If he does, he will be liable to pay a reasonable price for it. What is a reasonable price depends on the circumstances, but generally the Court will accept the invoice price. If a buyer sees the charge made for a case and chooses to keep it, he will be deemed to have accepted the price charged. Where a case is returned, the seller must, of course, bear the carriage for its return.

A habit is creeping into existence in some trades of charging for packing material and stating that the package is not returnable. This, of course, leaves the buyer open to any number of abuses. The seller could charge top prices for cases and crates without the buyer being able to object. Such a state of affairs is unwarranted at law unless there has been some agreement between the parties previous to the sale. To send goods and state on the invoice, "Charge for case, so much; case not returnable," is not enough to render the buyer liable. By the time the invoice arrives, the goods may have been dispatched, and the buyer cannot but receive them. The invoice in such a case cannot be considered as an agreement.

But where the seller's quotation or price list states that cases will be charged for and will be non-returnable, the buyer will have to bear the cost of packing; for in ordering goods it will be assumed that he orders them on the terms stated in the price list.

But the seller will not be able to charge any price he likes. Suppliers cannot foist on to buyers old cases and make excessive profits out of them. The Sale of Goods Act distinctly says that where no price is agreed, the buyer must pay a reasonable price.

Shortly stated, the law seems to be, where the parties agree previous to the sale, that the buyer shall pay for packages, the seller may charge him a reasonable or an agreed price. Where there is no agreement to pay for packages, the seller must pay for them unless the place of delivery is the seller's place of business. The seller may make an invoice charge for returnable cases, and if the buyer keeps the case he must pay this charge. Otherwise he may return it at the seller's expense and be credited in full with the invoice charge.

A very recent case in Ireland confirms this view. In that case a firm of mineral water manufacturers sold their goods in bottles branded with their name. The course of dealing with customers was to invoice the bottles at a deposit rate of 2s. per dozen, and when bottles were returned they were credited in full. Where bottles were not returned the customers were debited. A dealer in mineral water ordered a hundred dozen bottles, and when 48 dozen of them were empty claimed to keep them at the price charged, namely, 2s. per dozen. This price was, in fact, only a bookkeeping charge, the bottles being much more expensive. The Court held that the dealer was not entitled to retain the bottles. The sale was a sale of mineral water, not of bottles, and the bottles throughout remained the seller's property. The buyer is only entitled to keep the bottles at the seller's agreed price, 2s. not being a reasonable or agreed price. This case contained circumstances which arose out of the course of dealing. In the ordinary way, if a seller makes a charge for a package, it will be assumed that that is the value he places on it; and the buyer can keep the package on payment of the price invoiced. In the Irish case it was stated on the invoice that the bottles could not be purchased, but remained the seller's. The case shows, however, that a sale of goods does not necessarily include a sale of the package, and that neither seller nor buyer can force the other against his will to buy or sell the packing material.

Legal.

British Thomson-Houston Co., Ltd., v. Mullard Radio Valve Co., Ltd.

Mr. Justice Tomlin, in the Chancery Division, on March 11th, had before him the motion by the British Thomson-Houston Co., Ltd., against the Mullard Radio Valve Co., Ltd., which had been adjourned from a fortnight ago. Mr. Whitehead, K.C., for the plaintiff company, said that the motion was for an injunction restraining alleged infringement of a patent. On the last occasion he mentioned that a settlement might be reached, and he was glad to say that the parties had actually come to terms which would involve the discontinuance of the action. He had advised his clients that the best course would be to take no order on the motion except that the costs would be costs in the action.

Mr. R. Moritz, K.C., for the defendant company, assented, and his Lordship made an order accordingly.

British Thomson-Houston Co., Ltd., v. Metropolitan-Vickers Electrical Co., Ltd.

In consequence of the indisposition of Lord Dunedin the further hearing in the House of Lords of this action could not be proceeded with on March 14th, and had to be postponed.

Triumph Trust, Ltd., v. Smith.

In the Mayor's and City of London Court, before Mr. Registrar Dell, on March 8th, a claim was made by the Triumph Trust, Ltd., Old Broad Street, E.C., against Mr. F. Smith, Keighley, electrical engineer, for £9 balance of payment for a radio set. The Registrar said that the defendant had sent a letter to the Court pleading fraud and misrepresentation. He stated that he had returned the set because of faulty equipment. The plaintiffs' solicitor said that the set had not yet been received by the plaintiffs. The defendant, in addition to his agreement with the plaintiffs to hire the set from them, was to get a commission of £1 if he got other people to take similar sets. A witness said that it was not true that the plaintiffs agreed to employ the defendant as sole agent in his neighbourhood. The Registrar said he was satisfied that the plaintiffs were entitled to recover. The plaintiffs' representative said the claim of £9 was for balance of hire; the value of the wireless equipment was £13, but the defendant, upon payment of the balance of the amount, would be entitled to it. Judgment was given for the plaintiffs for the amount claimed.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A New Earthing Clip.

The accompanying illustration, fig. 1, shows a clip which has been introduced by Mr. G. Turnock, 41, High Street, Aston, Birmingham, to facilitate earthing connections on pipes and conduits. It is of the usual pull-up design, with clamping lugs served by a bolt and nut. The bottom portion of the clip is slotted and grooved internally. The earth wire is threaded through the slots, so that when the clip is tightened up the wire is pressed hard against the pipe. By means of the stamped-out portion for the internal groove, the contact is well protected. It is claimed that the grip obtainable is sufficient to carry the weight of an average man.

Improved Control Pillars.

An example of the range of control pillars developed by Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow, S.E., is shown in figs. 2 and 3. The apparatus is particularly suitable for use in connection with underground haulages in collieries, several of which have standardised on the equipment for all their haulages. These pillars, which have recently been improved in several respects, can be supplied for controlling motors up to 120 h.p. at from 440 to 660 V. The distinctive feature of construction is, of course, the assembly of all the control gear for the motor in a single housing, thus eliminating the expense incurred in the supplying and fixing of interconnecting pipes and cables between independent pieces of equipment. The removal of the control pillar for periodical overhaul or repair is also a simple matter, and a spare pillar can be set down and connected up in a minimum of time.

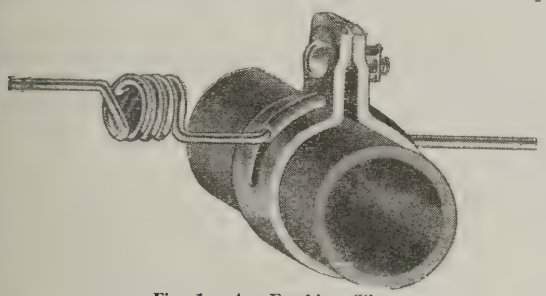


Fig. 1.—An Earthing Clip.

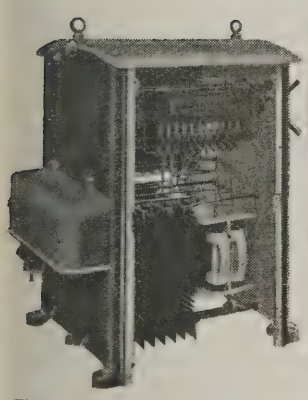


Fig. 2.—Electric Control Pillar, Interior.

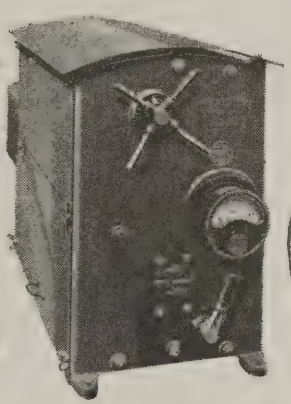


Fig. 3.—Control Pillar, Exterior.

For use with d.c. motors the makers' standard quick-break knife switch with an external operating handle is fitted, whilst for a.c. slip-ring motors a free-handle type of oil circuit breaker is supplied. Standard shielded-pattern fuses are employed for the d.c. equipment. The resistance is rigid, rustproof and unbreakable, the grids being pressed from a special resistance material, and adequately supported by mica insulation. Unless otherwise ordered, the resistances are supplied with a standard grid rating of two minutes over the first portion and continuously over the second portion for the smaller equipment, while for the larger pillars the grids are one minute, two minutes and continuously rated. The controller is liberally designed, the barrel contacts being of ¼-in. h.d. copper for all except the smallest size, in which 3/16-in. contacts are used for motors up to 20 h.p. A terminal box to take the incoming cable and motor leads is one of the improvements on the original design. A special operating gear having an "off" position catch to prevent the controller from being inadvertently carried through to the reverse position before the motor has stopped is supplied. Automatic air-break d.c. circuit breakers can also be fitted in place of switches and fuses for d.c. control pillars if required.

A New Street-Lighting Fitting.

The "White-Way" street-lighting fitting, fig. 6, is an example taken from a wide range of fittings specially designed for suburban use which has been introduced by the Engineering & Lighting Equipment Co., Ltd., Sphere Works, St. Albans, Herts. They are suitable for one 500-W lamp in the inverted position or for two lamps of 150, 200, or 300-W capacity in the ordinary position. The globe ring consists of a casting with a draining channel, and is provided with holes for accommodating the 5/16-in. brass screws by which a spun-copper retaining ring secures the globe at its neck. A centre supporting tube carries a small distribution box from which the lamp holders are suspended, and, by passing on to the canopy relieves the globe of all strain, it is claimed, due to high winds. The glassware is of the makers' "Lunax" quality, for which a lighting efficiency of 85 per cent. is claimed.

Two Special Automobile Lamps.

The leading lamp manufacturers have for some time past been experimenting to produce an automobile lamp which will eliminate glare and dazzle completely and avoid the necessity for dimming, dipping, or blacking-out, and it is interesting to learn that Messrs. Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2, have now placed on the market the "Duplo" lamp, fig. 4, by which, it is claimed, the object is efficiently achieved. This headlamp is gasfilled and provided with two filaments of equal lighting power; one furnishes a powerful light for normal use, and the second is fitted inside a metal cup which throws the rays toward the upper part of the reflector, whence they are reflected on to the road, thereby avoiding glare. As both filaments are of equal c.p., no reduction of light results from switching over from one to the other. The non-dazzling beam is also claimed to be of great assistance when driving in foggy weather. The lamp can be supplied for 6 to 7 V, 18 W (per filament), and 12 to 14 V, 36 W. Fig. 5 shows a twin-filament automobile headlamp which has been introduced by the British Thomson-Houston Co., Ltd., Rugby. This is also provided with two filaments of exactly the same wattage, one of which is situated at the focal point of the reflector, whilst the other is above this position. By means of a change-over switch the filament at the focal point is extinguished and the other lighted, giving the effect of a dipper. This lamp is provided with a corrugated glass bulb, which, it is claimed, eliminates all internal reflections, thereby reducing to a minimum all glare and dazzle. The Mazda lamp is supplied for working on 6-7 V, each filament having a loading of 18 W, and it is made with either English or American caps.

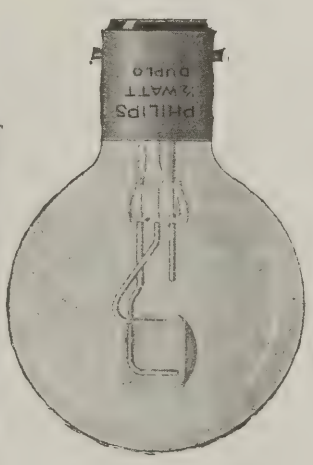


Fig. 4.—The "Duplo" Lamp.

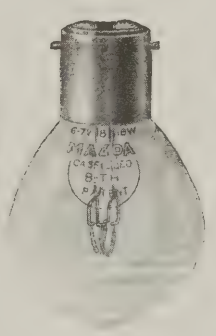


Fig. 5.—"Mazda" Anti-dazzle Lamp.



Fig. 6.—"White-Way" Fitting.

Electrical Progress in New Zealand.

The Trade Commissioner's Report.

MR. L. B. BEALE, Trade Commissioner in the Dominion of New Zealand, has forwarded to the Department of Overseas Trade a report upon the economic and commercial conditions in the Dominion during 1924, 1925, and the first seven months of 1926.

After a period of prosperity, New Zealand received a slight check during 1924-25 and the succeeding year owing to unfavourable weather conditions which affected farming, and to a decline in wool prices. As a consequence, in the twelve months ended June, 1926, imports exceeded exports by about £6,000,000, whereas in the preceding year there was a balance of £6,500,000 in the opposite direction. The general economic position is, however, thoroughly sound, and any favourable movement of price levels will not only maintain but enhance the prosperity of the Dominion. The State finances are said to be in capable hands. During 1925-26, £7,180,479 was spent on public works, &c., of which £4,700,000 was expended on railways, telegraphs and telephones, and hydro-electric power schemes.

Industry and Trade.

Factory production in the Dominion is stated to be steadily growing. The total value of products increased from £76,996,397 in the year ended March 31st, 1924, to £84,101,313 in 1924-25. This figure includes the value of the output of many industries closely associated with primary production as well as those devoted to heat, light and power. Electricity generation and supply is credited with a value of £1,668,743, as compared with £1,430,951 in 1923-24. The value of engineering products is given as £1,846,218, as against £1,644,224 in 1923-24.

The total value of imports during 1925 was £52,456,407; with the exception of the "boom" year of 1923, when the figure reached £61,595,828, this is the highest recorded. New Zealand's imports of electrical goods and apparatus are not mentioned separately in the report, but we are told that Germany's share of this class of trade was £18,385 in 1925, as compared with £12,069 in 1924 and only £878 in 1923.

Hydro-Electric Development.

It is stated that £5,134,496 had been expended on hydro-electric works up to the date of the report, and the Minister for Public Works announced recently that the developments in view called for the expenditure of at least £1,000,000 a year for the next four years, after which there would be a reduction, but not a cessation, of constructional activities. The capital expenditure upon the Mangahao scheme was over £2,000,000 at the date of the report. Wellington City Corporation and a number of power boards were supplied from this source during the year, and the load on the plant has developed very rapidly, the peak load rising to 18,100 kW, very nearly the full capacity of the station (19,200 kW). The load factor is said to be good. In view of the demand, arrangements have been made to expedite the execution of the main Waikaremoana scheme. It is hoped to have two 20,000-kVA sets in operation there by June, 1929. The largest scheme—that at Arapuni—(96,000 h.p.) is progressing. The work, which is in the hands of Sir W. G. Armstrong, Whitworth & Co., Ltd., was originally intended to be completed in August next, and it is not expected that the time will be greatly exceeded. The duplication works intended to raise the capacity of the Lake Coleridge plant from 16,000 to 36,000 h.p. are nearing completion. The first of the new 7,500-kW sets was put into operation in July last and the second was well advanced. The finishing of these four schemes completes the Government's present programme, and the supply will be sufficient for some time. In the South Island, however, where the power is more limited, further investigations are being made with a view to the development of likely hydro-electric resources. The Government has adhered to its promise to use only British plant wherever possible, and only a small proportion of the requirements has been purchased from foreign countries. In January last year a licence was granted to a local group for the development of 50,000 h.p. in the vicinity of Deep Cove, Doubtful Inlet, for electrochemical purposes, as well as a further 250,000 h.p. from Lake Manapouri. The total cost of the whole scheme is estimated at £5,000,000. The first stage of the Lake Monowai scheme of the Southland Electric Power Board was completed and the power switched on on May 1st, 1925. The present capacity is 4,000 kW, and is to be extended to 12,000 kW.

Telephones, Telegraphs and Broadcasting.

The Post and Telegraph Department reported record business during 1925-26, and a satisfactory balance was earned. The rapid increase in the use of the telephone is striking; the number of subscribers' and other stations has doubled since 1917, the total now standing at 130,186 (94.4 per 1,000 of population). Some 30 per cent. of the subscribers are now provided for by automatic exchanges. The system was put into operation in Auckland in 1925, and later in the year the remaining manual exchanges were converted in Wellington. Christchurch is now partially equipped, and Dunedin will soon be totally automatic. In March last a telephone cable was laid between the North and South Islands. During the past two years capital expenditure upon telephones and telegraphs has approximated £1,000,000 per annum, and an extensive programme is in prospect.

Interest in radio-broadcasting was limited until, in August, 1925, the Post and Telegraph Department entered into an agreement with a company which undertook to provide an efficient service for five years. The company took over the existing services and opened a new 500-W station at Auckland. Similar stations were to be erected at Christchurch, Wellington, and Dunedin. At the date of the report the number of receiving licences issued was 5,000, but there were signs of an improvement; the number of dealers' licences doubled during the last year covered by the report.

Railway Electrification.

In August, 1925, two well-known London consulting engineers submitted to the Government a report dealing with the proposed electrification of the suburban sections of the railways in the vicinity of the four main centres. Its chief immediate interest lay in its suggestion that electrification of the existing Christchurch-Lyttleton line might meet present difficulties in a more satisfactory manner and at a lower cost than the construction of the projected new double-line tunnel. After consultation with local interests, a detailed scheme of electrification has been drawn up, and is at present under the consideration of the Government, with, it seems, good prospects of adoption.

Preference for British Goods.

On April 1st, 1926, new regulations were brought into force which limited in general the application of the British preferential tariff rates to goods of the works cost of which half at least consists of British Empire material or labour or both, and which have undergone the final process of manufacture within the Empire. Goods not included within this heading nevertheless enjoy the benefits of preference if all processes of manufacture have been performed within the Empire from unmanufactured raw materials, or from certain specified partly manufactured raw materials. Broadly speaking, the effect of the new regulation has been to raise from 25 per cent. to 50 per cent. the proportion of British labour or material, or both, necessary to qualify for preference. The object in view has been to prevent manufactures of foreign origin qualifying by reason of final processes of finishing off or assembly carried out within the Empire, and thus to encourage the importation of goods thoroughly British in character. Whilst to a considerable extent this aim appears to have been achieved, the result has been in certain lines to divert a proportion of the trade to foreign sources of supply.

American Activity in Brazil.

The semi-official *Industrie und Handels Zeitung*, of Berlin, in announcing the sale to the General Electric Company by the "Cia. Brasileira de Energia Elettrica" of its power stations in the States of Rio de Janeiro and Bahia, expresses regret that by this sale the prospect of German industry participating in the contract for the extension of the Bananeiras power station has diminished. The purchase price is said to be 72,000 contôs (say £1,800,000) for the Rio de Janeiro works and 22,000 contôs (say £550,000) for those in Bahia. The transfer was to take place in about two months, the working staff to be retained, but the supervisors to be replaced by Americans. The Rio newspapers attributed this acquisition by the Americans to the desire to obtain control of fresh outlets for their products. It is recalled that the General Electric Co. has already bought the Cia. de Tramways, Luz e Forca, of Victoria, as well as the Expresa Paulista de Electricidade, of Pauru, and that it is also in negotiation with the Orion Company, of Parretos, which owns the Mariabondos falls in the Paulista district.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Private Bills.

The Bognor Gas and Electricity Bill has been read a second time in the House of Lords. The North Metropolitan Electric Power Supply Bill has been read a first time in the House of Commons.

A Fatal Explosion.

On March 8th, Mr. Day asked the Minister of Transport whether his attention had been drawn to the evidence given at the coroner's inquest on a woman who received fatal injuries in an explosion at her home, due to the fact that an electric feeder laid down along the road by the District Council was over 25 years old and encased in bitumen, and was burnt away for about 18 in.; and if he could state whether a periodical system of overhauling was carried out, in accordance with the requirements of the Ministry.

Colonel Ashley said that the Electricity Commissioners had been informed by the electricity supply company concerned that a gas explosion was the cause of the damage to the cables, and that the cable where the accident took place was in no way connected to the adjacent mains encased in bitumen, which were situated on the opposite side of the street.

Broadcasting.

On March 8th, the Postmaster-General, replying to questions, said that the number of broadcast receiving licences issued during the year 1926 was 2,178,000, as compared with 1,642,000 in 1925. The total receipts amounted to £1,089,000 and £821,000 respectively. Experimental wireless licences had been issued to several persons to enable them to undertake experimental work in the direction of the broadcasting of both still and moving pictures. Several systems had been suggested, but the matter was not yet out of the experimental stage.

Transatlantic Telephony.

On March 8th, Sir W. Mitchell-Thomson informed Captain Crookshank that for the period January 7th-31st, the running costs of the British end of the Trans-Atlantic telephone service, including sundry expenses incidental to the initiation of the service, amounted to approximately £2,000, and plant charges—depreciation and interest—to a further £1,900. It was expected that the service would be self-supporting.

Call Boxes in Post Offices.

On March 8th, Capt. Crookshank asked the Postmaster-General whether he could form any estimate of what would be the cost of installing a public telephone call box in every post office in this country.

Sir W. Mitchell-Thomson said that no reliable figure could be given without compiling an estimate for each individual office, but the total would probably be not less than £2,000,000.

Rural Telephones.

On March 8th, replying to Mr, Rhys, Sir W. Mitchell-Thomson said that the number of new rural exchanges authorised during the years 1924, 1925, and 1926, was 211, 191, and 141 respectively.

Compasses for the Fleet.

On March 9th, Sir Harry Brittain asked the First Lord of the Admiralty if he was aware that all the gyro-compasses in the Fleet were of foreign origin; that the essential gyroscopical units were made abroad; that instructions to officers at the compass observatory and in the Admiralty manual were limited to this particular apparatus; and would he have inquiries made into the matter.

Lieut.-Colonel Headlam, who replied, said that the standard gyro compass used in the Fleet was the Sperry type (American). At the end of 1913, as a result of competitive trial, it was decided to adopt this type instead of the Anschutz (German), the only other gyro-compass then on the market. From that time until the end of the war, as a result of the above decision, the Sperry Company of Brooklyn supplied the British Fleet with gyro-compasses. The scrapping policy after the armistice released a large number of those compasses; they had been reconditioned, and used for further service. As this was the only type of compass in use in the Navy no object was seen in describing other types in the Admiralty manual. When it again became necessary for the Admiralty to purchase any considerable number of gyro-compasses it would afford an opportunity to firms to submit instruments for competitive tests at sea. The foreign-owned organisation (The British Sperry Company) employed British labour and material, and compasses manufactured for the Navy were now made in this country. A further trial of a gyro-compass made by a British-owned firm would shortly be instituted.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Our Trade Names Supplement.

Accompanying this issue of the Electrical Review we are circulating the fourth of our quarterly Trade Names Supplements.

The E.D.A.-E.L.M.A. Campaign.

The official report for the week ended March 12th says that during the week demonstration electric houses were opened at Durham, Sunderland, Blyth, South Shields, Halifax, and Peterborough, and that further houses were to be opened shortly in the following districts:—Halifax, Birmingham, Stoke-on-Trent (2), Derby, Tamworth, Whitley Bay, Whickham, Saltburn, Darlington, West Hartlepool, Annfield Plain, and Newcastle. The Carlisle house was kept open until March 12th, and up to the time of the report had been visited by 10 per cent. of the population. An average of 1,000 people a day were attending the Minard Road (Glasgow) house; coloured lighting was used freely in the rooms of this house. The average daily attendance at Chesterfield is 500, and contractors are said to be delighted with the results. During the first six days about 3,000 people inspected the Leicester house; 80 per cent. of the inquiries related to water heating. The exhibition at Dumfries is reported to have been a success from the business point of view. An electrical exhibition is being run at Yarmouth by the local circle, and an essay competition for boys and girls has been arranged. The North-East Coast children's painting competition was successful.

In last week's official report the attendance at the Aberdeen house during the first nine days was given as 899. This should have been 8,999—a somewhat larger figure!

In our last issue we reported the opening of an all-electric house at Sunderland. We have now received from the



The Sunderland Demonstration House.

Borough Electricity Department samples of literature distributed at the house and photographs, one of which is repro-

duced herewith. One brochure treats of the advantages of the electric home and is well illustrated, and there are pamphlets dealing with the Corporation's appliance-hiring schemes, hire-purchase wiring scheme, and continuous hiring arrangements. Sunderland has an attractive two-part charge for domestic consumers.

A further mass meeting of supply engineers and chairmen of electricity committees was held on March 11th at the Lighting Service Bureau, Manchester. Mr. P. P. Wheelwright, of Blackburn, was in the chair, and Mr. W. E. Bush was the principal speaker. The meeting was chiefly concerned with ways and means of distributing further competition booklets. It was decided to order another 20,000 from E.D.A., and various members of the audience promised to assist in the distribution of large numbers. Mr. Bush stated that up to March 7th 50,000 ballot papers had been received, and that they were coming in at the rate of 1,500 per day. This compared with 40,000 from another somewhat similar competition run by a popular paper.

E.D.A. Annual Meeting.

The annual meeting of the British Electrical Development Association was held at the Savoy Hotel yesterday (Thursday) afternoon. The annual dinner took place at night.

Humour in Advertising.

The British Thomson-Houston Co., Ltd., has sent us a copy of the "Rag Rag," a magazine produced by Manchester University students for their Hospital Week. The contents are refreshing, and the advertising section is most amusing The B.T.-H. advertisement claims that Mazda daylight lamps "enable you to see as well in Manchester by day as by night." An announcement relating to Ferranti l.f. transformers reproduces the company's well-known musical scale, and says "Learn to play this at sight by the Ferranti method without hours of arduous practice." The advertisement of the Chloride Electrical Storage Co., Ltd., is headed "Many an Oxide makes an Exide."

Great Britain's Radio Exports.

The *Wireless Trader* publishes details of the exportation of radio apparatus from this country during January. The total value of the goods (including valves, £11,532) was £88,765. The three most important customers were Japan (£14,684), Australia (£12,980), and Russia (£11,123).

Electric Power in Industry.

The second preliminary report upon the third Census of Production deals with the cotton, and other industries. It was issued as a supplement to the *Board of Trade Journal* for March 3rd. The increased use of electrical power in the cotton trade since 1907 is shown by the following statement, in which particulars of the capacity of electric generators in cotton mills in the two years are given:—

Electric generators. Driven by	1924. KW.	1907. KW.
Steam engines, reciprocating ...	80,092	28,906
Steam turbines	25,545	2,681
Other power	3,875	487
Total	109,512	32,074

The total horse-power of electric motors driven by electricity generated in cotton factories was returned as 128,506. In addition, electric motors of a total horse-power of 176,959 were included in returns received for the year 1924 as driven by purchased electricity. Of this aggregate, 12,299 h.p., or about 7.0 per cent., was "in reserve or idle." Similar particulars were not obtained for 1907.

In the boot and shoe trades, in 1924, there were 3,401 h.p. of electric motors supplied by electricity generated at the factories themselves, while 32,519 h.p. of motors were supplied from outside sources.

The rubber industry returns for 1924 showed that 36,747 h.p. of motors were driven by factory-generated power and 56,238 h.p. by purchased power.

In 1907 the paint and varnish trades had an aggregate of 512 kW generating power; the figure for 1924 was 3,006 kW. Of the 36,431 h.p. of electric motors in use in 1924, 23,568 h.p. of them derived their energy from outside sources.

The supplement to the *Journal* for March 10th shows that in the grain-milling trades electric motors aggregating 68,521 h.p. were installed in 1924; of these a total of 13,437 h.p. were driven by electricity generated in the mills. In the sugar and glucose trades the total capacity of installed generating plant in 1924 was 18,004 kW, as compared with 4,205 kW in 1907; the aggregate power of electric motors was 33,883 h.p., of which 30,394 h.p. was supplied by the industries' own generating plant. The spirit distilling trade in 1924 had generating plant amounting to 5,041 kW (as compared with 503 kW in 1907) and the total h.p. of electric motors installed was 9,128 h.p. (3,022 h.p. purchased). The spirit compounding, &c., trade only had 351 h.p. of electric motors installed, and the tobacco trade had 11,764 h.p., energy for 9,485 h.p. of this being purchased.

Commercial Electrical Travellers.

The Electrical Trades Commercial Travellers' Association is holding a carnival dance to-night (Friday) at Victory House, Leicester Square, W.C.2.

The Power Efficiency Exhibition.

As we have already reported, a Power Efficiency Exhibition is to be held in Manchester from June 22nd to July 2nd. This, for the first time, will cover in one specialised trade exhibition the whole field of steam and power generation, transmission and utilisation. One of the most important sections will be steam generation. Here there will be boilers of all types,, boiler fittings, coal crushers, coal- and ash-handling plant, economisers, feed-water heaters, mechanical stokers, soot blowers, pulverised fuel plant, weighing equipment, &c. Attention will be given to gas firing, low-temperature carbonisation, and the transmission of power. An important series of conferences, &c., is to be held during the exhibition. The manager of the exhibition is Mr. F. Nasmith, 121, Deansgate, Manchester.

Trade Announcements.

Messrs. E. Brook, Ltd., Empress Works, Huddersfield.—The name of the above firm has been changed to Brook Motors, Ltd. No change has been made in the personnel or management.

Messrs. E. Mercer, Ltd., radio engineers, Castleford, have opened additional premises at 36, Carlton Street, in that town.

Messrs. Young, Osmond & Young, Ltd., have removed to Excelsior Works, The Broadway, Bexley Heath, Kent. Telephone: Bexley Heath, 519.

New Catalogues and Lists.

Messrs. L. McMichael, Ltd., Wexham Road, Slough, Bucks.—Monthly circular to the trade, with a blotter and pamphlet advertising the company's multiple switch and h.f. transformers.

The Rees Roturbo Manufacturing Co., Ltd., Wolverhampton.—Circular R238, illustrating and describing the company's engine-driven pumping sets for agricultural and other purposes.

Messrs. F. Gilman (B.S.T.), Ltd., Regent Street, Smethwick.—A descriptive catalogue of "Skatoscalo" boiler-scaling and rust-removing tools.

Metro-Vick Supplies, Ltd., Trafford Park, Manchester.—Illustrated and priced pamphlets dealing with the "Litlux" bed light and the "Cadillac" vacuum cleaner; and a mailing card fully describing the "Emvee" lampholder.

The Universal Manufacturing Co., 3, The Grove, Blackheath, S.E.10.—A price list of electric lamps and a card bearing samples of coloured enamels—opaque and transparent.

The Foster Engineering Co., Ltd., Morden Works, Wimbledon, S.W.19.—A brochure illustrating and describing the company's outdoor sub-stations.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—March stock list of dynamos and motors.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—Book 4, describing, with illustrations, electric watchman's or "tell-tale" clocks. Priced.

Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.—Leaflet No. 80, giving details and prices of "Philips" h.t. supply units for a.c. or d.c.

The Yorkshire Electric Transformer Co., Ltd., Dewsbury.—An illustrated leaflet advertising transformers for rural distribution.

Priorsells, Ltd., 110, Cannon Street, E.C.4.—A priced booklet and a series of pamphlets illustrating and describing the company's ultra-sensitive selenium cells for numerous applications.

The Grout Engraving Co., Ltd., 7, Bridewell Place, E.C.—Two illustrated booklets dealing with the company's work and containing examples.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet No. X4355, illustrating and describing switches for service in theatres, &c. Priced.

The Hart Accumulator Co., Ltd., Stratford, E.15.—A list of distinguished users of "Hart" batteries.

Siemens & English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, E.C.4.—Catalogue No. 160, dealing very fully with the "Siemens-Xcel" domestic electrical appliances, ranging from large cookers to irons. Priced and illustrated. Notes on running costs are included.

The Electric Furnace Co., Ltd., 17, Victoria Street, S.W.1.—Pamphlet D.2, describing the company's electric resistance furnaces. Illustrated.

The Mullard Wireless Service Co., Ltd., 21, Denmark Street, W.C.2.—A comprehensive catalogue of the company's valves, containing illustrations, details and prices of about 50 types—transmitting, detecting, amplifying, and modulating.

The Westinghouse Electric & Manufacturing Co., East Pittsburg, Pa., U.S.A.—Illustrated pamphlets, dealing with a vest-pocket ammeter and a cabinet portable voltmeter for radio purposes.

Messrs. Baxter & Caunter, Ltd., 219, Tottenham Court Road, W.1.—March price list of electrical materials, appliances, and accessories. Fully illustrated.

The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.C.2.—Two coloured posters, one dealing with a three-valve receiver employing "K.L.1" and "U.5" valves, and the other advertising the "Marconiphone" h.t. supply unit. Also a window slip advertising "Marconi" valves.

The Bastian Meter Co., Ltd., 58, Haymarket, S.W.1.—An illustrated and priced pamphlet, giving particulars of "Bastian" storage geysers.

Messrs. Hans Renold, Ltd., Burnage Works, Didsbury, Manchester.—An illustrated catalogue of "Renold" chains, &c.

BROOK MOTORS, LTD., Empress Works, Huddersfield.—An illustrated catalogue of single-, two-, and three-phase motors, squirrel-cage and slip-ring types.

THE LONDON ELECTRICAL CO., 1, Sherborne Lane, King William Street, E.C.4.—A well-illustrated, priced catalogue of radio receiving sets, components, and accessories.

Bankruptcy Proceedings.

A. J. GARROD, manufacturer of valves, sets, and parts used in wireless telegraphy, Whitehorse Place, Wellingborough.—Receiving order made March 4th, on creditor's petition. First meeting, March 21st, at the Official Receiver's office, The Parade, Northampton. Public examination, April 1st, The County Hall, Northampton.

O. WALKER (Albion Electric Co.), electrical contractor, 112, Albion Street, Wallasey.—First meeting, March 21st, at the offices of the Official Receiver, 11, Dale Street, Liverpool. Public examination, April 6th, at the Court House, Birkenhead.

Company Liquidations.

SELLING WIRELESS, LTD.—A meeting of members is called for April 12th, at the office of Messrs. Lee & Whitfield, Bank of Liverpool Chambers, Park Row, Leeds, to hear an account of the winding up from the Liquidator, Mr. J. A. Couper.

WIRELESS VALVES, LTD.—A meeting of members is called for April 20th, at the offices of Messrs. Blakemore, Elgar and Co., 9, King's Bench Walk, E.C.4., to hear an account of the winding up from the Liquidator, Mr. G. Freire-Marreco.

BRITISH WIRELESS SUPPLY CO., LTD.—First and final dividend on preferential claims of 8s. 4½d. in the £, payable at 12, Northgate, Bradford.

FOOLPRUFE PATENT ACCUMULATOR CO., LTD.—Winding up voluntarily. Liquidator, Mr. G. T. Berry, 32, The Square, Market Harborough. Meeting of creditors, March 25th, at 44, High Street, Market Harborough. Particulars of claims to the Liquidator by April 9th.

KNIVETOWN ELECTRIC WIRE CO., LTD.—Particulars of claims by April 16th, to the Liquidator, Mr. S. W. Tubbs, 24, Basinghall Street, E.C.

WOODSTOCK ELECTRIC LIGHT CO., LTD.—A meeting of members is called for April 4th, at the Town Hall, Woodstock, to hear an account of the winding up from the Liquidator, Mr. V. N. Tolley.

Dissolution of Partnership.

PARKINSON & TALBOT, plumbers, electricians, &c., Clayton West, near Huddersfield.—Messrs. W. A. Parkinson and J. E. Talbot have dissolved partnership.

Private Arrangements.

R. D. TREVOR ROPER, 6a, St. Leonards Road, Bexhill-on-Sea, electrical and radio engineer.—A meeting of creditors was held at the offices of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C., on March 9th, when Mr. E. H. Hawkins said that the debtor commenced trading on his own account four years ago as an electrical and wireless dealer. Later, he removed to premises in St. Leonards Road, and also took over a shop at another address. Last October the debtor required further capital and it was arranged that £200 should be put up provided a limited company was formed. A limited company was formed on October 20th last, and the purchase price which the company paid was £1,205, which was satisfied by fully-paid shares. The nominal capital of the company was £2,000, and shares were issued to the extent of £1,407. Instead of the debtor keeping the shares for himself he only took over 500, and the remainder were issued to his nominees, principally for cash advanced to the debtor before the limited company was formed. The debtor's own personal debts amounted to £615, and there were costs and other charges. The debtor had intimated to Mr. Hawkins that he understood that the limited company would discharge his liabilities, but Mr. Hawkins had gone into the matter, and so far as he could see there was no legal claim on the company. The debtor had been sued by several creditors, one of whom had issued a bankruptcy notice. The debtor had intimated to the creditors that he was prepared to offer a cash composition of 5s. in the £ in settlement of their debts. Several of the creditors had written to say that they were prepared to accept the offer, including the petitioning creditor. The creditors present recommended the acceptance of the debtor's offer, and it was decided that the suing creditors' costs should be paid in full.

E. W. DICKIE, trading as E. W. Dickie & Co., 13, The Broadway, Gleneagle Road, Streatham, S.W., electrical and radio engineer.—A meeting of creditors was held recently at the offices of Messrs. Veitch & Co., C.A., 9, Coleman Street, E.C., when Mr. H. J. Veitch presented a statement of affairs which showed liabilities of £1,469 and net assets of £554, leaving a deficiency of £915. There was also a lease of unascertained value. According to the trading figures presented for the two years ended December 31st, 1920, the sales were £6,210, there was a gross profit of £1,289, the expenses were £847, and there was a net profit of £442. The drawings were £522. For the year ended December 31st, 1921, the sales were £3,453, on which a gross profit was made of £1,014. There was a net profit of £266, and the debtor drew £402. During the following year there was a profit of £57 on sales of £2,505, while for the year ended December 31st, 1923, the profit was £374 on sales of £3,139. During the following year the sales were £2,535, there was a gross profit of £688, and a net profit of £126. During that period the debtor drew £283. For the following twelve months the sales were £2,425, there was a gross profit of £814, and the net profit was £256. The debtor drew £286. From January 1st, 1926, to March 8th, 1927, the sales were £2,039, the gross profit was £549, and there was a net loss of £36. The debtor drew £247. It was decided that the estate should be dealt with under a deed of assignment in favour of Mr. H. J. Veitch and Mr. A. J. Osborne, of Balfour House, Finsbury Pavement, E.C., as joint trustees, together with a committee of inspection consisting of the representatives of the Hart Accumulator Co., Ltd., Edison Swan Electric Co., Ltd., and Mr. P. S. Booth, representing creditors.

J. A. SMITH and C. H. MALLEY, trading as the Boro' Electric Co., 457, Borough Road, Birkenhead, electricians.—A meeting of creditors was held recently, at the offices of Mr. C. Semper, Liverpool, when a statement of affairs was presented which disclosed liabilities of £743, and assets of £130, leaving a deficiency of £613. The business was established on February 1st, 1923, with a capital of £200, found by Malley. Of that amount £100 was his own money, and £100 was lent to him by his father. The sum of £120 was expended in fitting up and decorating the shop. A full set of books had not been kept, but it was estimated that during the year ended January 31st, 1924, the turnover was £1,500, and in the following twelve months it increased to £1,700. During the year to January 31st, 1926, the turnover was about £2,000, and during the following year it was about the same amount. On February 4th the landlord distrained for rent, and a distraint for rates was also levied. The stock, which was estimated by the debtors to have cost £150, was removed for sale, and the debtors believed that it realised rather more than £50. The present position was attributed to losses on contracts and lack of capital. No definite offer was submitted, and no resolution was passed. The creditors include:—

	£		£
Advance Lamp Co. ...	153	Karpax, Ltd.	20
Henry & Paris, Ltd. ...	31	General Electric Co., Ltd.	202

H. A. RATCLIFFE, trading as United Agencies (Western), electrical and wireless dealer, 15, Charles Street, Cardiff.—A meeting of creditors was held on March 7th, at the offices of Messrs. Phœnix & Levinson, Cardiff, when the representative of Messrs. Siemens Bros. & Co., Ltd., one of the principal creditors, was elected to the chair. The statement of affairs presented showed liabilities of £7,208 and net assets of £1,622, leaving a deficiency of £5,586. The debtor commenced trading on June 1st, 1925. Prior to that date he was the local manager for a well-known firm in the trade. The debtor commenced with about £500 in cash, received from his father, who guaranteed the bank to the extent of £2,000. It was also understood that the father had guaranteed certain of the creditors' claims. During the past few months the debtor had been in ill-health. He was recently pressed by creditors, and on March 2nd executed a deed of assignment to Mr. Holbrook. There was a total loss of £6,086, accounted for by a loss on trading, bad and doubtful debts, written-off stock, depreciation, and personal expenditure. The turnover since the commencement had been £11,871. A resolution was passed confirming the deed of assignment already executed to Mr. Holbrook, and it was also decided that the debtor should be given seven days in which to find cash for the payment of a composition of 5s. in the £, failing which the estate should be realised under the deed, under the supervision of a committee consisting of the representatives of Messrs. Siemens Bros. & Co., Ltd., Poppleton & Appleby, Birmingham, and Clarke, Dovey & Co., Cardiff. The following are creditors:—

	£		£
Belling & Co.	42	Marconiphone Co., Ltd.	195
Benjamin Electric, Ltd.	25	Nathan, Frank J., & Co.	34
British Thomson-Houston Co., Ltd.	24	Oldham & Son, Ltd. ...	32
Chloride Electrical Storage Co., Ltd.	67	Philips Lamps, Ltd. ...	61
Ferranti, Ltd.	67	Radio Instruments, Ltd.	25
Graham Amplion, Ltd....	50	Shanks & Co., Ltd. ...	22
General Electric Co., Ltd.	771	Siemens Bros. & Co., Ltd.	275
Hardwicke, C. J.	21	Wolff, M. & A.	39
		"Z" Electric Lamps and Supplies Co., Ltd.	117

Deed of Assignment.

J. L. COURYER, electrical engineer, 181, Perth Road, Dundee.—Particulars of claims by March 21st, to the Trustee, Mr. P. J. McIntyre, 20, Reform Street, Dundee.

New Municipal Showrooms and Offices.

The Fulham Electricity and Lighting Committee has recommended that premises in Fulham Road be demolished and that new showrooms and offices be erected on the site at an estimated cost of £13,000.

At a meeting of the Nottingham Society of Engineers, on March 7th, strong opposition was raised to the projected establishment in Nottingham of a municipal showroom for electrical appliances, it being argued that if such an arrangement were made it would result eventually in the local supply undertaking losing the salesmanship of an enterprising body

of contractors. Mr. G. S. Haydon, resident engineer at the North Wilford power station, contended, however, that such a showroom would be a valuable asset in educating the public. It need not sell directly at all, but might refer inquirers to firms of contractors.

For Sale.

Mr. G. R. Lightfoot will sell by auction, on March 31st and following days, at 13, High Holborn, W.C., wireless and electrical trade stocks. By order of the D.A.D.O.S., Messrs. Horne & Co. will sell by auction, on April 5th, at Hilsea Lines Ordnance Depôt, Cosham, Portsmouth, electrical plant, cable, hand and machine tools, &c. By direction of the trustees, under a deed of assignment, Messrs. Trubshaw and Taylor will sell by auction, on March 30th and 31st, at 3 & 5, Mansell Street, Aldgate, E., the stock of an electric, gas and water fittings manufacturer, &c. (See our advertisement pages to-day.)

Social Events.

The Hackbridge Cable Company's Sports Club is holding its annual dinner at the Grey Hound Hotel, Carshalton, on Saturday, April 9th.

On February 25th the staff of the London Electric Wire Co. & Smiths, Ltd., held their annual ball at the Hotel Metropole, over 150 members of the staff and their friends being present. The gathering was representative of the board, the London office, the Leyton works, and the provincial branches.

The electrical staffs of the Doncaster Collieries Association, Ltd., held their second annual dinner and dance recently. Mr. C. C. Bleack, electrical engineer to the company, mentioned, in replying to a toast, that the amount of energy generated by the associated companies had risen from 16,250,000 kWh in 1922 to 27,330,000 kWh in 1925. Last year it fell to 21,500,000 kWh; had it not been for the coal stoppage it would have been something like 33 million kWh. Representatives of many of the leading electrical companies were present at the dinner.

The Electricity Supply Commercial Association (Greater London Division) is holding a dance on Saturday evening, March 26th, at the Poland Rehearsal Rooms, 49, Poland Street, W.1. Tickets can be obtained from delegates and the divisional and general secretaries.

The annual staff dinner of the Sterling Telephone and Electric Co., Ltd., was held at the Abercorn Rooms on March 4th, and was, as usual, well attended. The chair was taken by Mr. W. H. Peak, O.B.E., managing director, supported by Mr. C. E. Hunter, works manager, and Mr. N. Blades, chief telephone engineer. An excellent musical programme, provided by members of the staff, completed a very enjoyable evening.

Unemployment.

The Employment Exchange returns show that the number of unemployed continues to fall. On February 28th the total was 1,169,500, as compared with 1,196,060 on February 21st, and 1,107,140 on March 1st, 1926. The increase, as compared with last year, is due to the fact that there are 97,000 fewer men employed in the coal-mining industry; in most other branches conditions are better.

The Peruvian Market.

Mr. J. P. Trant, British Consul at Callao, has recently forwarded to the Department of Overseas Trade a report (dated October, 1926), upon the commercial, economic, and financial conditions in Peru. The general impression gained from Mr. Trant's introduction is that Peru is a settled country and has made considerable progress in the direction of important public works. Unfortunately, this policy of improvement has proceeded too rapidly, with the result that the public debt has increased to an abnormal extent, with a corresponding rise in taxation, which has affected industry badly. The mining industry, which is mainly under foreign control, maintained its position during 1925, when the production of copper rose in value from £P2,406,031 to £P2,829,666, and that of lead from £P37,171 to £P191,693. The statistics of foreign trade during the first six months of 1926 give the value of imported electrical goods as £179,714. In 1925, the value was £372,784. It is stated that the charges for electricity in the capital, Lima, are high, and restrict its use to lighting in the domestic sphere, and to the occasional pumping of water. There is consequently no market for cooking and heating apparatus. The demand for crude-oil engines for generating electricity, on the contrary, has been stimulated. Industrial development has been retarded by the high cost of power. Interest in broadcasting is stated to be languishing on account of the difficulties of providing suitable entertainment and picking up distant stations owing to atmospherics. The post and telegraph services have been taken over by Marconi's Wireless Telegraph Co. Ltd., for a period of 25 years. There are a number of small public telephone companies operating in Peru, but the Marconi Co. has secured preference in opening up new districts. In the Peruvian market keen American competition is encountered; conditions are all in favour of the United States. The appointment of local agents is advised rather than the sending of travellers, whose way is not made easy. The need for Spanish in communication is stressed.

The Basle Fair.

Details of this year's Swiss Industries Fair which will be held at Basle from April 2nd to April 12th, are now available. The new permanent fair buildings, which have been under construction during the past three years at a cost of ten million Swiss francs are now completed. They comprise, in addition to the six exhibition halls, a series of social and business rooms for the convenience of buyers, including private offices in which current business may be conducted. Special fare reductions will be granted to visitors to the Fair by the Swiss Federal Railways. An illustrated brochure has been issued by the fair authorities, and is obtainable from them or from the Swiss Legation in London.

Gift to Bradford Technical College.

Messrs. Jessop & Boydell, Ltd., electrical engineers and contractors, of Bradford, have made a gift of electrical instruments and resistances to the Electrical Engineering Department of the Bradford Municipal Technical College, and have received the thanks of the Technical Education Sub-Committee.

"Hand-to-Mouth" Buying.

A symposium of American views upon this subject, which is of great importance to manufacturers, is reproduced in the January *Journal* of the British Empire Chamber of Commerce in the United States. Generally speaking, the manufacturers condemn the practice of buying for immediate needs only; one of them states that it increases overhead charges to a great extent. Others realise that the improvement of transportation facilities has made the practice feasible for the retailer, and that view is put with some force by the president of the Pennsylvania Railroad (Mr. W. W. Atterbury). He says that the confused ideas upon the subject give the phrase "hand-to-mouth buying" an odium which is unreasonable.

"Forward buying in the sense that term was used years ago is no longer necessary or, in my opinion, desirable. There are several reasons for this: The transportation services now available eliminate risk that goods or supplies will not be on hand when wanted; piling up inventories is, industry has found, an undesirable practice; forward buying accentuates seasonal activity with corresponding slumps in employment; buying on an as-required basis spreads our production more evenly; and the tendency towards changes in design and requirements makes it undesirable to stock great quantities."

The *Journal*, while it can discern no effect of the policy at present, considers it possible that industry will in the future have to adjust itself to the altered conditions.

Local Exhibitions.

Bradford.—To wind up an Ideal Homes Exhibition, held for the first fortnight of March at Bradford—at which the Bradford Corporation Electricity Department had a series of highly attractive demonstration stands—a ball was given by the exhibition promoters on the evening of March 10th, and during the evening gold and silver medals were presented to the exhibitors whose stands had been declared, by a public ballot, to be the most popular. The Bradford Electricity Department secured the silver medal for local exhibits.

Epsom.—During the whole of last week an electrical exhibition, organised by the municipal Electricity Department was held at the Lecture Hall, Epsom. Messrs. Absalom & Garland, a local firm of electrical contractors, actively co-operated with the Department and exhibited a representative range of "Magnet" domestic appliances and lighting fittings.

Hampstead, N.W.—Products of the General Electric Co., Ltd., are also to form part of a "Science in Industry" exhibition which is to be held from March 29th to 31st at the Haberdashers' Aske's Hampstead Schools, Westbere Road, N.W.2. These will include a working refrigerator unit, lamps, and valves, &c.

The Canadian Market.

In the course of a recent letter to us, Mr. J. R. Cowley, city electrical engineer of Saskatoon, Saskatchewan, says:—"There is no reason why British manufacturers should not obtain a larger share of purchases in Western Canada other than the lack of representation and knowledge as to what is being done by them along the lines in which we are interested. It is the intention of this department to obtain tenders from British firms before placing contracts for steam and electrical equipment in the future."

The B.E.A.M.A.

The annual meeting of the British Electrical and Allied Manufacturers' Association was held in London yesterday (Thursday).

New Swiss Company.

A company has lately been formed in Geneva (17, Boulevard Helvetique) with the title La Société des Applications Electriques, to exploit the Swiss agency for the Frigidaire Corporation, of Dayton, U.S.A.

New Indian Companies.

Among the concerns recently formed in India in connection with electricity supply, are the Meerut Electric Supply Co., 3, Burn Bastion Road, Delhi, with a capital of 15,00,000 rupees, and the Baluchistan Electric Supply Co., Quetta, capital 10,00,000 rupees.

Chinese Company's Reorganisation.

The Great Eastern Battery Manufacturing Co., Shanghai, recently underwent reorganisation, increasing its capital by 50 per cent. and adding a carbon manufacturing department. The company makes batteries for radio work, flashlamps and bells, including the component parts of these.

Book Notices.

"Modern Industry." By Malcolm Sparkes. Pp. 64. London: Student Christian Movement. Price 1s. 3d. net.—"This booklet," says the Publisher's Note, "is intended primarily for those who are concerned about the relationship between Christianity and social problems." Its sub-title is "The Christian Line of Development," and it leads up to the control of industry by "industrial councils," with a view to raising wages and lowering prices.

"The Electricity (Supply) Act, 1926." By T. J. Sophian. Pp. vi+62. London: Sweet & Maxwell, Ltd. Price 4s. 6d. net.

The *Queen's Engineering Works Magazine* for January, received last week, is appropriately dedicated to the memory of the late founder of the works and chairman of the company, Mr. W. H. Allen, a portrait of whom forms the frontispiece. It is an excellent number, of 94 pages, containing many interesting articles.

"Electric Switch and Controlling Gear," by Dr. C. C. Garrard. Third Edition. Pp. xiv+783; figs. 649. London: Ernest Benn, Ltd. Price 63s. net.

"The Operation of Receivers from A.C. Mains." Pp. 8; 3 diagrams. London: Marconiphone Co., Ltd. Price 6d.—This booklet contains useful information for the conversion of wireless receivers of the multi-valve type for operation entirely off a.c. mains with the aid of KL.1 valves. The subject is dealt with in general terms to make the information universally applicable. The additional components required are enumerated and their prices mentioned.

"Chemical Engineering and Chemical Catalogue." Third Edition. Edited by D. M. Newitt, Ph.D.; p. 404; fully illustrated. London: Leonard Hill. Price 10s. 6d.—In this new edition of the chemical engineering catalogue considerable additions have been made in both the number of subscribers and the tables and data contained therein.

"Electric Power Stations," by L. W. W. Morrow. Pp. viii+326; figs. 177. London: McGraw-Hill Publishing Co., Ltd. Price 20s.

Australian Radio Action.

The Sydney *Daily Telegraph* reported recently that writs had been issued on behalf of Amalgamated Wireless (Australasia), Ltd., claiming £25,000 against the provisional directors of Victoria Radio Interests Pty., Ltd., for alleged trade libel in an advertisement published in certain Melbourne newspapers.

A Commercial Travellers' Club.

Mr. C. J. Kebbell, the secretary, has sent us particulars of the British Commercial Travellers' Club which is to be opened to-morrow (Saturday). The premises are situated at 24-28, New Oxford Street, W.C.1, and all the usual club facilities are provided. Membership is open to all commercial travellers and such other persons as may be approved by the Committee. The subscription is one guinea per annum.

A New Way of Packing Flex.

Messrs. W. T. Glover & Co., Ltd., have recently abandoned the old method of packing flex, *i.e.*, by coiling it, and are now doing it up in the form of balls as is usual with string. Packed in this way it can be pulled through a hole in the carton, whence it comes smooth, clean and unkinked.

Recent Contracts.

The Alton Battery Company, Ltd., has received a contract from the Nottingham Corporation for a battery of 256 cells for the North Wilford power station. During February three further orders for power station batteries were placed with the company, two being for Greece and one for Buenos Aires.

The Electric Furnace Co., Ltd., 17, Victoria Street, S.W.1, has received further orders for high-frequency electric furnaces for the manufacture of high-grade tool steel from Messrs. W. Jessop & Co., Ltd., Sheffield, and J. Holtzer & Co., Unieux, France. Each installation will be capable of melting about four tons of alloy steel per day.

Messrs. Simon-Carves, Ltd., have recently secured an order from the Whitehaven Colliery Company for firing three boilers with pulverised low-grade fuel. Other orders which the company has in hand include the final extensions at the Prince's Station, Nechells, Birmingham, where four Simon-Carves boilers, each rated to evaporate 150,000 lb. per hour on normal load (180,000 lb. on overload) are being installed with coal drying, pulverising and feeding equipment on the company's "Central" system; extensions at the Peterborough Corporation, including coal drying, pulverising and feeding equipment, 12 tons per hour; and for the Tilmanstone (Kent) Collieries, Ltd., the addition of Simon-Carves patent water-cooled combustion chambers to two Stirling boilers and the necessary pulverising plant.

The Pirelli-General Cable Works, Ltd., has secured an order from the Coventry Corporation for the supply and installation of approximately 30 miles of 3-core cable for a working pressure of 33,000 V. Each core of these cables will be separately lead sheathed and the three cores laid up together. The cable is made circular by means of tanned jute fillings, and the whole is then lapped with two compounded hessian tapes, which form the bedding for the single wire armour. The cable is compounded double hessian taped overall. The cables will connect the new super power station at Hawkesbury with the existing generating station at Sandy Lane, and with two sub-stations.

The General Electric Co., Ltd., has recently secured the contract for a complete cyclorama, cloud apparatus, panorama projectors, and a full battery of horizon colour floods for the New Carlton Theatre, Haymarket. It is also supplying a complete set of special 100-contact open coil metallic type dimmers arranged for remote control; the contractors are the Berkley Engineering Co. A further contract has also been secured for the stage lighting equipment which is being installed at the new Park Lane Hotel, W., which is to be opened shortly. The electrical contractors are Messrs. Tredegars.

Messrs. Hick, Hargreaves & Co., Ltd., have secured the order for the whole of the condensing plant and auxiliaries for the new Hams Hall generating station for the Birmingham Corporation.

Prices of Materials.

Messrs. James Forster & Co. reported on March 12th that the lead market became unsettled by the sudden declaration of a considerable tonnage of lead for early arrival from Burma, which brought about a fall on March 7th and 8th of 13s. 9d. a ton. The tone was afterwards steady, with prices practically unchanged, closing at £28 2s. 6d. for March, £28 6s. 3d. for April, £28 8s. 9d. for May, and £28 11s. 3d. for June. "In consequence of the drop in values, the home demand quietened down, consumers being somewhat apprehensive of any further fall. Buying, however, must be resumed before long, and the steadier conditions now prevailing will help confidence to return."

Messrs. Lindsay & Williams, Ltd., following their usual practice, have sent us a copy of their chart showing the course of prices of raw materials for the cable industry during 1926. The curves deal with American cotton, plantation rubber, h.c. copper wire, and pig lead.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, March 15th: Copper (electrolytic) bars, £63, 2s. 6d. dec.; ditto ditto sheets, no change; ditto ditto wire rods, £73, 2s. 6d. dec.; ditto ditto h.c. wire, 9 3/16d., 1/16d. dec.

Messrs. James & Shakespeare report, March 15th: No change in the prices of copper bar, sheets and rod, and English pig lead.

Messrs. Edward Till & Co. report, March 15th: India-rubber, Para fine, 1s. 5¼d., ¾d. dec.

Greek Telephone Concessions.

For the purpose of reorganising and extending the Greek telephone system, a new company was formed a little time ago with a capital of £500,000. Of this amount, 80 per cent. was subscribed by Siemens & Halske, and the remaining £100,000 by a Greek group. In this connection it may be recalled that about the middle of last year it was reported that a Belgian-English group had been granted a concession for the extension of the Greek telephone system.

Lighting and Power Notes.

Argentina.—Hydro-Electric Development.—By Presidential decree a commission is to be nominated to make a complete survey of the water power resources of Argentina. For this purpose a Hydraulic Investigation Bureau has been established under the Ministry of Public Works. The chief engineer will be Señor Don Lépori, who has been sent to study the principal water power resources of the United States and their application.—*Reuter's Trade Service* (Buenos Aires).

Australia.—Collie (W.A.).—The *Electrical Engineer* of *Australia and New Zealand* reports that steps are being taken to proceed with the electricity scheme for the towns of Collie and Bunbury and the surrounding districts in Western Australia. An Act of Parliament authorising the scheme and laying down the lines upon which it is to be controlled and financed has been passed. The undertaking will be administered by a trust consisting of five members, three of whom, including the chairman, will be appointed by the Government, and the other two by the municipalities of Collie and Bunbury. Of the necessary capital, the municipality of Collie will subscribe £60,000, the Bunbury municipality £50,000, and the Government £110,000. It is estimated that a station to meet the expected demand can be erected at a cost of £216,000. The present proposal is to supply the towns named and all towns and districts within a radius of about 40 miles of Collie. The energy will be sold in bulk to the various local authorities. Bulk supplies will be provided also for the coal mines at Collie. Electricity will be supplied to the mines at 1¼d. per kWh and to other consumers at 2d. per kWh.

Barmouth.—Electricity Supply.—It was reported at a recent meeting of the Urban District Council that the Electricity Commissioners have decided not to proceed with an application from Aberartro for an Order to supply electricity in the district. The application has been under consideration for three years, and £20,000 has been spent on initial work by the promoters. A sub-committee has been appointed to consider alternative schemes.

Barrow.—Extension Scheme Rejected.—The Electricity Commissioners have refused to sanction the scheme for extensions to the Corporation generating station at a cost of £60,000, and propose that other arrangements should be made to meet local requirements. The Council has appointed a deputation to interview the Commissioners.

Loan Sanctioned.—The Town Council has received sanction to the borrowing of £44,591 for main transmission line, mains and services, sub-station equipment and meters.

Brazil.—Hydro-Electric Development.—The Governor of the State of Rio de Janeiro has ordered a report to be prepared on the water-power resources of the central regions with a view to furnishing power for industrial purposes to several municipalities, including Sao Franciscao de Paula, Santa Maria Magdalena, and Sao Sebastiao do Alto. Industrial plants will be first established in the larger towns such as Campos Macaché, and Nictheroy.—*Reuter's Trade Service* (Rio de Janeiro).

Bury (Lancs.).—Street Lighting.—The Town Council has applied for sanction to a loan of £5,000 for lighting the main roads in the borough by electricity.

Canada.—Electrical Development.—A mercury-arc rectifier sub-station was put into operation at Verdun, Que., on February 9th by the Montreal Tramways Co. to meet the increasing needs for power in the city of Verdun and the vicinity, at a cost of $200,000. The station pressure is 12,600 V a.c., which is converted by transformers and rectifiers into direct current at 600 V. The electrical equipment was supplied by the Brown Boveri Co. of Baden, Switzerland; Nicholson Construction, Ltd., were the building contractors.

The Algoma District Power Company has decided to install an additional unit of 2,000 h.p. at Michipicoten Falls at once; plans are under consideration for rendering available the full capacity of the Falls. To do this will involve the removal of a large hill 150 ft. high and about 100 yards in length, so that the present bend of the river can be tapped for a new sluiceway. This will be a difficult and costly work, and a force of engineers is engaged in a preliminary survey. It is planned to remove the loose sand by hydraulic piping, and, in addition, there will be a great deal of rock work.

Cardiff.—Assisted Wiring Scheme.—The Finance Committee has considered the proposal of the Electricity Committee to set aside £20,000 towards the cost of an assisted wiring scheme, under which the Corporation would wire houses and install the necessary electrical fittings for lighting and heating purposes, and spread the cost over a period of years. According to the *Western Mail*, the chairman of the Electricity Committee states there are some 40,000 houses in the city, of which at least 30,000 do not use electricity. It is estimated that orders would come in for the wiring of at least 2,000 houses under the proposed scheme, and as it is not intended that the scheme should apply to houses with more than seven lights, the average cost of installation is placed at £10 per house. Instead of charging 4½d. per kWh, the customer would be charged, say, 8d. per kWh until the difference in the unit charge had wiped out the cost of the installation. The matter has been referred back to the Electricity Committee to prepare a complete scheme.

Clitheroe.—Inauguration of Supply.—An electricity supply for the district was formally inaugurated by the Mayor on March 9th. Electricity is supplied from the Lancashire Electric Power Co.'s station at Padiham to the Council's substation, in which two 300-kW transformers are installed. Accommodation has been provided for four additional transformers. The scheme included the laying of 14,000 yd. of distributing cable, 4,500 yd. of public light cable, and 5,000 yd. of e.h.p. cable, and the cost was £25,000. To celebrate the event a scheme of illumination was carried out.

Continental.—Russia.—The Glavelektro has presented a report to the Gosplan (State Planning Commission) on the plan for the electrification of the Donetz basin. The Glavelektro is in favour of the construction of small stations of from 12,000 to 20,000 kW, in addition to large stations of from 80,000 to 100,000 kW. Investigations are to be made this year in three districts in order to determine the site of a regional power station of 100,000 kW, so that a definite start can be made during the next financial year with the construction of the station. The independent construction of power stations, utilising gas plant, by metal works is approved, and it is estimated that during the next five years it will be necessary to order 13 sets with a capacity of 3,500 kW for the works belonging to the Southern Steel Trust (Yugostal). By the year 1930-1931, the Donetz basin will have, according to the plan, regional and subsidiary power stations with a total capacity of from 240,000 to 300,000 kW, excluding independent installations at various works. The Glavelektro insists on the necessity of using not only coal dust and coal of inferior quality, but also other waste matter, such as steam used in certain processes and gases from coke ovens and blast furnaces. —*Reuter's Trade Service* (Moscow).

A *Reuter* message from Leningrad says that at a recent meeting of the regional Elektroplan a report on the proposal for a hydro-electric power station on the Neva (Nevstrol) was finally approved. The station is to have a capacity of 60,000 kW, and the cost of construction is placed at 74,000,000 roubles. The plan is being sent to Moscow for approval by the Glavelektro.

The Berlin correspondent of the *Financial News* reports that the Soviet Government, after several years of consideration, has decided to carry out a project for the construction of a hydro-electric power plant on the river Dnieper and for improving the navigation facilities of the river. The Siemens Construction Union has been asked to send several engineers for the supervision of the work, and it is also to submit plans and details for the project. An American firm has also obtained a similar contract. The scheme is said to include the construction of a power station with a capacity of 650,000 h.p.

Germany.—What is claimed to be the largest Diesel engine for electricity generation purposes so far built has recently been constructed by the Blohm & Voss Shipbuilding and Engineering Co., of Hamburg, Germany, for the Neuthof power station of the Hamburgische Elektricitätswerke Gesellschaft. The engine, which develops 15,000 h.p., comprises nine cylinders having a bore and stroke of 860 mm. by 1,500 mm., the normal speed being 94 r.p.m. The engine is of the two-cycle type with a new system of scavenging the burnt gases, and is 76¾ ft. in length, 14 ft. in width, and 38¾ ft. in height. The three-phase generator, built by the Siemens-Schuckert Co., of Berlin, to which the engine is directly coupled, is also claimed to be the largest so far constructed; it is a 50-period, 6,000/6,300-volt machine and has a capacity of from 12,000 to 13,000 kVA. The stator has an external diameter of 26.8 ft. and a width of 7 ft. 2 in. The machine weighs altogether 233 tons, of which the flywheel rotor, which has 32 pairs of poles, is responsible for 111 tons.

Switzerland.—Contracts have been placed for the construction of the Ryburg-Schworstadt hydro-electric power station which is to be erected on the banks of the Rhine. The station will be built by the Motor Columbus Co., of Baden, and the transmission lines will be erected by the Rheinfelden Power Transmission Co. and the Baden Provincial Electricity Supply Co., of Carlsruhe. The station will have an output of 640 million kWh per annum.

Crediton.—Electricity Supply.—At a recent meeting of the Urban District Council a letter was read from Mr. Melhuish, the Council's electrical engineer, stating that the proposed scheme for the supply of electricity to the town had already dragged on for about five years and that it was now absolutely necessary for the Council to appoint an engineer to supervise the work, more particularly with regard to the erection of the h.p. lines from Exeter to Crediton. He stated that when in 1922 he arranged to assist the Council with the proposed scheme the intention was to have a small generating station and construct a distribution network in the town. Since then, however, that scheme had been abandoned, and it had been decided to take a supply from Exeter. He suggested that he should resign his appointment when the Council had chosen an engineer, which must be before the work was started, but he was prepared to act as honorary consulting engineer. The Council decided to invite Mr. Melhuish to meet it at once for a discussion of the matter.

Crowborough.—Electricity in Bulk.—The Crowborough District Gas and Electricity Co., which is carrying out extensions, has arranged for a bulk supply of electricity for the Tunbridge Wells Corporation.

Hastings.—Electricity Extensions.—The Electricity Committee reports that, owing to the increase in load on the electricity mains, it has become necessary to extend and renew h.p. mains and erect and equip new sub-stations at a cost of £27,500, for which purpose application is to be made for consent to a loan.

Hove.—Loan.—The Town Council is applying for sanction to a loan of £95,088 for electricity purposes.

Liverpool.—Loans.—Application is being made by the Electricity Committee for sanction to the borrowing of the following amounts:—Sub-stations: Buildings, £15,800; transformers switchgear, &c., £27,600. Lister Drive power station: Transformers, switchgear, &c., £69,200. Static sub-stations: Buildings, £80,000; plant, £150,000. Purchase of coal wagons £15,000. H.p. and l.p. mains, £300,000.

Electricity Extensions.—The following extensions are to be carried out:—Supply from Queen's Drive sub-station to Derby Lane area: L.p. mains, £3,855; h.p. mains, £6,214 a.c. mains, £4,370. Extension of mains to Woolton district £3,070. Sub-station at Hightown, and l.p. mains to be laid at an estimated cost of £2,180.

London.—Woolwich.—The Town Council has decided to lay a main transmission line in duplicate from Globe Lane to the Eltham sub-station at an estimated cost of £37,000, plus about £3 000 for switchgear.

Fulham.—The Finance Committee has recommended to the Borough Council that application be made for sanction to the borrowing of £1,800 for the erection of a combined gatehouse and sub-station at the entrance to the electricity works, and £2,000 for the provision of sub-station plant and equipment.

Parliamentary Bill.—The *Financial News* reports that the London and Home Counties Joint Electricity Authority is introducing a new Bill into Parliament for power to erect a generating station at Dukes Meadows, Chiswick, the construction of railways, docks, and other works, and the acquis

tion of land. Provision will be made for entering into agreements with Chiswick Urban District Council and others, and for power to abstract water from the Thames, &c. The Examiners of Private Bills found that the measure deposited at the end of last year failed in several particulars to comply with the Standing Orders of Parliament.

Maidenhead.—Electricity in Small Houses.—The Town Council has decided to supply electricity for cooking and lighting to the new housing site in Cox Green Road under a two-part tariff, consisting of a fixed charge of 1s. 8d. per week, plus 1½d. per kWh for electricity consumed. If the Housing Committee pays a preliminary amount of £5 per house on account of wiring, &c., the fixed charge will be reduced to 1s. 5½d. per week.

Peterborough.—Electricity Charges.—The Town Council has decided to offer an alternative tariff to consumers of electricity for domestic purposes of 12½ per cent. on the ratable value or assessment, plus £1 per annum service charge, and 1d. per kWh for electricity consumed.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Whitby.—Lighting: 8d. per kWh. Heating: 1½d. per kWh. Power: First 50 kWh per quarter, 6d. per kWh; next 950 kW, 3d. per kWh; beyond, 2d. per kWh.

Dover.—The 5 per cent. increase made owing to the coal dispute has been withdrawn.

Colchester.—The temporary increase of 25 per cent. is to be discontinued.

Conway.—Lighting: From 7d. to 6d. per kWh.

Leicester.—The temporary increase in charges of 10 per cent. is to be discontinued.

Weymouth.—Lighting: From 8d. to 7d. per kWh. Heating and power: From 2½d. to 2d. per kWh. Cooking and contract: From 2d. to 1½d. per kWh. Public lighting: From 4d. to 3½d. per kWh.

Portsmouth.—A reduction of ½d. per kWh under the following tariffs:—Domestic; business premises, &c. (maximum demand); power; and heating and cooking not taken under the domestic tariff. Lighting under the alternative flat rate: A reduction of 1d. per kWh.

Douglas (Isle of Man).—Lighting: From 8d. to 7d. per kWh. Power: From 2½d. to 2d. per kWh. Cooking: From 1½d. to 1¼d. per kWh.

Carmarthen.—*The Carmarthen Electric Supply Co., Ltd.*—Heating and cooking: 1½d. per kWh flat rate all the year round.

South Africa.—Wellington.—According to the *South African Engineer* the Municipal Council for some time past has been hard pressed to maintain a supply of electricity, but negotiations have now been concluded whereby the Electricity Supply Commission will give a supply of electrical energy from its Capetown undertaking, through an extension of the 33,000-V transmission line which has been erected as far as Huguenot. The supply is required urgently, and pending completion of the Commission's generating station at Salt River, it will be given from the Capetown Corporation's power station in Dock Road.

Southport.—Assisted Wiring Scheme.—The Corporation Electricity Committee has prepared an assisted wiring scheme intended to apply to old properties where gas is used. The scheme, which is not to apply to new houses, provides that such installations are to have a maximum of 12 lighting points, and are to be carried out by local electrical contractors, who must either be registered or members of the Electrical Contractors' Association. The proposals were submitted to a recent meeting of the Town Council, and, after discussion, referred back.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The Burford Electric Light and Power Co., Ltd., to supply electricity in certain parishes in the rural district of Witney; the Oswestry Electric Lighting and Power Co., Ltd., to extend its area of electricity supply so as to include the parishes of Selattyn, Oswestry Rural, and Whittington; Weymouth Corporation, to supply in the rural district of Weymouth, the urban district of Portland and certain parts of the rural districts of Dorchester, and Wareham and Purbeck; the West Cornwall Electricity Supply Co., Ltd., to supply electricity in the urban districts of St. Just, Madron, Paul, Ludgvan, Hayle, Phillack, Padstow, and Wadebridge, and the rural districts of West Penwith, Redruth, Helston, East Kerrier, Truro, and St. Columb Major.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Darlington Corporation to supply electricity in parts of the rural districts of Darlington and Croft.

Stockton-on-Tees.—Loan.—The borough electrical engineer has recommended that application be made for a further loan of £10,000 for mains and services.

Stoke-on-Trent.—Conference of Committees.—The Corporation has asked the chairmen and vice-chairmen of the Housing, Gas and Electricity Committees to confer on the question of the supply of gas and electricity to housing estates with a view to saving expenditure on the provision of duplicate systems of pipes and cables.

Torpoint.—Electricity Supply.—The Urban District Council has rejected the offers made by the Torpoint Electricity Supply Co., Ltd., and is to proceed with its own application for an electricity Order.

Torquay.—Loans.—The Town Council has received sanction to a loan of £12,500 for mains and services, and has applied for sanction to a further loan of £8,199, being the estimated expenditure on the first section of additional h.p. mains, and £2,500 for transformers and switchgear for the main substation in Upton Valley.

Tunbridge Wells.—Loan.—The Town Council has applied for sanction to a loan of £28,395 for electricity purposes.

Price Reduction.—A reduction of ¼d. per kWh has been made to consumers on the ratable value and room basis systems of charges, making the price 1d. per kWh in the borough, and 1¼d. outside the borough.

Walton-on-Thames. — Purchase of Undertaking.—The Urban District Council has received sanction to the purchase of the local electricity undertaking of the Urban Electric Supply Co., Ltd., and has received permission to borrow £90,000 for the purpose.

Watford.—Loans Sanctioned.—The Town Council has received sanction to loans of £5,000 for transformers and switchgear, £2,500 for meters, and £30,000 for mains and services.

Tramway and Railway Notes.

Australia.—Railway Electrification.—It is anticipated that the electrification of the Milson's Point to Hornsby line, New South Wales railways, will be completed about the middle of this year, after which conversion of the main suburban line will commence.

Brazil.—Railway Improvements.—Tenders are being considered for improvements to the Sorocabana Railway, owned by the State of Sao Paulo, leased to the Sorocabana Co. and controlled by the Brazilian Railway Co. The scheme includes the laying of 140 km. of double track, the electrification of over 100 km. of line, and the erection of a new passenger station at Sao Paulo, at an estimated cost of 11,000 to 11,500 contos of reis.—*Reuter's Trade Service* (Sao Paulo).

Continental.—Switzerland.—Work is progressing on the Federal railways, and with the completion of the fourth power station at Vernayaz (Simplon district) additional supplies of electrical energy will be placed at the disposal of the State. It is estimated that Vernayaz will have an output of over 100,000 h.p.

France.—It is reported that the whole suburban line from Paris to St. Germain will be electrically operated as from March 20th. Express trains will cover the distance (21 km.) in 27 minutes instead of 50 minutes as at present. On March 2nd an electric train, made up of four coaches, was tested on the section from Rueil to St. Germain. The trial was satisfactory, particularly in the St. Germain tunnel, where the gradient is a steep one.

In the course of a recent paper read before the French Society for the Encouragement of National Industry on "The Practical Application of Wireless Telephony," Commandant L. Julien mentioned that experiments had been made by the Paris Tramways Co. with one of its tower wagons used for repairing overhead conductors fitted with wireless apparatus so that those in charge of the vehicle could be communicated with while out at work. The tests had been made on a wavelength of 100 metres and a power of 100 watts, and had proved quite successful within a certain range. In order, however, to enable communication to be established with the most distant sections of the tramway system, it would be necessary to increase the power to 250 watts.

Croydon.—Abandonment of Route.—The *Daily Telegraph* reports that the Borough Council, on March 7th, confirmed its decision of January 24th to close down the Addiscombe section of the tramway on March 31st. The motion was carried by 30 votes to 18, after the Council had heard a deputation which presented a petition of protest signed by over 5,000 residents. The Council also resolved to accept the London General Omnibus Company's offer of a service of 'buses in lieu of trams between Croydon High Street and Woodside railway station. The deficiency on the whole of the tramway undertaking for the year ending this month was reported to be £66,000, and the estimated deficiency for the coming year was given as £70,000.

Glasgow.—Tramway Extension.—The Corporation Tramways Committee is to consider the extension of the tramway on the London Road beyond Auchenshuggle when the bridge widening at Mount Vernon is completed.

London.—Tramcar Improvements.—The Highways Committee of the L.C.C. has recommended the expenditure of £54,000 for the provision of rearranged seating and other improvements on 250 tramcars.

Tube Station Site.—The Underground Railway Co. has bought a site for a station at Arnos Grove, Palmer's Green. Lord Ashfield, in a letter to the secretary of the Middlesex Federation of Ratepayers' Associations, states that the reason for the purchase at the present time is the development which is about to be started on the Arnos Grove estate, and which might result in the land becoming more costly to acquire at a later date, when it might be required in connection with the extension of the London Electric Railways northwards from Finsbury Park.

Southern Railway.—New Line.—There is a good prospect of a start being made in the near future with the construction of the Wimbledon and Sutton Railway. Authorisation for the work was obtained in 1910, but from time to time it has been delayed for various reasons. Under its existing statutory powers the Southern Railway Co. is required to complete the railway not later than July, 1928, but it is promoting a Bill in Parliament which includes a clause extending that period. According to *The Times*, the company has intimated to the Wimbledon Town Council that it contemplates beginning the construction of the railway in the early part of next year, and of completing the work within two years from the start. Negotiations are being pushed forward for the acquisition of the necessary land. In view of this, the Wimbledon Corporation has refrained from petitioning against the Bill.

Telegraph and Telephone Notes.

"Beam" Radio-telegraphy.—Australian Service Tests.—A report issued by Marconi's Wireless Telegraph Co. states that the short-wave wireless "beam" stations which have been built for the British Post Office by the Company, at Grimsby and Skegness, for communication with Australia, have successfully passed their official seven-days' test, and the Company has been informed by the General Post Office that they have more than fulfilled the conditions required by the contract.

Bulgaria.—New Radio Station.—Four well-known European firms (two German, one French, and one British) have tendered for the construction and equipment of a wireless telegraph and telephone station at Sofia to cost about 30,000,000 leva, a sum greatly exceeded by many of the tenders. The German firm of Lorenz (Berlin) made two offers, one for a station costing 95,000,000 leva, and the other for a station costing 42,000,000 leva. The Telefunken firm (Berlin) also submitted two tenders, one at 54,000,000 leva and the other at 50,000,000 leva. The Marconi concern (London) submitted two tenders, one at 60,000,000 leva and the other at 40,500,000 leva; and the French concern (Telephones Sans Fil) submitted three, the first at 30,950,000 leva, the second at 32,200,000 leva, and the third at 29,000,000 leva. The offers are being considered, and a decision is expected shortly.—*Reuter's Trade Service* (Sofia).

Cape Verde Islands.—Radio-Telegraph Service.—Marconi's Wireless Telegraph Co., Ltd., announces the inauguration of a telegraph service from London to the Cape Verde Islands. Telegrams for transmission to the Islands will be accepted marked "*via* Marconi" at any Marconi office, or at any railway, or postal telegraph, office in Great Britain and Ireland. The ordinary rate per word is 2s. 3d. to St. Vincent and 3s. 1d. to St. Thiago; the deferred rate is half, and the urgent rate triple, these amounts.

New Zealand.—Telegraph and Telephone Service.—The capital expended during the year ended March 31st, 1926, on improving the telegraph facilities in New Zealand to meet the standard of modern requirements, and on extending the telephone exchanges to provide for additional business, amounted to £931,661. The telegraph and telephone revenue showed an increase of £146,642 over that of 1924-25—the previous best year in the history of the telegraph and telephone service. Pole-line and wire work carried out during the year represented the erection of 1,776 miles of pole-line and 15 640 miles of open aerial wire; in addition, 270 miles of lead-covered cable were laid for subscribers' circuits, containing 73,700 miles of wire. As a result of special efforts made during the year to overtake the arrears of telephone subscribers' services, a new record was established for new connections, the total for the year (13,368) being 64 in excess of the number connected during any previous year.

The Telephone Service.—Comparative Progress.—In reply to a recent question in the House of Commons, the Postmaster-General gave the following figures as representative of the number of telephones in use per 1,000 of population in the countries named on December 31st, 1925:—Great Britain (including Northern Ireland), 31; United States of America, 150; Canada, 130; Denmark, 95; New Zealand, 94; Sweden, 72; Australia, 68; Norway, 66; Switzerland, 50; Germany, 43; Netherlands, 30; Austria, 23; Belgium, 22; Argentina, 19; France, 18; Japan, 10. No later figures for those countries were available, he said, but the figure for Great Britain on January 31st, 1927, was 33.

Transatlantic Telephony.—Cuba-England Service.—A telephone service between Cuba and England was inaugurated on March 11th by Dr. Martinez Ortiz, Cuban Secretary of State, who talked direct to the British Foreign Office with Mr. Locker Lampson, Under Secretary of State, and the Cuban Minister in London. The charges will be 87 dollars for the first three minutes and 29 dollars for each additional minute.—*Reuter* (Havana).

Running Cost.—In reply to a question in the House of Commons, Sir W. Mitchell-Thomson, Postmaster-General, said that for the period January 7th to 31st the running costs of the British end of the Transatlantic telephone service, including sundry expenses incidental to the initiation of the service, amounted to approximately £2,000; and plant charges, depreciation and interest, to a further £1,900. It was expected that the service would be self-supporting.

New Receiving Station.—The G.P.O. staff at Kemback (Cupar, Fife) has made rapid progress with the erection of power house, receiving room, and antenna system, and by next month it is expected the new station will be ready to receive wireless telephony from America, which will be transmitted by underground cable direct from Kemback to London. The aerial consists of three parallel wires, carried on telegraph poles, three and a quarter miles in length and two miles apart. It is perfectly directional, being in correct line with the American sending station. British and American receiving panels are being erected and 12 valves will be used on each set. A staff of 12 men will be employed, four being on each watch.

Radio Notes.

Dominican Republic.—Service Restarted.—Towards the middle of March broadcasting was to recommence in the Dominican Republic under the auspices of the Radio-telegraphic Service, from station H-1-one-C, installed by the Radio Club of Santo Domingo.—*Reuter's Trade Service* (Port-au-Prince).

Licences.—Last Year's Figures.—It was recently announced officially that the number of broadcast wireless receiving licences issued in 1926 totalled 2,178,000, as compared with 1,642,000 in 1925. The total receipts amounted to £1,089,000 during 1926, against £821,000 in 1925.

North Wales.—Relay Station.—The Corporation of Bangor, after discussing the proposal for the establishment of a broadcasting relay station in North Wales, has decided to make formal application for the station to be located in that town.

South Africa.—New Company.—It is understood that negotiations have been concluded for the formation of a South African broadcasting company to take over the Johannesburg area. A share preference will be given to listeners, who will receive the first 10 per cent. of profits, the Government sharing the remainder with them and using its position to reduce costs, says the *Daily Mail*. The company's licensing conditions provide for the erection of a powerful station within nine months. The Government is to appoint two directors and the Radio Society one. To check piracy, the sale of wireless set parts to non-licence holders will be prohibited. The Government retains the right to take over the service after five years.

Turkey.—First Station.—Turkey has the distinction of having installed the first broadcasting station of the Near East. It is located at Stamboul and began operations last month, says *World Radio*, and it is anticipated that a second station will be working at Angora in a year's time. It was constructed by the Compagnie Générale de Télégraphie Sans Fil, Paris, with a power of 6 kW. The station is actually situated in Osmanie, but the studio is in the G.P.O., Stamboul, nine miles of cable linking it to the transmitter. Turkey's population is about 14 millions.

United States.—Underground Transmission.—Station WRNY, in New York City, is preparing to broadcast on a short wave below fifty metres, simultaneously with the regular broadcast on 375 metres. In addition, with the co-operation of Prof. James H. Rogers, the station will shortly go "on the air" with a buried aerial. As soon as the weather permits, says *World Radio*, a terra-cotta pipe, through which the aerial will be drawn, will be buried about 6 ft. under ground at Coytesville, N.J., where the transmitter is located. During the war extreme ranges were obtained by underground transmission, and WRNY will be the first station in America to broadcast on such an underground aerial.

A report issued at Washington, D.C., by the United States Department of Commerce, says that there are 164 broadcasting stations in Europe, over 700 in the United States, 85 in the remainder of North America, 38 in South America, 16 in Asia, 28 in Oceania, and 9 in Africa.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Adwick-le-Street.—March 21st. Urban District Council. Cables, boxes, pillars, and necessary materials and apparatus for a distribution network scheme. (March 4th.)

Australia.—MELBOURNE.—April 26th. Postmaster-General's Department. Telephone switches. (B.X. 3254.)* Instrument cords. (B.X. 3255.)*

April 12th. Cord-type switchboards. (B.X. 3280.)*

May 10th. Telephone relays. (B.X. 3333.)*

May 17th. Resistances and reactances. (B.X. 3307.)*

May 23rd. State Electricity Commission. Switchgear and accessories. (B.X. 3285.)*

May 9th. 6,600-V transformers and spares. (B.X. 3331.)*

SYDNEY.—May 9th. Electricity Department. Suction auxiliary switchgear. (B.X. 3338.)*

Ayr.—March 23rd. Ayrshire Education Authority. Electric lighting and central heating of new primary school at Irvine. Plans with Master of Works, Education Offices.

Beckenham.—April 4th. Electricity Department. Three e.h.p. transformer sub-station switchboards. (See this issue.)

Bristol.—April 11th. Electricity Department. 39 miles (approx.) 3-core, paper-insulated cable. (See this issue.)

Dundee.—Cleansing Department. Electric lighting installation for the Department's premises at Broughty Ferry. Mr. George Baxter, city engineer, 91, Commercial Street, Dundee.

Edinburgh. — March 21st. Electricity Department. Twelve months' supply of cables, box frames and covers, house service fuse boxes and fuseboards, meters and meter boards. (March 4th.)

Erith.—March 24th. Electricity Department. H.p. and l.p. underground cables, joint boxes, &c. (See this issue.)

Halifax.—March 22nd. Board of Guardians. Electrical fittings for six months. Mr. A. T. Longbotham, clerk, Carlton Street.

Hazel Grove and Bramhall.—March 23rd. Urban District Council. One oil circuit breaker and kiosk and seven 20-kW transformers and kiosks, cables and two e.h.p. sub-station switchgear panels. (March 4th.)

Ilford. — March 22nd. One 500-kW rotary convertor, with transformer, switchgear, &c. (March 4th.)

India.—March 22nd. India Store Department. Two 250-kW Diesel-engine alternator sets, with switchgear, transformer, &c. (February 18th.) 30,000 oil insulators. (March 4th.)

Kettering.—March 23rd. Electricity Department. E.h.p. and l.p. armoured cables and one 1,000-kVA transformer. (March 4th.)

Kilmarnock.—April 6th. Ayrshire Electricity Board. Two water-tube boilers, with superheaters, economisers, air heaters, mechanical stokers, and coal-handling plant. (See this issue.)

London.—HOLBORN.—April 13th. Board of Guardians. Electric lighting installation at the London Road, Mitcham, schools. (See this issue.)

SHOREDITCH.—March 22nd. Board of Guardians. Electric ovens, fish fryer, and griller. Mr. J. C. Clay, clerk, 213, Kingsland Road, E.2.

LONDON COUNTY COUNCIL.—March 29th. Electric lighting installation for Sudbourne Road elementary school, Brixton, S.W. (approx. 136 points). (See this issue.)

Manchester.—March 22nd. Tramways Department. Copper bonds. Mr. H. Mattinson, general manager, 55, Piccadilly, Manchester.

March 22nd. Board of Guardians. Electric main cable required at Styal Cottage Homes, Styal. Mr. E. Hargreaves, Superintendent of Works, Union Offices, All Saints.

New Zealand. — WELLINGTON.—May 31st. Public Works Department. 50-kVA transformers for the Waikaremoana electric power scheme. (B.X. 3294.)* 50-kVA transformer for Arapuni scheme. (B.X. 3293.)*

April 5th. 500-kVA transformers for the Lake Coleridge power scheme. (B.X. 3343.)*

June 7th. Railway sub-station equipment, Lake Coleridge electric power scheme. (B.X. 3295.)*

May 4th. General Post Office, Stores Division. Sub-station protectors. (B.X. 3286.)*

June 13th. New Zealand Railways. Machine tools, workshop equipment and overhead electric travelling cranes. (A.X. 4344.)*

June 6th. Six electric locomotives. (A.X. 4355.)* Overhead equipment for the Christchurch-Lyttelton electrification scheme. (B.X. 3301.)*

Oldham.—March 26th. Electricity Department. One 80-ton electric travelling crane. (March 4th.)

Plympton St. Mary.—March 31st. Urban District Council. H.p. cables, underground and overhead mains, h.p. and l.p. switchgear, transformers and transformer kiosks. (March 11th.)

Rathmines and Rathgar.—March 26th. Urban District Council. Electrical supplies, including lamps, meters, fuse boxes, copper wire, engine-room stores. Forms of tender from the Electricity Works.

Rhondda.—March 26th. Electricity Department. Twelve months' supply a.c. ordinary and prepayment meters, mains and house service material. (February 25th.)

Rochdale.—March 21st. Electric lighting installation, Bamford Workmen's Club. Particulars from the Secretary.

Roumania.—BUKAREST.—April 2nd. 600,000 porcelain insulators. (B.X. 3314.)*

Sheffield.—New Century Pictures, Ltd. Electric lighting installation at the Albert Hall, Sheffield. Particulars from Messrs. Chadwick, Watson & Co., 9, Albion Street, Leeds.

South Africa.—JOHANNESBURG.—April 8th. Municipal Council. Ironclad cut-outs. (B.X. 3332.)*

DURBAN, NATAL.—March 28th. Corporation. 9½ miles 6,600-V cable, 17 miles combined pilot and telephone cable. (See this issue.)

Southend-on-Sea.—April 9th. Light Railways and Electricity Department. Remote-controlled rotary convertors. (March 11th.)

Walthamstow.—March 23rd. Electricity Department. L.p. cables and v.i.r. wires for 12 months. (March 11th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Belgium.—Belgian, German, French, Czecho-Slovakian, Dutch and British (British Insulated Cables, Ltd.) companies competed early last week for an armoured cable contract for the municipal authorities of Saint Gilles, Brussels. The lowest offer was that of a Belgian concern.

East Ham.—Cleansing Committee. Recommended:—
New battery for electric vehicle (£219).—Chloride Electrical Storage Co., Ltd.

Eastbourne.—Electricity Committee.
Coal handling plant—

W. J. Jenkins & Co., Ltd. (Accepted.) ...	**£1,144**
New Conveyor Co.	1,415
Naylor Bros., Ltd.	1,528
Mitchell Conveyor Co.	1,565
Babcock & Wilcox, Ltd.	1,754
Ed. Bennis & Co., Ltd.	1,795

Hull.—Electricity Committee. Accepted:—
Electrical equipment for two electric houses on the Cottingham Housing Estate (£152).—W. L. Harrison, Ltd.
Telephones Committee. Accepted:—
Cable (£897).—W. F. Dennis & Co.

India.—BOMBAY.—Corporation. Accepted:—
Re-wiring municipal head office building (Rs.11,775).—Sterling Electric Works.

Leeds.—Tramways Committee. Accepted:—
200 yd. manganese steel guard rail (£360).—Edgar Allen and Co., Ltd.

London.—ADMIRALTY. Accepted:—
Resistance rod.—Edison Swan Electric Co., Ltd.

ISLINGTON.—Borough Council.—The contract for electric lamps for 12 months has been placed with the Milton Electrical Co., Ltd.; Edison Swan Electric Co., Ltd., has received the contract for electric lamp globes.

Shoreditch.—Lighting Committee. Recommended:—
Cable (£6,118).—W. T. Glover & Co., Ltd.
1,500-kW remote-controlled automatic converting plant and switchgear (£9,453).—Hewittic Electric Co., Ltd.
E.h.p. switchgear equipment for Whitton Street (£3,152).—British Thomson-Houston Co., Ltd.

Tilbury.—Urban Council. Accepted:—
Switchgear and transformers (£1,870).—Metropolitan-Vickers Electrical Co., Ltd.
Sub-stations and mains (£35,547).—Watshams, Ltd.

Weymouth.—Electricity Committee. Accepted:—
Supply and laying cables at housing estates (£2,176).—Johnson & Phillips, Ltd.

Forthcoming Events.

British Electrical Development Association.—Friday, March 18th. Royal Society of Arts, W.C.2. 7.30 p.m. "Refrigeration." Mr. N. E. Barber.

Association of Mining Electrical Engineers (North of England Branch).—Saturday, March 19th. Newcastle. 3 p.m. "Standardisation of Colliery Electrical Requisites." Mr. C. D. le Maistre.

Institution of Electrical Engineers.—Informal Meeting.—Monday, March 21st. 7 p.m. "Domestic Electrical Refrigeration." Mr. R. J. Mitchell.

(Mersey and North Wales (Liverpool) Centre).—Monday, March 21st. University, Liverpool. 7 p.m. "Illuminating Engineering," Mr. J. W. T. Walsh; and "Problems of Public Lighting by Electricity," Mr. H. T. Harrison.

(North-Midland Centre).—Tuesday, March 22nd. Hotel Metropole, Leeds. 7 p.m. Ordinary meeting.

(North-Western Centre).—Tuesday, March 22nd. Engineers' Club, Manchester. 7 p.m. "Notes on the 60,000-V Underground Network of the Union d'Electricité." Col. E. Mercier.

(East-Midland Sub-Centre).—Tuesday, March 22nd. Technical College, Derby. 6.45 p.m. "Powdered Fuel." Mr. G. H. Lake.

(Tees-Side Sub-Centre).—Monday, March 21st. Cleveland Technical Institute, Middlesbrough. 7 p.m. Ordinary meeting.

(South-Midland Students' Section).—Friday, March 18th. Annual joint meeting of the Graduates' and Students' Sections of the Institutions of Civil, Mechanical, and Electrical Engineers. Discussion: "That the Centralisation of Public Services is Desirable."

(Scottish Students' Section).—Wednesday, March 23rd. Royal Technical College, Glasgow. 7.30 p.m. Ordinary meeting.

(London Students' Section).—Friday, March 18th. Imperial Hotel, Russell Square, W.C. 7.15 for 7.30 p.m. Annual dinner.

Friday, March 25th. London. 6.15 p.m. "Electricity in the Works Laboratory." Mr. R. E. Snoxell.

Royal Society of Arts.—Monday, March 21st. 8 p.m. Cantor lecture. "Some Industrial Applications of Electrothermics." Mr. G. I. Finch.

Batti-Wallahs' Society.—Tuesday, March 22nd. Hotel Cecil. Annual dinner and dance.

Illuminating Engineering Society.—Tuesday, March 22nd. Lighting Service Bureau. 6.30 p.m. Discussion on "Problems in Illumination and Practical Solutions."

Royal Institution.—Tuesday, March 22nd. 5.15 p.m. "X-Rays and the Chemical Molecule." Dr. G. Shearer.
Saturday, March 26th. 3 p.m. "Alpha Rays and Atomic Structure." Sir Ernest Rutherford.

Institute of Wireless Technology.—Wednesday, March 23rd. Engineers' Club. 7 p.m. "Methods of Approximating the Reception Factor," by Mr. E. H. Turle.

Meter Engineers' Technical Association.—Thursday, March 24th. Lighting Service Bureau. 7 p.m. Annual general meeting. Discussion on "Queries and Problems."

Electrical Association for Women (South Wales and Monmouthshire Branch).—Thursday, March 24th. City Hall, Cardiff. 6.30 p.m. Inaugural meeting.

Birmingham Electric Club.—Friday, March 25th. Grand Hotel. 7 p.m. "Electricity Supply in the Midland Area." Mr. S. T. Allen.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, March 25th. Newcastle-on-Tyne. 6 p.m. "Pure Science." Sir Richard Glazebrook, F.R.S.

Physical Society.—Friday, March 25th. Imperial College of Science. 5 p.m. Ordinary meeting.

Electricity Supply Commercial Association (Great London Division).—Saturday, March 26th. Poland Rehearsal Rooms. 7.45 p.m. Dance.

Electrical Power Engineers' Association (Northern Division).—Saturday, March 26th. Midland Hotel, Manchester. 5.30 for 6 p.m. Annual dinner.

Notes.

Another X-Ray Martyr.

The *Daily Telegraph* reports that Dr. Dawson Turner, who was for twenty-nine years X-ray and radium expert at the Royal Infirmary, Edinburgh, and who is now living in retirement near Godalming, Surrey, has lost another finger owing to X-ray dermatitis. Early in his career Dr. Dawson Turner sustained severe burns, which eventually led to one of the fingers on his right hand being amputated. He is the inventor of a special tube which has added considerably to the efficiency of X-ray apparatus.

A Diesel-Electric Ship.

Scott's Shipbuilding and Engineering Co., Ltd., Greenock, has received from American owners an order for the hull of an oil-tank vessel of 12,500 tons, which will be propelled by Diesel-electric machinery. The electrical installation through which the power will be transmitted to the propellers will be provided by the British Thomson-Houston Co., Ltd., of Rugby, and all the machinery will be fitted on board at Greenock by the builders of the hull. The vessel will be the first constructed on the Clyde for propulsion by machinery of this type.

An Electric Sign Paradise.

According to Mr. Arthur Williams, of the New York Edison Company, in New York City's "Great White Way" there are 1,243,538 lamps in electric signs alone, aggregating 25,000,000 candle-power. More than 7,000 additional signs, containing 125,000 lamps, have been added to the skyline of Manhattan during the past two years. There are now 19,000 electric signs in use on Manhattan Island, south of 135th Street alone.

Electrical Aids in Fire Fighting.

A fire escape carrying, among other new features, a telephone, has been designed by Supt. Neal, of the Leicester Fire Brigade, and has been adopted by one of the principal firms supplying fire equipment. The escape has a ladder 85 feet long, to which, in addition to a pump working independently of any other machine (in itself a novelty), there is attached the telephone and a searchlight. The latter will enable firemen to see the character and quantity of the contents of any portion of a burning building that is not already involved. The telephone will be used for communicating with the firemen at the top of the escape during a fire. This is done at present by shouting, or by sending a messenger up and down the ladder. The first escape of the new pattern will probably be supplied to the Leicester Fire Brigade.

Testing Mining Gear.

Members of the Mining Institute of Scotland visited the Mile End works of Messrs. Mavor & Coulson, Ltd., Glasgow, on March 2nd, when special testing apparatus for ensuring that electrical mining gear will not endanger the safety of gas-infested underground workings was inspected. Formerly the gear manufactured by Messrs. Mavor & Coulson was sent to the Sheffield testing station, which is staffed by the University. Recently, however, the firm began experiments with apparatus to carry out safety tests in the works, and a satisfactory system has been evolved which enables them, as part of the routine, to test practically all their mining manufactures. The process consists of filling with a highly explosive gas mixture the explosion cover of the plant to be tested, and placing it in a sealed chamber flooded with an easily ignited gas mixture. The mixture under the cover is then electrically fired: if the cover is perfect it withstands the resulting explosion; if it is not, the surrounding explosive in the sealed chamber is ignited. In the event of the first explosion inside the cover not being followed by an explosion in the chamber, the gas mixture in the chamber is fired to ensure that its failure to explode was not due to its own composition. This ensures not only that the first test is sound, but also that the explosion cover of the plant is able to withstand explosion pressures outside as well as inside.

The visitors also saw demonstrations of new models of coal cutters and coal-conveyors manufactured by the firm. One of these models is a shaker conveyor, the height of which is only 16 inches, thus enabling it to be operated easily in a minimum seam of 18 inches.

Transmission Line Regulation.

The Westinghouse Electric Co., U.S.A., announces the acquisition of patents covering an invention by a San Francisco electric engineer, Mr. Frank Baum, by which he hopes to make possible the transmission of electric power over distances of 500 to 1,000 miles from the main power sources without the development of erratic voltage conditions. At a cost not exceeding 20 per cent. above the original outlay it is estimated that the capacity of any long line can be increased 75 per cent. According to *The Times*, Mr. Baum's invention provides for the "connection of a plurality of automatically regulated synchronous condensers at uniformly spaced distances to high-voltage transmission lines," thereby converting a long line into a series of short lines, in each of which the factors causing voltage instability can be corrected, for example, by auxiliary power from steam plant.

Fatality.

Leading-Aircraftman Dobbs, of the Royal Air Force, whilst carrying out the first test of "balloon-jumping" in this country near the Stag Lane Aerodrome, Hendon, came in contact with an overhead electric wire and received a fatal electric shock.

Electric Vehicles in the United States.

An electric truck handbook for 1927, with route maps, ferry time-tables, and other useful hints for owners and operators of electric trucks and commercial transportation men generally, has been issued by the Automobile Bureau of the New York Edison Company. This book makes it an easy matter for operators to ascertain the nearest electric truck garage in the New York Metropolitan District, and, besides full instructions covering the charging of truck batteries, contains much necessary information in a condensed form, including tables of charging rates for storage batteries and typical monthly garage rates in New York City, as well as lists of manufacturers. It is distributed by the Edison Company, free of charge. A similar publication would be useful in this country.

Lighting Unit Tests.

The correct design of the bowl or globe for enclosed lighting units is of supreme importance for obtaining the required diffusion and distribution of light, and in this connection a series of tests recently carried out by the Illuminating Engineering Department of the Edison Swan Electric Co., Ltd., is of particular interest. The tests were undertaken with the object of determining the distribution of light from the firm's "Swanlite" enclosed glassware units; the results of the tests are illustrated in graph form in fig. 1. Two fittings, each equipped with 200-W gasfilled lamps were mounted at a height of 9 ft. above the working plane; the spacing between units was 12 ft., and the intensity of light from each was measured at distances of 1 ft. from points immediately under them. The respective curves are illustrated at A and B, showing that in each case the maximum and minimum intensities were 5 and 1.25 foot-candles; the resultant illumination of the two units is indicated by curve C, which, had the fittings been spaced 11 ft. apart, would have been a straight line. Fig. 2 shows the "Swanlite" fitting, which is of the flat type, specially designed for the illumination of shops and stores where goods are displayed on counters and shelves.

A Skysign Rhapsody.

Marinetti, the Italian artist-poet and apostle of Futurism, who has the Shavian gift of shaking people out of conventional ruts and shocking them into thinking twice, has burst into rhapsodies on the triumph of electric light over the powers of darkness. In an open letter to Mussolini, he pleads that skysigns be not abolished from the great square that lies at the bases of the majestic buttresses of the Cathedral of Milan. Marinetti's prose loses its clanging precision in translation, but here is the sense of his panegyric to brilliant light:—

Traditional Critics of the Traditional Schools really think that the æsthetic qualities of the Piazza del Duomo di Milano will be safeguarded by abolishing illuminated signs! Ignoring the preoccupation of certain believers who know how to pray only in darkness and who do not see God in the divine electric light that to-day reigns in all the churches of Europe, I come forward to proclaim that illuminated signs in general, and those of the Piazza del Duomo in particular, constitute indispensable beauty.

No need for Futurist genius to see in illuminated signs our ardent evening prayer to the sun that it may soon return to warm the life of the world!

Illuminated signs are the sane sober optimism that one obstinately opposes to the desperation of gloom.

Illuminated signs are the gay flowers, the ripe fruits, the dancing nymphs of the new Futuristic æsthetics of speedy ferro- and bold concrete.

Illuminated signs are hygienic salvation. They are the denigration of sickly twilight, of nostalgic moonlight, and of the bars full of depressing melancholy.

They are our artificial constellations, daughters of our implacable will: lively, portable constellations to console us for those beyond our reach.

Illuminated signs are the profound scientific, industrial and commercial dynamism of the city—displayed on the rooftops to rival the dynamism of the stars.

Beautiful with a new but secure beauty, they answer the noblest and most crying of our needs—the curtailment of our submission to the half-death of dreams and night.

A Brazilian Development.

The Brazilian newspapers announce that the Cia. Brasileira de Energia Electrica, of Rio de Janeiro, which supplies electricity for light and power to the town of Bahia and the surrounding district, intends greatly to enlarge its power station in Bananeiras on the Paraguassú. A sum of £750,000 is mentioned as the expenditure on these extensions, which would apparently entail the doubling of the present capital of the company. When the additional plant is installed, there will be eight turbines in operation instead of three as at present, each machine being of 5,200 h.p. capacity. With the completion of this scheme, the lighting system of the town can be developed, more power can be placed at the disposal of the tramways and local industries, while extensions of the telephone installation, both local and trunk, are also contemplated.

B.E.S.A. Publication.

The British Engineering Standards Association has recently issued an addition to the B.S.S. for Insulated Annealed Copper Conductors for Electric Power and Light (No. 7-1926). This consists of data relative to a twin flexible cord, the conductors of which are insulated with pure and vulcanised india-rubber, twisted together and sheathed overall with tough-rubber compound. This flexible cord is intended for use only with pendant electric light fittings on voltages up to 250 V. The flexible is new only in the sense that it is provided with a coating of cab-tire sheathing. The details are given on an addendum slip which will be issued with all copies of specification No. 7-1926 sold in future. Those already in possession of the specification can obtain a copy of the slip free of charge by sending a stamped envelope to the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1.

The George Montefiore Prize.

The triennial international prize competition of the "Fondation George Montefiore" for 1926 has had to be postponed until this year; the prize amounts to 20,500 fr., and is awarded for the best original work submitted on the scientific progress and the technical applications of electricity in all its branches. Essays must be in French or English. The last date for them to be received is April 30th, 1927. Particulars regarding the conditions to be observed can be obtained from the general secretary, Association des Ingénieurs électriciens sortis de l'Institut électrotechnique Montefiore, 31, Rue Saint Gilles. Liége, Belgium.

Service Notes.

The Air Council has decided to increase the number of prize cadetships offered for competition annually from three to twelve. These cadetships enable boys to complete the two years' course at the R.A.F. Cadet College, Cranwell, at a cost of only £40 in all to their parents. Particulars can be obtained from the Secretary, Air Ministry, London, W.C.2.

Electricity Works in Austria.

From *Elektrotechnik und Maschinenbau*, of Vienna, we have received a copy of the "Statistics of the Austrian Electricity Works and Electric Railways" for 1926, issued by the Elektrotechnische Verein of Vienna in co-operation with the Verband der Elektrizitätswerke—the first to appear after several years' intermission. It is a volume of 214 pages, differing notably from its predecessors. Its contents are divided into five sections, which are respectively an alphabetical index of electricity works; statistics of works of 20-kW capacity and upwards; particulars of the prime movers of all works over 500 kW in size; statistical data of electric railways; and a series of summary tables of data.

From the tables it is seen that the total plant installed has a capacity of 772,770 kW, in 457 stations, nearly the whole of which is a.c., the d.c. plant amounting to 8,160 kW in 98 works; 22 other works, however, supply three-phase and direct current, their aggregate capacity being 37,550 kW. From 322 stations, with 601,800 kW of plant, three-phase only is supplied. Sixteen stations have plant installed in excess of 10,000 kW, totalling 512,400 kW, and 14 fall between 5,000 and 10,000 kW, aggregating 99,770 kW.

The average size of station is 1,700 kW. Most of the power is derived from waterfalls, on which 325 stations depend entirely, with 517,830 h.p.; 61 use water and steam or oil, and 20 use steam alone, aggregating 227,830 h.p.

The supply pressures, output, prices, &c., are given very fully; the pressures appear to be as various as in this country, and several frequencies are in use, but 50 cycles is by far the most common.

The volume is well produced and contains a large amount of information.

A New Dutch Association.

With the object of developing the use of electricity in Holland a new association, known as the Central Electrotechnische Commissie, has recently been formed at Eindhoven. The new body is composed of representatives of the Dutch Association of Electricity Station Managers, the electrical section of the Dutch Metallurgical Association, the Electrobond, the Association of Directors of Electricity Supply Undertakings, the Dutch Association of Electrotechnical Employers and the Dutch Association of Electrotechnical Wholesalers.

Electrical Power in Ports and Harbours.

In a paper under the above title, by Mr. W. A. Perry, recently read before the Institution of Engineers and Shipbuilders in Scotland, the author shows clearly the advantages of electrical over other forms of power for operating the various equipment and conveyances required at the docks for loading and unloading. Naturally, much attention is given to electric cranes, and the various types are dealt with separately, with regard to the duties performed by each. The various methods of supplying travelling cranes are discussed in detail, and the relative merits and disadvantages of each are put forward. The different cabling systems suitable for harbour work are also considered, as well as the motor and control equipment. In supporting the electric crane from the economical point of view, the author estimates the annual running costs for a steam crane, suitable for handling 150,000 tons per year, at £1,340. The costs for an electric crane suitable for the same work he puts at £850.

American Distribution Practice.

Changes in the transmission and distribution system of the Brooklyn Edison Company during the past four years are briefly described in the January issue of the A.I.E.E. *Journal*, mention being made of the effect of the changes on the system's efficiency. In 1927 a low-voltage, a.c. network will be installed and extended to care for the load growth until it becomes the principal supply system for low-voltage energy in Brooklyn. The plan of development is described in detail, the unique features claimed being: First, a suitably designed network unit consisting of a three-phase, 500-kVA. low-loss transformer, with an automatic network circuit-breaker mounted in the low-voltage pothead of the transformer. Secondly, the operation of the high-voltage feeders without regulators, at 27,000 volts, direct from the generating station. Thirdly, the ultimate plan of interlacing the high-voltage feeders to reduce the overload on transformers and to maintain good voltage regulation with one feeder out of service, and to pick up overload in areas of different load characteristics to obtain the advantage of diversity. It is shown that this plan of development ensures better service to the customer from every point of view, makes for safer working conditions on the system, results in general system improvement and involves less total investment, as well as a considerable reduction in losses and operating costs. The appendices describe tests made to determine whether arcing and short-circuit faults in the network will be self-clearing, the permissible voltage fluctuations on incandescent lamps, and the dissipation of heat from transformer vaults.

Italian Electrical Associations.

Hitherto there have been two electrical engineering associations in Italy—the A.E.I.E. and the A.N.I.E.L. It is now reported from Rome that an amalgamation has been effected of the two bodies, which will in future be known as the Unione Nazionale Industrie Elettriche. Signors S. E. Volpi and G. Ponti have been elected as the first honorary and acting presidents, respectively.

A Helium-Oxygen Atmosphere for Divers.

The use of a mixture of helium and oxygen in place of air for breathing in deep diving and other high-pressure work is reported by the Bureau of Mines, U.S.A., to result in greater speed of recovery from exposure to the high pressure, and in freedom from the suffering and danger due to "bends"—*i.e.*, the excessive absorption of nitrogen by the blood. Writing to *Science* of January 14th, Dr. Elihu Thomson, who was recently awarded the Faraday Medal by the Council of the Institution of Electrical Engineers, points out that he investigated the inhalation of mixed gases in 1873, and in 1919, when helium gas appeared to be available in quantity, he wrote to Dr. W. R. Whitney, of the Research Laboratory, General Electric Company, Schenectady, suggesting the use of helium and oxygen for respiration, as a means of extending the limit of depth attainable by divers. He also wrote to the Bureau of Mines in the hope of obtaining helium, but did not get any. A further letter was sent to Dr. J. C. McLennan, of the University of Toronto, in January, 1920, explaining his proposition, and the latter drew attention to the suggestion in *Nature*. Dr. Thomson complains that no acknowledgment of his priority of invention has been made by the Bureau of Mines. It was reported that the sunken submarine S-51 was raised by divers using this method.

Appointments Vacant.

Five engineering draughtsmen for H.M. Office of Works. Salesman (£200) for the Corporation of Hastings Electricity Department. Chief electrical engineer for Synthetic Ammonia and Nitrates, Ltd. Switchboard attendant for the Norwich Corporation Electricity Department. Cable jointer for the Venezuela Telephone and Electrical Appliances Co., Ltd. Junior technical officers for the Admiralty Experimental Establishment. Costing clerk (£200) for the Borough of Great Yarmouth Electricity Department. Shift engineer for the Bedford Corporation Electricity Department. Chief engineer for the Bombay Electric Supply and Tramways Co., Ltd. (Rs. 2,100 per month). Shift charge engineer (£390) for the Croydon Electricity Department. Scientific officer for research for the Air Ministry (£504). Three district mains engineers (£366) for the Hackney Borough Council Electricity Department. Relief shift charge engineer for the Beckenham Urban District Council Electricity Department. Clerk of the works for the Seaham Harbour Electricity Department. (See our advertisement pages to-day.)

Lecture.

Water Power.—Speaking at the annual meeting of the Aberdeen Chamber of Commerce, Prof. Blackadder, of the Chair of Engineering at Aberdeen University, dealt with the water power in the north of Scotland. It had been computed that in this country there was about 900,000 h.p. which had some possibility of being reasonably developed in an economical manner, of which about 200,000 h.p. had been developed. In Scotland about 270,000 continuous h.p. was available which might be developed economically. Some of it was being developed by the Lochaber and Grampian schemes. Round about the Aberdeen district there were ten sources of power of the first rank for commercial development. Among them were Loch Skene, Loch Kinord, and Loch Muick (which had been surveyed), also Loch Einach and Loch Morlich, in the Cairngorms. Together, they were estimated to yield about 2,720 continuous horse-power, while the electricity station at Aberdeen was of 30,000 to 40,000 horse-power. That gave an idea of how little there really was compared with what seemed to the ordinary man to be the large amount available.

Tennis-Court Lighting.

Real tennis, which is one of the oldest ball games in the world, still has many enthusiastic adherents, and endeavours are being made to re-establish it as a national game. One of its ardent advocates is Capt. MacLean, whose famous court at Rusthall House, Tunbridge Wells, was first designed in 1884. In order that play may be possible at any hour, after a series of tests 12 1,000-watt Osram gasfilled lamps have been installed in the ceiling; they are mounted in special dispersive reflectors, and shielded so that players when facing the net are not affected by the brightness of the inner edge of the reflector. The scheme was designed by the General Electric Co., Ltd., and was carried out by Messrs. Fredk. Hayden, Ltd., of Tunbridge Wells. The system employed provides an average uniform intensity of light of the order of 25 foot-candles, as compared with an average daylight intensity of approximately 53 foot-candles at floor level; the maximum reading is 28.6 foot-candles, and the minimum 18.3 foot-candles. Daylight readings revealed a maximum of 91.8 and a minimum of 23.1 foot-candles, showing a disparity in light intensity of as much as 68.7 foot-candles between one part of the court and another, while the greatest disparity in illumination by artificial light is only 10.3 foot-candles.

Ex-British Westinghouse Reunion.

On March 11th, at the Hotel Cecil, London, Mr. Leslie R. Morshead presided at the ninth annual reunion of ex-British Westinghouse men. Mr. J. D. Allan proposed "The Association," and seized the opportunity to recall many humorous incidents of the days gone by. Mr. Morshead, in reply, was able to hold his own in his genial way. He remarked that the Association now had over 400 members, and said that it was probably unique in the electrical industry in that it was representative of every branch of the business. Later he submitted the "Silent Toast" to the memory of all those members who had passed away and particularly to the three who died during the past year, Messrs. T. Dagnall, R. C. Rogers, and J. Nasmith. The entertainment side of the reunion was this year enlivened by community singing. The usual ballot held for life membership of the Association was won by Mr. H. B. Tilley. The proceedings went with a swing from the start, and the evening generally was voted one of the best that had been held. We understand that the committee is making arrangements for the tenth reunion to be held next year at the Hotel Cecil, London, which is to be of a special character, as a "Milestone" occasion.

Free State Electricity Bill.

An Electricity Supply Bill, supplementary to the original Shannon Bill, introduced in the Free State Dail recently, aims at giving to the State complete control, not merely of the Shannon power system, but of all electricity concerns in the State. Provision is made for the constitution of a Board of Control, and it is proposed to allocate a sum not exceeding £3,100,000 for the acquisition, when necessary, of existing electrical undertakings. The necessary finances for the Board are to be provided from the Central Fund by the Free State Ministry of Finance, by way of loan, which must be repaid principal and interest, in such fashion as the Ministry requires. The Bill defines the general duty of the Board as follows:—To operate the Shannon works; to maintain them to distribute, utilise and sell electricity generated by the Shannon; and to control, co-ordinate and improve the supply, distribution and sale of electricity in the Free State. The measure provides that all charges made by the Board for electricity supplied after December 31st, 1932, must be such that the total revenue derived in any year will meet all the expenses of the administration in that year, and also provide for interest, sinking fund renewals, depreciation, &c. Six months after the passing of the Bill no person can sell electricity except under licence from the Board: *a*, as "permit" revokable at will by the Board, and *b*, as licence constituting him an "authorised undertaker" and undertaker" and giving him the powers now enjoyed by "statutory undertaker." The Bill provides that the Board of Control may compulsorily acquire any electricity undertaking and itself operate it, but it must indemnify the former owner from all debts and liabilities owned by him on account of the undertaking. Provision is also made for the Board to fix the retail prices for electricity to be charged to consumers by any undertaker, and, if an undertaker objects to the charge he can compel the Board to buy him out or to operate the business for him under terms laid down in the Bill. The Board can close generating stations or may require an undertaking to alter the type of current or the frequency or pressure of supply. This provision is designed apparently to secure standardisation of supply. A schedule to the Bill sets out the method of reckoning the compensation of persons who suffer loss of employment by reason of the closing down of a generating station.

Electrical Association for Women.

The fourth evening lecture arranged by the E.A.W. for women demonstrators and domestic science mistresses was given at the E.L.M.A. Lighting Service Bureau, London, on March 9th by Miss Margaret Partridge, B.Sc. With the aid of a few lampholders, pieces of flex, a screwdriver, and a pair of pliers, Miss Partridge kept her large audience interested for over an hour, showing how simple household repairs could be effected.

The lecture on March 23rd will be given by Mr. Morton, of Kelvinators, Ltd., on "Electric Power Appliances in the Home."

Extra-High-Pressure Cable Discharges.

In reply to inquiries that we made, we have received the following additional particulars from Mr. D. P. Sayers regarding the phenomena described in his letter on p. 370 of our March 4th issue:—In one case the cable was 0.15-sq. in., 3-core, paper-insulated and lead-covered (no earth sheaths), 11-kV working pressure, and wire armoured with one layer of jute under and over the armour wires. The cable was laid direct in the ground for a distance of five or six miles, and each end was terminated in a switch cubicle, the tails being bolted to isolators. The terminal box at one end had a copper bond bolted to a main earthing strip running throughout the cubicle-type switchboard, and the box was bonded to the cable with a brass gland wiped to the lead. The cable was tested at about 30 kV, direct current, obtained from a spark rectification set, and after it had been discharged, a copper strip was bolted across the three bottom isolator blocks and to the main earthing strip. There was no question that the lead, armour, and cores were efficiently earthed, as this end was handled without any effects, and it was not until an hour or so afterwards that a shock was obtained from the cores at the other end of the line.

Another case occurred with one of three single-core cables, paper-insulated, lead-covered, 0.2-sq. in. section, built for a working pressure of 33 kV to earth. About 660 yards of this cable was laid in ducts or troughing alongside the permanent way of a railway, and was then tested at about 140 kV with a Delon set. The cable sheath, together with the frame of the testing set, was earthed to the rails by means of a special clip made for the purpose, and the extra precaution had been taken of connecting a copper band to a near-by water main. After the test, the lead sheath was beaten down on to the copper core and plumbed over, and subsequently during the same process at the other end of the line, a shock was obtained.

Low-Temperature Carbonisation.

In a publication under the above heading of the Department of Scientific and Industrial Research, Fuel Research Technical Paper No. 17, price 6d. net, a preliminary account is given of the construction and behaviour of the latest vertical cast-iron retorts erected at the Fuel Research Station of the Department for the low-temperature carbonisation of bituminous coal.

A French Science Meeting.

A four-days' meeting of the French Association for the Advancement of Science is to be held in Algiers from April 13th to 16th next. M. Miramont de la Roquette, of that city, has been appointed chairman of the Electrical Section of the Conference.

Standard Transport Cost Sheet.

For some time past the Electric Vehicle Committee of Great Britain has been designing and compiling a standard form of cost sheet for owners of electric vehicles, in particular, though the sheet produced can be used in connection with other types of transport, and therefore forms a ready means of obtaining a fair comparison of working costs. The accurate determination of such costs is most important to every business concern; it will enable the user to see at a glance how his money is spent on transport, and to ascertain quickly which system is the most economical under his own particular working conditions. Copies of the cost sheet are obtainable from the British Electrical Development Association, 15, Savoy Street, London, W.C.2, price 1s. 3d. per dozen, or 10s. per hundred, postage extra.

Institution Notes.

Institution of Electrical Engineers.

INFORMAL MEETING.—At the informal meeting, on March 7th, Lt.-Col. K. Edgcumbe was in the chair, when Capt. P. P. Eckersley opened a discussion on "Wireless as a Factor in World Communication"; sketching the history of broadcasting, he reviewed apparatus of the past, paying a special tribute to the work of Hughes, who developed the first coherer. He said arc transmission was no doubt a robust engineering job, which accounted for the fact that there were more arc stations now in existence than any others. He emphasised his view that the true function of broadcasting was its use for communication where no better means were available; and that its object was not merely to provide a weak reflection of theatrical or concert entertainment. He believed there was an enormous future for wireless communication operating during the dull hours on a deferred-letter basis, but anticipated a breathing space of fifteen or twenty years before television need be considered as a candidate for a few wave-lengths.

Diesel Engine Users' Association.

At the March meeting of the Association a paper by Mr. P. A. Holliday on "High-Revolution Oil Engines" was read. The author referred to the satisfactory working results of heavy-oil plant in the power stations of the Southend-on-Sea Corporation, ex-submarine engines which had been converted for land use. He said it was difficult to determine the source of prejudice which undoubtedly existed in some quarters against high-revolution engines running on heavy oil. If revolutions, particularly those of the four-cycle, single-acting engines, were to remain at the old level, where must one look for progress? Viewing the possibilities of progress in electricity generating sets for land and sea, it was reasonable to expect some reduction in weight and occupied space; it had not yet been determined to what extent it would be possible to carry the high-revolution engine design into larger powers.

The Institute of Metals.

The annual general meeting of the Institute of Metals was held in London on March 9th and 10th, and amongst the numerous papers presented were those mentioned below:—

A paper entitled the "Investigation of the Effects of Impurities on Copper: Part V—The Effect of Bismuth on Copper," by Prof. D. Hanson, D.Sc., and Grace W. Ford, B.Sc. (Teddington), describes experiments made on copper containing up to 0.1 per cent. of bismuth, and the effects of small quantities of bismuth on the casting, hot- and cold-rolling, mechanical properties, electrical conductivity, and microstructure of copper. They confirm the great embrittling effect of bismuth, and indicate that when more than a trace of bismuth alone is present in copper the working properties, particularly the cold-working properties, are seriously affected; the solid solubility of bismuth in copper has also been investigated.

In Part III—"The Effect of Arsenic on Copper," Prof. D. Hanson, D.Sc. (Birmingham), and C. B. Marryat, B.Sc. (Teddington), describe investigations into the effects of arsenic on a series of alloys containing up to 1 per cent. of arsenic. Part IV deals with a similar series of tests on copper containing up to 2 per cent. of arsenic and 0.1 per cent. of oxygen, with a view to ascertaining the influence of each of these elements on the presence of the other. Experiments on the gassing of copper by hydrogen have also been undertaken. The effect of arsenic on the conductivity of the metal is very profound; it is much greater than the effect of oxygen and iron, and is such that arsenic should be excluded as rigidly as possible from high-conductivity copper. The impurity appears to reduce the crystal size in castings, but this effect is not appreciable in worked and annealed material. It was found that with copper containing oxygen in addition to arsenic little difference in the electrical conductivity was observed.

A paper on "Electric Furnaces in Non-Ferrous Metallurgy," by D. F. Campbell, M.A., A.R.S.M. (London), deals in a practical way with the principal electric furnaces now used for melting alloys of copper, nickel, zinc, and silver, with special reference to induction furnaces of normal and high frequency.

A paper on "The Mechanism of Inverse Segregation in Alloys" contains an appendix on "The Accurate Determination of Copper in Bronze by Electrolysis." by R. A. F. Hammond, B.Sc., A.R.C.Sc., A.I.C. (Woolwich).

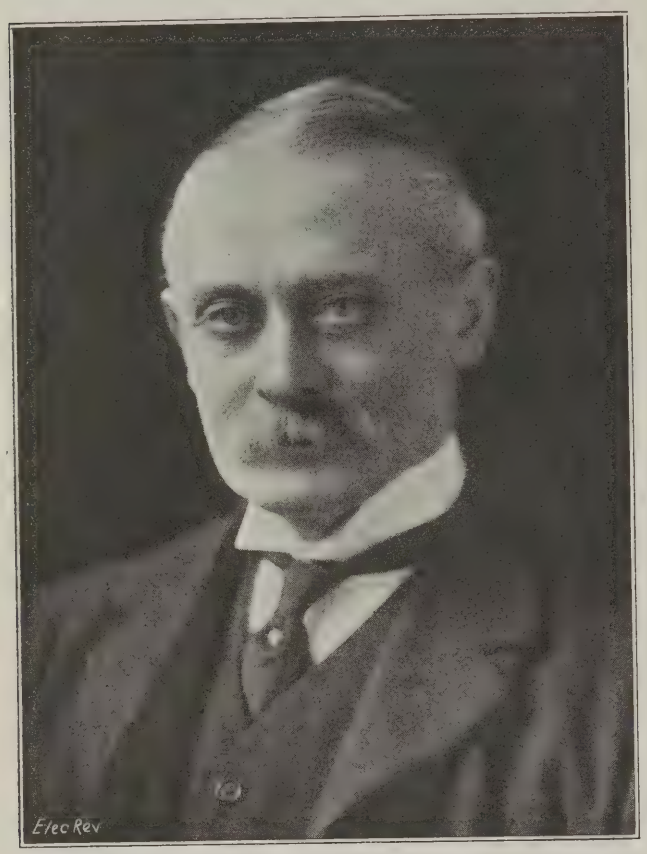
A paper on "Magnetic Analysis as a Means of Studying the Structure of Non-Magnetic Alloys," by Prof. K. Honda, Sc.D. (Sendai, Japan), and Prof. H. Endo, M.Sc. (Sendai, Japan), shows by means of examples that magnetic analysis applied to the case of non-magnetic elements, which are paramagnetic or diamagnetic, affords a very convenient method of studying the equilibrium diagram for the alloys consisting of these elements. Not only is the melting, or transformation, point of an element given by a sharp discontinuity of the susceptibility-temperature curve, but the liquidus and the solidus of an alloy are also marked by a sharp break, or bend, in the same curve; in some cases, small solubility is marked by a very large abrupt diminution of the diamagnetic susceptibility of one component on adding a small quantity of the other. Magnetic analysis is also a very convenient method for the study of the actual state of an alloy when above its melting point, that is, in detecting the existence of an intermetallic compound in the liquid phase, the degree of dissociation of the compound with the rise of temperature, &c.

The Council reported that the membership had grown to 1,801. Research had been made during the year into problems connected with the corrosion and protection of condenser tubes, and had resulted in a simple explanation being found for a number of actual cases of corrosion.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

At a meeting of the Grand Council of the Federation of British Industries on March 9th, Lord Gainford, P.C,. D.L., was nominated as president-elect of the Federation in succession to Sir Max Muspratt, Bt. Lord Gainford's



Elliott & Fry] [*London.*

Lord Gainford, P.C., D.L.,
President-elect of the F.B.I.

activities lie mainly in the direction of collieries; he is a director (and vice-chairman) of Pease & Partners, Ltd., and many other colliery companies. To electrical men he is known as a director of the County of London Electric Supply Co., Ltd., while he is familiar to the public as vice-chairman of the British Broadcasting Corporation. Apart from his industrial experience, Lord Gainford has had a long career in the public service. In 1889 he was Mayor of Darlington, and he subsequently sat in Parliament for about 14 years. He has held the posts of President of the Board of Education and Postmaster-General, among other appointments. During the war he served on the Claims Commission in France and Italy.

Mr. J. H. Tonge, M.I.E.E., consulting engineer, has been elected president of the Rotary Club at Preston. Prior to his retirement at the end of 1922, Mr. Tonge was for 30 years managing engineer of the Preston electricity undertaking, most of the time for the National Electric Supply Co., Ltd.

Mr. R. C. Harris, electrical manager for Messrs. Clarke, Chapman & Co., Ltd., of Gateshead-on-Tyne, who has been with the firm for 20 years, is resigning his position and is taking up agencies in the N.E. Coast area.

Leeds Corporation Tramways Committee recommends increasing the salary of Mr. W. Chamberlain, the general manager and chief engineer, from £1,500 to £1,600 per annum.

The *Financial Times* states that Mr. W. Higgins, chairman of the Pernambuco Tramways and Power Co., recently left for Brazil, accompanied by the secretary, Mr. H. Harper, in order to visit the company's properties in Pernambuco.

Mr. James A. Erskine, a graduate of the Royal Technical College, Glasgow, has received an appointment in the electrical engineering department of the Monongahela Coal Operators' Association, Virginia, U.S.A. He has had experience of mines in Scotland and Canada.

We congratulate Mr. Francis C. Polden, the well-known City electrical contractor, upon his election to the Court of Common Council of the City of London as a representative of the Vintry Ward.

Mr. F. J. Cleveland has given up his position as chief technical assistant to Messrs. J. S. Withers & Spooner, and has opened an office as a patent agent at Bank Chambers, 29, Southampton Buildings, Chancery Lane, W.C.2.

The new chairman of the London County Council is Mr J. M. Gatti, managing director of the Charing Cross Electricity Supply Co., Ltd.

The paragraph in our last issue relating to the salary of the Southport borough electrical engineer was incorrect. We understand that no increase of Mr. Moxon's salary has been under consideration.

Obituary.—Mr. A. C. Forshaw.—The death took place on March 9th at Stockport of Mr. Alfred Christian Forshaw, who was for many years with the Direct United States Cable Co., first in Liverpool and later in London, where he was general manager of the Metropolitan office. He was 80 years of age.

Ald. E. B. Smith.—The death was announced last week of Alderman Edward Bremner Smith, J.P., chairman of the Oswestry Electric Lighting Co.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Synchronola Radio Co., Ltd.—Private company. Registered March 2nd. Capital, £400 in 317 ordinary shares of £1 each and 1,660 deferred shares of 1s. each. Objects: To carry on the business of manufacturers of and dealers in the high-frequency radio transformer invented by W. & F. Butterworth, and to register the name "Synchronola" as a trade mark to be applied to this transformer. The permanent directors are:—W. Butterworth (chairman), 39, Bottom-o'-th'-Moor, Chorley Old Road, Bolton; F. Butterworth (managing director), 150, Brownlow Road, Horwich; Dr. B. Rai, Duff House, Horwich. Qualification of first directors: one share; of other directors, 150 ordinary shares. Remuneration as fixed by the company. Registered office: 150, Brownlow Road, Horwich, near Bolton.

Alpha Electric Welding Co., Ltd.—Private company. Registered March 7th. Capital, £1,000 in £1 shares. Objects: To acquire the business of boiler repairers and general engineers, &c., carried on as "The Alpha Electric and Oxy-Acetylene Welding Co., Ltd.," at Newport, Mon., and at Swansea, Glam. The subscribers (each with one share are:—F. A. Saunders, 55, Lambert Street, Newport, Mon accountant; F. Pinnett, Chaseley, Alteryn Avenue, Newport Mon., clerk. The first directors are to be appointed by th company or subscribers. Qualification, £25 shares. Remunera tion as fixed by the company. Secretary: F. A. Saunder 55, Lambert Street, Newport, Mon.

Strouds (Bellingham), Ltd.—Private company. Regis tered March 5th. Capital, £100 in £1 shares. Objects: T carry on the business of electricians, electrical, radio an mechanical engineers, manufacturers of and dealers in a apparatus used in connection with wireless telephony, & The first directors are:—Mrs. Ethel E. Stroud (chairman), Farmfield Road, Downham, Bromley, Kent; C. J. Turner, 6 Simpsons Road. Bromley, Kent. Qualification: £1. Solicitors Cohen, Dunn, Page & Moore, Audrey House, Ely Place, E.C. Registered office: Bellingham Station Buildings, Catford, S.

Winfield & Reeves, Ltd.—Private company. Registere March 5th. Capital, £200 in 1s. shares. Objects: To carr on business as manufacturers of electrical fittings and illum nated signs, metal workers, &c. The directors are:—R. Winfield, 11, Nelson Crescent, Ramsgate, electrical enginee C. H. Morrell, 1, The Terrace, Champion Hill, S.E.5, accoun ant; E. J. Evershed, 60, The Ridgway, Wimbledon, S.W.1

solicitor (managing director); W. G. Reeves, 160, Commercial Road, Peckham, S.E.15, electrical engineer. Secretary: C. H. Morrell. Solicitors and registered office: Helliwell, Harby and Evershed, 231, Strand, W.C.2.

J. Briggs Electrical Contractors, Ltd.—Private company. Registered March 10th. Capital, £5,000 in £1 shares. Objects: To acquire the business carried on at Golden Square, Regent Street, W., as "J. Briggs & Company," and to carry on the business of electrical engineers and contractors, &c. The directors are:—J. G. Briggs, "Dalkeith," Ickenham, Middlesex, electrical engineer (permanent chairman and managing director); C. V. Ramsey, 17, Church Lane, Hornsey, N.8, surveyor. Registered office: Grafton House, Golden Square, W.1.

Macilafone Co., Ltd.—Private company. Registered March 9th. Capital, £2,000 in 1,900 10 per cent. preference shares of £1 each and 2,000 ordinary shares of 1s. each. Objects: To carry on the business of manufacturers of and dealers in all kinds of telephone appliances and parts thereof, &c. The subscribers (each with one £1 share) are:—E. McBean, 7, Avignon Road, Brockley, S.E.4, solicitor's clerk; J. G. Argold, 2, Dacre Gardens, Lee, S.E.13, solicitor's clerk. The first directors are to be appointed by the subscribers. Secretary (*pro tem.*): E. McBean. Solicitors: W. H. Speed and Co., 18, Sackville Street, Piccadilly, W.1. Registered office: Thanet House, 231, Strand, W.C.2.

Electro Trust, Ltd.—Public company. Registered March 11th, with a nominal capital of £300,000 in £1 shares (180,000 6 per cent. cumulative preference and 120,000 ordinary). The objects are to acquire and hold shares, stocks, debentures, debenture stock, bonds, obligations and securities issued or guaranteed by any company, constituted or carrying on business in Great Britain or elsewhere, and in particular by any company dealing in electric lighting, electrical appliances of all kinds, or any business relating to electricity, &c. The minimum cash subscription is seven shares. The subscribers (each with one ordinary share) are:—F. C. Howard, E. G. C. Jones, H. Quennell, A. J. Graham, A. M. Welsford, R. J. L. Scott, and G. T. Weeks, all solicitors, of 18, Austin Friars, E.C. The first directors (to number not less than three nor more than six) are to be appointed by the subscribers. Qualification, £250 shares or stock. Solicitors: Slaughter & May, 18, Austin Friars, E.C.2.

Nigerian Power and Tinfields, Ltd.—Public company. Registered March 10th. Capital, £100 in 5s. shares. The objects are to carry on in Nigeria or elsewhere the business of producers and suppliers of electric power, electricians, mechanical engineers and manufacturers, workers and dealers in electricity, motive power and light; to acquire or obtain control of mines, minerals, mineral and other properties, &c. The minimum cash subscription is seven shares. The subscribers (each with one share) are:—L. C. Walker, 79, St. George's Avenue, Tufnell Park, N.7, incorporated accountant; H. J. Guntay, "Langston," Riverhead, Kent, secretary to public company; R. S. Williams, 21, Ventnor Villas, Hove, Sussex, merchant; and four others. Qualification, 100 shares. Remuneration, £250 each per annum (chairman £300), free of income tax (but not super-tax), and a percentage of the profits. Solicitors: Birkbeck, Yeo & Co., Finsbury House, E.C.2. The registered office is at Finsbury Pavement House, E.C.2.

Official Returns of Electrical Companies.

North Metropolitan Power Station Co., Ltd.—Trust deed dated February 25th, 1927, to secure £850,000 debenture stock, charged on freehold land at Enfield, with buildings, plant and machinery thereon, rentals or other sums receivable by the company under an agreement dated October 5th, 1926, or under a lease dated February 2nd, 1927, and all rights and interest of the company therein and (as a floating charge) on the company's undertaking and other property, present and future, including uncalled capital. Trustees: Consolidated Trust, Ltd., Dashwood House, 69, Old Broad Street, E.C.2.

Pinnacle Switchgear, Ltd.—Satisfaction in full on February 28th, 1927, of debenture dated July 20th, 1926, securing £1,000. First debenture dated February 28th, 1927, to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: T. M. Richards, 12, Kildare Gardens, W.2.

W. L. Gray, Ltd.—Particulars filed of £750 debentures, authorised February 2nd, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Beko Lamp Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated February 16th, 1927, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Temple Cox Research Co., Ltd.—Issue on February 14th, 1927, of £430 debentures, part of a series.

Joseph Evans & Sons (Wolverhampton), Ltd.—Satisfaction to the extent of £1,000 on February 28th, 1927, of debentures dated December 18th, 1907, securing £50,000.

International Wireless Manufacturers, Ltd.—H. Smith, of 4, York Buildings, Adelphi, W.C.2, ceased to act as receiver and manager on January 16th, 1927.

Natwirco, Ltd.—H. E. Burgess, Senior Official Receiver, of 33, Carey Street, W.C.2, was appointed receiver on March 2nd, 1927, under powers contained in debenture dated October 22nd, 1926.

City Notes.

County of London Electric Supply Co., Ltd.

The directors' report for the year ended December 31st last states that the amount available for distribution, including £24,098 brought forward, was £794,350. After meeting debenture interest, &c., transferring £28,975 to the contingency fund, and £190,679 to the depreciation reserve, there remains a balance of £466,541. An interim dividend at 5 per cent. was paid on 1,330,000 ordinary shares; it is proposed to pay a final dividend at 5 per cent. on 3,103,334 ordinary shares, leaving £51,374 to be carried forward. The net capital expenditure during the year was £1,326,185, of which £813,089 was accounted for by mains and £219,998 by buildings. The total capital expenditure now stands at £8,411,397. The amount of energy sold during the year was 145,714,062 kWh, as compared with 93,845,622 kWh in 1925; the number of consumers rose by 14,517 to over 84,500. The report makes mention of the capitalisation of reserves and the allotment of four new shares to each three ordinary shares held by the shareholders. During the year the company obtained a Special Order for the Merstham area, and the mains have now been extended to that area. A Bill is being promoted in the present session of Parliament for the extension of the company's powers and its area of supply in the County of Essex, and for other purposes. To deal with the increased load and prospective demands the company secured the Electricity Commissioners' consent to the completion of the first section of the Barking station, and the work was commenced in May last. The meeting is to be held on March 29th.

Liverpool Overhead Railway Co.

The annual meeting was held at Liverpool, on March 9th Mr. M. H. Maxwell presiding. The chairman said the past year had been full of difficulties to the board and the management, and the results were disappointing. Reductions in expenditure had been effected by changes in the staff, and the effect of that would be felt in the current year. Alluding to the tramway service, now discontinued, he said there had been written off £30,763 against tramways capital account, but apart from the tram shed and certain cables which were being used by the railway, the cars and equipment formerly in use would realise little more than scrap value. Competition with the Liverpool Corporation tramway system and the L.M. & S. Railway had to be reckoned with. The company could not raise its fares, and it was out of the question to reduce them to the level of the tramways. Negotiations had been continued with the Corporation, and it was thought possible that the company might be able to obtain a quotation for a supply of power on favourable terms, which would obviate a capital expenditure of about £13,000. At the same time, the directors were making investigations as to the advisability of installing a turbine set at the generating station, which would reduce the cost of generation. It was hoped that a new station just south of the new Gladstone Dock would be ready for traffic when the new dock was officially opened next July.

German Companies.

The *German-Atlantic Telegraph Co.*, Berlin, reports net profit and balance forward amounting to 152,000 marks, as against 13,000 marks in 1925; half is transferred to the reserve fund and the balance carried forward. It is mentioned that the Emden-Azores cable is now open to traffic, and a dividend is expected for the current year.

The *Elektra Co.*, Dresden, reports net profits of 1,385,000 marks for 1926, as against 1,231,000 marks in the previous year. It is proposed to pay a dividend of 12 per cent. on the share capital of 10,000,000 marks, as against 10 per cent. for 1925.

The *Saxony Works, Light and Power Co.*, Dresden-Niedersedlitz, states that, in spite of unfavourable conditions, the turnover during 1926 was approximately the same as in the preceding year. The net profits were 755,000 marks, and the dividend remains at 6 per cent.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

Adelaide Electric Supply Co.—250,000 6½ per cent. "C" cumulative preference shares of £1 each, fully paid, Nos. 500,001 to 750,000.

Metropolitan Electric Supply Co.—500,000 ordinary shares of £1 each, fully paid, Nos. 1,000,001 to 1,500,000.

Yorkshire Electric Power Co.—773,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 830,001 to 1,603,000.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Electrical Distribution of Yorkshire.—300,000 new ordinary shares of £1 each, issued at £1 5s. per share, partly paid and fully paid, Nos. 500,001 to 800,000.

Perak River Hydro-Electric Power.—331,237 ordinary shares of £1 each, fully paid, Nos. 1 to 331,237; £75,000 7 per cent. participating debenture stock.

Westminster Electric Supply Corporation, Ltd.

The report for 1926 is prefaced by a statement that the accounts have been prepared in accordance with the London Electricity (No. 2) Act, 1925, and are not comparable with those of previous years. The balance of net revenue for the year is £137,077, and from this are deducted interim dividends paid (1s. per share on ordinary), leaving £86,921. After meeting the balance of preference dividend it is proposed to pay a final dividend at the rate of £5 16s. per cent. on the ordinary shares and to carry forward £1,503. Sir A. B. W. Kennedy has retired from the post of engineer-in-chief, and he has been succeeded by Mr. P. L. Riviere. To fill the vacancy on the board thus caused and one due to the death of Mr. C. S. Gilman, Mr. W. A. Pearman (general manager) and Mr. D. M. Touche have been appointed directors. The capital account shows an expenditure of £179,704 since June 30th, 1925, principally upon mains. The amount of energy sold during the past year was 44,594,030 kWh. The meeting was to be held on Wednesday last.

Bristol Tramways and Carriage Co., Ltd.

The revenue for the past year amounted to £1,086,926 and the expenses to £985,267. With the balance brought forward, there is a net revenue of £107,073. After providing for debenture interest and preference dividend, it is proposed to transfer £10,000 to reserve for contingencies and renewals and to pay a final dividend of 4 per cent. on the ordinary shares, leaving £4,989 to be carried forward. The reserve fund now stands at £372 378. There were increases in the number of passengers carried and in the traffic revenue. The report records the death of Mr. J. H. Howell, a director, and states that Mr. S. E. Smith, C.B.E., manager for the last eight years, has been appointed to the board. The meeting was to be held yesterday (Thursday).

Hendon Electric Supply Co., Ltd.

After meeting debenture interest, preference and interim ordinary dividends, &c., for 1926, there remains a surplus of £31,749. Of this £5,726 is placed to general reserve, £5,000 to income-tax account, and £8,000 to repairs and renewals fund. A final dividend of 2s. per share, free of tax, is recommended on the ordinary shares, and after providing additional remuneration for directors, £2,014 is carried forward. The interim ordinary dividend was at the rate of 10 per cent., tax free. During the year an issue of 50,000 6 per cent. cumulative preference shares of £1 each was made, at the price of 20s. 6d. per share, and the premiums, totalling £1,285, have been transferred to general reserve. The meeting was to be held on Wednesday this week.

British Insulated Cables, Ltd.

The report for the year ended December 31st last records a profit of £607,853, to which is added £224,918 brought forward, making £832,771. After providing for debenture interest, preference dividend, interim ordinary dividend, &c., there remains £690,054, which it is proposed to allocate as follows:—Depreciation, £85,000; to reserve, £200,000; final dividend of 10 per cent. on the ordinary capital, making 15 per cent. for the year (£133,333); leaving £271,721 to be carried forward. The directors consider that in view of the difficult industrial conditions prevailing during the year under review, the results are satisfactory. They express their regret at the death of Sir J. S. Harmood Banner, Bt. (vice-chairman), who had been a director since 1902. The meeting is to be held on March 21st, at Liverpool.

Ericsson Telephones, Ltd.

A dividend of 8 per cent. is recommended on the ordinary shares. The dividend for 1925 was 16 per cent., and there was an issue of bonus shares.

Metropolitan Electric Supply Co., Ltd.

A final dividend at the rate of 12 per cent. per annum is recommended on the whole of the ordinary capital, making 8 per cent. for the year. This is equivalent to 12 per cent. on the old ordinary capital.

Imperial Tramways Co., Ltd.

The revenue account for 1926 shows that after paying the debenture interest and the interim preference dividend, there is an available balance of £12,452. Of this £3,814 is transferred to reserve for depreciation and contingencies, the balance of the preference dividend is paid, and a balance of £3,838 is carried forward. The company has received a dividend of 7 per cent. upon its holding of ordinary shares in the Bristol Tramways and Carriage Co., Ltd., but nothing has been received from the London and Suburban Traction Co., Ltd. The report records the death of Mr. J. H. Howell and the appointment of Mr. S. E. Smith, C.B.E., to fill his place on the board.

Waygood-Otis, Ltd.

The profit for the year ended December 31st last was £88,772, as compared with £45,180 for the last nine months of 1925. To this is added £17,428 brought forward, making £106,200. The reserve receives £45,000, £6,000 is transferred to the pensions fund, and after the payment of a final dividend of 7½ per cent. on the ordinary shares (making 10 per cent. for the year), £17,200 is carried forward. An equivalent dividend was paid in respect of 1925. A sum of £30,000 has been brought from the reserve for the purpose of writing down goodwill and patents to £30,000. The meeting was to be held on Wednesday last.

Bruce Peebles & Co., Ltd.

The report for 1926, which is to be presented at to-day's annual meeting, records a profit of £24,509, to which is added £8,656 brought forward, making £33,165. From this £5,000 is transferred to depreciation reserve, and after meeting the preference dividend, it is proposed to pay a dividend of 10 per cent. on the ordinary shares, leaving £6,812 to be carried forward. The separate factory for the production of transformers, which was mentioned in the last report, is now in full working order.

Midland Electric Corporation for Power Distribution, Ltd.

The net profit for the past year fell from £173,307 to £163,481. Adding £30,963 brought forward, there is an available balance of £194,444. After paying debenture interest, allocating £30,000 to depreciation and £50,000 to reserve, it is proposed to pay a final dividend of 2s. per share on the old ordinary shares (making 10 per cent. for the year as for 1925) and 1s. 4½d. per share on the new shares, leaving £31,132 to be carried forward. In the previous year £40,000 was devoted to depreciation; the contribution to reserve was the same. Meeting: March 21st.

Ceara Tramway, Light and Power Co., Ltd.

Speaking at the recent annual meeting, the chairman (Mr. E. H. R. Trenow) said that in less than three years the company had been able to provide additional equipment to the value of over £50,000 without raising new capital. In the same period the debenture debt had been reduced from £309,000 to £252,000. During the last ten years there had been unbroken progress and the gross income had increased nearly four-fold. The directors asked for power to apply part of the balance of profit carried forward in the repayment of outstanding profit warrants and in payment of a dividend not exceeding 2½ per cent. on the ordinary shares. The report and accounts were adopted.

American Telephone and Telegraph Co.

The report for 1926 states that the total earnings were $197,910,965 and the net earnings $138,931,386. Interest absorbed $21,940,986, dividends $86,496,345, and contingency reserve $4,000,000, leaving $24,494,055, which has been carried to surplus. During the year 781,000 telephones were added to the system, making the total 17,574,000. The company's assets are valued at $3,256,000,000. The Bell System's accounts show total revenues of $823,216,735 and a net income of $155,061,019. Dividends took $100,614,437 and miscellaneous appropriations $5,048,000, leaving a balance of $49,398,582.

Marconi's Wireless Telegraph Co., Ltd.

At the annual meeting on Tuesday last the directors' proposals, which were outlined in our last issue, were adopted. A report of the meeting will appear in our next issue.

St. James' and Pall Mall Electric Light Co., Ltd.

The directors announce a final dividend of 1s. 3.3d. per share on the ordinary shares, making, with the interim payment, the standard dividend for the year in accordance with the London Electricity (No. 2) Act.

London Electric Supply Corporation, Ltd.

A final ordinary dividend of £5 11s. 5 1/7d. per cent. has been declared, making £8 8s. 6 6/7d. per cent. for the year.

Swiss Company.

The *Swiss Company for the Electrotechnical Industry*, Basle, proposes to pay a dividend of 8 per cent. on each of the three classes of shares for 1926, as in 1925.

Newcastle and District Electric Lighting Co., Ltd.

Although the prolonged coal stoppage last year adversely affected the company's business the net profit was slightly higher at £16,8.0, after providing for debenture interest, &c., and allowing £18,000 for depreciation (as against £20,000 in 1925). Adding £15,545 brought forward, there is an available balance of £32,355. As reported last week, it is proposed to pay a dividend of 7 per cent., leaving £15,555 to be carried forward. During the year mortgage debentures to the extent of £4,360 were redeemed and loans amounting to £2,973 were repaid. The meeting was to be held yesterday (Thursday).

City of London Electric Lighting Co., Ltd.

The directors recommend the payment of the balance of the preference dividends and a final dividend of 2s. per share on the ordinary shares, making 15 per cent. for the year. They have also decided to capitalise £400,000 of the company's reserves and to distribute to the ordinary shareholders 400,000 ordinary shares of £1 each, credited as fully paid, in the proportion of one such share for every two existing ordinary shares. These new shares will rank *pari passu* with the existing ordinary shares as from January 1st, 1927, and therefore will not participate in the above dividend.

Davis & Timmins, Ltd.

Out of a net profit of £3,747 for 1926, plus £24,588 brought forward, it is proposed to pay a final ordinary dividend at the rate of 10 per cent. per annum, making 8 per cent. for the year. £18,894 is carried forward. Messrs. J. Kerr-Bock and F. Le Neve Foster have been appointed to vacancies upon the board caused by the death of Sir Henry Mance and Mr. V. Negus. Last year's dividend on the ordinary shares was the same, but there was also a bonus of 17 per cent., free of tax.

Tees Power Station Co., Ltd.

The profit for the past year was £85,009, and after providing for debenture interest and reserve (£20,000), and adding £1,764 brought forward, there is available £37,799. It is proposed to pay a dividend of 3¾ per cent. (as for 1925) and to carry forward £2,062. The authorised share capital has been increased to £975,000 by the creation of 40,000 new £1 shares, and 20,000 of these have been allotted to the Newcastle-upon-Tyne Electric Supply Co., Ltd.

Telegraph Construction and Maintenance Co., Ltd.

The report for the past year shows a net profit of £125,910. Adding £105,852 brought forward, there is available £231,762. It is proposed to transfer £30,000 to reserve (making £330,000), to pay a final dividend of 7½ per cent., free of tax (making 15 per cent. for the year, as for 1925), and to carry forward £112,123. The meeting was to be held yesterday (Thursday).

W. Canning & Co., Ltd.

The profit for the year ended December 31st last was £41,336, and to it is added £4,228 brought forward, making £45,564. A dividend of 10 per cent., plus a bonus of 6d. per share, is recommended on the ordinary shares, £10,000 is transferred to reserve, and £1,000 is put to the employés' benevolent trust fund, leaving £4,564 to be carried forward.

Automatic Telephone Manufacturing Co., Ltd.

The profit for the past year was £161,497. It is proposed to allocate £40,000 to depreciation and £35,000 to general reserve, and after paying a final ordinary dividend of 6¼ per cent. (making 10 per cent., as in 1925), £59,851 is carried forward.

International Automatic Telephone Co., Ltd.

The report for 1926 shows a profit of £119,884 (against £109,522). It is proposed to pay a final dividend of 6¼ per cent. on the ordinary shares (making 10 per cent. as before), and a dividend of 10 per cent. on the deferred shares (the same), leaving £38,583 to be carried forward.

Colombo Electric Tramways and Lighting Co., Ltd.

The Colombo correspondent of the *Financial Times* reports that the Ceylon Government has agreed to purchase the company's lighting and power undertaking for £245,000. The traction system, which is operated under a municipal concession, remains unaffected.

Radio Corporation of America.

The net profit for the past year was $7,367,100 (as compared with $5,737,206). Of this, $1,855,090 has been allocated to reserves for patents, &c., and $4,632,010 has been added to surplus account. The current assets now exceed current liabilities by $19,167,824.

Pinchin, Johnson & Co., Ltd.

The net profit for 1926 was £148,339, as compared with £142,276 for 1925. The reserve receives £27 000 (as against £25,000), the ordinary dividend is maintained at 30 per cent., and £30,571 is carried forward.

Stewarts & Lloyds, Ltd.

A dividend of 2½ per cent. has been declared on the ordinary shares, as against 7½ per cent. last year.

County of Durham Electrical Power Distribution Co.

The report for 1926 shows a net profit of £34,477, and to this is added £2,242 brought forward, making £36,719. It is proposed to pay a dividend of 6¾ per cent. (as against 6 per cent. for 1925) on the ordinary shares and to carry forward £607. The meeting was to be held on Wednesday last.

Cammell Laird & Co., Ltd.

The directors report a loss of £73,575 for 1926, and are unable to recommend dividends on the preference or ordinary shares. The last ordinary dividend (5 per cent.) was paid in 1922.

English Electric Co., Ltd.

The directors state that they are unable to recommend the payment of the final dividend on the preference shares. The last ordinary dividend was 5 per cent. for 1924.

Hadfields, Ltd.

A dividend of 2½ per cent. has been declared on the ordinary shares, as against 3 per cent. for 1925.

Bogota Telephone Co., Ltd.

An interim dividend of 5 per cent. has been declared.

Stocks and Shares.

MONDAY EVENING.

WITH the Budget so near at hand, Stock Exchange markets are taking an active interest in its possibilities. The investment stocks and shares are vulnerable to fresh taxation proposals that fall directly upon incomes or estates. Faced with a probable deficit of at least 30 millions in respect of the current financial year, the Chancellor has to budget for a coming twelvemonth that should be free from such industrial disturbances as a general strike and a coal stoppage. Mr. Churchill has a reputation of readiness for the acceptance of sporting risks. The voices of authority proclaim that national trade is on the eve of pronounced revival. Taking these two considerations in conjunction, the Stock Exchange is disposed to look for no further direct taxation than that which may perhaps fall upon tobacco, foreign wines, and a few licence duties. Prices of investment stocks are therefore moderately steady, although business in such securities travels upon a narrow gauge.

The English Electric Company provided rather an unpleasant shock to equipment shares as a whole by passing the final dividend on its preference shares. The interim dividend was duly met last September. Of late the price of the ordinary—which shares have received nothing since 1s. in May, 1925—has shown a very dull tendency, but expectation had assumed the payment of the preference dividend this month, and the postponement came as a surprise. The shares are cumulative. On the week the price is 4s. down at 13s. 6d., and the ordinary dropped 2s. 6d. to 11s. 3d. Both classes of shares are difficult at present to sell.

Siemens gave way to 28s. 9d., and a dull tendency set in, but Metropolitan-Vickers gained 1s. to 29s. 3d., and General Electrics put on a few pence.

General Electric ordinary shares are the subject of a special recommendation by the First British Guaranty Trust, Ltd., in a weekly circular issued by this firm, who consider that an immediate purchase on three-monthly account should show very satisfactory results. The firm "confidently expect to see an advance in the shares from their present quotation of 32s. to £2 or over," between now and the issue of the report at the end of June. The G.E.C. paid 7½ per cent. last year, 6 per cent. for 1925, and the First British Guaranty Trust looks for 10 per cent. shortly. The last-named may not be an unreasonable, even if it is an optimistic, anticipation, but if it were to be fulfilled, £2 per share would look a high price, giving 5 per cent. on the money. Nothing is said in the advice as to whether the firm buy any shares in the Stock Exchange market if an investor accepts their offer to pay 20 per cent. of the purchase price (calculated upon the market value) now, with no further obligation to put up more money until the end of three months. The offer is not one that will commend itself to the prudence of the investor who likes to know that his shares have actually been purchased and that he has some tangible security given him in exchange for the 20 per cent. of the purchase price of the shares which he is asked to provide.

Further consideration is being given to the issues of the provincial power and supply undertakings. The Llanelly and District Electric Company pays no dividend for last year (ELECTRICAL REVIEW, p. 401), owing to the coal dispute, and the Fife Tramway, Light and Power Company has cut its dividend from 6 per cent. to 3 per cent. Nevertheless, the market is not a bad one. Lancashire Light and Power and Midland Counties are both harder. Electrical Distribution of Yorkshire ordinary are changing hands around 29s. The new shares, issued at 25s. in the proportion of three for five old shares, have become negotiable, the price being about 2s. 9d. premium. A fair demand for them has already developed.

Another dramatic rise in Brazilian Tractions, lifting the price 4 points to 132—last Friday it touched 134—is an outstanding feature of the markets. The preferred improved to 115. The persistent nature of the demand gives the buying an air of American inspiration. Most stocks and shares connected with Brazil have lately benefited by the hope that the country may resume, this year, the sinking fund for redemption of Brazilian bonds, and the Traction Company is declared to be doing very well. For shares in respect of 6 per cent. dividends to stand at 132 obviously requires special justification. Anglo-Argentine Trams are better, and the Mexican Utility group is still moving in favour of stockholders. A rally of 4 in British Columbia Electric Railway deferred stock, after the continuous dwindling in the price, attests the impression that the fall had gone far enough to render the stock an attractive investment. Private advices from Vancouver go to show that British Columbia is participating in the more prosperous conditions which have returned to Canada. Singapore Trams strengthened to 10s.

British Electric Traction ordinary stock remains at 145½; if it were to be quoted amongst trust companies' stocks, as it should be, the price would probably stand higher. A steady advance in the ordinary and deferred issues of the trust group is one of the minor features of present-day markets, but B.E.T. is still included amongst "Tramway and Omnibus" descriptions in the Stock Exchange Official List. There is only a limited market in the stock; its price of 145½ looks high; but, as a lock-up investment, it deserves inclusion in any well-chosen list of holdings for probable appreciation in value.

Notable strength is shown by Districts, where the price quoted ex dividend last week is 3 points up at 60½. Metropolitan Consolidated has strengthened to 64, and Underground £1 shares are the centre of lively animation at their advanced price of 16s. 3d. London Electric ordinary is 2 points harder at 60½ ex dividend. A rise of 1½ lifted London United Tramways 4 per cent. debenture to 51, and the preference rose to 5s. 6d. London and Suburban Traction preference put on a few pence at 7s. Metropolitan Electric Tramways 4½ per cent. debenture is 2 up at 65½.

Marconis present a better aspect than they have done for some time past. The price touched 17s. and then reacted a trifle. This week's meeting is expected to give the board the necessary majority for passing the directors' resolutions. These latter met with vigorous opposition from the English Shareholders' Committee, but the board has received support, both strong and influential. If the official recommendations are carried, the outlook for the Marconi Company is promising, and an early return of dividends seems to be reasonably assured. Marconi Marines are 9d. higher at 23s. 3d., and Canadian Marconis strengthened to 4s. The meeting on Tuesday in this week was expected to prove a lively affair.

Several interesting reports have made their appearance during the past few days. The County of London Electric Supply had a net revenue for 1926 of £770,250, being nearly £47,000 higher than the 1925 figures. The company paid an interim dividend of 5 per cent. and a final at the same rate, the latter on the capital that had been increased by £1,770,000 by the capitalisation of reserves and distribution of these in the shape of ordinary shares, the price of which is better at 28s. The Westminster Electric Supply Corporation's net revenue of £137,000 is £35,000 less than that of 1925. The total dividend on the ordinary shares for 1926 took £110,800, against £113,300 required for the payment of 3s. a share on the ordinary in 1925. The Charing Cross Electricity Supply Company makes up its standard dividend for the year in accordance with the London Electricity No. 2 Act.

The County of Durham Electrical Power Distribution is paying 6¾ per cent. on the ordinary shares, against 6 per cent. a year ago. The Telegraph Construction and Maintenance Company increased its profit last year, but the dividend is retained at 10 per cent., tax free. British Insulated Cables made a gross profit of £607,900 last year, which goes against £670,300 for the previous twelve months. The dividend of 15 per cent. is repeated. This time, however, there is much more capital than there was a year ago. The Midland Electric Corporation for Power Distribution reports a net profit of £163,500, being about £10,000 lower than that made in the corresponding period. The ordinary dividend of 15 per cent. is maintained, with the addition of 1s. 4¼d. per share on the new shares. India Rubber preference eased off to 15s.

Automatic Telephones are dull at 53s. 3d. sellers, the previous dividend of 10 per cent. being repeated. The net profit of £161,500 is £1,800 down as compared with 1925. International Telephones keep steady at 43s. for the deferred. Dividends of 10 per cent. on these and on the ordinary are declared. Bogota Telephones at 31s. 3d. have acquired a small rise upon declaration of a 5 per cent. interim dividend. Monte Video Telephones at 35s. and United River Plates at 8¾ are both better than they have been. The cable group is lacking in features.

St. Maurice preference are good at 20s. South Wales Power 6½ per cent. preference rose to 17s. 6d. The rubber share market is not quite so good as it was last week. Business has fallen off to some extent. Engineering shares hold their ground, but iron and steel descriptions manifest a disposition to droop for want of public interest.

Share List of Electrical Companies.

	Nom.	Dividend. 1924.	Dividend. 1925.	Price Mar.14 1927.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	60/9	—	4 12 0
Brompton Ordinary	£1	10	10	25/-	—	5 12 0
Charing Cross Ordinary	£1	15	15	25/6	—	5 9 10
do. do. ½ Pref.	£1	4½	4½	17/-	—	5 6 0
Chelsea	£1	12	12	25/-	—	5 12 0
City of London	£1	15	15	2½	—	... ...
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Clyde Valley	£1	8	8	30/-	—	5 6 8
County of London	£1	15	15	25/-	+6d	5 0 0
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	£1	7	8	26/3	—	6 2 0
do. 7% Pref.	£1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	£1	10	10	30/6	—	6 11 9
Kensington Ordinary	£1	15	15	24/6	—	5 14 3
Lancs. Light and Power	£1	7½	7½	5/-	+6d	6 0 0
London Electric	£1	10	10	24/-	—	5 17 8
do. do. 6% Pref.	£5	6	6	5⅞	—	5 10 4
Metropolitan	£1	11	11	2£/6	—	5 9 10
do. 4½% Pref.	£1	4½	4½	17/-	—	5 9 10
Midland Counties	£1	5½	6	22/-xd	+1/-	5 9 0
Newcastle-on-Tyne Ordinary	£1	7	7	22/-	—	6 7 8
do. 5% Pref.	£1	5	5	17/6	—	5 14 3
do. 7% Pref.	£1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	£10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	£1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	£5	17½	17½	25 6	—	5 9 10
South London	£1	15	15	24/6	—	6 8 0
South Metropolitan Pref.	£1	7	7	1¼	—	6 8 0
Urban Ordinary	£1	4	7	25/6	—	5 9 10
do. 6% Pref.	£1	6	6	20/6	—	5 17 1
Westminster Ordinary	£1	15	15	25 6	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	£1	8	8	29/6	—	5 8 4
Home Rails.						
Central London Ord. Assented	Stock	4	4	70	—	5 14 4
Metropolitan	"	5	5	64	+½	4 18 9
do. District	"	8½	8½	61	+1½	5 14 9
Underground Electric	£1	Nil	Nil	16/3	+3d	1 17 0
do. do. Income	Bonds	6	6	101	—	*5 18 10
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	100	—	6 0 0
do. Def.	"	1½	1½	28⅞	—	6 6 0
Automatic Telephone	£1	8	10	53/3	—	3 15 0
Chili Telephone	£5	5	6	6½	—	4 12 4
Cuba Sub. Ord.	£10	5	5	6⅜	−⅛	7 8 2
Eastern Extension	£10	10	10	17⅜	—	*5 13 4
Eastern Tel. Ord.	Stock	10	10	172½	—	*5 16 0
Globe Tel. and T. Ord.	£10	10	10	18½	—	*5 8 1
do. do. Pref.	£10	6	6	11	—	5 9 1
Great Northern Tel.	£10	22	20	26¾	—	7 10 0
Indo-European	£25	8½	10	46½	—	*5 7 6
Marconi	£1	10	Nil	16/3	+1/3	...
Marconi-Marine	£1	10	7½	23/3	+9	6 9 0
Oriental Telephone Ord.	£1	12	12	53/3	+8/9	4 12 0
United R. Plate Tel.	£5	8	8	8¾	—	*4 11 5
Western Telegraph	£10	10	10	17	—	*5 17 8
Home and Foreign Trams, &c						
Anglo-Arg. Trams First Pref.	£5	5½	5½	3½	+1/6	8 9 2
do. do. 2nd Pref.	£5	6	6	3½	+1/6	9 4 8
do. do. 5% Deb.	Stock	5	5	71½	—	7 0 0
British Electric Traction Ord.	"	7	8	145½	—	5 10 0
do. do. 6% Pref.	"	6	6	109	—	5 10 1
Brazil Traction	£100	4	5	132	+4	4 11 0
Brit. Columbia Elec. Rly. Pcf.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	"	96/-	136/9	116½	—	*5 7 6
do. do. Deferred	"	129/5	8	158	+4	*5 1 8
do. do. Deb.	"	4½	4½	79½xd	—	5 7 6
London & Sub. Trac. 5% Pref.	£1	2½	Nil	7/-	—	Nil
London United Tram. Deb.	Stock	4	4		+1½	7 16 10
Mexico Trams, 5% Bonds	—	5	5	½	+1	6 18 0
Mexican Light Common	£100	Nil	Nil	45	+2	Nil
do. Pref.	£100	Nil	Nil	97½	+1	Nil
do. 1st Bonds	—	5	5	71½	+1	6 19 10
Yorkshire (West Riding)	£1	5	—	8/9	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	£1	12	18	52/6	—	4 19 0
British Aluminium Ord.	£1	5	10	47 6	+6d	4 4 9
British Elec. Transformer Pref.	£1	Nil	7	18/8	—	7 18 0
British Insulated Ord.	£1	15	15	68/9	—	4 7 0
Brush Ord.	£1	10	10	28 3	—	7 1 0
Callenders	£1	15	15	3½	—	4 5 0
do. 6½% Pref.	£1	6½	6½	23/9	—	5 9 0
Crompton Ord.	£1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 0
Electric Construction	£1	10	10	31/3	—	6 8 0
Enfield Cable Pref.	£1	7½	7½	1¼	—	6 6 0
English Electric	£1	5	Nil	11 3	−2/6	... ...
do. do. Pref.	£1	6	6	13/6	−4/-	... ...
Gen. Elec. Pref.	£1	6½	6½	28/6	—	5 10 0
do. Ord.	£1	5	7½	31/3	+3d	4 16 0
Henley	£1	16	20	39/3	—	4 9 0
do. 4½% Pref.	£5	4½	4½	4¼	—	5 6 0
India-Rubber	£1	5	5	1	—	*5 0 0
Johnson & Phillips	£1	10	17½	2¾	—	6 10 0
Met.-Vickers Ord.	£1	8	8	29/3	+1/-	5 9 0
do. Pref.	£2	8	8	2-⅝	—	6 18 0
Siemens Ord.	£1	7½	7½	28/9	−9d	5 4 0
Telegraph Construction	£12	20	10	29¼	—	*4 0 0

* Dividends paid free of Income Tax

U.S.A. Electrical Exports.

Figures for 1925 and 1926 compared.

BELOW are shown the values of electrical machinery and apparatus exported from the United States during the 12 months ended December last. Comparative figures for the year 1925 are added, and notes of increases or decreases are also given :—

	1925. Thousands. $	1926. Thousands. $	Inc. or dec. Thousands. $
Electrical machinery and apparatus (total)	73,790	84,226	+10,436
Generators—			
Direct current—			
Under 500 kW	848	960	+ 112
500 kW and over	428	455	+ 27
Alternating current—			
Under 2,000 kVA	303	188	− 115
2,000 kVA and over... ...	1,901	1,273	− 628
Steam turbine generator sets	796	1,412	+ 616
Accessories and parts for generators	1,089	920	− 169
Self-contained lighting outfits	1,076	1,151	+ 75
Batteries—			
Flashlight batteries	1,214	1,674	+ 460
Other primary batteries ...	1,204	2,020	+ 816
Storage batteries	2,683	3,443	+ 760
Transforming or converting apparatus—			
Power transformers	2,175	2,231	+ 56
Other transformers	1,315	1,266	− 49
Rectifiers, double-current, and motor generators, dynamotors, synchronous, and other convertors ...	967	1,557	+ 590
Transmission and distribution apparatus—			
Switchboard panels, except telephone	2,305	2,193	− 112
Switches and circuit breakers over 10 A	2,424	2,618	+ 194
Fuses and fuse blocks ...	343	352	+ 9
Watt-hour and other measuring meters	447	493	+ 46
Volt, watt and ampere meters and other recording, indicating and testing apparatus	1,696	2,152	+ 456
Lightning arrestors, choke coils, reactors and other protective devices	707	709	+ 2
Motors, starters, and controllers—			
Motors under 1 h.p.	2,102	1,200	− 902
Stationary motors—			
1 to 200 h.p.	2,472	3,207	+ 735
Over 200 h.p.	604	884	+ 280
Railway motors	808	1,127	+ 319
Electric locomotives—			
Railway	482	1,842	+1,360
Mining and industrial ...	331	759	+ 428
Starting and controlling equipment			
For industrial motors ...	1,159	1,395	+ 236
For electric railway and vehicle motors	278	203	− 75
Accessories and parts for motors	2,040	2,181	+ 141
Electrical appliances—			
Electric fans	917	948	+ 31
Electric lamps—			
Metal filament	1,250	1,603*	+ 353
Other electric lamps	244	281	+ 37
Flashlights	1,342	2,058	+ 716
Searchlights and projectors	562	574	+ 12
Motor-driven household devices	1,206	1,744	+ 538
Domestic heating and cooking devices	1,340	1,722	+ 382
Industrial electric furnaces and ovens	252	253	+ 1
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, &c. ...	1,415	1,478	− 63
Telephone apparatus—			
Magneto telephones	125	105	− 20
Other telephones	498	332	− 166
Telephone switchboards ...	799	2,219	+1,420
Other telephone equipment ...	2,298	2,468	+ 170
Railway signals, switches, and attachments	803	505	− 298
Bells, buzzers, annunciators and alarms	171	296	+ 125
Signal and communication devices—			
Radio apparatus	9,904	8,794†	−1,110
Telegraph apparatus	497	1,018	+ 521
Other electrical apparatus—			
Spark plugs, magnetos, and other ignition apparatus ...	2,708	1,904	− 804
Insulating material	1,545	1,380	− 165
Metal conduit, outlet, and switch boxes	797	1,164	+ 367
Sockets, receptacles and lighting switches	1,595	1,718	+ 123
Electric lighting fixtures, interior and street	1,314	1,860	+ 546
Other wiring supplies and line material	1,132	1,164	+ 32
Other electrical apparatus ...	6,883	7,423	+ 540
The following, not included in the total of electrical apparatus, were also exported :—			
Insulated iron or steel wire or cable	268	276	+ 8
Insulated copper wire or cable	4,900	4,816	− 84

* These were distributed as follows :—Europe, $61,000; Canada, $16,000; Central America, $79,000; Mexico, $267,000; British West Indies, $26,000; Cuba, $184,000; Argentina, $205,000; Chile, $116,000; other South American countries, $202,000; Australia, $188,000; New Zealand, $43,000; British South Africa, $44,000; other countries, $116,000.

† Included in 1926: Transmitting sets and parts, $556,000; Receiving sets, $2,874,000; Valves, $868,000; Receiving set components, $2,016,000; Receiving set accessories, $2,481,000.

Indian Electrical Imports.

THE Trade Commissioner at Calcutta (Mr. D. M. Clarke) has forwarded to the Department of Overseas Trade a survey of the import trade of India during the period from April 1st to December 31st, 1926.

In the course of this it is stated that the imports of electrical machinery were valued at Rs. 173 lakhs, as compared with Rs. 147 lakhs in the corresponding period of 1925. Boiler imports are given as 50 lakhs, against 73. In electrical machinery the United Kingdom imports increased from 120 lakhs to 140 lakhs, and those from the United States from 11 lakhs to 16¼ lakhs. The majority of the boilers were from the United Kingdom, her imports during the two corresponding periods of 1925 and 1926 being 65 lakhs and 48 lakhs respectively. With regard to other electrical goods, the position is shown in the following table :—

	1925-26. Rs. lakhs.	1926-27. Rs. lakhs.
Electric fans and parts	19	22
Electric wires and cables (rubber insulated)	30	23½
Electric wires and cables (other)	14½	20½
Bare copper wire (electrolytic) (other than telegraph and telephone wires)	11½	14
Telegraph and telephone instruments ...	5½	2½
Electric lamps and parts	14½	14½
Electric lamps (other sorts)	3	9
Electric lamps (parts and accessories) ...	2	6½
Batteries	7	7½
Accumulators	8½	11
Electric lighting accessories and fittings ...	13	11
Electric meters	5	4
Electrical instruments, other sorts	3½	2½
Switchboards	2½	3
Electrical goods and apparatus not enumerated	25½	28
Wireless apparatus	5	4

The increase in the imports of electric fans is due to increased shipments from the United Kingdom, whose share rose from 11½ lakhs to 14½ lakhs. In electric wires and cables the United Kingdom supplied 21¾ lakhs. Of the trade in electric wires and cables, insulations other than rubber, the United Kingdom supplied 90 per cent. of the imports. In bare copper wire 10½ lakhs came from the United Kingdom; the United States provided the majority of the remainder, a portion of it being in connection with the electrification of the Bombay, Baroda and Central India Railway. Of the 2½ lakhs for telegraph and telephone instruments, over 2 lakhs came from the United Kingdom. In electric lamps, the United Kingdom's imports increased to 5½ lakhs; the Netherlands supplied the second largest total, 5 lakhs. In electric lamps, other sorts, the United States supplied over 7½ lakhs, the United Kingdom's share being only ½ lakh. The United Kingdom's share of batteries was 2½ lakhs, and the United States' 3½ lakhs. Of the import of accumulators, 90 per cent. came from the United Kingdom. In electric lighting accessories and fittings, the United Kingdom supplied 7¾ lakhs and Germany 2¼ lakhs. In meters the United Kingdom supplied 3½ lakhs, 85 per cent. of the total imports. Practically all the switchboards came from the United Kingdom. Of wireless apparatus the United Kingdom supplied 3½ lakhs.

The British Industries Fair.—V.

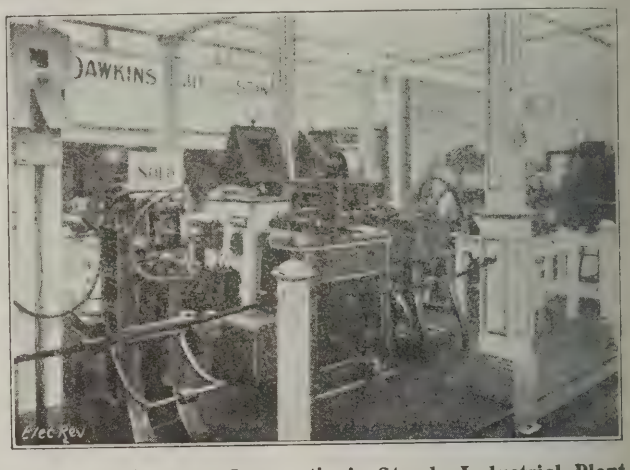
Exhibits at Birmingham.

In this issue we conclude our notes upon the Birmingham section of the British Industries Fair, and in doing so reproduce photographs of the stands of two regular exhibitors.

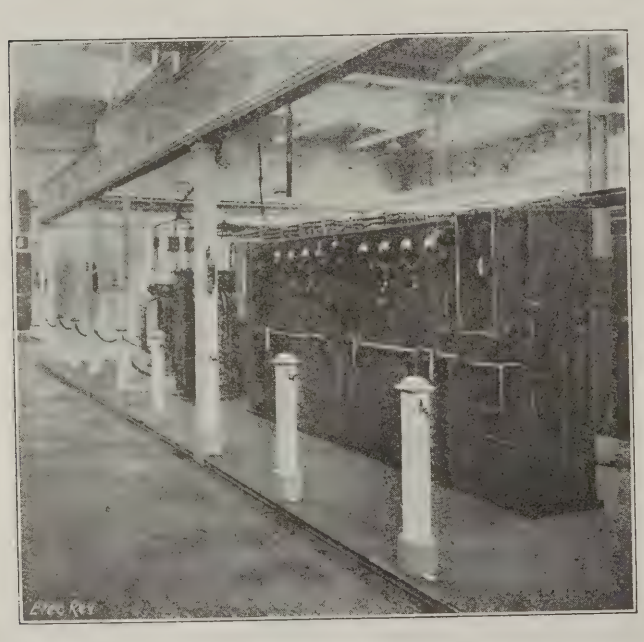
The first three views show the display of the Birmingham Corporation Electric Supply Department, which was bigger than ever this year. The first picture is a general view of the exhibit which comprised all kinds of domestic and industrial appliances. The second illustration shows welding plant, representing the industrial section. The third view is of a separate stand upon which a working sub-station was erected



The Birmingham Corporation's Stand—Domestic End.



The Birmingham Corporation's Stand—Industrial Plant.



The Corporation's Sub-Station.



Display by Premier Electric Heaters, Ltd.

for dealing with the Fair electricity supply; here are seen the control panels of the 460-kW mercury-arc rectifier sub-station and part of the bank of three 100-kW transformers. Apart from being an interesting exhibit in itself, the sub-station served a useful purpose in supplying energy to the exhibitors, whose requirements now exceed the capacity of the plant installed by the Fair authorities for the purpose of lighting the building and demonstrating machinery, &c.

The other illustration shows the comprehensive nature of the domestic appliance exhibit arranged by Premier Electric Heaters, Ltd. This, too, surpassed the company's previous efforts, and was a very bright and stimulating display.

Electric Transmission, Ltd.

This exhibit was divided into three groups, which readily represented the company's products. These were overhead transmission line material: transformer terminals; and outdoor pole-top switchgear. All the porcelain shown by the company was manufactured by Messrs. Taylor, Tunnicliffe & Co., Ltd. In the first group, pin and cap and pin-type insulators used on overhead construction were shown. The pin-type insulators are fixed to their spindles through a neat thimble, which ensures that the porcelain will not be subjected to the internal expansion stresses produced on the materials by variations of temperature. The spindle head has a specially rounded thread to obviate damaging the thimble on the one hand, and the creation of corona, due to sharp points within the porcelain hole, on the other. The cap and pin-type insulators have also been expressly designed to protect the porcelain against expansion stresses, and they can be used for the highest voltages. For heavy mechanical loadings strain insulators are supplied with a clamp, which is suitable both for copper and aluminium steel core conductors. In the second group two specific designs were shown: All-porcelain terminals for voltages up to 33 kV, and condenser-type terminals for voltages from 33 to 66 kV. The condenser-type terminal is a joint product of the company and Micanite and Insulators Co., Ltd. No compound is used in the air-filled terminals, but nevertheless corona is neither apparent or audible until voltages well above the working pressure have been reached. The terminals are guaranteed hot-oil tight. The condenser-type terminals are noticeable for the small amount of compound used, the porcelains being specially manufactured to ensure a close joint between the paxolin—the upper portion of which is cylindrical—and the porcelain. The condenser-type terminal is also hot-oil tight, its puncture value being exceedingly high. In the outdoor pole-top switch

gear group there were three chief exhibits: rod-operated isolating switches, remote-control isolating switches, and air-break switches. The rod-operated isolating switches have a springless main locking device, which prevents the blade opening under the influence of electro-magnetic forces. The remote-control isolating switches incorporate a square operating bar instead of the conventional tube, this ensuring positive and simultaneous movement of the blades, and the operating mechanism is adjustable. The operating mechanism of the air-break switch is similar to that of the remote-control isolating apparatus. The blades are opened by means of rocking insulators, thus eliminating any torsional stresses between the porcelain and the pin. The rocking insulator is connected to the blade by means of a link combination, which imparts a rapid movement to the blade; an ice-breaking mechanism is also incorporated.

George Nobbs, Ltd.

On this stand was exhibited a range of the latest models of the instantaneous-type water geysers as designed to meet the I.E.E. regulations. In these a separate switch and water valve are provided for fitting, particularly in the case of the bath geyser, in a position out of reach of persons standing in the bath. The larger sizes are built for medium voltages divided into two equal circuits and for three-wire d.c. up to 600 V, or they may be divided into approximately three equal circuits with a triple-pole switch for three-phase working. An interesting line displayed was the "Genii P.S." water heater, which has been designed for use in places where a geyser is not practicable. The water valve is fitted on the cold-water side of the heater, for which the makers claim many advantages, the principal of which is that the heater cannot be subjected to the pressure of the water mains. No air or steam vent is necessary, neither can any steam pressure be set up in the tank. The tank is of light construction and fitted with a loose cover. It is supplied in various sizes to give any hot-water storage capacity. An exhibit of special interest was the "Genii" electric urn for boiling water. This is designed for use in bars, canteens, hairdressers' and other places where a constant supply of hot water is required. It is strongly made and finished, constructed of copper, polished outside and tinned inside. A lever draw-off tap, a top cover, lifting handles, and immersion heater loading with 98 per cent. efficiency are fitted. Somewhat similar are the "Genii" jar-lined urn and the "Genii" rectangular-type water boiler for fixing to a wall or bulkhead. Other exhibits included the "Genii" electric hot-water radiator and the "Genii" electric hot-water towel rail and rack. The latter has been constructed to meet the demand for a low-priced article, and is made in two standard designs and lengths. The first has a solid crystal rod with nickel-plated brass end brackets and a nickel-plated tubular heater 24 in. in length. The second is of similar design, only 36 in. in length. Both may be safely used on the ordinary electric light circuit, the consumption being very low.

Bromford Tube Co., Ltd.

This company exhibited a range representing all classes of weldless steel tubes from 10-in. bore down to ¾ in. in lengths up to about 45 ft. Of interest were the specimens of metalised tubing, a process for coating tubes both inside and out, the thickness of the coating being anything between a few thousandths and 1/16th of an inch.

Henry Wiggin & Co., Ltd.

Many types of wire were shown upon this stand, and element wires for electric fires were given prominence by being shown in use in "Creda" and "Belling" fires.

British Electrical Repairs, Ltd.

Examples of re-wound electrical machinery formed the bulk of this exhibit. Commutators, armatures, field coils, &c., were shown.

Ad-Shades, Ltd.

A large collection of art shades (silk, parchment, and composition) was exhibited by this company. All of these reached a very high standard of design.

Mersey Cable Co., Ltd.

Disposed about this stand were a number of drums bearing samples of the company's cables, in addition to sections and lengths of wires and cables upon showboards.

Porcelain Electrical Fittings Association.

This Association had a large combined stand upon which were displayed porcelain electrical parts of all kinds made by its members.

Wilkins & Wright, Ltd.

Numerous examples of brassware for electric lighting were shown by this company, including canopies, chains, bowl rings, &c. In addition, complete radio sets ("Utility") and components were displayed. The latter included triple condensers, micrometer dials, plugs and jacks, &c.

P.I.V. Gear Syndicate, Ltd.

Upon this stand were exhibited examples of drives incorporating the company's positive infinitely variable gear. In essence this gear comprises two cones upon a shaft, which can be moved towards or away from each other. The inner faces of these cones slope inwards towards the centre and are radially slotted. A special form of belt employed has steel slatts running transversely through the links, and these engage with the slots in the pulley cones, giving a positive drive. A simple arrangement is provided for moving the cones so gradually as to give an almost imperceptible change of speed.

Lea Recorder Co., Ltd.

Among this company's exhibits were "V"-notch recorders for boiler-feed water and condensate. "Cubi-meters" for measuring coal were also on view. These embody an adaptation of the "V"-notch principle, but in the place of a float a swinging door is fitted to operate the recording mechanism, and the flow of water is replaced by an endless belt which conveys the coal through the aperture beneath the door. When the flow of coal ceases the door falls and cuts out the recording mechanism.

Bull Motors, Ltd.

The main exhibit upon this stand was a portable arc-welding set consisting of a motor-generator and switchboard mounted on a trolley. The design of the generator eliminates wasteful resistances in the arc circuit, and it is claimed that the standard 25/200-A set takes only 8 h.p. when loaded to its maximum. Other exhibits were a 2,400-V a.c. generator for marine radio transmission and examples of the company's industrial motors. A collection of photographs indicated the range of the company's activities, which include the manufacture of valve filament lighting dynamos, trolley 'bus motors, 1,000-cycle, single-phase alternators for radio purposes, organ-blowing equipment, &c.

Upon the same stand appeared a new "Brookhirst" combined motor switch and controller and an "Airedale" star-delta starter.

Premier Electric Heaters, Ltd.

This company, as usual, had an excellent display of its fires and domestic appliances. All of these were notable for their excellent finish in addition to their working qualities. Fires, irons, urns, kettles, saucepans, hot-plates, and small cooking apparatus formed the bulk of the exhibit. Special interest was displayed by visitors in the company's safety device for electric kettles and similar apparatus. This consists of a metal bridge which is maintained across the contacts in the bottom of the kettle by a nut fitted with a split sleeve. This sleeve becomes overheated when the kettle boils dry and falls apart allowing the bridge to fall and break the circuit. A new sleeve can be fitted in a few moments.

Lightfoot Refrigeration Co., Ltd.

The examples of its work shown by the company were an "Ellarcold" automatic refrigerator in operation cooling a cabinet of 20 cu. ft. capacity; and another set combined with an ice-making tank. The latter plant is driven by a 1-h.p. motor, and is capable of operating an 800 cu. ft. capacity chill room.

May & Padmore, Ltd.

Among the electric fires shown was a new imitation coal fire fitted with two 1,000-W bars in the front, and finished in oxidised silver. There were also a number of bowl fires and soldering irons, and a new curling-tong heater.

Estler Bros.

This firm showed typical low-voltage electric furnaces for industrial processes requiring temperatures up to 1,100 deg. C. In these is incorporated a transformer which reduces the pressure to between 3 to 6 V, and the elements, instead of being fine wires as usual, are of heavy sheet steel, ensuring better distribution of heat and longer life. The furnaces can be fitted with automatic heat control.

Castle Fuse and Engineering Co., Ltd.

The exhibit of this company comprised a range of eight "Triumph" fuses for currents of from 5 to 300 A. These can be arranged for switchboard mounting or fitted into iron cases. The company also showed various examples of fuse unit assemblies from small distribution boards to heavy triple-pole ironclad boxes for industrial service.

Thos. De La Rue & Co., Ltd.

Upon this stand were shown numerous examples of moulded insulating material, including fireproof articles.

Other Exhibitors.

In addition to those firms which we have mentioned in this and previous issues there were a number of exhibitors who showed one or two electrical or allied items. Such were the Stainless Iron and Alloys Co., Ltd. (electric fires and an electric cooker in stainless iron); John Harper & Co., Ltd. (electric heater); James Smellie, Ltd. (lighting fittings); A. Bell & Co., Ltd. (electric fire); Scupham & Wood, Ltd. (wooden electrical accessories); Mond (Staffordshire) Refining Co., Ltd. (joint box compounds); Ryder & Davidson (small geared motors); C. & J. Swingler (bowl chains and fittings); Davis & Timmins, Ltd. (screws and terminals); Joshua Buckton & Co., Ltd. (armature balancing machine); the Silglas Co. (shades); Phillips & Day, Ltd. (lighting standards); and Smalls, Ltd. (mica products).

Illuminating Engineering.

Conditions governing good lighting: some street-lighting problems.

(*Résumé of Proceedings before the* Institution of Electrical Engineers.)

(*Concluded from page* 412.)

At the ordinary meeting of the Institution of Electrical Engineers on March 3rd, two papers relative to the above-named subject were presented. An abstract of Mr. J. W. T. Walsh's paper, together with a report of the discussion on both, was published in our issue of March 11th. The other paper is dealt with below.

Public Lighting.—(*Abstract.*)

By Lieut.-Com. Haydn T. Harrison, R.N.V.R., M.I.E.E.

The demands of modern civilisation are such that the height, spacing, and position of light sources should be re-arranged to avoid the use of very brilliant light sources and to reduce obstructions to vehicle and pedestrian traffic which are liable to endanger the safety of the public. Examples of overhead suspension and of the usual method of supporting by means of columns are cited, with the object of comparing them with the suggested solution of the problem.

High-class Thoroughfares.—It is a mistake to attempt to attain by increasing the power of the existing light sources the high degree of illumination now demanded, as these light sources would need to be too brilliant to be pleasant and would in many cases defeat their own object by reducing visibility, on account of glare. The solution of the problem lies in the use of gasfilled electric lamps.

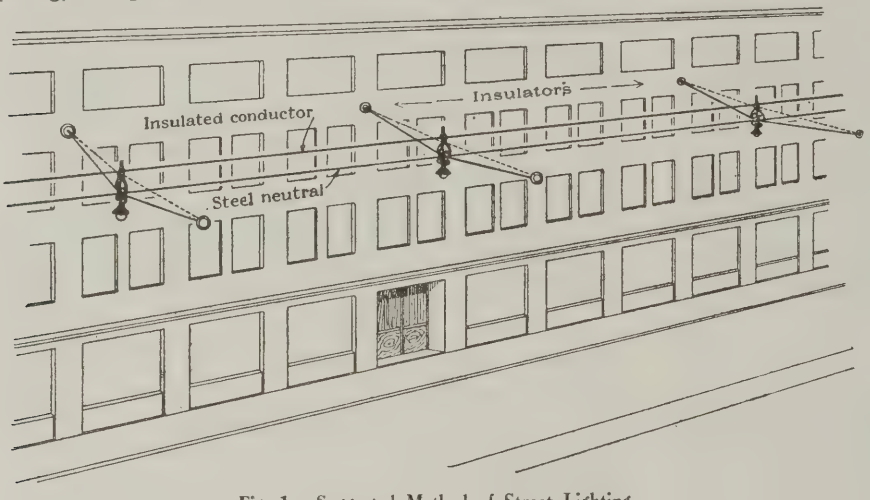


Fig. 1.—Suggested Method of Street Lighting.

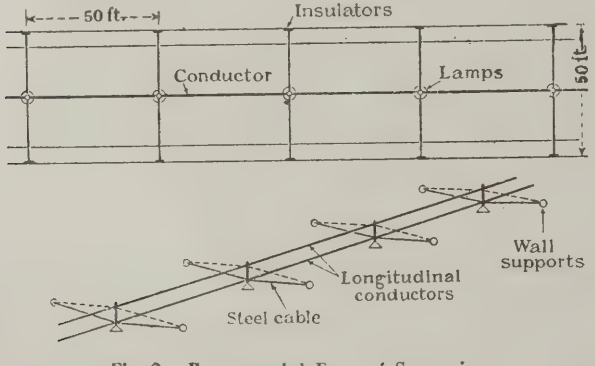


Fig. 2.—Recommended Form of Suspension.

That a completely new system must cost more to install than to convert the existing light sources, need not necessarily be the case; but, even if it should be so, the economies resulting from the more simple control and reduced cost of maintenance will more than compensate for the increased capital charges.

Buildings on either side of the street form a natural fixing for suspension. Where such buildings do not exist, or are unsuitable, steel columns set back from the road against the frontage, or in place of the buildings, would be inconspicuous and free from obstruction. Difficulties in the way of obtaining permission for fixings on privately-owned property are rare in shopping districts where improved lighting will benefit trade; there should therefore be no difficulty, with the help of the Electricity Commissioners, in obtaining Parliamentary powers to prevent permission for such fixings being unreasonably withheld.

A sample installation is diagrammatically illustrated in fig. 1, in which the buildings on one side only are shown. The form of suspension recommended is shown in fig. 2, but, if desirable to reduce the number of fixings to one-half, that shown in fig. 3 could be adopted. The steel span wires, guy wires, and longitudinal wires are insulated where attached to the buildings, or other supports, being earthed only at the switch, or feeding point, and thus become the neutral, or earthed, conductor of the system. The insulated conductor, which is threaded through reel insulators at each fitting and passes longitudinally down the centre of the street, does not carry any weight beyond its own. Where the streets bend, guy wire of small section can be taken from the top of the fitting to a wall fixing away from the centre of curvature; should it be advisable for appearance, this may be done on both sides as shown by dotted lines in figs. 1 and 2, without appreciable extra expense to all spans, in order to make the point of support of the conductor more rigid. Such guy wires do not take any weight and can therefore be of very small section. The terminal ends are guyed in the usual manner from a further point on both sides, and a large factor of safety is ensured owing to the light weight of the fittings to be suspended and to the large sag which is allowed, any swinging being prevented by the longitudinal wires and conductors; a sag in the supporting span wires of as much as 10 per cent. of their length does not adversely affect the appearance.

In the case of 50-ft. spacing with approximately 50-ft. spans, 25 ft. high, allowing for fittings weighing 20 lb. and conductors for a 1,000-ft. run with a voltage-drop of 5 per cent. when using 500 watts per fitting at 200-240 volts, the strain on any fixing will not exceed 100 lb. and, with a safety factor of 10 on the span wires, the outside diameter of any wire would not exceed 0.3 inch. The electrical details described above allow for the guard wire shown in fig. 2 to be of copper, as it acts as the neutral or earth-return conductor and is therefore of the same conductivity and resistance as the insulated main. If the construction shown in fig. 3 is used, this wire can be dispensed with, or reduced in section, depending on the area and conductivity of the diagonal span wires, which then become conductors.

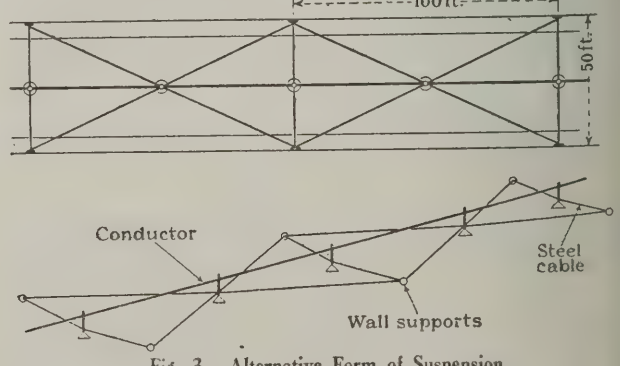


Fig. 3.—Alternative Form of Suspension.

The illuminating problem is simple, the distribution of light being arranged for in accordance with the ratio of the spacing to the height, as in an ordinary factory bay or elongated area. The use of diffusing globes is a matter of taste, as the height proposed is sufficient to keep the light sources well out of the field of vision. Due to the number of

supports, any likelihood of a live wire falling is a very remote contingency, and as they are insulated with a permanently flexible medium, no danger would result. Nevertheless, should it be advisable No. 16 s.w.g. copper catenary wire can be used between the live conductor and the guard wire at intervals.

The attention necessary for such an installation becomes a relatively small item of cost. Modern gasfilled electric lamps only require renewal two or four times per annum, depending upon the efficiency at which they are operated; cleaning, except where the atmosphere is heavily laden with smoke and dirt, is generally carried out 12 times a year. Access to the light sources should be gained by means of electrically-propelled and operated battery tower wagons especially designed for the purpose. The cleaner, without lowering the platform, could move from lamp to lamp, and it is estimated that one man could deal with an installation of 1,000 lamps at the spacings suggested (or even when spaced at 100 ft.), which represents a total cost of attention not exceeding 4s. per lamp per annum.

The cost of lighting and extinguishing becomes negligible where the lamps are controlled on the group system by time switches, or by the police, as one switch can be made to deal with many hundreds of lamps if relays are introduced at the feeding points.

It has been stated that an average life of 2,000 hours can be obtained by operating lamps at a pressure 5 per cent. below that marked on them, but this would result in a reduction of nearly 20 per cent. in the candle-power (with high-power lamps); thus the energy should be increased by that amount. With electrical energy below 1½d. per unit a saving would still be effected. When lamps are allowed to burn out at various times, the labour cost of renewal is increased, as a greater number of special visits has to be made for that purpose, and noticeably irregular lighting results, owing to the great variation in candle-power often found between two adjacent light sources, due to one being new and the other of extreme age.

Light diminution causes include the following:—

(1) Original tolerances allowed to lamp manufacturers by the B.E.S.A. Specification; reduction of 12.5 per cent. (2) Decrease in power during 1,000 hours; reduction of 10 per cent.

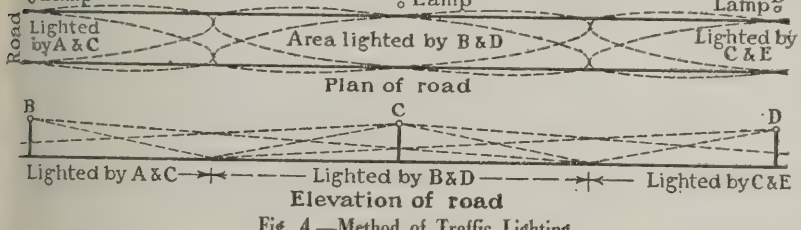


Fig. 4.—Method of Traffic Lighting.

(3) Reduced pressure at point of connection (4 per cent. allowed) causing reduction of light, say, 10 to 16 per cent. (4) Absorption of light by dirt up to, say, 25 per cent. If all these factors were to operate adversely to their maximum extent at the same time, the illumination would be reduced by over 50 per cent. Fortunately such a contingency does not often arise, but a reduction to from 60 to 70 per cent. of the designed illumination is not uncommon and should be allowed for.

The prime cost of an installation such as that described by the author, including all the necessary materials, and erection, is as follows:—

(a) Minimum 1 foot-candle ... ... £650 per mile.
(b) Minimum 0.5 foot-candle ... ... £575 per mile.
(c) Minimum 0.25 foot-candle ... ... £525 per mile.

When fixings cannot be obtained on buildings, steel poles can be of relatively small dimensions if guyed outside the limits of the street, and the increased cost would probably not exceed 50 per cent. Maintenance and operating costs, including electrical energy at 1d. per unit, four lamp renewals per annum, lighting and extinguishing, cleaning, interest and sinking fund on a 10 years' loan basis are approximately:—

(a) Minimum 1 ft.-candle ... £1,000 per mile per annum.
(b) Minimum 0.5 ft.-candle ... £600 per mile per annum.
(c) Minimum 0.25 ft.-candle £475 per mile per annum.

Comparison with existing practice shows that for the same standard of illumination the operating cost above-mentioned would be little more than that required to cover the interest and sinking fund, despite the fact that these do not include the mains.

Less Important Thoroughfares.—The problem of side streets, residential streets, roads used for traffic, country-town and suburban districts and the numerous slums in all large towns is, in the author's opinion, by far the more important, not only on account of its magnitude, but because it affects the safety and to a large extent the welfare of the masses.

Side streets, lanes, alleys and slums can all be dealt with on the lines suggested for the better-illuminated streets, as they are generally narrow and the buildings eminently suitable for fixing. The minimum degree of illumination to be aimed at should not be less than 0.1 foot-candle, which could be obtained by light sources spaced 100 ft. apart and 25 to 30 ft. high, and consisting of 100-watt lamps in suitable reflectors. The capital cost of such an arrangement, based on switch feeding points at half-mile intervals, would not exceed £450 per mile, including conductors. The operating charges, allowing for repayment of the loan in 10 years and 1d. per unit for the supply of energy, would work out at approximately £165 per mile per annum, or probably much the same as the present form of "beacon" lighting giving a minimum illumination of 0.0015 foot-candle, *i.e.*, practically darkness between light sources.

The middle-class residential districts and suburbs are more difficult to deal with, owing to the buildings being set back from the road; this problem should be dealt with in conjunction with the private supply, as the decision may rest upon the suitability of the underground or overhead system, bearing in mind that developments in this country tend towards a.c. distribution, in which case overhead conductors have many advantages when dealing with this class of district.

If existing lamp posts and lanterns must be used, it is imperative in the majority of districts that their numbers should be doubled in order to reduce the spacing to a reasonable limit, and that the most powerful light sources permissible, considering the low height, be introduced. The cost of the change will, however, probably exceed that of a complete new installation on modern lines.

Traffic Lighting.—High roads, arterial roads, and those used by modern high-speed traffic through rural districts, require consideration on account of the danger they represent to the public.

The author has carried out many tests on the "beam" method of traffic lighting, in order to investigate the proposals published in his paper on "Street Lighting" before the National Illumination Commission at Geneva in 1924, in which he suggested that the source of illumination should be rigidly fixed below the level of the eye in order to prevent glare completely by removing the lamps from the field of vision. The result fulfils all the requirements scheduled by the authorities who have issued regulations on the subject of headlights, but the effect on the public is so extraordinary that it is doubtful whether the method will ever become popular.

From research and the regulations already published and adopted for motor-car lighting, it would appear that in order to preserve the safety of the public as one approaches a light source its power should be reduced and the illumination on the obstruction remain the same.

A solution of the problem is to use, say, 30-ft. high light projectors rigidly supported on the sides of buildings or poles carrying the necessary overhead conductors. These may be spaced at distances, say, of 300 ft., or from 17 to 20 to the mile. To produce an illumination of 0.25 foot-candle on a vertical object at any part of the road the maximum candle-power would need to rise to about 40,000 at a distance of from 300 to 400 ft., which does not cause inconvenience. The power would be diminished at 250 ft. to 16,000 candle-power, and at 150 ft. to 6,000 candle-power; and at 100 ft. it would fall to zero, as the light from the source beyond the adjacent one comes into operation. The lamps and reflectors would be of the motor-car headlight type, easily constructed and maintained. The result required can be obtained without difficulty by using 50-watt lamps of low voltage (say, 10 to 12 volts), of which there would be two at each support, or a total of 100 watts, *i.e.*, say, 2,000 watts per mile.

The capital cost, including overhead mains and pole supports, would not exceed £300 per mile, the cost of electrical energy at, say, 1d. per unit being £35 per mile per annum. The cost of lamp maintenance is difficult to estimate, as 10-12 volt 4-ampere lamps are not largely used at the present time in this country, but there is no reason to suppose that it would exceed £2 per point, or £40 per annum, and might not reach half that figure.

With d.c. the lamps would need to be in series of approximately 20 on the 200-240 volt circuits. With a.c. separate 100-watt transformers or compensators wound for a high efficiency at a constant full load could be used, thus making it possible to vary more easily the number of lamps on one circuit. The general principles are illustrated in fig. 4, from which will be noted the effective means of overcoming glare.

Open Spaces, &c.—For lighting open spaces, parks, bridges, &c., the use of underground conductors is generally essential, and, with the exception of bridges, all-round light distribution is required. For open spaces of large area the best effect can be obtained with powerful light sources on very high standards.

State Inspection of Dams.

As the result of investigations and suggestions which have been made consequent on the failure of the Dolgarrog dam, North Wales, last year, a Bill has been drawn up and presented by Major Owen to the House of Commons. The Bill provides for the inspection at any time by the Secretary of State of any dam, embankment, or reservoir in the country, either during the course of construction or when completed. Further, in the event of any dam, &c., being found defective, the owner is to be called upon, under penalty, to remedy the defect.

The Electrical Production of Steam.

The economic production of steam by electric boilers is possible when the cost of electricity is low: 200 installations are believed to be in operation at high efficiency, giving satisfaction.

(Abstract of Paper read before the INSTITUTION OF ENGINEERING INSPECTION.)

AT a meeting of the Institution of Engineering Inspection, held in London, on February 25th, Mr. C. J. Wharton, O.B.E., M.I.E.E., read a paper in which he showed that it was a commercial and economic proposition—under certain circumstances—to generate steam by electricity. The conditions required were very cheap electricity, all machinery in the works electrically driven, and yet a quantity of live steam required for process purposes in the mill or factory. The inventor of one type of electric boiler had suggested as a formula that where electricity could be obtained per kilowatt-hour at a price equal to from one-third to one-fourth of the cost of a kilogram of coal, electrical production of steam began to be economic. Translated into English terms, the author put it roughly that where coal was 30s. per ton and electricity 0.1d. per unit, coal *might* economically be displaced by electricity for the production of such steam as was required for purposes other than power; but undoubtedly every case required individual investigation.

Last year the proposition was put before him by clients in South America that for approximately 10 hours out of the 24 they used from 1,000 to 1,500 kW less than their average load, and that the bulk supply company was prepared, if the consumers could fill up this valley in the load curve, to supply energy at a price of between 0.07 and 0.08d. His clients took into their works continuously several thousand kW at 6,000 volts, 50 periods, the greater part of it being transformed on the premises to 400 volts. Their power was all electrical, but they required for the manufacture of one of their products a quantity of steam amounting to 20,000 lb. per day, and this amount was likely to be doubled. It was required at a pressure of between 10 and 20 lb. Fuel, however, was very expensive, and it was a question whether it would be possible to substitute electricity for the fuel.

Such figures for electricity as those mentioned above were not obtainable in this country, but he had found that the subject had been fully worked out in Sweden and Germany, and to some extent in Canada, Switzerland, and Italy. Numerous works in the first-named two countries were using electric boilers with complete satisfaction. The London representatives of the makers of the Swedish and German systems had held out the promise of such performances as were almost impossible to believe without personal investigation, and he had decided that the systems should be inspected, and that the users should be asked to give their views. All the statements made by the manufacturers were borne out by the users; the extraordinary efficiency, the ease of working, the absence of any injurious effects on the boiler itself, and the general perfect satisfaction experienced by the users were most surprising. Nearly every engineer in charge of an electric boiler, whether it had been working two, three or four years, emphatically declared that he had no maintenance charges whatever. The author had inspected an installation at Freiburg, with regard to which the City Engineer, Mr. E. Eitner, had stated that it had fully justified the expenditure and had proved a great commercial success, that the upkeep costs of the boiler had been absolutely nil, and that the boiler worked silently and gave no trouble to the supply circuit, the loading of the three phases being perfectly balanced. The only exception to the "no costs" reports met with was in the case of a pulp mill at Gota, Sweden, where a bank of three large boilers, each taking 3,000 kW, was working at 10,000 volts, and, with the exception of two weeks in each year, had been running at full load for 24 hours a day for four years. The only renewals in that time had been some electrodes and a few porcelain parts; this was considered by the user to be highly satisfactory under such severe conditions. The boiler shells showed no trace of pitting or corrosion.

The underlying principle of the two systems of boiler was the same, *i.e.*, the boiler, relatively to the output, was a small one of vertical type, with three iron electrodes immersed in water, and three-phase current at 3,000 to 10,000 volts was applied, the water itself being the resistance whence the heat was obtained. The details, however, varied considerably.

In the Swedish, or "Volta," type the water level in the boiler was kept uniform, and variations according to input of electricity and output of steam were obtained by raising or lowering vertical tubes surrounding the electrodes, which shortened or lengthened the path of the current, the entry of the conductors in this case being through the bottom of the boiler to vertical electrodes fixed to the base of the shell.

In the "Penzold," or German, system the leads were brought in through the top, and hanging electrodes were used with piled disks of insulating material surrounding them to direct the course of the current, while the work done was varied by raising or lowering the water level. Both systems might be made wholly automatic or might be hand-controlled.

In practice he could find no difference in the satisfaction given to the user, that satisfaction being based upon (1) the very high efficiency of conversion; (2) the extreme cleanliness of the operation; (3) the small space occupied for a large output; (4) the complete automatic possibilities, reducing attendance costs to almost nothing; (5) the virtual absence of repairs, maintenance and depreciation.

The efficiency claimed was nearly 100 per cent., as practically every kWh expended was returned in B.th.u., the only loss being the heat lost by radiation. This loss could be brought down to the lowest dimensions by thorough lagging of the whole of the boiler, and the makers guaranteed an efficiency of 96 per cent. There was a further loss, however, due to blowing-off the mud deposited from the impurities in the water. It was essential, of course, that the conductivity of the water should remain constant. Perfectly pure water could not be used, in view of its high resistance; a certain amount of impurity was necessary, but as this did not pass over with the steam, the conductivity of the water gradually increased, so that it was necessary to blow out the surplus and keep the water in the boiler at approximately uniform analysis. The net result was that with feed water at 68 deg. F., one kWh would produce 2.75 lb. of steam at a gauge pressure of 114 lb., and the installation with which he was concerned was guaranteed to do that. Similar results had been obtained in other plants which he had seen working on the Continent.

Dealing with the space occupied, he referred to a case in which three Lancashire boilers were supplying a large building with steam. The building was owned by the municipality which also owned the electricity supply system; whenever current could be spared the electrical system was used, and was greatly preferred. The comparison between the two with regard to space required was significant, for the electric boiler occupied a space in the corner not more than 7 ft. by 7 ft., including switchgear and everything else, and it did the same work as the three Lancashire boilers.

The manufacturers of the Swedish and German plants had worked out very complete automatic systems for regulating the input of electricity and/or the output of steam, and no attendance was required for hours at a time. In the South American works with which he was concerned, the boiler was not connected directly to the consuming mains, but fed a Ruths accumulator, because a cheap supply of electricity was not available at the time when the steam was required, and switches were arranged so that when the full capacity of the accumulator was reached the current was automatically cut off and the boiler went out of action. On the other hand, if steam were being used during the time the boiler was working, the pressure in the accumulator would fall according to the demand, and the input from the boiler was automatically increased, so that the pressure and quantity of steam entering the accumulator might be varied to suit the demand.

The very small amount of wear and tear in the electric boiler was undoubtedly attributable to the fact that the greatest heat in the whole apparatus was at the point where the steam was generated, in the middle of the water, and the lowest temperature was necessarily at the outside of the boiler plates. Incidentally, this made for small heat radiation.

The electrodes, of course, might be expected to show some signs of deterioration, but owners of boilers which had been working 10 or 12 hours a day had told him that there was no wear of the electrodes after two, three, or even four years of use. This was due to the fact that in both types of boiler the greatest heat was developed, not at the electrode itself, but at some distance from it. This result was brought about in the "Volta" boiler by the movable tubes, which acted as a deflecting shield, whilst the makers of the "Penzold" boiler, considering that the porcelain or quartz tubes were liable to fracture, had evolved a system of surrounding each electrode by four rods which carried a number of insula

ing disks, so constricting the passage from electrode to electrode, or electrode to shell, that the greatest heat was developed away from the electrode itself. He had heard of other makes of electric boilers in which these deflecting shields were not used, with the result that an arc was sometimes formed, which not only ate up the electrode, but also caused considerable out-of-balance on the phases, which, of course, would be fatal to the success of any such boilers if connected to a general electricity supply system.

The plant for the works in South America consisted of one boiler for three-phase, 6,000 volts, the maximum input being 1,000 kW, and maximum output per hour 2,750 lb. of steam at 114 lb. pressure. The dimensions were: height 7 ft. 2 in., and diameter 4 ft. 6 in. There was also one Ruths steam accumulator complete, having a capacity of 19,800 lb. of steam, its length being 57 ft. 6 in., and its diameter 10 ft., with all valves and fitments, including oil-driven automatic valves for 80 lb. and 24 lb., respectively. There was one oil-cooled transformer, 1,000 kVA capacity at 6,000 volts, ratio one-to-one, wound for delta-star. The transformer was required because the power company supplied on the non-earthed or delta system, and the supply to the boiler must of necessity be earthed. Indeed, the action in the boiler was somewhat complicated, being of a combined star and delta nature, but at any rate the boiler shell must be earthed, and the one-to-one transformer was the easiest and safest way out of the difficulty. Steam generation would take place mostly at night, but a certain amount of electricity would be available at meal times, and as the electric boiler could be started up in a few minutes, even an hour's generation of steam would help to keep the accumulator full. The author anticipated results from this installation equal to those obtained on the Continent. He believed there were at present over 200 installations of electric boilers producing steam at high or medium pressure, or heating water for internal warming.

Inasmuch as it was usual to couple with electric installations a system of storage, the author described the Ruths accumulator system.*

In the South American plant its main object was to store up the steam energy which could be produced economically at night and to give it out during the day. It was to be put on the roof of a two-storey building, and provision was being made to triplicate the installation at some future date. It was calculated that the saving, as compared with the present fuel-fired system, would be so great that the whole capital cost of the installation would be covered in three years.

In conclusion, the author said that although the cost of electricity in this country could hardly be expected to rival that referred to as obtainable in South America, and that consequently electric boiler installations on a large scale could hardly be looked for here, there might be cases in which the raising of a small quantity of steam by electricity would be an economic proposition.

Discussion.

Mr. C. M. Read (who visited Sweden on Mr. Wharton's behalf for the purpose of investigating the electric boilers in use there) said the point which had impressed him most was that the use of the electric boiler was looked upon almost as common practice in Sweden; quite a number were installed, and in every case, apparently, they were giving every satisfaction. The use of the Ruths accumulator appeared to be even more general. He was inclined to favour the "Volta" system, in which the current was led in from the bottom, for various reasons. He had looked particularly for signs of pitting of the boiler shell due to electrical action, but there were no signs of pitting at all, and there appeared to be no scaling of any sort. The marks of riveting were still to be seen, although the boiler had been in use for two or three years. He had heard that Swedish engineers were experimenting with boilers having a voltage of 33,000 V. They were not worked by the electrode system, he understood, but by applying the current—three phases—to three separate jets of water, the jets being directed one against the other.

Mr. McKinstry (Metropolitan-Vickers Electrical Co., Ltd.) said that in this country there would be a very small market for this kind of plant, but British engineers had to cater for all kinds of conditions in all parts of the world, and for that reason it was of very great interest to them to learn of systems of this description. He knew of cases in India, Australia, and New Zealand where electricity could be supplied at prices which would make the operation of a system of this kind feasible.

Mr. Norman Swindin referred to his experience with a submerged flame boiler, and said he could quite accept the statements with regard to the extremely high efficiency and the absence of scale, due to the fact that the heat was supplied from the inside of the boiler and not through the plates from the outside.

Mr. N. Dufty (of the A.E.G.), dealing with the suggestion that there was very little call for electric boilers in England, said his firm had under construction seven locomotives, driven by steam, for use in rolling mills, the steam being generated by electricity during periods of light load. That had been found to be an economical proposition. Replying to questions as to the feed of the "Penzold" boiler, he said it operated with a magnetic cut-in and cut-out. There had been no trouble with the leading-in insulator. His company had a boiler of 135,000 volts under construction. There was an electric boiler water-heating plant in operation in London. Dealing with criticism of the fact that the order for the Rio plant had been placed in Germany, he said that if British manufacturers wanted orders in Brazil they should send engineers there, just as the Germans had to do.

Mr. S. S. Jewsbury (Messrs. G. N. Haden & Sons, Ltd.) said that his firm had been working on the same lines as Mr. Wharton, and he had visited the Continent to ascertain the most suitable type of electrically-heated boiler to use in connection with the heating and hot-water supply installations at the head offices of the Newcastle-on-Tyne Electric Supply Co. After careful consideration it was decided to provide two electrode type boilers, each having a capacity of 1,000 kW, and working at a line pressure of 6,000 volts. These boilers would generate steam at a pressure of 50 lb. per sq. in. above atmosphere, and would supply it to calorifiers for heating the water in the large heat-storage cylinders of the heating apparatus. Current would be taken between 7.30 p.m. and 7.30 a.m. The building would be warmed during the day by the hot water from the storage cylinders. Similar storage apparatus would be provided for the hot-water supply installation. Each boiler would be capable of regulation between 300 and 1,000 kW, and would have a full-load capacity of 2,800 lb. of steam per hour. Automatic devices would be provided for regulating the steam pressure and the water level. It was hoped that the plant would be working by August this year, and it was anticipated that during the course of the general exhibition to be held in Newcastle next year the Electric Supply Co. would allow visitors to see the steam boilers in operation. As the result of its investigations, his firm was convinced that there was an opening for apparatus of this type in this country, and especially in London; but, of course, each individual case must be investigated on its merits.

The Chairman (Mr. R. P. Wilson), referring to Mr. Wharton's statement that, with coal at 30s. per ton and electricity at 0.1d. per unit, the production of steam by electricity was justified, said that although those conditions did not obtain here, Mr. Jewsbury's remarks would appear to indicate that there were many cases in this country in which the circumstances were such as to bring about an almost identical set of conditions. Our central-station engineers did not appreciate what was apparently a paradoxical point of view, namely, that in many cases it paid to sell electricity at less than it cost to produce.

* A full description appeared in the Electrical Review of May 28th, 1926.

Electricity on Board Ship.

The Royal Mail Steampacket Company's new motor-ship, *Alcantara*, which arrived at Southampton from the builders, Messrs. Harland & Wolfe, recently, has a very complete electrical installation, supplied by four Diesel-driven generators, of a combined capacity of 1,600 kW, in addition to a 75-kW emergency dynamo placed above the margin line, which can supply light and power for all essential services if required. Over 50 large fans are installed throughout the ship for the supply of cool air, in addition to over 450 smaller fans in the state rooms and public rooms for local ventilation. The heating is also electric throughout, there being some 500 large heaters distributed throughout the various apartments, each separately controlled, in order that heating may be regulated at will. All the engine-room and deck auxiliaries are electrically operated, for which over 130 motors are installed, besides those mentioned for driving the ventilating fans; they are of various sizes, the largest being those for the manœuvring compressors, which are of 180 b.h.p., and for the compressors of the refrigerating plant each motor is of 110 b.h.p. A novel device comprises an illuminated track-chart installed in the entrance to the first-class quarters which has a little model ship operated from the electric clock system, and indicates the ship's position at any time during the voyage. Lighting is carried out by some 4,000 electric lamps distributed throughout the vessel, which include the lights for navigation purposes, Morse lanterns, and the high candle-power lamps and lanterns for working the cargo, and in connection with the illumination of the boats under the latest Board of Trade regulations. The ship is fitted with echo sounding gear. In the hospitals and barbers' shops electrical apparatus is installed; there are seven electric lifts and hoists. Cooking is entirely electric: there are five large ranges and two ovens for the bakeries; in addition to salamanders, grills, fish fryers, and toasters; two mincing machines; one cake whisk; one coffee mill; one bacon slicer; one ice-cream machine; four plate washers; three potato peelers; two dough mixtures; one printing machine; one laundry motor; one gymnastic motor; a photographic printing machine; and a very complete system of bells and telephones.

The radio-telegraph installation consists of standard Marconi 1½-kW quenched-spark and valve transmitters, and a valve receiver covering all commercial wave-lengths, augmented by a direction-finder installation. The musical interests of the passengers are catered for by Marconi band-repeater equipment; four microphones and six loud-speakers are included. The *Alcantara*, of 22,181 gross tons, with accommodation for 1,800 passengers and crew, commenced her maiden voyage to South America on March 4th.

The "Ideal Home" Exhibition.

A Review of the Electrical Features of this year's show at Olympia, London.

(*Continued from page 408.*)

ACCORDING to Sir John C. W. Reith, Director-General of the British Broadcasting Corporation (Inc.), every eighth home in America is licensed for the reception of broadcast radio-telephony, while in Great Britain receiving equipment is installed in nearly 3,000,000 out of about 7,000,000 homes. No "Ideal Home" Exhibition would therefore be complete nowadays without a display of receiving apparatus, and it is accordingly fitting that some space at Olympia has been devoted to exhibits of this character.

The B.B.C. Demonstration.

At past shows the B.B. Co. allowed visitors to see how programmes are broadcast, the actual performances taking place in a specially-constructed sound-proof studio being watched through glass windows. This year, however, the point of view of the listener is receiving special attention:

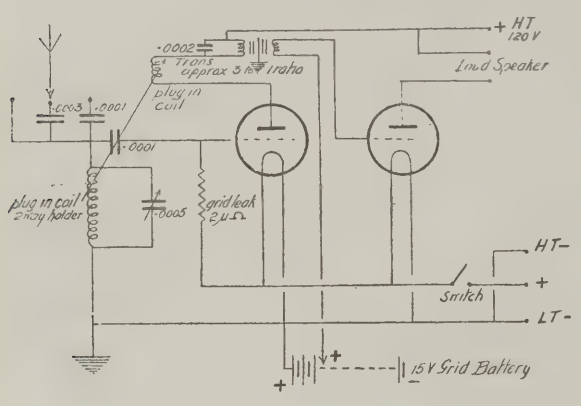


Fig. 2.—A 2-valve Receiver Diagram.

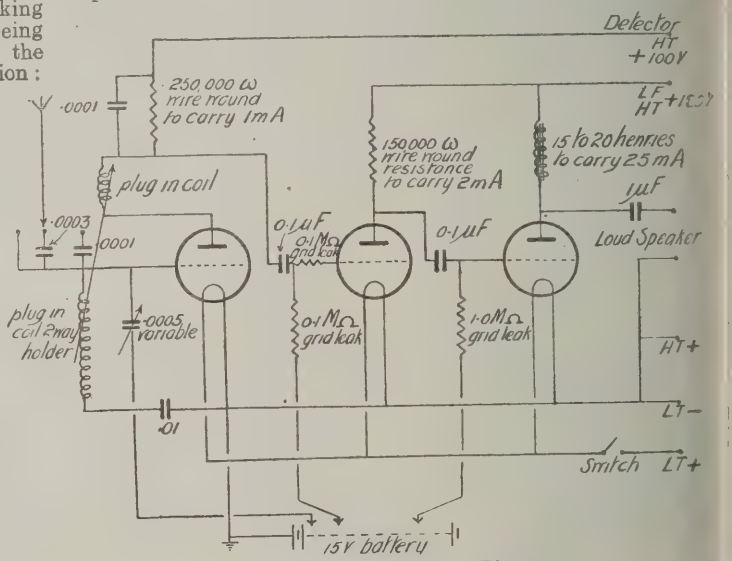


Fig. 3.—A 3-valve Receiver Diagram.

three different types of sets are in operation, the object being to demonstrate the quality of reception and excellence of reproduction it is officially considered well-chosen loud-speaker sets should be capable of within the service areas of the B.B.C. stations. In this way the public is afforded for the first time a reliable and unbiased standard of comparison.

The instruments are representative of cheap, medium-priced, and expensive outfits; no consideration whatever has been given to such factors as appearance, attention having been devoted entirely to sound design and technical merit. The speakers employed are concealed from view and the names of the makers of the component parts wherewith the receivers were built have not been revealed, but the circuit diagrams (figs. 2, 3, 4 and 5, reproduced herewith) are displayed for inspection, and comparable results are obtainable from carefully-assembled high-grade apparatus of reputable make purchasable through any dealer of standing. The two- and three-valve sets (figs. 2 and 3) presumably operate cone speakers, whilst the large set (fig. 4) is a 5-valve, straight-circuit outfit, with one stage of high-frequency amplification; the last stage of low-frequency magnification consists of two large-power valves connected in parallel for driving a moving-coil type of speaker, and the power supply is obtained from lighting mains, fig. 5 indicating how the connection thereto is made.

The novelty of distant reception, which caused receivers to be judged by the number of transmitting stations they were capable of being tuned to, is waning, and vigorous preference is now being shown for quality; that is, fidelity of reproduction of the local programme. Manufacturers are rising to the occasion, and the British Broadcasting Corporation's admirably conceived effort at Olympia will be of practical value to all concerned. Its demonstration of actual possibilities should satisfy most people, whilst the large combination is in a class by itself.

A Cliftophone-Celestion Demonstration.

One of the most interesting of the radio exhibits has been arranged to demonstrate the capabilities of equipment made by Cliftophone, Ltd., and the Celestion Radio Co., to reproduce music of adequate volume in the New Hall. Several systems of electrically reproducing and thermionically amplifying gramophone music and speech are on the market, but one of the particular merits of the above-named outfit is its British origin and workmanship throughout.

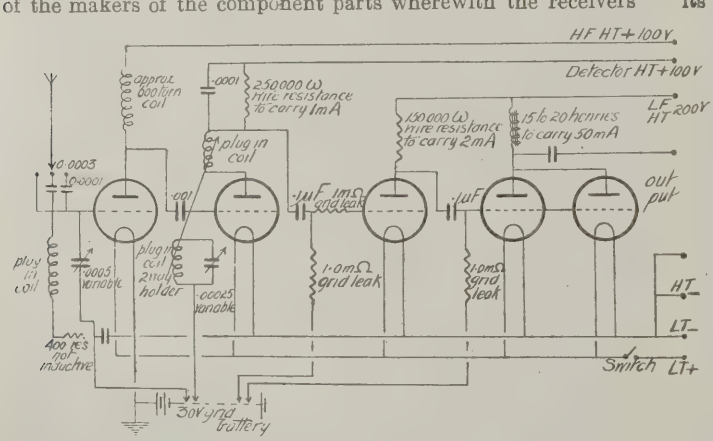


Fig. 4.—A 4-stage Set, supplied from A.C. Mains.

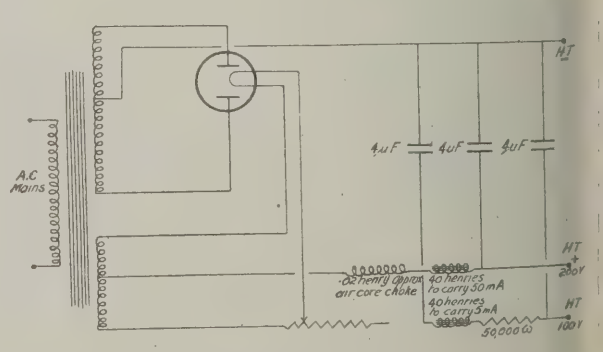


Fig. 5.—Method of Obtaining High-voltage Supply from A.C. Mains.

Mr. W. E. Clifton, the inventor, employs an ordinary type of clockwork gramophone, records and steel needles: the usual sound box and tone arm are, however, replaced with a needle-actuated electromagnetic current generator (said to be constructed on unusual lines) which couples the machine to a thermionic amplifier. The latter is small in dimensions, and incorporates a valve switch and means of controlling the volume; the magnification of the three Marconi valves used is of a large order with a total plate current 20 mA, whilst

the circuit employed is claimed to be of novel form. Details are, however, not available for publication.

To convert the electrical output of the amplifier into sound, three standard "Celestion" A3 radiophone loud-speakers* (one of which is illustrated in fig. 6) are used in parallel: each

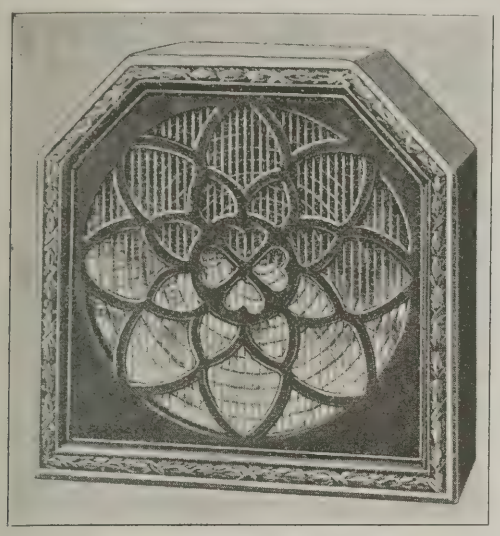


Fig. 6.—Standard "Celestion" Loud Speaker.

being of 2,000 ohms resistance, the impedance of the combination is of the high order of several hundred thousand ohms. The choice of the "Celestion" horn-less speaker is a tribute to its qualities, and the outfit functions satisfactorily, the musical effect being of a pleasant character.

Other Radio Exhibits.

The Cunard Steam Ship Co.'s exhibit affords some idea of the many comforts provided on passenger liners; a fully-equipped wireless cabin is on view, the apparatus including a direction-finding outfit, and an operator is on duty to explain the function of the various pieces of plant, which was manufactured by Siemens Brothers & Co., Ltd., of Woolwich.

The Halycon Wireless Supply Co., Ltd., displays a selection of portable broadcast receivers of the multi-valve type; in addition to these standard models, a portable 7-valve super-heterodyne set is shown, the tuning of which is claimed to have been simplified.

Messrs. S. G. Brown, Ltd., besides samples of their wide range of products, are showing a receiving set that dispenses with the use of valves and accumulator, yet operates a 21-in. loud-speaker. It may be arranged to work with an indoor, outdoor, or frame aerial within a radius of six miles from a broadcasting station and 15 miles from Daventry.

Messrs. Peter Curtis, Ltd., have several patterns of their receivers on view, housed in handsome wood cabinets; also the Curtis-Clayton tester, which is a single-valve receiver with a self-contained frame aerial, but it can also be used as a universal testing instrument, as a wavemeter, a generator of sustained audio-frequency current, a calibrated variable condenser, and for the measurement of resistance, voltage, current, &c.

The "Donotone" loud-speaker, patented by Mr. P. S. O'Donnell is housed in cabinets of handsome and original design, and is of novel construction. The pole pieces of the usual electromagnet are wound for a very high impedance and across them is a spring armature, to the centre of which is fixed a small glass disk holding a flat diamond. Another diamond (pointed) is attached to one end of a short steel rod, which has a reciprocating motion in a sleeve, a light helical steel spring between the rod and sleeve maintaining the two diamonds in simple contact with one another; sound is produced by a tapping, similar to the vibration of an electric bell armature. Several silk disks, from 2 in. in diameter upwards, are threaded concentrically on to the sleeve, the largest (12 in. in diameter) being attached to the free end of the diamond-pointed rod; all the disks are free to vibrate. Several inches in front of the disks a series of gongs, of the spiral clock type, are screwed individually around the mouth of the flare, with metal baffle plates between them; the 24 gongs, ranging from treble C to bass C, are chromatic and tuned to sympathetically respond to their own notes.

L. G. Hawkins & Co., Ltd.

This exhibit comprises an almost complete range of electrical labour-saving equipment for the home, including the scientifically designed "Miller" and "Ivanhoe" lighting fittings and "Universal" electric cookers, suction cleaners, and washing and ironing machines. The "Kelvinator" electric refrigerator plays an important part on this stand, a variety of sizes being shown. It might be safely said that the exhibit is representative of every kind of electrical apparatus for domestic use. Some excellent designs of such apparatus as electrical coffee percolators are attracting the attention of those in search of home-beautifying utensils. Demonstrations are being given practically continuously of electric ironing, cooking, and coffee making. It is of interest to note that Messrs. Hawkins are proud of their claim to be among the pioneers in the representation of the electrical industry at the exhibition. They first exhibited in 1920.

Hotpoint Electric Appliance Co., Ltd.

This firm is emphasising in particular the use of electricity for domestic laundry work, and an interesting feature of the display is the "Maytag" gyrafoam washer, fig. 7, which has only recently been introduced in this country, and which, it is claimed, is the only electric washing machine on the market into or from which the clothes may be put or taken while the machine is running. The tank is rectangular in shape, the corners being suitably rounded inside, and stands on four legs equipped with rollers. The agitating or disturbing element is in the form of four vertical blades projecting from the interior of a shallow cup at the bottom of the tank. This is rotated in alternate directions by means of a crank attached to the shaft of a worm-driven wheel, the worm being belt driven from a small motor conveniently housed under the tank. The effect of the movement is certainly quite distinct from that of the usual rotary action. A vertical extension of the crank shaft to the top of the tank, with its housings, serves as a fixing and driving medium for a wringer, knife cleaner, and a mincing machine. The apparatus can also be used for dish washing, the tank accommodating a wire basket for this purpose. It is interesting to learn that the West Ham electricity undertaking is hiring out these washers on an ordinary rental basis.

Another interesting piece of electrical apparatus to be seen on this stand is the "Eco-Dry" cabinet for the indoor drying of clothes. This is a cast-aluminium cupboard equipped with the necessary sliding brackets and a suitable

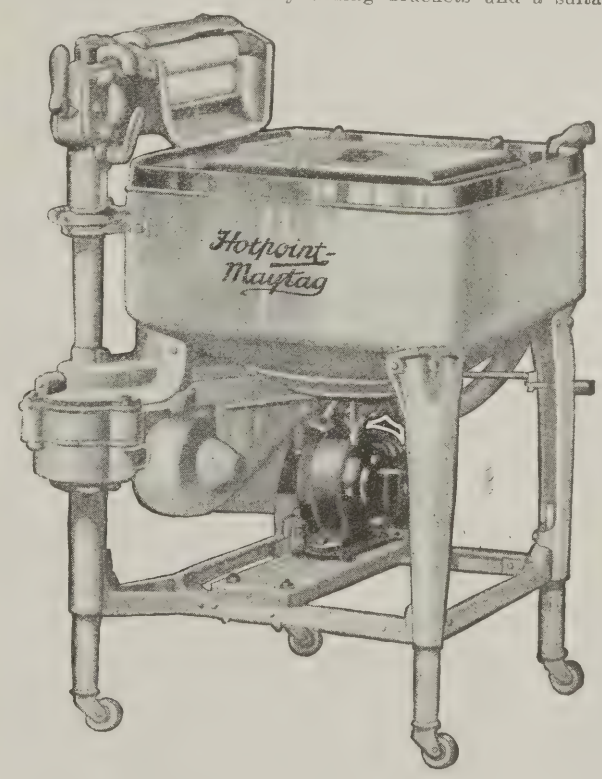


Fig. 7.—The "Maytag" Electric Washer.

exhaust chamber. It is loaded at 3 kW. The "Hotpoint-Utenco" ironer is also shown by this firm. The outstanding feature of this machine is its two-roller principle of construction. The polishing roller, which is evenly electrically heated, revolves five times faster than the feed roller, thereby producing a gloss equal, it is claimed, to that obtainable by means of a hand iron. The rollers are self adjusting. On the pedestal carrying the rollers is bracketed the driving motor, about ¼ h.p. The heating loading is 1,000 W. The "Hotpoint WB25" wash boiler is also exhibited. This holds 10 gallons of water and is provided with immersion heaters. Of particular interest in the cooking equipment shown on this stand is a new type of totally enclosed boiling plate. The elements are housed in a sheet-metal box, which is bolted to the cast top-plate. The under side of this is treated with a special insulating material. The plate is sent out sealed, complete with a 3-pin plug, under a 12 months' guarantee. It is interchangeable with the existing 3-heat plates.

With regard to the large electric-light shades at Olympia, described in our last issue, we are asked to make it clear that Messrs. Wm. McGeoch & Co., Ltd., were not the contractors for installing the shades, but were responsible to the architect, Capt. Tanner, for them. Messrs. Walford Art Co. were engaged by Messrs. McGeoch as sub-contractors.

(To be continued.)

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* For constructional details see Electrical Review, June 19th, 1925, p. 995, and September 3rd, 1926, p. 380.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

The Price of Electricity for Home Use.

Hearty congratulations on your leader concerning the reduction in the price of electricity for domestic purposes. Could not you see your way to having a special "Economic" number of the Review, with reports from one or two undertakings enlightened?

In this connection may I suggest that the two-part tariff be adopted throughout the country, and, furthermore, be the only tariff as far as domestic supply is concerned? This for three very good reasons:—

(1) Considering the complex nature of the subject, it is simple, and is the only tariff that is fair (or can be made so) to both consumer and supply undertaking.

(2) By means of rebates on kW connected and type of load it lends itself readily to preferences for large consumers and those who by various devices improve the load factor. This system of rebates will obviate any necessity for double metering or time switches, thereby keeping down capital expenditure.

(3) The standing charge and the price per unit could be, and should be, revised every year, or, for that matter, every six months, bearing in mind not only the number of new consumers connected, but the capital charges involved in the new extensions.

I am convinced that the price of electricity is the biggest factor in deciding the rate of increase in domestic electrification, and a systematic reduction in the price, based on the previous six or twelve months' working, widely advertised, would be the best way of bringing in new consumers, and encouraging the extended use of current by old ones.

£40,000,000 (if my memory serves) was spent at last year's motor show, simply because the car industry had created a demand by reducing the price, instead of carrying on after the manner of supply undertakings.

Cyril J. Crawshaw, B.Sc.

Newcastle-upon-Tyne, *March 11th*, 1927.

River Water—or Cooling Towers?

The reason given by Mr. R. J. Kaula in his letter dated February 7th, 1927, why turbine manufacturers rigidly confine the consumption guarantee to one set of conditions, appears to the writer to be quite inadequate, for it ignores the fact that the terminal pressure will vary over an appreciable range according to the season of the year. In a river-side station the terminal pressure will vary from round about 0.7 in. Hg. in the winter to about 1.4 in. Hg. in the summer, and such variation is not controllable. Therefore, the turbine will have to operate over such a range normally, and it will entirely depend upon the season of the year when the official acceptance tests are made as to what terminal pressure will be realised. Surely the purchaser is entitled to call for a guarantee covering the normal variation of an important condition. The writer fails to see why a guarantee giving definite consumptions at, say, 0.8 in., 1.1 in., and 1.4 in. Hg., should be any less clear or unequivocal than a guarantee giving the consumption at, say, 0.9 in. Hg. only. To the writer, the two forms appear to be equally clear, and from the point of view of comparing the relative merits of tenders and also from a testing point of view, the guarantee covering the normal variation in conditions offers definite advantages to the purchaser. Readers interested in this side issue will find it adequately outlined in a paper on "Performance Guarantees for Power Plant, with reference to Official Acceptance Tests" by the writer submitted at the 1924 I.M.E.A. Convention.

Mr. Kaula states that the thermo-dynamic efficiency of two units operating at the respective terminal pressures given in the article will be practically the same. If the term "thermo-dynamic efficiency" is given its true meaning—the ratio of heat output to heat input—the statement is obviously incorrect. Presumably the term "thermodynamic efficiency" has been used to denote "efficiency ratio." (In the writer's opinion the modern fashion of using thermo-dynamic efficiency to denote efficiency ratio should be discouraged as leading to needless confusion.) In whatever sense the term was used, the writer is unable to agree with the statement, as it is contrary to the test results available at present. The statement may become true as design progresses, but the time is not yet. The writer regrets that he is unable to accept Mr. Kaula's estimate of from 7 to 8 per cent. better steam consumption for the respective cases until reliable test results are available in support thereof.

Mr. Kaula contends that test results on the same turbine at different terminal pressures are misleading. This contention only holds good if the turbine is designed for a higher terminal pressure, or lower vacua, than that at which the tests are made. If the turbine is designed for the lowest terminal pressure at which the tests are made, as was the case in the article, then the results are truly comparative. This is amply demonstrated by the characteristics of the consumption-terminal pressure curves in the article. In fact, it is the only practical way of determining the value of advances in the design of the exhaust end of turbines.

The letter of Mr. E. Fawssett in your issue of March 4th gives somewhat better test results than those in the original article. The writer has the privilege of being conversant with the resources and ability of the test department controlled by Mr. Fawssett, and has no hesitation in accepting the figure put forward, namely, 6 per cent. at full load, as accurately representing a value achieved on a large-sized modern turbine. The result quoted would have been more helpful still if the size of the unit, the initial steam pressure, and the percentage of steam bled off for feed heating, had been given. The writer surmises that the capacity of the sets in question was from 20,000 to 25,000 kW, that a very appreciable amount of bleeding was part of the design, and that the sets were put into commission last year. The machines on which the results of the article were based were of 12,000 kW (economical load) and were put into commission in 1921 (scarcely ten years old as stated by Mr. Fawssett), so that in five years, with the turbine size doubled, and with the development of extensive bleeding (the latter appreciably affects the gain due to terminal pressure), the gain realised is still appreciably short of the theoretical, and is still only about 60 per cent. of that claimed over ten years ago, when the actual results were not so good as those shown in the article. Incidentally, the test value quoted by Mr. Fawssett is appreciably lower than that claimed by Mr. Kaula, and there can be little doubt about the size and modernity of the sets in question.

It should be pointed out that the value quoted by Mr. Fawssett almost certainly represents the maximum gain that can be realised at present for the largest-sized turbines, and that this maximum will not be realised with turbines of smaller capacity; also it does not follow that turbines even of the same, or larger, size by other makers will necessarily realise an equal gain. All the power stations are not going to be equipped with such large-sized turbines, for some years at any rate. It should also be pointed out that as initial steam pressure increases (the modern tendency) the gain due to terminal pressure decreases.

With the definite modern trend towards increased initial steam pressure the gain due to decreased terminal pressure falls successively, as is illustrated by the following table based on Callender's heat-drop tables:—

Theoretical Decrease in Steam Consumption due to Decreasing Terminal Pressure from 1.8 in. Hg. to 0.9 in. Hg. abs.

Initial Superheat Constant at 200 deg. F.

Initial pressure, lb./sq. in. gauge	400	600	800	1,000	1,200
Theoretical gain, per cent....	6.9	6.4	6.1	5.8	5.6

Taking account of the modern trend toward increased initial pressure, it will be realised that the figure quoted by Mr. Fawssett practically represents the highest gain to be achieved, for advances in turbine design will be more than negatived by the decrease in the heat drop as initial pressures increase.

Summing up, on the evidence available, it may be said that at the present time the value of river water as compared with cooling towers will vary from about 4 per cent. with medium-sized turbines to about 6 per cent. for the largest size of modern turbines.

Mr. Fawssett's letter was welcome as giving authentic test results. It does not nullify the objects of the article, but helps to carry the matter a stage further, the objects being to investigate the actual gain due to using river water, and to point out that the actual gain was usually considerably over-estimated.

Stoke-on-Trent, *March 9th*, 1927. **J. N. Waite.**

The "H" Type of Cable.

In view of the recent controversy in your columns regarding 33,000-volt cable, with particular reference to the "H"-type cable, it is interesting to note that, in connection with the electrification of the Berliner Stadtbahn, orders have just been placed for 265 km. of 30,000-volt three-core cable.

Of this quantity, 184 km. is specified to be of the "H" type, the sections being 120 sq. mm. and 95 sq. mm., and 81 km. of the normal or belted type, the sections being 70 sq. mm. and 25 sq. mm.

The cable is to be manufactured in lengths of 800 metres.

London, *March 8th*, 1927. **E. Bowden.**

Two-Part Prepayment Meters.

I am pleased to note that Mr. Howell's remarks, and my own, at the last E.D.A. meeting, have received the attention they deserve, and that the Meter Engineers' Technical Association has set up an Expert Committee to deal with this very important question. It is about 12 months since I brought this matter up, and there was promise then of some form of British-made "two-part prepayment meter" coming on the market. For some reason this has not yet been given to us.

There are at least three makes of Continental meters of this type available, and in use in thousands, to my knowledge.

My own opinion is that the two-part prepayment meter is a real necessity, particularly with assisted wiring schemes and two-part tariffs being taken up by supply authorities. I maintain that the consumer would put 5s. or 6s. a month in the meter at once, by way of a fixed charge, if he had to, just as much as he would pay the rent once a month, and, moreover, if the small consumer knew he had to put the money in the meter for the fixed charge, before he could get current, he would do so. This is only a matter of education and custom. By asking for the fixed charges through a collector, the consumers can, and often do, say they will pay next month, and often run up a debt.

If the patent rights of those meters already being manufactured are the stumbling-block, then I suggest that our manufacturers should do the same as some Diesel-engine makers do, and take out a licence to manufacture in this country one of the already patented meters of the type required.

I hope the Meter Engineers' Expert Committee will draw a "winner" from our British meter manufacturers. I think they have a "sporting chance."

H. W. Watts,
Electric Light Department, *Resident Electrical Engineer.*
Epsom, *March 7th*, 1927.

Power Supply for Wireless Sets.

The difficulty between Mr. P. K. Turner and "Interested" appears to me to admit of a comparatively simple explanation.

It is a fact of observation that to produce a material increase in volume of *undistorted* reproduction necessitates an increase in power-valve (output) capacity which appears to be considerably greater than in proportion to the resulting increase in volume. It is possible to have undistorted reproduction with quite a small power (valve), *e.g.*, 4 mA at 120 volts (*i.e.*, 0.48 watt) as quoted by "Interested," or even with an ordinary receiving valve, at a relatively moderate volume, but it is essential for a large volume of undistorted reproduction to have a large power (valve) consuming, say, 20 mA at 200 volts (*i.e.*, 4 watts) as quoted by Mr. Turner. In my own case, for satisfactory operation of two or three speakers, each with a good volume, I use no less than 24 mA at 250 volts (*i.e.*, 6 watts) (LS.5 valve).

It is hardly necessary to confirm Mr. Turner's contention of the self-evident absurdity of comparing reproduction of *equal* volume when utilising a small power and a large power respectively, it being clear that if a large power valve is worked just within satisfactorily undistorted volume, a small power valve would be overloaded on the same *output* and would cause distortion.

There is another thing to take into account in this matter, and that is that our own estimation of volume varies according to circumstances. When everything has been and is quiet it is possible in an ordinary room to enjoy quite low-power undistorted reproduction, and even imagine that it is loud; but in other circumstances it is very necessary to have much louder reproduction, for which there can be no question but that the contention of Mr. P. K. Turner is correct.

E. Fowler Clark, B.A., B.Sc., A.M.I.E.E.
Derby, *March 10th*, 1927.

Although I stated that my last letter should be the final one in connection with the above question, I trust that you will find room for this in reply to one from Mr. Turner in your issue of March 11th.

In the first place, I certainly do not agree with Mr. Turner's idea of a comparative test; in spite of the quite voluminous correspondence that has taken place it is evident that Mr. Turner has not yet quite grasped my contention, and I trust that I may be allowed to recapitulate a little.

This very interesting correspondence, from its inception and before Mr. Turner or I entered the field, dealt quite definitely with BROADCAST receivers, by which I understand the ordinary commercial set, or home-constructed set with commercial components, and not laboratory instruments. I have endeavoured to keep it on these lines, and it will be remembered that the statement to which I originally took exception was as follows: "Our own receivers," said Mr. Turner, "consume from 13 mA in the 2-valve type to 20 mA in the larger receivers, below which it is impossible to obtain good reproduction." This I maintained was excessive and unnecessary in a broadcast receiver, and I stated that I could get "distortionless" (later amended to "pleasing") results with an expenditure of 8 mA only on a 4-valve receiver. I pointed out that in addition to this, the receiver I was using employed three transformers in the low-frequency amplifier (incidentally, it also dispenses with grid batteries), which was also not in agreement with Mr. Turner's views.

My next contention was that the final test of the quality of reproduction of a broadcast receiver is the competent human ear. A person buying a broadcast receiver does not take it to a laboratory for test and to study wave-forms; but I agree that the tests for a laboratory instrument might be those suggested by Mr. Turner. We are not, however, concerned with these at the moment, as the discussion deals with broadcast receivers only.

I have the greatest respect for Mr. Turner's qualifications, and do not propose to enter into any discussion with him on the research side, but to confine myself to the commercial side. I am very sorry that the name of the makers of the receiver that I am using was mentioned by Mr. Turner, although that in itself is a guarantee of the excellence of the instrument, but praise or criticism of definite commercial products in a correspondence column is not as a rule very edifying.

If Mr. Turner will carefully read my letters he will find that my claim for "equal performance" will amount to this: that any standard commercial broadcast receiver, consuming 8 mA with four valves, will give equal performance to any other equally standard instrument consuming 20 mA or more. He cannot seriously think that I would compare a commercial receiver with a laboratory instrument, especially in view of my "humorous" reference to museum specimens.

My idea of a test would be to take the two receivers to be compared, each with their own loud-speakers, &c., to various parts of the country, the more difficult the position the better, and there demonstrate the two instruments to a group of persons competent to judge on aural results alone. Questions of strength or selectivity *must* enter into the test conditions of a broadcast receiver, and the tests described by Mr. Turner, although interesting, are hardly those to which commercial receivers should be submitted, and would convey nothing to the unfortunate individual who may be considering the purchase of a receiver and will have to pay the running costs if it has a consumption of 20 mA.

March 11th, 1927. **Interested.**

[This correspondence may now be regarded as closed.—EDS. ELEC. REV.]

Portable Domestic Appliances: Earthing and Flexibles.

We are very glad to see that the question of domestic earthing is being discussed freely in the technical Press. Mr. Joshua Rose sums up the matter briefly; but his statement is adequate, because the necessity of providing complete protection against shock in the home is so obvious that no more is required to secure agreement than the mere mention of it. The aim of all electrical manufacturers should be to ensure the safety of the consumer, and Mr. Rose's suggestion that the Institution of Electrical Engineers should place this matter before the Home Office is a very sound one.

We take this opportunity of referring to your short editorial article, entitled "Faults in Flexibles," appearing on page 374 of your issue of March 11th, and of supporting you heartily in your reminder that here, as always, prevention is better than cure. As a result of our careful and prolonged consideration of methods of preventing these annoying troubles, we have adopted, as is well known, the use of cab-tire-sheathed flexibles for all our plugs to the entire exclusion of ordinary flexibles, which are much too weak mechanically to be satisfactory; and our further provision of a short length of flexible metallic tubing surrounding the sheathing at the point of entry to the plug removes the last chance of breakdown. As you rightly point out, faults in flexibles, though small things in themselves, are very irksome to users, especially if they are frequent; they are therefore a possible hindrance to the extended domestic use of electricity, and as such should be rendered impossible. **A. Reyrolle & Co., Ltd.**

Hebburn-on-Tyne, *March 11th*, 1927.

Faults in Flexibles.

I suggest that the writer of the leaderette under the above title, in your issue of March 11th, does not read the advertisements in your journal. Or if he does read them, he has overlooked or forgotten that we manufacture and have advertised our "Thermoid" flexible cord, which is designed to overcome faults due to the continual bending of the cord, particularly at the point of entry. "Thermoid" flexible cord has been used with much success on all kinds of portable apparatus, since we introduced it more than ten years ago. It has a cotton-covered conductor of combined steel and copper wires which is insulated with vulcanised india rubber; two twisted cores are made circular with cotton wormings, braided with worsted and finished with glace cotton braid. It is a strong, well-padded flexible cord which does not kink and which does not support combustion. We make it also with asbestos serving instead of worsted braiding.

You complain that manufacturers do not devote enough attention to this matter of flexible cords for portable apparatus, but we trust that after this explanation you will credit our company with having made an effort to overcome the trouble.

Where we seem to have failed is in getting everybody to read our advertisements and literature, and to take action when they have read them. **W. A. Moore,**
Advertising Manager,
W. T. HENLEY'S TELEGRAPH WORKS CO., LTD.

London, *March 15th*, 1927.

[Our correspondent has made "a very palpable hit"; we congratulate his firm on the design of its flexible cord, of which we shall make trial.—EDS. ELEC. REV.]

A Metering Problem.

With reference to the letter from your correspondent "E.H.K.P.." which appeared in your issue of March 4th, and to the two letters on the same subject in your current issue, we would like to draw particular attention to Mr. Frank Rostron's remarks to the effect that "all the information necessary to ensure arrival at the correct conclusion is not available."

It would appear that they apply with particular force to the present case, for we have the strongest possible reasons for believing that the Aron meter concerned had never been correctly connected to its transformers, with the inevitable result that the meter combination "has never read correctly," and we may here state that large under-registrations are generally traceable to this cause rather than to inaccuracies in the meters themselves. **Aron Electricity Meter, Ltd.**
F. A. NIELD.

London, *March 11th*, 1927.

With reference to " E. H. K. P.'s " metering problem, it is rather unfair to condemn one meter and state the other to be correct when, with a portable standard meter, no two read alike, unless the supply company has tested the Sangamo, which appears to me unlikely. I think the quickest way out of the difficulty would be to send the portable standard to some neutral testing department, such as the School of Technology, which would give a more satisfactory conclusion. I may state that it is not common practice to connect other makes of meters and transformers together, first, because at the makers' each meter is tested with its own set, and, secondly, taking this case in point, the makers would not guarantee their meter with any other make of transformer.

March 8th, 1927. **F. J. M.**

Supply Undertakers' Regulations.

We have just had our first experience with the County of London Electric Supply Co., which has recently started supplying electricity in this district. For a small private-house wiring installation carried out by us we had adopted our usual practice of putting in a consumer's ironclad combined main switch and fuse. After the undertakers had laid in their cable and fuses, they flatly refused to connect, or install, the meter, or even test the wiring, until this switch and fuse was replaced by separate articles, it apparently being their regulation that the meter must be connected between them. They require the consumer's switch to protect their meter, and insist that the consumer's main fuse shall be on the consumer's side of the meter.

We, and others that we have referred the matter to, have never heard of such a requirement, and apart from questioning the desirability of such an arrangement and the undertakers' power to insist on it, surely it is a patent absurdity not to allow the consumer's fuse to be on the undertakers' side of the meter as well as the switch.

If this regulation can be enforced, it means that the ironclad combined switch and fuse—quite a recognised and sound piece of apparatus—is entirely ruled out and will not be allowed by these undertakers. We should like to have your readers' opinions on the matter, and to hear what can be done to enforce the provision of a supply if the requirement is illegal.

Wanstead, *March 5th*, 1927. **C. & E.**

A Handicap to Electrical Progress.

I would appear to have interested a kindred spirit in " F. Curius Dentatus," who replies to my letter in a parable. He infers that I am amused at something that is not new, counsels moderation, advises people, when asked for absurd deposits, not to complain; and urges that supply authorities do not understand business in the ordinary sense.

I do not agree. The fable of supply authorities not being business people died years ago. There is a jest, but what Kipling called " a bitter jest," in this subject, of which " F.C.D." misses the point. I still claim to have discovered a new incident, and for the benefit of all other busy electrical engineers, who to my surprise up to now have taken no notice, I will endeavour to put the point in the plainest English :—

Leicester, a progressive city in the prosperous Midlands, population about a quarter of a million, possesses up-to-date gas and electricity supplies. These are directed by a committee of some of the finest business men in the city, whose policy is carried out by a recognised business manager. This body announces to citizens, and so to the world, that the deposit it requires for gas lighting and cooking in a house is £2; and for part lighting only the same house by electricity, £5.

Logically, there is only one conclusion : Its opinion, based on knowledge, practice, and experience, is that *electricity for household use is more than two-and-a-half times as dear as gas.* The strange fact also exists that, in spite of this opinion, which it backs to the extent of refusing business, it still wastes money on propaganda and allows the E.D.A. to do likewise. One at least hopes that the rest of the gas industry is not aware of the convictions of Leicester.

Cardiff, *March 7th*, 1927. **Ivan Fawcett.**

Ferranti and Edison.

Like many, I expect, I was much interested and very pleased to read your article relative to the election of Ziani de Ferranti to be a Fellow of the Royal Society—a most worthy acknowledgment of a very worthy man; but what interested me almost as much was the coupling of his name with that of Edison.

I wonder how many there are to-day who remember the advent of each in this country, and had the privilege of coming into personal contact with both. How widely different were the two men—Ferranti a self-reliant personality who depended entirely upon himself—it seemed just the opposite with Edison. True, I saw a good deal more of Ferranti, and only some years later became associated with Edison—I think it was Jubilee year—whereas my interests with Ferranti ended in or about 1884.

I know, however, I was not alone in taking a comparatively detached view of Edison, compared with Ferranti, the reason being, I think, that one rarely heard the name of Ferranti except " on his own," whereas Edison seemed always to be coupled with someone else, in spite of the fact that Edison was some 14 or 15 years the older. Take the Edison-Bell telephone, the Edison and Swan lamp, and the Edison-Hopkinson dynamo as a few only of many instances.

The only " combine " I remember of Ferranti's—an almost commercial necessity—was Ferranti, Thomson & Ince, and even this, I rather think, was almost a marriage combine. But the doctor's early times were by no means all honey, and many were the anxious days and nights spent in Appold Street and elsewhere.

The present generation must not forget that in those days we worked with about 50 volts; induction was practically unknown; and as for " phasing "—no one had heard of it. So much greater therefore the credit to the man who overcame all difficulties—so to speak—single-handed.

Luton, Beds., *March 8th*, 1927. **Harry South.**

The Salaries of Engineers.

The correspondence on this subject which you have recently published has been of considerable interest to the members of this Society, which was founded with the purpose of improving economic conditions within the engineering profession.

There can be no two opinions on the question of the general average of engineers' salaries: that it is deplorably low is beyond dispute. The Salary Census taken by this Society in 1923 and again in 1925 showed that, bearing in mind the nature of their work and the time and expense of their training, engineers belonged to one of the worst-paid professions. The figures were published in your columns at the time, but we will be pleased to supply them to any inquirers who may care to write to us for them.

The task of attempting to improve matters is a slow and difficult one. If engineers would create for themselves a representative protective body, similar to the British Medical Association, that task would be rendered easier. The scientific institutions cannot be got to move in the matter; they take the view that to do so would be outside the scope of their activities.

This Society has come definitely to the conclusion that the surest and soundest method of raising the status of the profession is the statutory enactment of a comprehensive measure of registration for engineers. The Engineers' Bill now before Parliament has been prepared and put forward by the Society as its chief contribution to the solution of the present economic difficulties of the profession. If all those who are interested in raising the status of engineers would help us in furthering the progress of the Engineers' Bill, with a view to its early passage into law, they would be doing something practical towards the raising of salaries.

Society of Technical Engineers,
Richard Hazleton, *Secretary.*

London, *March 11th*, 1927.

I have followed with great interest the letters in your " Correspondence " columns on the subject of engineers' salaries.

The failure of the I.E.E. to defend itself against the charges of indifference levelled against it is a striking proof of the lofty contempt with which that body persistently treats the vast majority of its members. The Institution, by its silence, admits that it is willing to accept the subscriptions of hundreds of underpaid electrical engineers, whilst caring nothing about their welfare. The Benevolent Fund is a good scheme, but the vast majority of the members of the Institution simply cannot afford to support the Fund. It is consequently hopelessly inadequate; but it could be made unnecessary for such a fund to exist, if the members of the Council would take an interest in the rank and file of the Institution.

Your last correspondent was right when he laid part of the onus on the employers, but the manual worker found out half a century ago that the employers of this country could not be taught morality unless there was force at the back of the teaching. We see the result to-day in the advanced Socialism of the manual workers. In America the employers have realised that to have contented employés is sound economy. In this country, on the contrary, our employers are driving their technical staffs more and more into the Socialist ranks. When that party realises the readiness of thousands of middle-class people to support a moderate Socialist policy, it will sweep the country. The employers will then have only themselves to thank if they find themselves in trouble.

Transmission.

March 12th, 1927.

With reference to the letters in your columns *re* engineers' salaries, I would thoroughly endorse the sentiments expressed by these martyrs to electrical science, who have spent much money and time on education in order that their employers may reap a rich harvest.

These " poor blighters " have given up to study many weary hours after their daily task has been completed, which might have been used for healthy recreation.

Surely it is the conditions from which these Human Documents that you have published have arisen, which give rise to Socialistic tendencies, and it is not surprising to find that comment has been withheld by the bodies concerned, as doubtless they have been justly put to shame.

March 11th, 1927. **Delta Star.**

The Birmingham Electric Club.

Annual Dinner.

THE sixteenth annual dinner of the Birmingham Electric Club was held at the Grand Hotel on March 11th.

Mr. A. C. BAKER, chief engineer of the Birmingham Corporation Tramways, in proposing "The Electrical Industry," commended the Electricity Act as having been devised to provide the greatest good for the greatest number. The electrification of railways had not developed as rapidly as some of them wished. Fortunately, however, there was a move in certain directions, although nothing had yet happened, towards the electrification of main lines. He thought it was only a matter of a short time before they would see some development in that direction. The speaker declared that tramways were not likely to be scrapped for many years to come. Tramways in this country used about 700,000,000 kWh of electricity annually, costing about £3,500,000. If tramways were scrapped, the electrical industry would lose a good customer.

Mr. GEORGE VERITY, in responding, said he believed an era of great prosperity was coming through the agency of the Electricity Act, the publicity given to the industry, and the forward movement all along the line. Initiative and enterprise had placed the electrical industry in the forefront. Household lighting, heating, and cooking would provide one of the greatest developments that the industry had experienced.

The civic toast was proposed by Mr. D. G. BROOKS (secretary of the club), who reviewed the inventions of famous Birmingham men in the realm of mechanics and combustion, to which the Lord Mayor (Ald. A. H. JAMES, C.B.E.) responded. Alluding to the national electricity supply scheme, his Lordship said its provisions in the main were excellent, but in their application one must necessarily have some regard to the welfare of local industries. He was glad to say that the Electricity Commissioners had sanctioned the continuance of the 25-cycle system in Birmingham.

Commander R. L. NICHOLSON, D.S.O., proposed the toast of "The Birmingham Electric Club," and the President (Mr. T. BIRKETT), in reply, said that the club brought together various interests for the common good of the industry.

Mr. F. FORREST, M.I.E.E., proposed the health of "The Visitors," and Col. J. F. LISTER, C.M.G. (chairman, South Midland Centre, I.E.E.) responded.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

20,528. "Multi-channel telegraphy." F. E Pernot. August 15th, 1925. (266,268.)

20,794. "Method and arrangement for directional transmission and reception by means of electric waves." W. Hahnemann. October 29th, 1924. (Addition to 237,900.) (242,236.)

23,311. "Electrical hair or massage brushes." A. Lloyd. December 30th, 1925. (266,269.)

26,119. "Electric condenser arrangement." Etablissements Merlin & Gerin (Soc. Anon.). January 30th, 1925. (246,799.)

27,781. "Telephone systems." Standard Telephones & Cables, Ltd., J. H. E. Baker and J. R. Hardwick. November 4th, 1925. (Cognate applications, 28,214/25, 28,215/25, 31,774/25, and 31,775/25.) (266,026.)

28,161. "Thermionic valve-amplifying arrangements." M. Graham, A. Graham (legal representatives of E. A. Graham (deceased)) and L. H. Paddle. November 9th, 1925. (266,029.)

28,299. "Automatic electrical switching devices." W. J. Gladitz and F. C. Hohs. November 10th, 1925. (266,031.)

28,615. "Electromagnetic switch." C. Bruynis. November 13th, 1925. (Convention date not granted.) (243,007.)

28,627. "Automatic telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. November 13th, 1925. (266,037.)

28,872. "Electrolytic separation of metallic chromium." F. W. Würker. November 16th, 1925. (266,045.)

28,901. "Self-feeding electrically-heated water boilers." Jackson Boilers, Ltd., and H. Hargreaves. November 17th, 1925. (266,048.)

28,926. "Testing of automatic and semi-automatic telephone exchanges." Standard Telephones & Cables, Ltd., and A. H. Cameron. November 17th, 1925. (266,270.)

29,015. "Selecting switches for use in telephone exchange systems." Standard Telephones & Cables, Ltd., and G. Deakin. November 17th, 1925. (266,054.)

29,016. "Electrical wave filters." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). November 17th, 1925. (Patent of addition not granted.) (266,055.)

29,267. "Telephone exchange systems." Standard Telephones & Cables, Ltd. (Bell Telephone Laboratories, Inc.). November 20th, 1925. (266,062.)

29,268. "Telephone exchange systems." Standard Telephones & Cables, Ltd. (Bell Telephone Laboratories, Inc.). November 20th, 1925. (266,063.)

29,383. "Magnetic alloys and their application in the manufacture of telegraphic and telephonic cables." W. S. Smith and H. J. Garnett. November 20th, 1925. (266,066.)

29,992. "Thermionic transmitters and receivers." G. Schotel. November 27th, 1925. (266,068.)

30,115. "Telephone loud-speakers." S. G. Brown. November 28th, 1925. (266,271.)

30,249. "Electric inductance coils." E. L. Wildy and London Electric Wire Co. & Smiths, Ltd. November 30th, 1925. (266,071.)

31,766. "Electrical contacts." British Thomson-Houston Co., Ltd., H. Trencham, and H. C. Heath. December 16th, 1925. (266,086.)

32,061. "Diaphragmless microphones." E. Reisz. August 11th, 1926. (Convention date not granted.) (258,542.)

1926.

817. "Device for extinguishing discharge tubes functioning as switches." Siemens & Halske Akt.-Ges. January 12th, 1925. (245,804.)

1,016. "Electrical regulator systems." C. Filmer and Metropolitan-Vickers Electrical Co., Ltd. January 13th, 1926. (266,103.)

1,858. "Electric gland couplings." Walsall Hardware Manufacturing Co., Ltd., A. E. Read, and A. E. Millard. January 22nd, 1926. (266,109.)

2,380. "Electric switches." A. N. Penman and Norwest Electrical Manufacturing Co., Ltd. January 27th, 1926. (266,110.)

2,527. "Electric motors." W. Parry, S. Dale, and Metropolitan-Vickers Electrical Co., Ltd. January 28th, 1926. (266,111.)

2,713. "Adjusting mechanism for condenser dials, coil holders, and like electrical apparatus." J. Hester. January 30th, 1926. (266,113.)

5,614. "Electric discharge tubes and apparatus for producing flash.s." L. Seguin and A. Seguin. March 5th, 1925. (248,743.)

7,523. "Electric heating elements." General Electric Co., Ltd., A. Kinnes, and M. S. H. Hunt. March 18th, 1926. (266,151.)

7,686. "Electric furnaces for melting or producing glass, water-glass, Portland cement, aluminous cement and other substances." C. E. Cornelius. March 23rd, 1925. (249,554.)

8,292. "Electric furnaces." British Thomson-Houston Co., Ltd. March 26th, 1925. (249,880.)

8,472. "Storage battery box." L. A. Doughty. March 29th, 1926 (266,157.)

8,612. "Rheostats and the like." E. J. L. Delfosse and Ormond Engineering Co., Ltd. March 30th, 1926. (266,161.)

9,443. "Flywheel magnetos." Soc. d'Applications et de Fabrications Industrielles Safi. June 12th, 1925. (253,484.)

10,153. "Receivers of high-frequency electric energy." S. Y. White. April 18th, 1925. (250,967.)

10,777. "Amplifying device for radio apparatus." Dubilier Condenser Co. (1925), Ltd. October 1st, 1925. (259,176.)

12,118. "Electric ignition apparatus for internal-combustion engines." F. C. Perrem. May 11th, 1926. (266,174.)

12,489. "Elimination of disturbing oscillations in radio signalling systems." L. M. Jackson (Lorenz Akt. Ges., C.). May 14th, 1926. (266,178.)

12,729. "Automatic telephone systems." Deutsche Telephonwerke und Kabelindustrie Akt.-Ges. December 17th, 1925. (263,079.)

12,730. "Automatic telephone systems." Deutsche Telephonwerke und Kabelindustrie Akt.-Ges. December 17th, 1925. (263,080.)

13,694. "Sound-reproducing diaphragms." Brandes Laboratories, Inc January 7th, 1926. (264,120.)

14,067. "Control of electric generators and interconnected motors." British Thomson-Houston Co., Ltd. June 3rd, 1925. (253,127.)

14,261. "Safety device for series-connected incandescent electric lamps." F. Eckhardt and M. Hohnekamp. February 20th, 1926. (266,185.)

14,553. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. June 9th, 1925. (253,535.)

15,027. "Systems of electric supply and distribution." British Thomson-Houston Co., Ltd. June 15th, 1925. (253,561.)

16,764. "Magnetic core, more particularly for Pupin coils." Allgemeine Elektricitäts-Ges. July 6th, 1925. (254,749.)

17,161. "Electrical heating." J. Barrett and R. F. Wright. July 8th, 1926. (266,199.)

17,859. "Regulation of asynchronous electric machines." Siemens-Schuckertwerke Ges. July 17th, 1925. (255,480.)

17,877. "Switch arrangement for electric lighting installations and the like." R. Hurlimann. July 16th, 1926. (266,203.)

23,168. "Diaphragms for magnetic telephone receivers." L. Kilborn. September 20th, 1926. (266,236.)

23,191. "Electrical contact plug." W. Hesse. September 18th, 1925. (258,622.)

23,403. "Insulated electrical conductors." C. B. Backer. October 9th, 1925. (259,552.)

25,291. "Electric arc furnaces." International General Electric Co., Inc. October 9th, 1925. (259,615.)

26,397. "Wire-wound resistors." Dubilier Condenser Co. (1925), Ltd. April 14th, 1926. (266,248.)

27,230. "Head telephones." H. Kuchenmeister. February 17th, 1926 (266,252.)

27,347. "Apparatus for injecting water and air through the sparking plug electrode and into the cylinder of internal-combustion engines." H. Fischer. November 2nd, 1925. (Addition to 244,090.) (260,629.)

27,688. "Devices for disconnecting electric overhead conductors in case of breakage." J. Elzer. November 4th, 1926. (266,255.)

29,016. "Electric couplings." J. Sax & Co., Ltd., and R. Ball. November 17th, 1926. (266,262.)

30,360. "Electric drives for vehicles." Soc. Anon. des Ateliers de Secheron. January 13th, 1926. (264,463.)

31,998. "Sound-recording and reproducing apparatus." De Forest Phonofilms, Ltd. December 19th, 1925. (263,180.)

33,082. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). September 9th, 1925. (Divided application on 263,909.) (266,266.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within month from March 9th. In the case of foreign applications, the names and addresses of the British representatives are also given :—

Spotter. No. 472,913. Class 8. Electric batteries.—P. Schmidt, trading as the Elektrotechnische Fabrik Schmidt & Co., Berlin. (Wheatley and Mackenzie, 40, Chancery Lane, W.C.2.)

Octron (lettering and design), No. 475,562, all goods in Class 8; and Octron (lettering only), No. 475,560, and No. 475,564. Class 18. Electric alarms (as systems in buildings) and complete lighting sets for vehicles. Octron, Ltd., 32, Charlotte Street, Birmingham.

Blue Spot-Marblock. No. 475,883 Class 8. Instruments and apparatus for use in radio-telephony and telegraphy.—Ideal Radio-telefon und Apparate Fabrik Gesellschaft, Berlin. (Lewis W. Gould, 5, Corporation Street, Birmingham.)

Ancahevea. No. 476,717. Class 8. Electric cables.—Callender's Cable and Construction Co., Ltd.

Mon Gallia (lettering and design). No. 473,491. Class 40. Caoutchouc in plate, strip and moulded form and accumulator casings made therefrom.—Compagnie Générale d'Electricité, Paris. (Cruikshank & Fairweather, 65-66, Chancery Lane, W.C.2.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Reconstruction of theatre; manager, Aberdeen Picture Palace, Ltd.

ALDERSHOT.—Extensions to hospital, including X-ray department, for the Committee; S. Friend, architect.

ALMONDSBURY.—Mental colony; Bristol Medical Officer of Health.

BARNSLEY.—200 houses by direct labour; borough engineer.

BETCHWORTH (Surrey).—Alterations, &c., Wonham Manor, for Sir R. Butler, Bart.

BRADFORD.—Public hall; Special Corporation Committee. Central garage; city architect.

BRISTOL.—Housing scheme (110), St. Anne's site, flats, Eugene Street, and baths and wash-houses, Broad Weir (£65,000), for the T.C.; L. S. McKenzie, city engineer, 51, Prince Street.

BURTON-ON-TRENT.—56 houses; borough engineer, Winshill. Electricity supply, Woodville Pottery; Mansfield Bros., Ltd.

BURY (Lancs.).—Houses (200), for the T.C.; James Byron, Ltd., builders.

CARLISLE.—Billiard hall and assembly hall, Fisher Street; J. Leslie, architect. Extensions to bakery, Junction Street (electrical work), for the Co-operative Society; S. W. B. Jack, architect, Lloyd's Bank Chambers.

CHELTENHAM.—80 houses, Hanover Street; Mr. Malvern, borough architect.

CHESHAM (Bucks.).—Housing scheme (150), for the U.D.C.; the clerk.

CHESTERFIELD.—100 houses, Gloucester Road, and Tapton View Road, for Corporation; S. Higton & Sons.

COLCHESTER.—Extensions, Royal Grammar School, for Essex E.C.; J. Stuart, county architect, Springfield Old Court, Chelmsford.

DARLINGTON.—Town hall and municipal buildings; borough surveyor.

DARTFORD.—Bank premises, High Street, for Lloyd's Bank, Ltd.

DERBYSHIRE.—Agricultural institute, for the C.C. (£3,970); Walkerdine, Ltd., builders.

DONCASTER.—Sanatorium, Weston Road, for the T.C.; Dr. Adshead, architect.

DOUGLAS (I. of M.).—Municipal office accommodation; Special Corporation Committee.

DUMFRIES.—Additional 130 houses, Balmoral Park, for the T.C.; burgh surveyor.

EASTBOURNE.—40 houses, Victoria Drive; borough engineer.

EAST SUSSEX.—Mental colony; County Medical Officer of Health.

ELY.—Housing scheme (40), St. John's Road, for the U.D.C.; W. McKelvie, architect, Silver Street.

EXHALL.—Central school, Ash Green; A. C. Bunch, county architect, 27, Binswood Avenue, Leamington Spa.

FALKIRK.—Five blocks of houses for Falkirk Iron Co., Ltd. (£7,800); the manager.

FIFESHIRE.—Extensions at Kirkcaldy District Infectious Diseases Hospital (£2,500); J. Cameron, Thornton, chairman of Hospital Committee.

GARLANDS.—Extensions to Mental Hospital, for Cumberland and Westmorland Joint Committee (£20,000); the clerk, Carlisle.

GLASGOW.—Warehouse, &c., at 163-164, Sauchiehall Street, and 81-85, Renfrew Street, for Smith (Glasgow), Ltd., 84, Gordon Street; the manager. Garage at Govan (£11,000); city engineer. Stores and meter workshop, Sydney Street; Corporation meter engineer.

HARWORTH (Worksop).—Houses (164), for Barber, Walker and Co.

HAZEL GROVE (Stockport).—Joinery works, School Street, electrically equipped, for G. Fryer (£10,000).

HIMLEY.—Extensions, sanatorium (£11,110), for Staffs., Wolverhampton and Dudley Joint Committee for Tuberculosis; the clerk.

HULL.—Secondary school, Pickering Road; Education Committee. 250 houses, Trinity House Estate, for J. P. Backwell; F. Runton Waller.

INVERNESS.—Motor spirit depôt for Shell-Mex, Ltd. (£9,000); the manager, Aberdeen.

IRISH FREE STATE (Dublin).—266 houses on the Drumcondra and Glasnevin sites, for the City Commissioners; city architect, Exchange Buildings, Lord Edward Street.

IRVINE.—School (electric lighting) for Ayrshire E.C.; W. Reid, master of works, Education Offices, Ayr.

LANARKSHIRE.—Church at Gartcosh (£6,000); Rev. D. S. Mackenzie, Gartcosh.

LEYBURN.—Kinema, for A. P. Haigh, 2, St. Mary's Place, Barnsley.

LEYLAND (Lancs.).—Additional housing scheme (40), for the U.D.C.; surveyor. Extensions to works, for Leyland Motors, Ltd., Leyland Paint and Varnish Co., and J. E. Baxter & Co.

LONDON (Limehouse, E.).—Premises, Thomas Street, for Sanders Bros. (Stores), Ltd.; Higgins & Thomerson.
(Hendon, N.).—1,020 houses, Watling Estate, for L.C.C.; C. J. Wills & Sons, Ltd.
(S.E.).—Extensions, South-Eastern Hospital (£33,750); Metropolitan Asylums Board.
(Penge, S.E.).—School, Anerley, for the E.C.; the clerk.
(Woolwich, S.E.).—Houses (47), Postell Estate, for the Royal Arsenal Co-operative Society.
(Kensington, S.W.).—Premises, corner Finborough Road and Richmond Road; Sir Aston Webb & Son.
(Westminster, S.W.).—Buildings, Millbank; Imperial Chemical Industries, Ltd.
(Long Acre, W.C.).—Masonic temple, with lifts, &c.; H. V. Ashley, architect.

LUTON (Beds.).—Factory, Guildford Street, for A. Hucklesby, Ltd. Extensions to works, Kingsway, for B. Laporte, Ltd.

MANSFIELD.—Additional 124 houses, for the T.C.; borough surveyor.

NEWHAVEN.—41 houses, for the T.C.; Sherren, Ltd., Cooksbridge.

NEW MILTON (Hants).—Hotel (£12,000), for Mrs. S. A. Ellis; Wallis & Holding, Bournemouth, architect.

NEW ZEALAND (Dunedin).—Town hall for the City Council (£81,000).—*Reuter.*

NORTHAMPTON.—Showrooms and workroom, Mercers Road and Drum Lane; A. & L. Knight.

OLDBURY (Birmingham).—Additional 56 houses, Londonderry Farm site, for the U.D.C.; surveyor.

PONTEFRACT.—School (550 places), Baghill Housing Estate, for the Borough E.C.; borough surveyor.

POOLE.—100 houses, for the T.C.; borough engineer. Town hall, for the T.C.; E. J. Goodacre, borough engineer.

RENFREWSHIRE.—Halls for Thornliebank U.F. Church; the minister.

ROTHERHAM.—Additional housing schemes, Herringthorpe (1,000), for the T.C.; borough surveyor.

ST. AUSTELL.—Houses (50), for the U.D.C.; J. H. Lobb, builder, Mevagissey.

STEVENAGE.—Additional housing scheme (300), for the U.D.C.; R. Gandy, surveyor.

STRETFORD.—School, Low Moss Lane; Education Committee. Alterations, First Avenue; Ford Motor Co. (England), Ltd.

SUNDERLAND.—Housing scheme (216); borough engineer, Town Hall.

SWINDON (Wilts.).—Additional 100 houses, Hurst Estate, for the T.C.; borough surveyor.

TORQUAY.—38 houses, Windmill Hill; Seston & Guscott. 50 houses to complete Windmill Hill Estate; borough engineer. Extensions, tram depôt, Marychurch Road; Torquay Tramway Co., Ltd.

WALMER.—Houses (50), Downs Road, for Dennis, Ltd.

WEYMOUTH.—Re-erection of portion of the Gloucester Hotel; Mr. Finnegan, manager (several thousand pounds).

WORCESTER.—Factory, Diglis, for Lewis Beck, Ltd., Bexville Works; R. T. Earl, managing director.

The

Electrical Review

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Contents:

	PAGE
E.D.A. Activities	461
The B.E.A.M.A. Meeting	462
State Electricity in the Irish Free State	462
The Retail Electrical Trade	462
A Small Hydro-Electric Scheme (*illus.*)	463
Automatic Telephony in Sheffield (*illus.*)	464
Easy Payments and the Law, by W. Eric Jackson	466
The Electrical Industry Reviewed	467
Business and Industrial Notes	470
Lighting and Power Notes	475
Tramway and Railway Notes	476
Telegraph and Telephone Notes	476
Radio Notes	477
Contract Information	478
Forthcoming Events	479
Notes	480
Institution Notes	482
Our Personal Column	482
Financial Section—	
New Companies Registered	483
Official Returns of Electrical Companies	483
Financial Section—*continued.*	
City Notes	484
Stocks and Shares	487
Our Foreign Electrical Trade	489
The British Electrical Development Association	490
New Electrical Devices, Fittings and Plant (*illus.*)	491
The "Ideal Home" Exhibition (*illus.*) (*concluded*)	492
What is Electricity? by Prof. W. M. Thornton	493
Electric Lamps and Valves	494
Correspondence—	
A Handicap to Electrical Progress	495
The Wireless Receiver as a Load	495
The Salaries of Engineers	496
Faults in Flexibles	496
Electric Cookers in Housing Schemes	497
Parliamentary News	497
Legal	497
Reviews	498
Published Specifications	499
Trade-Mark Applications	499
New Work for Contractors	500

E.D.A. Activities.

LAST week the British Electrical Development Association held its annual meeting—a private function—and its annual dinner, at which a well-earned tribute was paid to its activities and to the colossal effort which it has put forth during the twelve months in collaboration with E.L.M.A.

There are numerous thriving societies and institutions in connection with the electrical industries, each of which more or less adequately serves the interests of its members; but, with the exception of the E.T.B.I., there is none other than E.D.A. whose objects are so largely altruistic, so advantageous to the public at large—and none which so efficiently fulfils the purposes for which it was created. In any reference made to the work of the E.D.A. during the year 1926, full recognition must be given to the fact that its widespread activity has been largely responsible for the marked rate of progress in the use of electricity for domestic service. The cumulative effect of its seven years of activity would alone have produced notable advance if there had been no intensive campaign during the past six months and no help from a seven months' coal shortage. To take a single instance of the far-reaching influence of its work, we may quote the fact that at the Electric House arranged by the Association at the Ideal Home Exhibition of a year ago 150,000 visitors passed through the building, and the large number of 12,000 inquiries resulted. This, followed by the electric-house and other campaign operations which have been proceeding in most parts of the country, has been bearing fruit over very large areas, and some of this fruit has fallen to those who have not deserved it; by this we mean that concerns which have never given the smallest financial support to the organisation have been receiving a reward that they have not earned. We mention this circumstance in the hope that it may quicken some consciences.

At the annual dinner of the Association which followed the meeting, Dr. S. Z. de Ferranti warmly commended the plan of "co-operative advertising" so

effectively put into practice by E.D.A., and Mr. C. A. McCurdy, K.C., president of the Advertising Association, expressed his enthusiastic admiration of the great campaign which is now drawing to a close, describing it as the most efficient and the most ably organised scheme of propaganda that he had ever seen.

At a later stage, Sir Andrew Duncan, chairman of the Central Electricity Board, who made an excellent impression by his declaration that the policy of the Board would be essentially one of friendly and helpful co-operation with all branches of the electricity supply industry and in no sense autocratic or domineering, expressed his appreciation of the admirable work already accomplished by E.D.A., and his conviction that the Association would be a most powerful ally of the Board in carrying out the work for which the latter was constituted. As we have pointed out on previous occasions, the Government scheme does nothing to promote the consumption of electricity, except by freeing the hands of the municipal authorities; that most important and indispensable complement to the work of the Board is left to be provided by the electricity supply industry itself, and it is indeed fortunate that a fully organised and ably directed machine in the form of the Electrical Development Association is in existence which, if adequately supplied with funds, may be relied upon to fill the need.

Such an occasion as the annual dinner, when the work of a particularly heavy year is in mind, affords a fitting opportunity for paying a tribute to the hard-working and painstaking way in which the experienced and tactful Director of the Association, Mr. J. W. Beauchamp, has carried out the duties of his increasingly important office. He has carried on under the heavy burden of recent days without losing his accustomed equanimity or becoming overwrought—which could hardly have been possible had he not confidence in the ability of the Business Manager, Mr. V. W. Dale, the spirit and energy of an experienced staff, and the campaign support of Mr. W. E. Bush. The industry owes much to Mr. Beauchamp for the organisation and direction of E.D.A. during the past seven years, and we make bold to suggest that on the next public occasion of the kind "a few words" from him would be in the nature of a "star turn."

The B.E.A.M.A. Meeting.

An ample summary of the operations of the Council of the B.E.A.M.A. during the past year will be found on later pages of this issue, together with a fairly full abstract of the speech in which the Chairman (Lieut.-Col. R. K. Morcom, C.B.E.) reviewed the course of the electrical industry and the various factors affecting it at home and abroad. In recent years we have come to regard the annual remarks of the B.E.A.M.A. chairmen as authoritative and sound, and we commend the present review to the careful consideration of all our readers. It is important that we should keep ourselves well informed periodically regarding the state of affairs in the various markets of the world, as well as the changing features of the international situation in respect of industrial competition. The turnover for the industry in 1926, though a record, was really a record "by way of an over-flow of pent-up waters." The position of the industrial motor section—a serious decline in orders is reported—is a matter for profound regret, and it is greatly to be hoped that we shall shortly witness a sustained revival of those other industries which at present are insufficiently electrified. Happily, in spite of all obstacles, we have been able to maintain our position as leading supplier of electrical goods abroad; indeed, with exports totalling £18,194,000 in 1926, the electrical industry "takes first place among the engineering export industries of the country." But the financial co-operation of America and Germany is operating greatly in favour of the industrial position of the latter now that she can borrow at 4 to 5 per cent. instead of 10 per cent. interest. The Dawes plan has intensified the competition that we are experiencing from Germany, and "it has served to bring France, Germany, and the United States into closer co-operation with a view to dominating the world markets." After covering these and various other features of the situation as it is officially viewed to-day, the chairman closed by urging the increased need for associated effort in our electrical and allied industries.

State Electricity in the Irish Free State.

The "Electricity (Supply) Bill, 1927," which passed its second reading in the Dail Eireann last week without a division, is a remarkable document. Whilst it resembles in some respects, and is obviously inspired by, our Act of 1926, it goes far beyond that measure in scope and tenor; this arises partly from the fact that it is to take the place of all existing legislation on electrical matters in the Free State, which is wholly repealed (with the sole exception of the Shannon Electricity Act, 1925), but still more from the unprecedented character of the system which it outlines.

The new "Electricity Supply Board" which is to be constituted, on the lines of the Central Electricity Board, is to be entrusted not only with powers and duties such as are exercised by that Board, but also with those of the Electricity Commission, and those of an authorised undertaker empowered to buy, sell, or manufacture anything electrical in any part of the Free State; it is to be armed with compulsory powers to control the supply and sale of electricity, to acquire electrical undertakings, to vary areas of supply, to purchase land, to secure wayleaves, to fix tariffs, and to close generating stations. Arbitration is provided for in some instances, and the Board's regulations for electricity supply, curious to say, must be approved by Dail Eireann; but its powers are extraordinarily wide, and the only control to which it is subject appears to be the right of the Executive Council of the Dail to dismiss any or all of the members of the Board. Speaking in the Dail, Mr. McGilligan emphasised the independence of the Board and its freedom from interference by his Department: once it was set up, he said, he would personally have no interest or responsibility for it. He had given the Board full powers to assume the position of being sole supplier, and the sooner it did that, the better!

We believe in the firm hand and the settled policy, in any class of business; but we have no faith at all in the conduct of trading undertakings by the State, or in the nationalisation of electricity supply, which is here contemplated, and the abolition of private enterprise. The provisions of the Bill savour of confiscation, from which even the municipalities will not be exempt; such a measure could never pass the second reading in a British Parliament.

The Retail Electrical Trade.

Accompanying the present number of the Electrical Review we are circulating to every reader a copy of our second supplement, the *Electrical Retailer and Dealer*. We repeat our request to readers to make the existence of this publication known to their smaller trade acquaintances who are transacting sales direct with the general public. We are anxious to bring it to the notice of every electrical trader, whether he is an electrical contractor, a hardwareman or an ironmonger, an electrical staff employé in a store, or an assistant in the showroom of an electrical contractor or an electricity supply department. If we can ensure that there is a spirit of enterprise being stimulated amongst all men and women in these classes by the reading of appropriate specialised literature which will keep them informed of movements and products, we shall be able to feel that we are doing something to raise the standard of efficiency in a section of the trade which so far has not been conspicuous for its strength, and may, perhaps, in actual fact have been neglected or even received the cold shoulder.

A Small Hydro-Electric Scheme.

The utilisation of a 3-ft. fall for supplying, in conjunction with a storage battery, a comparatively large rural area.

IT would be difficult to estimate the power which is running to waste over the low-head waterfalls on the small streams and rivers in this country. Many of these falls are situated out of the reach of the public supply systems, and it must be worth the while of the surrounding inhabitants to consider the utilisation of the available power for the generation of electricity to fulfil their needs for lighting, heating and power. The problem of utilising the power is, of course, much more difficult when the fall is very low, and perhaps this accounts for more of the streams not having been harnessed than is the case. That the problem can be solved successfully is evidenced by a scheme which has been completed at Avington, on the river Itchen, for the supply of electricity to the seat of Sir John Shelley Rolls, Bart., on whose estate the installation has been put down, and to the surrounding villages of Avington, Easton, and Itchen Abbas, although the available head of water is only three feet, fig. 1.



Fig. 1.—Power Station and Tail Race.

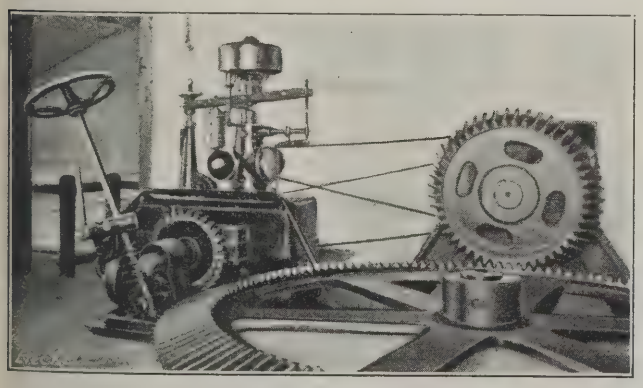


Fig. 2.—Driving Gear and Governor.

For this scheme an old dam, put down some 45 years ago in connection with a water-wheel which was used for grinding corn, has been recommissioned. A 23-h.p. Turgo vertical-shaft turbine, 45 in., 54 r.p.m., made by Messrs. Gilbert Gilkes & Co., Ltd., has been installed, and uses some 5,200 cu. ft. of water per min. Its speed is kept constant during varying loads and differences in head level by means of a Gilkes oil-pressure governor, fig. 2. The turbine belt drives, through spur gearing, a 13-kW Laurence, Scott & Co. dynamo at 550 r.p.m. This machine generates at 220 V; it is over-compounded, but arrangements are made for the short-circuiting of the series field during battery-charging operations.

The turbine plant is used in connection with a 120-cell battery, installed by Messrs. Pritchett & Gold and E.P.S. Co., Ltd., which is capable of a 30-A discharge for 5 hours. By running the turbine plant continuously and charging the battery during light-load periods, a supply can be given on peak loads considerably above the output of the running plant; a most important feature in connection with such small water installations.

A marble switchboard, fig. 3, constructed by Messrs. A. W. Sclater and Son, who were the engineers responsible for the whole scheme, accommodates the necessary measuring instruments and switchgear, including a system of change-over switches by means of which the supply at any time can be given by either the generator, fig. 3, or the battery, or both. A battery charging booster, also of Messrs. Laurence, Scott & Co.'s manufacture, forms part of the installation. It is a separately excited belt-driven machine, with an output of 40 A, 100 V.

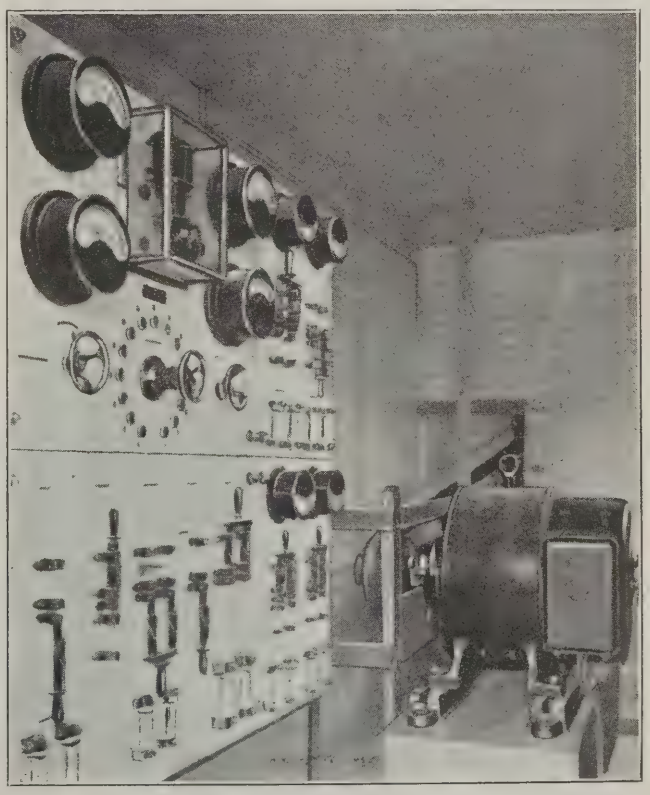


Fig. 3.—Switchboard and Generator.

It is of interest to note that since the plant was installed, the output has been considerably

increased by slightly raising the head at the banks and clearing the tail race where the water has to pass through the small-span arches of a public bridge.

Transmission to Sir John's residence, Avington House, and the villages is effected by means of Henley underground cables, about 4½ miles of which have been used. Besides supplying about 2,000 lamps, the plant provides for heating and cooking in Avington House and a number of the houses in the villages. Power for water pumping and a cold-storage plant is obtained from the installation, which also serves two dairy farms on which electricity is used for power. The consumers include three public houses, three churches, three village halls, and two post offices. A number of cottages are supplied under a free-wiring scheme at 10d. per kWh.

Nearly all the wiring in the villages is carried out with the Henley wiring system, and Avington House is wired with Henley 2,500-megohm wire, drawn into screwed tubing.

Another small hydro-electric installation put down by Messrs. Sclater & Son, for Capt. the Hon. T. H. Watson, Milverton, Somerset, has some interesting features. Here a 12-ft. head of water in a very small stream gives continuously an output of about 12 h.p. The turbine in this case is entirely ungoverned, being so designed as to withstand its own runaway speed, which is about 80 per cent. above that of full load. The line pressure is, however, maintained constant by means of an Isenthal solenoid voltage-regulating device, resulting in a considerable saving in the initial outlay.

Automatic Telephony in Sheffield.

The recent inauguration of automatic switching in the Sheffield telephone area constituted a world record from the point of view of the number of exchanges transferred simultaneously: new "Siemens" equipment has replaced eleven old manually-operated exchanges.

THE latest instance of progress in the provision of automatic telephony in this country is of outstanding importance, for the change-over of the Sheffield area probably constituted a world record so far as the number of exchanges involved in one transfer is concerned, and is certainly the largest in this respect yet undertaken by the British Post Office authorities.

On March 5th nine new automatic exchanges were opened simultaneously, and eleven old manual exchanges were closed down. The transfer to the new system commenced at midnight and was completed in five minutes, the whole operation being entirely successful, so that the Sheffield area now includes the automatic exchanges referred to in Table I. A new manual common-battery exchange, fig. 2, has also been provided, which has 25 trunk positions, 22 "A" positions, 3 junction and miscellaneous positions, and a 16-position monitors' desk for dealing with inquiries.

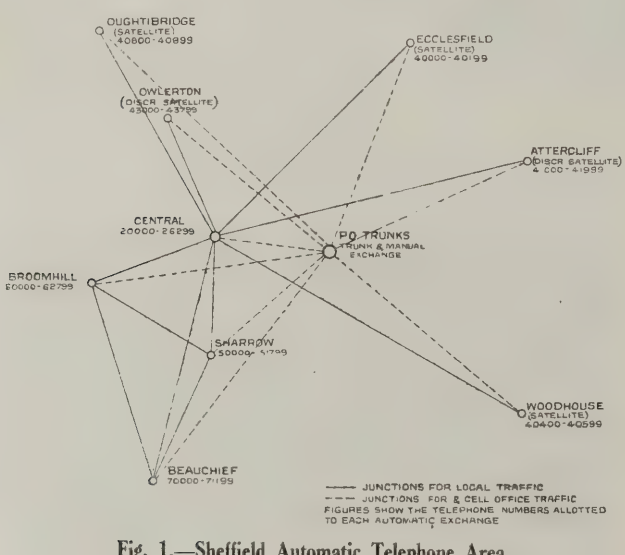


Fig. 1.—Sheffield Automatic Telephone Area.

Table I.

Exchange.	Initial equipment.	Ultimate capacity.
Central	6,300 lines	9,000 lines
Broomhill	2,800 ,,	3,500 ,,
Beauchief	1,200 ,,	1,900 ,,
Sharrow	1,800 ,,	2,600 ,,
Attercliffe	1,000 ,,	1,500 ,,
Owlerton	800 ,,	1,200 ,,
Oughtibridge ...	100 ,,	100 ,,
Woodhouse... ...	200 ,,	400 ,,
Ecclesfield	200 ,,	300 ,,
Total ...	14,400 ,,	25,000 ,,

The new exchanges give a full automatic service within the area, all subscribers being able to "dial" each other and also call direct the new manual exchange which deals with trunk and other calls outside the area, call-office lines, &c. The relative locations of the new exchanges and the inter-connecting junction scheme are shown in fig. 1. Central (fig. 3), Broomhill, Beauchief, and Sharrow are main exchanges, the



Fig. 2.—New Manual Trunk Exchange at Sheffield.

other five being automatic satellites (fig. 4) of Central: two satellites (Attercliffe and Owlerton) are equipped with discriminators which enable calls between subscribers on the same satellite to be completed locally, instead of using junctions to and from the main exchange; these two exchanges also have direct junctions to the trunk exchange. The other three satellites, on which there is comparatively little local traffic, complete all calls *via* their main exchange. All subscribers' numbers are of five figures: the first digit selects the exchange in the case of calls to subscribers on the main exchange, and either the first and second, or the first, second, and third, in the case of calls to the satellites.



Fig. 3.—A Portion of the Central Automatic Exchange.

Public call offices will continue to be used as though they were working on a manual exchange, telephones at such offices not being equipped with dials; they are joined to their automatic exchange in the same manner as ordinary subscribers, except that their preselectors (*i.e.*, line switches), instead of engaging a free first selector when the receiver is lifted, have direct access to a small group of junctions from their automatic exchange to "A" operators' positions in the trunk exchange. The preselector automatically selects a disengaged junction, and the call is indicated to the "A" operator by a lamp signal and answered on a standard cord circuit. All positions in the manual exchange are equipped with dials which enable the operators to dial direct to any number in the area. The trunk operators can also dial subscribers on the Chesterfield automatic exchange, which is 12 miles distant.

All the exchange equipment was made and installed by Siemens Bros. & Co., Ltd., of Woolwich, being the No. 16 system which is already in use in Edinburgh and at other places.

Additional points of interest of the Sheffield system are the 8-position test desk (fig. 5) at Central, from which all line testing in the area is done, and the arrangements for controlling the battery-charging at the small satellite exchanges, which have no permanent-duty man; at these exchanges the charging current is switched on by hand and is automatically cut off when the battery is fully charged. Most of the new exchanges are housed in new buildings, the largest being Central on an island site near the Cathedral; the automatic equipment, power plant, main frame, &c., were installed on the top floor before the outer walls of the lower floors were filled in.

The street telephone kiosks, of which Sheffield possesses more than any other town, excepting London, will also be converted to the automatic system soon.



Fig. 4.—Woodhouse Satellite Exchange.

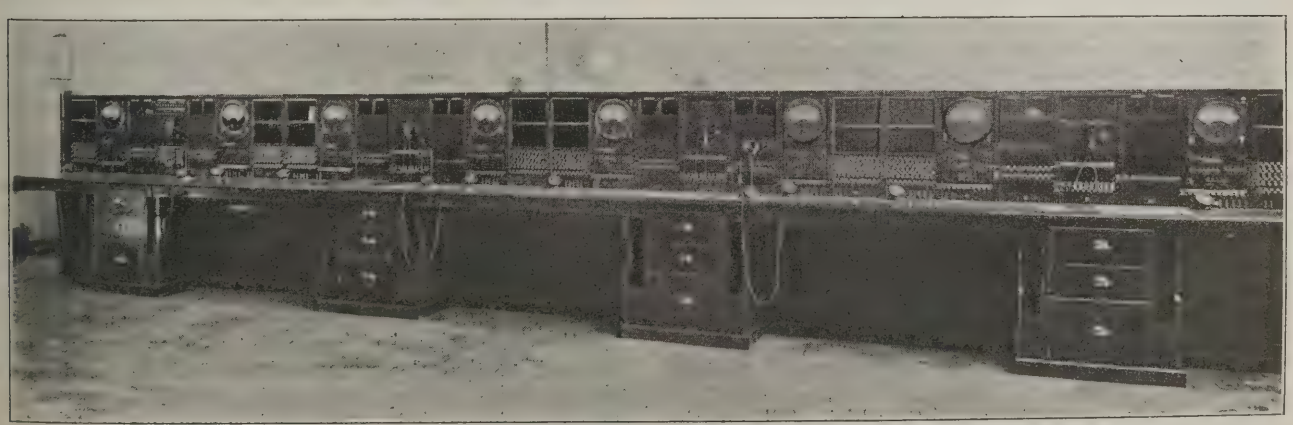


Fig. 5.—Central Exchange 8-position Test Desk, Sheffield.

Easy Payments and the Law.

The necessity for clearly defining the difference between "deferred payment" and "hire-purchase" systems of selling in view of the legal difficulties obtaining in that connection.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

THERE was a time when the "gradual payment" or "easy terms" system of dealing was confined to the sales of furniture and musical instruments. Nowadays the system extends into every trade, even to wireless equipment and motor-cars. The system, of course, has now passed out of the cloud of suspicion that was once around it, and it is recognised as conferring benefits on both the buyer and the seller. The shortage of money makes difficult the sale of highly-priced articles unless gradual payments can be arranged. Moreover, if the hire-purchase system is properly worked, it should involve no loss, and in most cases a higher profit. The chief difficulty is that the seller has to wait so long for his money; but this is overcome by the existence of finance corporations which are willing to finance transactions of this kind by advancing capital to the seller and recouping themselves out of the instalments under the hire-purchase agreement as they fall due.

There are, however, one or two legal snags which traders should be aware of before setting out upon a series of hire-purchase contracts. First of all, the distinction should be noted between (*a*) a purchaser who buys an article and pays the agreed price in instalments, and (*b*) a person who hires an article, paying rent for it and becoming its owner when so much rent has been paid. The first case is one of ordinary sale, the second is not a sale at all, but a hiring. In the first type of transaction, the supplier loses all hold upon the goods, and the buyer becomes absolute owner. He can sell, pawn, or destroy the goods as he pleases, and is only responsible for the agreed price. Hence it will be appreciated that such a transaction with a fraudulent or unsubstantial buyer offers little security for the supplier. The buyer may dispose of the goods and neglect to pay, and if the seller sues him for the price, the buyer may turn out to be a man of straw.

On the other hand, in a hiring agreement the supplier remains the owner of the goods all the time until the full number of instalments have been paid. If the buyer makes default by selling or damaging the goods or by not keeping up the instalments, the supplier may take back the goods without any obligation to return any part of the money paid. Moreover, the buyer (or hirer as he should be called) can be sued for damages, and anyone to whom the buyer has re-sold the goods can be sued by the real owner for keeping them.

Thus a very great distinction must be made between the "deferred payment" system and the "hire-purchase" system. Sellers are apt to confuse the two, and judging from current advertisements and trade literature, the distinction is not always appreciated. Whether a particular transaction falls within either class will depend on the terms of the agreement, which should always be in writing (although this is not legally necessary) and stamped with a 6d. stamp. Any words indicating that the supplier is to remain the owner, or that the payments are to be for hire and not as payment of the price, will suggest a hire-purchase agreement, but the use of the words "easy terms" or "instalments" will not.

There are numerous agreements which fall on the dividing line between the two classes, having certain features belonging to one class and at the same time having similarities to the other. And the difficulty is not always overcome by the use of such words as are mentioned above. For courts of law do not look at an odd word or two, but to the whole of the circumstances.

It is important, however, that a line should be drawn; for the Sale of Goods Act provides that where a person "having bought or *agreed to buy* goods" obtains possession of them with the seller's consent, any transfer by the buyer to an innocent third party shall bind the original owner. This means, as was pointed out above, that a person who buys goods can re-sell them even though he has not yet paid for them, whereas a hirer of goods cannot dispose of them. If he does, the owner can reclaim them from any person into whose hands they have come.

But the Sale of Goods Act includes persons who have agreed to buy, in the class of persons who can dispose of the goods to a third party. It has been held by the Courts that a hire-purchase contract which provided that the hirer should have the goods, pay rent for them, and become owner when twelve payments had been duly made, was a person who had "agreed to buy," *i.e.*, had agreed to become a buyer when twelve payments had been made. And the same was held in a case where the agreement said that the buyer should, when all the rent had been paid, become owner on payment of one shilling. The result was that the buyer, who had sold the goods to a third party, was able to defeat the owner's rights. The owner could not recover the goods; all the could do was to claim the unpaid instalments.

The point which impressed the Court was that in neither of the above-mentioned cases had the buyer (or hirer) any power to return the goods. The agreement bound him to keep them, pay for them, and ultimately become buyer of them. Hence he was a "person who had agreed to buy."

The Court pointed out that if the agreement had said that the buyer could have at any time returned the goods without being under any further liability, the position would not have been the same. For if a person can send them back at any moment, sacrificing what he has already paid, but being under no further obligation, it seems obvious that he is not a person who has definitely agreed to buy them.

Suppliers should, therefore, make sure that all their hire-purchase contracts contain the following or some similar clause: "The owner agrees that the hirer may at any time terminate the hiring by delivering up the goods to the owner, the hirer still being liable to pay any rent due up to the termination of the hiring in this manner."

There is no doubt that suppliers would be well advised to have their agreements drafted by some competent lawyer who knows the conditions of the trade. Conditions vary according to the type of goods sold: some goods deteriorate quickly, some are liable to damage, some require frequent adjustment or repair, and others are fitted as fixtures to the hirer's premises. All these varieties of circumstance need to be taken into account, so that the owner's rights over the goods, and the condition of the goods while out of his possession, may be safeguarded. And the law relating to this class of transaction is full of difficulties for the owner, without adding to them by blunders in the agreement.

The Electrical Industry Reviewed.

The Annual Report and Meeting of the B.E.A.M.A.

WE have received a copy of the speech delivered at the annual meeting of the British Electrical and Allied Manufacturers' Association, held on March 17th, by the Chairman, Lt.-Col. R. K. Morcom, C.B.E. The Press luncheon, at which the chairman's speech has been given for several years past, was not held this time. We give an abstract of Col. Morcom's review and our usual full summary of the report of the Council. The report does not on this occasion mention whether there was any change in the total membership during 1926. Col. Morcom has been re-elected Chairman of Council for the third year.

The Electrical Industry in 1926.

By Lt.-Col. R. K. Morcom, C.B.E. (*Abstract.*)

At the beginning of 1926 the factors favouring an expansion of trade justified optimism; but any forecast was bound to be overshadowed by the menacing situation in our coalfields and the artificial stimulus to German activities inherent in the Dawes Scheme. During the year, inflation in France and Belgium increased the adverse factors through the consequent increase of production in those countries. Nothing but a rapid increase in world demand could possibly prevent a serious over-production crisis in Europe. Unfortunately, on a falling market demand always lags. As a result there was soon acute depression in Germany, and a threat of acute depression in all producing countries. It might have been possible to curtail production by international agreements, but, as these were either impossible or undeveloped, it soon became obvious that the coal strike could by no means be averted. This had the effect of cutting down our production to such an extent as to save Europe from catastrophe, but at terrible expense to Great Britain. France and Belgium showed a steady increase in production, and Germany made good her initial depression. Only late in the year, Italy suffered from an adverse credit position. Outside Europe, Chile suffered severely, both from the rapid decline in the price of copper and the keen competition of German potash. In Argentina, the meat war continued to be a cause of depression. In Brazil, futile attempts at stabilising the milreis still restricted trade. There was an increased producing power of the Indian people, which, along with the stabilisation of the rupee, produced an active market. The United States, with its tremendous internal wealth, produced record results in almost every industry.

The two dominating factors have been the coal crisis and the Electricity Supply Act. The shortage of fuel due to the strike brought into great prominence the efficiency and economy to be derived from electrification; the highly-electrified industries were able to keep up their outputs with few exceptions. The electrical manufacturers themselves were able to do a large turnover during the crisis, and only in the autumn began to feel the pinch of inadequate steel supplies.

The passing of the Electricity Supply Act co-ordinates the problem of generation and transmission of electricity in this country, and ends the uncertainty of the previous four years.

The Association supported the Bill and can take to its credit several good features embodied in the Act. The influence of the national scheme will clearly be felt more directly by makers of heavy generating plant, cables, and switchgear, than by the makers of small plant, but the fear that the extension and installation of private generating plant will be much affected is probably groundless. It is very improbable that the coal, iron and steel industries, and those requiring process steam, will find any advantage in taking power from the network.

Industrial power stations should be encouraged to provide power supplies for their own requirements from waste gas or low-grade fuel or as a by-product of process steam. Such surplus, if it could be absorbed into the distributing network, would increase the overall efficiency of generation. The Central Electricity Board has full powers to encourage development on such lines. The definition of costs of production in the generating stations is such as to allow a fixed and equitable return on capital expended or invested. This should encourage the use of plant of the highest efficiency and durability, and discourage the purchase of inferior plant merely to incur low initial outlay.

During the acute depression the electrical industry was the one bright spot, and certainly in generating plant, transformers, switchgear, control gear, and meters, there was a good increase in turnover. Unfortunately, in industrial motors there was again a serious decline in orders. Such a decline means that our other industries are insufficiently electrified, and are thus handicapped in the fierce race of modern trade. The electric motors installed in industry in the United States were actually 22,247,660 h.p. in 1924, and are estimated to exceed 24,000,000 h.p. to-day. The German census of 1925 shows 13,000,000 h.p., while, in this country, a maximum estimate is 5,000,000 h.p., of which our three large industries, iron and steel, coal, and textiles, account for 2,800,000 h.p.

Generally the turnover for the industry in 1926 was a record, but the record was really by way of an overflow of pent-up waters. The demand for electricity was increasing at the rate of 700,000,000 kWh per annum, sufficient to cause a demand for 500,000 kW of new plant, apart from renewals. Probably 600,000 kW total should have been required for public supply alone. Actually, the total sanctioned by the Electricity Commissioners averaged 425,000 kW for the period 1920-25, while for 1925-26 585,700 kW was sanctioned. We seem to show a deficit of at least 600,000 kW from normal, and this deficit will have considerable influence on the trend of our business. This country is not spending enough on its electrical development. In the United States, public utility companies raised £300,000,000, while here the maximum annual expenditure on generation, transmission, and distribution is about £30,000,000. Allowing for the difference of population, we are only spending 25 per cent. of what we should compared with the U.S.A. There is hope of rectifying the position, for a number of super-power stations have been begun or projected, aggregating 2,000,000 kW at full development.

The British electrical industry has been able to maintain its position as leading supplier of electrical goods abroad. The Monograph submitted to the International Economic Conference shows how, compared with Germany, the United States, and Switzerland, we have moved much more rapidly since 1913, and strengthened our hold on overseas markets. In seven years we have supplied generating plant aggregating almost 2,000,000 kW, and the results obtained from such plant have been sufficient to create a tradition of high operating efficiency in every part of the world. In traction, in control and switchgear, in transformers, the same record has been achieved, and the electrical industry, with exports totalling £18,194,000 in 1926, takes first place among the engineering exporting industries of this country. Competition was felt most in South America, India, and Australia during 1926, and, in each case, the United States constituted the main opposition. With the possible exception of Australia, which is still supporting United States products in many branches of the industry, the British manufacturer was actually able to improve his position in almost every market. In Brazil, in Argentina, in Chile, in Japan, and even in Canada, the relative position occupied by Britain showed a considerable improvement. Trade is being resumed also with the Continental countries, and a number of important orders, which would otherwise have gone to Germany or the United States, were secured, especially in Spain and Central Europe. Our financial resources are great enough to ensure us a preferential position, and are now being employed with favourable results in Eastern and Central Europe.

Looking at the general industrial situation, the indications do not seem to be towards any great expansion of trade. A certain number of orders held up by the coal stoppage and now placed give an appearance of activity to certain areas, but behind it all lies the great shadow of serious world under-consumption of basic products. And in this restricted market our powerful competitors make it certain that our difficulties will become increasingly great. German industrial firms have borrowed from the United States over £60,000,000 worth of new capital, the main industries affected being coal-mining, iron and steel, electricity supply, and electrical manufacture, while the financial resources of the country have increased so greatly that the manufacturers can obtain advances at a discount rate even less than that ruling in this country. A year ago, the German manufacturer had to pay at least 10 per cent. for such accommodation, but now he can obtain it easily at 4-5 per cent. This is a factor of very great importance indeed in important long-term contracts.

Another factor that has assisted the German manufacturers, particularly the electrical manufacturers, is the closeness with

which the financial policy of the State has adapted itself to industrial policy. As an instance, the Russian credits totalling £15,000,000 with State support have enabled German industry to adopt a very forward policy in the Russian market. In the present state of demand, it seems wise to encourage any market that has great expansive possibilities. The realisation of stable monetary conditions on the Continent has been attended by an increase in unemployment. The growth of rationalisation, the development of horizontal trustification in Germany, accompanied by amalgamations on a large scale, and the formation of a number of international agreements have tended to bring the main industrial countries of Europe into close contact with each other, with the result that something like a European economic *bloc* is emerging.

The artificial aids to competitive efficiency represented by currency depreciation and inflation generally have now been practically removed, but in their place has come a more determined Protectionist policy and a movement towards association of producers, both technical and financial. There are signs also that a number of important markets are suffering from depression—Japan, China, Chile, and Egypt, chief among them. The great upward movement in American production has come to an end, activity in January being the lowest recorded for the last three years.

Until prices move upwards again, which possibly may take place towards the latter half of this year, it is difficult to see how demand on export account will improve; our prosperity as an industrial and trading nation depends on continuous activity in world trade. The Dawes Plan represents a great menace to British exporting industries. We can feel it already in the intensified competition which we are suffering from Germany, while it has served to bring France, Germany, and the United States into closer co-operation with a view to dominating the world markets. Germany has already made inroads on our position in cables and industrial motors, though we have held our own in generating plant and traction material. But it is essential that we should work at maximum efficiency and retain our position. The best means to such an end is to strengthen and develop the home market. In the heavy sections, the programme already sanctioned, and those which will be stimulated by the operation of the Electricity Act make an improving home demand probable. The new spirit, which the discussions on the Act have encouraged, and the need for bringing industrial plants up-to-date, should stimulate a revival in demand for medium and small size plant. In particular, all possible should be done to stimulate the demand for industrial motors, and so not only reduce the depression of that section, but put them in a position to face world competition on the basis of a home demand more comparable with that enjoyed by their great rivals.

The Council's Report.

THE Council commences its report by stating that, though 1926 began with every indication of expanding trade, it was one of the most disappointing in post-war history. The coal stoppage and the general strike brought industrial production almost to a standstill; trade suffered both from the interruption of manufacturing activity and from the diversion to competitors of orders in many important markets. Complete recovery will take some time, but the opinions of leading banking and industrial authorities indicate hopeful prospects of trade revival.

"The creation of stable currency systems in Europe—France and Italy alone have not taken steps to stabilise financial conditions—points to the elimination of unfair competition based on currency depreciation, and an improvement in the competitive situation so far as the British manufacturer is concerned. The rapid fall in prices of many basic commodities such as copper, cotton, lead, rubber, and chemicals, has contributed to a slight decrease in material costs, but, on the other hand, has weakened the economic and financial position of many markets, such as Chile, Central Africa, Egypt, and made overseas demand less active." The electrical industry, due to the fact that many plant extensions could no longer be delayed pending the new supply legislation, was an exception to the general depression, and reported an increase both in turnover and in orders received. The passage of the Electricity (Supply) Act released several large power schemes, and there is hope of increased activity during 1927, provided that all sections of the community realise the necessity of working together towards stability. The B.E.A.M.A. office accommodation was increased during the year.

Sir Robert Horne, P.C., M.P., Mr. Emile Garcke, and Mr. C. P. Sparks have been elected vice-presidents. Captain R. S. Hilton, managing director of the Metropolitan-Vickers Electrical Co., Ltd., was elected vice-chairman of Council in June, in place of Mr. P. J. Pybus, who retired on becoming chairman of the English Electric Co., Ltd.

The Electricity (Supply) Bill) came into force as an Act on January 1st of this year. "It is obvious that developments will take some time to mature under the Act, and an effort will probably be made, first of all, to determine the seven electricity districts still in abeyance and to complete the series of 15 districts into which Britain has been divided, before any steps will be taken towards realisation of a plan of national co-ordination."

A tribute is paid to the director, Mr. D. N. Dunlop, who, with the sanction of the Council, brought together the various bodies in the electricity supply and contracting branches of the industry, with the result that their interests were reconciled and an agreed clause was presented to the Ministry of Transport, which now stands as Clause 48 in the Act.

Since the last Annual Report, the enlarged British National Committee referred to therein has assumed responsibility for the participation of Great Britain in the future activities of the World Power Conference; the director is chairman of this Committee. The first sectional meeting of the World Power Conference was held at Basle, Switzerland, during the year, and the Sectional Meeting on Fuel Problems will be held in London in September, 1928, under the auspices of the British National Committee.

The report refers to the monograph on the electrical industry, prepared in connection with the International Economic Conference of the League of Nations, which was reviewed in the Electrical Review, March 4th, p. 329.

The Economic and Statistical Department of the Association considerably extended its range of activities during 1926. It has kept in touch with financial and commercial interests; it has been consulted by international bodies, such as the International Economic Conference, regarding developments in industry; has furnished information to the International Labour Office and the Board of Trade Committee on Industry and Trade; has exchanged statistics with leading associations in other countries; and serves to guide the course of expert opinion on the electrical industry.

Reference is made to the various publications issued by the Committee, and to the various articles in newspapers at home and abroad regarding the British electrical industry. The advertisement campaign of the Publicity Department directed to increasing the prestige of the industry is mentioned. The same department supplied information to other associations in support of electrical development, and was active in many of the Dominions, syndicating special articles and notices dealing with the electrical industry. In conjunction with the Economic and Statistical Department it has been working to create an atmosphere favourable to intensive electrical development and the realisation of large power schemes, both at home and abroad.

The sixth annual report of the Electrical Research Association makes it clear that the E.R.A. has now thoroughly established its usefulness. The Council regards the work of this Association as of national importance.

The scheme of educational scholarships, which has been in successful operation for the last six years, was brought to a conclusion during the year, the funds for it having come to an end. The Committee has laid down lines for an enlarged scheme, which proposes to open out the awards both as to subject-matter and the field from which candidates may be drawn. The number of oversea students in members' works at the close of the year was 162, a decrease of 22 on last year's return.

With regard to conditions of contract, the report says:—"The routine work in the legal department is reported by the solicitor as having been normal during the year, but he desires to draw the particular attention of members, when examining their contracts, to the preliminary portion of them embodying what is known as the 'Agreement.' The 'Agreement' always refers to the set of conditions 'annexed hereto,' and not infrequently it happens that it contains clauses which are contrary to and *override* those conditions. Such words are sometimes overlooked by the examiner of the contract, once he has been satisfied that the conditions annexed thereto are in order. Particular care should therefore be taken in reading the 'Agreement,' and any dubious points referred to the Association. No alterations in the text of the I.E.E. model sets have been proposed during the year."

An important addition was made to the Council's "Instruction to Members" in regard to fair-wages clauses. After 12 months' experience of the voluntary use of two out of the three well-known clauses and several years' experience of the first (*i.e.*, dealing with labour in the factory), the Council decided that all these clauses should be made mandatory, and accordingly that rule was put into effect last autumn. "No serious difficulty has yet been encountered, and it is hoped that in due time most public bodies will follow the lead of the chief railway companies in arranging to accept clauses which, unquestionably, are, as their title correctly implies, 'fair' both to purchaser and contractor; and will, if not already in accord, gradually alter their standing orders to admit of their use."

An outstanding feature in connection with standardisation work during the year was the plenary meeting of the International Electrotechnical Commission held in New York in April. "An important principle recognised was that temperature *rise* (and not *total* temperature) is the fundamental basis of the I.E.C. rules for rating. It is gratifying to know that British practice, as enunciated by your representatives, is having its due influence on international standardisation."

The Standardisation Committee has completed a draft set of rules covering the method of declaring efficiencies for motors and generators, transformers, rotary convertors, and motor convertors. The draft was submitted to the I.E.C. and was referred to the National Committees for consideration.

Researches conducted by the E.R.A. on flameproof enclosures have made it possible to adopt a definition of flameproofness which has been embodied in a British standard specification. Specifications for flameproof apparatus are now under consideration.

During the past year the B.E.S.A. has registered "BESA" as a trade mark to be used on articles which comply with the appropriate British standard specification. Licences for the use of the mark are granted only under such conditions as will ensure that the articles so marked do actually comply. The introduction of this trade mark should be of the greatest service to British manufacturers.

A specification for lighting and power transformers which is the result of several years' work on the part of the Transformer Technical Committee is regarded by the B.E.S.A. Electrical Sectional Committee as one of the finest technical productions yet issued by that Association.

During the year the Traffic Committee continued its collaboration with the Traders' Co-ordinating Committee in opposing the Schedules of Standard Charges, submitted to the Railway Rates Tribunal by the railway companies. Its members also prepared special evidence on the companies' proposals with regard to Part 6 of the Schedules, which deals with "Merchandise of an exceptional character sent by merchandise train." In this term are included pieces of machinery exceeding 12 tons in weight. At the present time pieces of electrical machinery in excess of 10 tons in weight are surcharged on a rising scale, referred to as "The Heavy Weight Scale." Certain classes of machinery are exempt from these surcharges, being permitted to take advantage of a "mileage scale of charges." Under the schedules the mileage scale is to be abolished, and all pieces of machinery exceeding 12 tons will be subject to surcharge. The Committee regards these surcharges on electrical machinery as unjustifiable, and as a result of interviews with a committee representing the railway companies, it was agreed that the minimum weight should be raised from 10 to 12 tons, and that the surcharges should be imposed, not on the total weight, but on the excess weight over 12 tons. The companies further conceded the principle that the surcharges should not take the form of a percentage addition to the standard charges, but should be based on a sliding scale in which the price per ton per mile decreased with increasing distance. At a later stage the companies submitted to the Tribunal their proposed scale which commenced at 7d. per ton per mile for the first 10 miles, and decreased to 1d. per ton per mile for distances exceeding 100 miles. The Committee resisted these proposals, and the evidence submitted to the Railway Rates Tribunal, supported by considerable data in the form of tables and charts, showed that whilst relief had been given to purely electrical machinery, the new surcharges imposed on prime movers would, in many cases, make the cost of transport on a combined generating set greater than before. The railway companies then voluntarily agreed to reduce the proposed scale by 33⅓ per cent., and this reduction has since been confirmed by the Tribunal. The effect of this decision will mean that the carriage charges to be paid by the heavy-plant sections of the Association will be, at least, £3,000 per annum less than would have been the case under the railway companies' proposals, and will, in the majority of cases, be below the present charges. At the present time the difference between the charges at companies' risk and owner's risk is of the order of 10 to 20 per cent., depending on the class of goods, but in the companies' proposals the deduction is of the order of from 2½ to 12½ per cent., and the greatest volume of traffic will be carried in those classes for which the proposed allowances are respectively 2½, 3¾, and 5 per cent. The Committee will collaborate with other trading interests in resisting these proposals, but it is hoped that some satisfactory arrangements may be arrived at without having recourse to litigation. In settling the revised Classification of Merchandise, the Committee succeeded in obtaining modifications of the companies' proposals which will be of considerable benefit to members of the Association. Among these modifications was a lower classification of steam condensers, representing a saving in transport charges of about 20 per cent. The Committee has also been successful in obtaining a revised classification for ironclad switchgear.

The Committee reminded members that as their ordinary shipping policies did not protect them against damage due to fire and other causes which might occur in railway or dock warehouses in which their goods might be stored awaiting lifting on board, they should cover this risk by insurance.

In order to put an end to recurring disputes regarding loss and damage an agreement has been made under which, subject to certain conditions, the railway companies will pay the net loss less 10 per cent. when the goods are carted by the trader at one end of the journey, and less 15 per cent. when cartage is performed by the trader at both ends. This agreement came into force on October 1st, 1926.

The Export Committee gave further attention to the question of amendments to Dominion Customs duties, particularly those in Australia. To ensure adequate support for the memorandum transmitted to the Australian Customs authorities, those members interested in Australian business decided to appoint in Australia an Australian tariff expert to support the views put forward in the memorandum. Progress cannot yet be reported, but the effort is being maintained. The question of the import duties on catalogues charged under the Australian Customs tariff also received careful consideration with a view to action. During the year there were two conferences of all members of the Association known to be represented in Australia.

The two new sets of conditions of contract, to govern f.o.b. and c.i.f. contracts, were still under discussion by the appropriate I.E.E. Committee when this report went to press. The Export Committee devoted a considerable amount of time during the year to the conditions of the India Stores Department, and had the attendance at once of its meetings of Colonel Pitkeathly, chief engineer of that department, who, after hearing the manufacturers' views, undertook to give careful consideration to the Committee's suggestions for amending the department's conditions. The Committee also secured the interest of the chief inspecting engineer of the Egyptian Government in respect of conditions of contract.

In place of the November meeting of the Export Committee a conference was held of all members of the Association, known to be interested in Indian business, when Mr. T. M. Ainscough, H.M. Senior Trade Commissioner, Calcutta, gave his views regarding the present position and prospects of the British electrical and allied industry in India. Mr. Ainscough also urged that some arrangement should be made for the systematic training of accredited Indian students. The Export Committee joined in the general protest against the continuation of the Anglo-Spanish Commercial Treaty in view of the very high duties imposed by decree.

The Standard System of Cost Accounting in the Electrical Industry, prepared by the Estimating and Accounting Committee, has been completed, and is in the hands of members. The Council believes that its general adoption as a basis of costing will lead to greater efficiency in the industry.

The activities of the Electrical Development Association are briefly indicated in the report. Its supply membership at December 31st was: Municipal, 150; company, 125; colonial, 4; total 279; an increase of 27 on the preceding year. Its principal activity during 1926 included the organisation of the great campaign.

The following exhibitions were, during the year, made free to members under the Exhibition Standing Rule: Smoke Abatement Exhibition, Birmingham; Physical Society's Exhibition; Better Housing Exhibition, Glasgow; Clean Foods Exhibition, Cardiff; Heating and Cooking Exhibition (Clyde Valley Power Co.), Helensburgh; Heating and Cooking Exhibition, Pudsey Corporation; Office of Works Industrial Exhibition; Bakers' Exhibition, London.

The Council acknowledges the assistance received from other institutions.

Practical Results with Chromium Plating.

Under this title the *American Machinist* abstracts a paper read before the S.A.E. at Detroit, in which Mr. W. N. Phillips states that chromium plating has been used for considerably over a year on the Oldsmobile radiator. The method used is to produce as smooth a surface as possible, and then apply a light coating of chromium. In order to get this smooth surface, it is the practice to copper- and nickel-plate the steel parts; then, after the articles have been buffed to a high finish, a light coating of chromium is applied. It is somewhat difficult to produce nickel plating under 0.001 in. thick that will stand a salt spray test of 15 hours. However, a steel base, plated with this amount of nickel, then chromium plated, will stand 80 to 100 hours of salt spray test.

The chief material used in chromium plating is chromium trioxide, which can be purchased at about 35 c. per lb., with the possibility that, as the use increases, the price will decline. In applying chromium, high current densities are used with very short emersions (*sic*).

On plug gauges, thread gauges, and the like, the use of chromium has been very successful. The gauges are ground about 0.0005 in. undersize, then brought up by plating an excess of chromium, and later ground to size, or by plating the gauges exactly to size. When the gauge has finally worn out, it is stripped and a new coating of chromium applied. It is thus possible to use the same gauge for an indefinite period. It is in this work that the control of hardness is of particular importance. It has been possible to produce gauges that last from 2 to 25 times longer than the best steel gauges with one plating.

Owing to the low coefficient of friction between chromium and other metals, chromium has been applied for burnishing tools with a great deal of success. Files used for cutting soft metals can be chromium-plated with great advantage, inasmuch as the metal does not clog up the file.

It is necessary to back up chromium plating with hard metal, if the article plated is to be put to hard usage. In other words, if the impact is great, the steel parts should be carburised before applying chromium.

Hardening Copper.

The discovery of a new process for hardening copper was recently announced at a meeting of the American Institute of Mining and Metallurgical Engineering. Mr. M. G. Corson, a consulting engineer, who invented the process, explained that the copper was hardened by an alloy of 5 per cent. nickel and about 1 per cent. silicon, heated to various high temperatures. Virtually, the same principle was used as in making duralumin, another hard metal.—*Reuter's Trade Service* (New York).

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

According to the official report for the week ended March 19th, 90 electric demonstration houses have now been opened, and it is conservatively estimated that 1½ million people have visited them. During last week houses were opened at Ipswich, Paisley (Ralston), and Stoke-on-Trent (two). Further houses are to be opened shortly at Whitley Bay, Malton, Heaton (Newcastle), Saltburn, Birmingham, Tamworth, West Hartlepool, and Annfield Plain. The following attendances are recorded at some of the demonstration houses:—Paisley, 400 a day during the first four days; Aberdeen, 16,736 in 16½ days—over 10 per cent. of the population; Glasgow (Minard Road), 12,133 in 12 days; Potteries, 1,000 on opening day; Chorlton, average over 1,000 a day. Between 8,000 and 10,000 people visited the four-day exhibition at Dumfries, and the results are said to be satisfactory. Recently a special effort has been made to interest school children in the better home-lighting competition, and applications have been received for nearly 80,000 booklets. The E.D.A.'s stock of posters, window bills and supplementary literature is practically exhausted; only a few hundred are left. Ballot papers have been coming in lately at the rate of two or three thousand a day; it is now certain that the public response to the competition compares favourably with any similar trade effort ever made in this country.

No. 8 of "Home Lighting News" calls for a big final "push" by electricity suppliers, contractors, and retailers. To encourage an effort E.D.A. offers to those who have previously ordered competition booklets, 50 per cent. of the number free of charge upon application. The March window display is dealt with; this concentrates upon spring cleaning, and is devoted to a contrast of ancient methods with the modern (vacuum cleaner) way of doing the work.

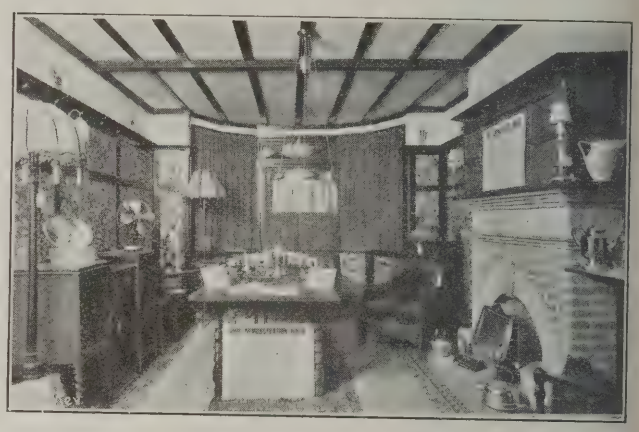
We reproduce herewith views of two of the demonstration houses equipped in connection with the Campaign.



The Carlisle Demonstration House.

The first is that at Carlisle, and appears to be a typical middle-class home, representative of a vast number.

The other house is at Hendon and our view shows the dining room containing a large number of electrical appliances, including five types of lighting fittings, and a number of table devices.



The Hendon Electric Home.

Another illustration is a night view of the South Shields Electric House. This is of the modern semi-detached villa type, and on the ground floor are a drawing room, dining room, kitchen, and scullery; upstairs there are a front bedroom, small front bedroom, and back bedroom, together with bathroom, &c. The house was loaned by the builder on completion. The wiring was carried out by a local firm of contractors, and the fittings, cooking apparatus, &c., were from several manufacturers. The furnishing was done by a local firm. The house was formally opened by the Mayor (Councillor J. Ranson) on March 9th. After the opening and inspection of the house, those invited were entertained to tea. The number of people who visited the house on the first day was 3,000. Up to March 17th the total number of visitors was 13,588. Attention was drawn to the house by a number of effective methods. The whole of the work was carried out by the local circle in conjunction with local wiring contractors and other co-opted members.



An All-Electric House at South Shields.

An all-electric house was formally opened at Taunton by the Mayor on March 11th. The exhibition was organised by the Taunton Electric Circle and domestic labour-saving devices, together with a variety of other electrical appliances, are included in a very complete display.

Two neighbouring all-electric houses were opened at Shelton, Stoke-on-Trent, on March 17th, and they are to remain open until the end of the month. The houses were erected by the Corporation Housing Committee and furnished by two local firms. The electrical equipment was supplied by the City Electricity Department. A leaflet is being distributed giving some details of the exhibition and also calling attention to the Campaign competition. The local Press has been freely employed to advertise the houses, and one advertisement gave the names and addresses of 22 electrical contractors, &c., from whom competition booklets can be obtained.

Local Exhibitions.

Cardiff.—The accompanying picture shows the Cardiff all-electric house, to which we recently made reference. It was erected by Messrs. G. L. Ward & Co., and furnished and



An All-Electric House at Cardiff.

equipped by Messrs. David Morgan in conjunction with the builders. In its general design it followed the lines of the prize house which is being awarded in connection with the E.D.A.-E.L.M.A. Campaign.

Yarmouth.—An electrical exhibition, organised by the Electricity Department, was held at Yarmouth from March 15th to 24th. A number of local electrical contractors co-operated, and the products of several national manufacturers were displayed. A booklet was issued for the occasion in which were set out full particulars of the Corporation's service as well as the advantages of "doing it electrically." Cooking demonstrations were given by a representative of the Jackson Electric Stove Co., Ltd., whose cookers form a part of the Corporation's hiring scheme.

Electric Power in Industry.

The fourth preliminary report upon the Census of Production, 1924 (published with the *Board of Trade Journal* for March 17th), shows that in the coal-mining industry generating plant of a total capacity of 778,363 kW was in use during 1924 (as against 151,000 h.p. in 1907). The total power of electric motors installed was 1,568,360 h.p., and power for 1,030,139 h.p. of these was generated by the industry itself. In 1907 the aggregate h.p. of electric motors installed was 492,000. Electricity to the value of £112,000 was sold by the industry during 1924. The coke and by-products industries reported generating plant with a total capacity of 37,264 kW. The installed electric motors had an aggregate rating of 69,043 h.p. The manufactured fuel trade possessed 2,983 kW of generating plant (against 239 kW in 1907), and had 5,525 h.p. of electric motors installed. The generating plant installed in the railway carriage and wagon-building trade aggregated 15,207 kW (against 8,168 kW in 1907). and the industry had 62,506 h.p. of electric motors.

Recent Contract.

Messrs. E. A. Langrish & Co., Ltd., Wardour Street, W.1, have obtained a contract for installing complete kinematograph equipment at the Nottingham City Mental Hospital, Mapperley. This is only one of the many similar installations carried out during the past few months. The projector outfit supplied is a "Kalee" all-British No. 7 model of the rear-projection type, the projector being placed at the rear of the screen.

Commercial Electrical Travellers.

The Electrical Trades Commercial Travellers' Association held a successful carnival dance at Victory House, Leicester Square, on Friday evening last, about 100 members and friends being present. Despite the mild weather, exponents of the Charleston were indefatigable, and Mr. Tom Dally's orchestra, which once again provided the music, was busily employed in meeting their demands. The profuse distribution of fantastic paper hats and other novelties enlivened the proceedings, which were consecrated by the singing of the Frothblowers' Anthem. The catering, as usual, was excellent, and Mr. Moir, hon. secretary, and those who assisted him in making the arrangements, are to be congratulated on their efforts.

Power in Factories.

The monthly *West Ham Power and Factory Gazette*, published by the West Ham Electricity Department, contains particulars of factories and factory sites available in the district, as well as numerous illustrations of the application of electric power to industry. Full details of the Department's service are included.

Employment During February.

The March *Ministry of Labour Gazette* states that employment in the engineering industry continued to improve during February in all parts of the country. The general percentage of unemployed fell from 13.1 in January to 11.6. In the electrical engineering branch there was a fall in unemployment from 6.8 to 6.5 per cent. Upon the other hand, the two other principal electrical groups showed a decline in employment. In the electrical wiring and contracting industry the unemployment figure was 8.9 per cent. (against 8.0 per cent. in January), and in the electrical cable, wire and lamp manufacturing group it was 8.6 per cent. (against 8.3 per cent). The actual numbers of unemployed were as follows:—Electrical engineering, 4,995; wiring and contracting, 1,237; and cable, wire and lamp manufacturing, 7,595.

Cheaper Electric Lamps Wanted.

A plea for cheaper electric lamps was made by Mr. E. Cross, the Rotherham electrical engineer, at the annual dinner of the Sheffield branch of the Electrical Contractors' Association last week. They were now getting a class of consumer of electricity, he said, who could not afford to pay 3s. or 3s. 6d. for a lamp. It would pay manufacturers to sell lamps cheaper and, in consequence, more of them.

Unemployment.

The fall in the number of employed continued during the week ended March 7th, when a reduction of 25,380 was recorded. The actual total was 1,144,100, as compared with 1,169,480 on February 28th, and 1,094,082 on March 8th, 1926.

A "Rawlplug" Competition.

In our advertisement pages to-day details are given of a competition which is open to all users of "Rawlplugs," and particularly electricians. A number of attractive cash and other prizes are offered.

The Japanese Earthquake.

The recent severe earthquake in Japan caused comparatively little damage, the total being officially put at 10 million yen. The property of the Tokyo Electric Light Co. was not seriously affected; the estimated cost of the damage done is stated to be £4,000.

Metropolitan-Vickers in Russia.

The Times reports that a five-year agreement between the Leningrad Machine Trust and the Metropolitan-Vickers Electrical Co., Ltd., has been approved by the Soviet People's Commissars. The Trust obtains access to all the Vickers laboratories, workshops, and technical offices, as well as to all patents. Messrs. Vickers will send to Russia a certain number of engineers, mechanics, and technical *personnel*.

Lamp Manufacture in Russia.

In order to render the country less reliant on foreign tungsten wire, for use in the manufacture of electric lamps, plant for its production has recently been installed at the Baskakow cable works in Moscow, where about 328,000 ft. per month is now being turned out. A tungsten wire-making plant is also being established in the old Provodnik works, Leningrad.

Proposed New French Customs Tariff.

The *Board of Trade Journal* for March 17th was accompanied by a translation of the first part of the new Customs tariff which the French Government has under consideration. The principal object of the revision is to ensure, for a number of years, the defence of the national industries. An important feature of the new tariff is the provision made for the periodical adjustment of the rates of duty in relation to changes in the general level of wholesale prices.

The National Radio Exhibition, 1927.

The Radio Manufacturers' Association states that full particulars of the 1927 exhibition will be published in the course of next month. It is the intention of the Association to afford its members special facilities on one day to view the show.

North Metropolitan Progress.

The Spring Number of "Use Electricity," published by the North Metropolitan Electric Power Supply Co., shows that during 1926 no fewer than 7,274 new premises were connected to the company's system. In the same issue are articles upon the company's demonstration houses; the electric kitchen; shop-window lighting, &c.

Trade Announcements.

Mr. Frank Gilman has removed his office to Grange Works, Grange Road, Smethwick.

Mr. A. J. Wells, electrical and radio engineer, has opened new premises at 5, Crawley Green Road, Luton, Beds.

The Electricity Distribution of North Wales and District, Ltd., is shortly opening offices and showrooms at Nantwich.

Messrs. Kent Bros. Electric Wire Co. & E. H. Phillips, Ltd., state that on April 1st their registered offices and stores will be removed to West Park Works, Mortlake Road, Kew Gardens, Surrey ('phone: Richmond 3941). For local customers a stores will be retained at 43, Berners Mews, London, W.1.

As from to-day, Mr. A. J. Makower's address will be: 200, High Holborn, W.C.1. Telephone: Museum 4265.

Catalogues and Lists.

Messrs. F. & A. Parkinson, Ltd., Guiseley, Leeds.—A blotter advertising the company's motors and bearing a view of the works.

Volta, Ltd., Kern House, 36-38, Kingsway, W.C.2.—Two pamphlets addressed to retailers dealing with the company's sales policy, and three illustrated leaflets describing "Volta" vacuum cleaner attachments. Also an adhesive stamp advertising the "Volta."

Messrs. Walter McGee & Son, Ltd., Albion Works, Paisley.—Leaflets Nos. 110-114, illustrating and describing "Emcol" a.c. motors, including a special flameproof (mining) type.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—A priced and illustrated catalogue of ironclad switch- and fuse-gear. Views of the company's Witton works are included.

Messrs. Royles, Ltd., Irlam, near Manchester.—A folder advertising the company's water and air heaters, strainers, &c.

Messrs. Tipper Bros., Bradley Bridge Tube Mills, near Bilston, Staffs.—A pamphlet advertising the firm's "Tibro" electrical conduits ranging from ½ in. to 2 in. external diameter.

Messrs. A. H. Hunt, Ltd., Tunstall Road, Croydon.—A sample of "Clutch" insulating tape, a feature of which is the retention of its adhesive properties for a very long period.

Mr. Alan Wright, 124, Chancery Lane, W.C.2.—A cut out containing details and prices of "Inventum" electric cisterns and arranged for overprinting.

Pritchett & Gold & E.P.S. Co., Ltd., 50, Grosvenor Gardens, S.W.1.—A brochure containing very full particulars of the construction and manufacture of the company's accumulators for train lighting.

Mr. Charles Selz, 47, New Cavendish Street, W.1.—A leaflet bearing a view of Mr. Selz's showrooms, and (on the reverse) a guide to their position.

The Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N.17.—A priced and illustrated folder describing "Bencolite" units for artistic lighting.

Messrs. Ernest F. Moy, Ltd., Greenland Place, Camden Town, N.W.1.—Sheet No. 150, containing an illustrated description of the company's large motor-operated rheostats. The example depicted has a capacity of 470-160 A, and a resistance of 1.1 ohms.

Houghton-Butcher (Gt. Britain), Ltd., 88-89, High Holborn, W.C.1.—"Houghton's Radio News" for March, containing details and prices of radio apparatus, special lines for retailers, and illustrated articles on selling, &c.

The Vaughan Crane Co., Ltd., Openshaw, Manchester.—Booklet 261, describing the company's pulley blocks, &c.

Bankruptcy Proceedings.

A. J. Garrod, Whitehorse Place, Wellingborough, Northants, radio manufacturer.—The receiving order in this matter was made on March 4th on a creditor's petition. The statement of affairs shows ranking liabilities of £2,947, against assets of £466, leaving a deficiency of £2,481. The debtor attributes his failure to the calling in of borrowed capital when his experiments were in a critical stage and not quite perfect. It appears that he was formerly interested in wireless in Australia, and in May, 1924, came to England with £600 free capital. In the following September he started trading as the Unitron Valve Co. at his present address with £350 capital, and was successful until August, 1925. He borrowed £250 as he was experimenting on a wireless valve, and this was afterwards increased to £750 with a further £250 guaranteed at the bank. Later he borrowed £750 from the petitioning creditors. In November, 1926, he endeavoured to form a company to exploit his wireless valve, but he was unable to do so, and in December he closed down.

G. E. Grainger, trading as Grainger & Co., 38, Market Street, Ashby-de-la-Zouch, wireless engineer.—The first meeting of creditors was held on March 16th, at the Official Receiver's office, Nottingham. The debtor's deficiency was put at £571. He attributed his failure to bad trade, lack of business experience, loss on contracts through underestimating, and living beyond his means. He commenced business with his brother in April, 1925. They had no capital but each contributed a quantity of wireless accessories to a total value of about £40. In June of the same year, trade not being good, his brother retired and debtor continued the business. He admitted having been aware of his position shortly after he commenced business. The case was left in the hands of the Official Receiver as trustee of the estate.

E. Cowley, trading in co-partnership as George Hill & Co., 22, Chantry Lane, Great Grimsby, electrical engineer.—The application for the discharge of this debtor was heard on March 17th at the Town Hall, Great Grimsby. He was a partner in the firm of George Hill & Co. He joined the firm in November, 1920, supplying £150 capital, money loaned by his father. The partnership liabilities amounted to £652, against assets of £262. It was stated that the firm was in difficulties when debtor joined. The debtor's discharge was granted subject to a suspension for one year.

G. Mason & G. E. Tinsley (Mason & Tinsley), electrical engineers, 6, Alberta Terrace, and 94, Upper Parliament Street, Nottingham, and G. Mason (separate estate).—Last day for proofs for dividend March 30th. Trustee, Mr. L. A. West, Official Receiver, 4, Castle Place, Nottingham.

P. Ford, electrical contractor, 4a, Macdonalds Lane, Corporation Street, Manchester.—Receiving order made March 14th, on a creditor's petition.

A. Stock, electrical and radio engineer, 323, Chapel Street, Salford.—Receiving order made March 16th, on debtor's own petition.

R. A. Burnell, electrical engineer, Harefield Park, Harefield, near Uxbridge.—Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released March 10th.

F. A. & R. Hartley (F. A. Hartley & Son), electrical engineers, 98, Katherine Street, Ashton-under-Lyme.—First and final dividend of 3s. 6½d. in the £, payable March 28th, at the Official Receiver's offices, Byrom Street, Manchester.

F. A. Hartley (separate estate).—First and final dividend of 20s. in the £, payable March 28th, at the Official Receiver's offices, Byrom Street, Manchester.

R. Hartley (separate estate).—First and final dividend of 20s. in the £, payable March 28th, at the Official Receiver's offices, Byrom Street, Manchester.

J. V. Figgins (V. Figgins), plumber, sanitary and electrical engineer, &c., 97, Fore Street, St. Marychurch, Torquay.—First and final dividend of 1s. 9d. in the £, payable at the Official Receiver's offices, Exeter Bank Chambers, 67, High Street, Exeter.

T. F. Collier, electrician, 116, Union Street, West, Oldham.—Receiving order made March 11th, on a creditor's petition.

R. P. Reeves (Lux Spotlight Projector Co.), electrician, 5, Say's Corner, North Quay, Great Yarmouth.—Public examination held March 23rd, at the Town Hall, Great Yarmouth.

Company Liquidations.

Gil-Ray Trading Corporation, Ltd., Sicilian House, Sicilian Avenue, W.C., radio and electrical manufacturers.—A meeting of creditors was held at the company's offices on March 14th, when Mr. S. B. Saunders, liquidator, presided. A statement of affairs was presented, which showed liabilities of £2,023 and an estimated amount available to meet the debenture holders' claim of £78. The deficiency, so far as the creditors were concerned, was £2,023. The liquidator said that there would be nothing for the unsecured creditors. The capital issued and allotted was 1,002 preference shares of £1 each, and 2,000 ordinary shares of 5s. each, so that the total deficiency as, regarded contributories, was £3,525. The company was formed in July, 1925, with a cash capital of £1,000, and in May, 1926, a further £500 was put into the business, which amount was secured by a debenture. During the early part of the company's trading it did fairly well, and good orders were received for a crystal which it manufactured. Soon after, the slump in the wireless trade set in, and business became very bad. It was hoped that increasing trade would be brought about by the Manchester Exhibition, and the company had a stall there, and a great deal of time was spent on it. Things did not turn out as anticipated, however, and the exhibition authorities refused to allow the company's stock to be taken away. Consequently the debenture holder appointed a receiver. The present directors had not drawn any fees since the commencement of the company. The debenture holder was also a director of the company, and besides advancing the £500, which was secured by the debenture, he had also loaned sums from time to time without security. At the present time he stood to lose about £2,000. It was resolved that the matter should be left in the hands of the present liquidator. The following are creditors:—

	£		£
Gaskill, —	250	Auto Sundries	59
Barney, —	56	Hirst Bros.	23
Fuller's United Electric Works, Ltd.	35	Yeoman, —	68
		Johnson, A. E.	76

Evalasio Distributing Agency, Ltd., 49, Leswin Road, Stoke Newington, London, N., and Cross Street, Islington, wholesale and retail wireless dealers, &c.—A meeting of creditors was held on March 11th at the offices of Messrs. Hacker, Rubens & Co., 23, Surrey Street, W.C. The chair was occu-

pied by Mr. M. G. Hacker, liquidator in the voluntary liquidation of the company and receiver for the debenture holders. He stated that the liabilities were approximately £325 to the trade and £150 to cash creditors. The assets were apparently sufficient to fully discharge the amount due to the debenture holders, but as far as he could see, there would be no surplus available for the unsecured creditors. The company was incorporated on February 7th last to take over the business of the Evalasio Distributing Agency previously carried on by Messrs. W. H. Stevens and E. F. Keal at Stoke Newington, and that of the Edal Wireless Co., at 2, Cross Street, Islington, N. Part of the consideration for the transfer of the assets was the issue of two debentures totalling £850 to two cash creditors who had advanced money to the Evalasio Distributing Agency. The company had a nominal capital of £100 in £1 shares. No resolutions were passed, and the voluntary liquidation of the company will therefore be continued with Mr. Hacker as liquidator.

Joseph Booth & Bros., Ltd., electrical engineers and crane manufacturers, Rodley, near Leeds.—A meeting of creditors was held at Leeds on March 18th. The liquidator, Mr. Alfred Walton, presided. The statement of affairs presented showed unsecured creditors for trade accounts, £9,427; unsecured loan creditors, £32,028; fully-secured creditor, £45,977 (being the bank, which held a debenture for £50,000); and preferential creditors, £3,773. The net assets were estimated at £13,233, leaving a deficiency of £28,221. Mr. Reginald Armstrong, solicitor to the company, said that Mr. Walton was appointed receiver by the debenture holders on February 21st last and as liquidator on March 2nd by the shareholders. After a number of questions had been asked and answered, it was decided to leave the matter in the hands of the liquidator, with the following as an informal committee of inspection:—Messrs. H. E. Catton (Catton & Co., Ltd., Leeds), Douglas Illingworth (Douglas Elliott & Co., Ltd.), Raymond Hartley (Clayton & Co., Ltd.), J. Blackett (Blackett, Hutton & Co., Ltd), and A. Cripwell (Corfield & Cripwell).

The liquidator pointed out that at the moment there was nothing definitely decided as to whether the business should be carried on or wound up, but in the course of the next fortnight he was seeing some people regarding the future of the company. The latter had several contracts on hand, but it was not yet quite certain that it would complete them. If there was a chance of completing the contracts profitably, it would be done. The following are creditors:—

	£		£
Blackett, Hutton & Co., Ltd.	614	*Iron and Coal Trades Review*	152
Catton & Co., Ltd. ...	208	Iron Trades Employers' Ins.	116
Clayton, Hy., Ltd. ...	333	London Elect. Wire Co. and Smiths, Ltd. ...	140
Clayton, Son & Co., Ltd.	146	Lilleshall Co., Ltd. ...	162
Chloride Electrical Storage Co., Ltd.	759	Leigh & Sullivan, Ltd.	111
Elliott, Douglas & Co., Ltd.	507	Lowrey, Weston and Whalley	131
Electro-Mech. Brake Co., Ltd.	179	Metro-Vick. Elect. Co., Ltd.	546
Engineering, Ltd. ...	114	Rotherham Forge and Rolling Mills Co., Ltd.	176
Geslett, W. D.	995	*Railway Gazette Trans.* (1910), Ltd.	112
Gordon, J., & Co. ...	105	Smith, T. & W., Ltd. ...	109
Hartley, W. Y., & Son	366		
Hanson, B. & S. ...	147		
Helme, Edwd., & Co., Ltd.	525		

Autoveyors, Ltd., wireless contractors, 84, Victoria Street, S.W.1.—A meeting of creditors was held on March 15th at the company's offices. The chair was occupied by Mr. E. W. Dilley, who had been appointed to act as the receiver for the debenture holders, and as the liquidator in the voluntary liquidation. The statement of affairs presented showed ranking liabilities of £18,802, including trade creditors for £9,542. The total claim of the bank was £3,494, but it held direct security of the value of £1,500 and a guarantee for a similar amount from Mr. C. Cook, to whom a charge was given on March 4th, 1924. A second bank was shown as a fully-secured creditor for £495, holding security deposited by Mr. S. H. Martin. The executors of Mr. J. Browne-Martin ranked as the cash creditors in the statement for £4,000, and interest of £156; they were also debenture holders for £2,175. The net assets were £1,318, leaving a deficiency of £17,484, so far as the creditors were concerned. The issued capital of the company consisted of 12,317 cumulative 8 per cent. participating preference shares of £1 each and 35,981 ordinary shares of 1s. each. All the issued shares were fully paid, and, as regarded the shareholders, there was a deficiency of £31,600. The company was formed in October, 1919, with a nominal capital of £100, which was immediately increased to £26,000. The company was formed to deal in motor cars, but later took up wireless. In 1922 Mr. Chapman joined the company, and conducted the wireless department; finally the whole concern was devoted to wireless. By December, 1924, the losses on the trading had increased to £10,530; in two years the company had lost approximately £7,000. About October, 1923, the directors approached the late Mr. Browne-Martin, who advanced £4,000 on the security of a debenture, of which about £2,000 had since been repaid. Since December, 1924, the company had suffered a series of reverses, but the directors had backed the concern by providing guarantees to the bank, and had used every endeavour to obtain money. Mr. P. Houstoun, of the British Traders' Association, remarked that last year a committee of the principal creditors was appointed, and it was then thought that further financial assistance would be forthcoming with a view to the business being continued. In answer to questions, the chairman stated that he had acted as the secretary of the company. In March, 1924, the company owed a substantial amount to various creditors. The largest creditors were then given bills of exchange, and all accounts were paid. The creditors were aware of the position. The representative of Standard Telephones & Cables, Ltd., the largest trade creditors, proposed a resolution that the voluntary liquidation of the company should be continued with Mr. Dilley as liquidator. This was carried, and a committee was appointed consisting of the representatives of Standard Telephones and Cables, Ltd., the Marconiphone Co., Ltd., and Metro-Vick Supplies, Ltd. The following are creditors:—

	£		£
Atkinson & Co., Ltd. ...	41	London Press Exchange, Ltd.	122
British Thomson-Houston Co., Ltd.	297	London Electric Wire Co. & Smiths, Ltd. ...	25
Burndept, Ltd.	28	Linklaters & Paines ...	96
Benjamin Electric, Ltd.	50	London Assurance Co. ...	46
B.S.A. Radio, Ltd. ...	202	Mullard Radio Valve Co., Ltd.	337
Cossor, A. C., Ltd. ...	185	Marconiphone Co., Ltd.	1,159
Carrington Mfg. Co., Ltd.	100	Metro-Vick Supplies, Ltd.	447
Celestion Radio Co. ...	151	Martin & Haslett ...	150
Cahill & Co., Ltd. ...	104	Meawser, Walter (Berlin)	410
Dubilier Condenser Co., Ltd.	41	McMichael, L., & Co., Ltd.	36
Deverell, Gibson and Hoare, Ltd.	338	Marks & Clerk	64
Ever-Ready Co. (Gt. Britain), Ltd.	266	Rothermel Radio Corporation of Great Britain, Ltd.	43
Edison Swan Electric Co., Ltd.	131	Samson-Clark & Co., Ltd.	386
Farthing, J. W.	25	Standard Telephones and Cables, Ltd. ...	1,762
Fine Stampings, Ltd. ...	57	Flack & Millward ...	160
Graham, Alfred, & Co., Ltd.	67	London Telephone Service	30
Gambrell Bros., Ltd. ...	51	Westminster Electric Supply Corporation, Ltd.	40
General Electric Co., Ltd.	216	Cook, Charles	75
Garnett, Whiteley and Co., Ltd.	23		
Hartley & Hartley ...	114		
Harrison & Jarvis ...	32		
H.S. Electric Co., Ltd.	30		
Igranic Electric Co., Ltd.	67		

Deansgate Electro Radio (Manchester), Ltd.—A petition for the winding up of this company has been presented to the County Court of Lancashire by Messrs. M. & A. Wolff, of 9-15, Whitecross Street, E.C., and will be heard in Manchester on March 30th.

Electrical Stores (Nottingham), Ltd.—Particulars of claims by April 16th to the liquidator, Mr. S. H. Hill, 1, St. Peter's Church Walk, Nottingham.

Carpax Co., Ltd.—Meeting of creditors, April 4th at the Onward Hall, Onward Buildings, 207, Deansgate, Manchester. Liquidator, Mr. J. Wilson, 2, St. James's Square, Manchester.

The National Register.

The accounts of the National Register of Electrical Installation Contractors for the past year show an increase of over £350 in the receipts, while the expenditure was slightly lower. The excess of income over expenses thus rose from £319 to £708. The balance sheet shows a satisfactory financial position. The report of the Executive Committee is to be presented at the annual meeting, which is to be held at the Institution of Electrical Engineers on March 28th (2.30 p.m.).

The Czecho-Slovakian Cable Industry.

In a recent article in the *Prager Tagblatt* Herr Emil Kolben, of the well-known Kolben Co., of Prague, stated that raw materials for the electric cable industry were subject to very heavy ship and railway freights and also heavy Customs duties, being almost all obtained outside Czecho-Slovakia. This cause, together with severe internal competition, had driven a number of small cable factories out of business and rendered necessary the creation of a Czecho-Slovakian Insulation Cable Central Sales Organisation, which had been formed under the title of "Isotuba." It was hoped that this organisation would enable the member firms to turn their attention to export business, which had so far been impossible.

New French Companies.

La Société Meridionale d'Energie Electrique is the name of a company which has lately been formed in Paris (4, Rue Sainte Anne) with a capital of 1¼ million francs, to establish electricity supply systems in the Midi and south-west districts of France.

Under the auspices of the French Thomson-Houston Co. a new concern has been formed in Paris with a small nominal capital and the title Société d'Usinage des Tubes pour l'Electricité.

Social Events.

The annual dinner of the Willesden Electricity Department was held at the Social Clubroom, Salusbury Road, on March 12th. The chief engineer (Mr. A. W. Blake) presided, supported by Councillor W. A. Hill (chairman) and other members of the Electricity Committee. An excellent musical programme provided by members of the staff followed the dinner. During the evening Mr. Blake presented a silver challenge cup to a team representing the sub-stations staff who had secured the highest number of points in a series of games competitions between the various departments.

On March 18th the annual dinner of the staff of Messrs. Watson & Sons (Electro-Medical), Ltd., was held at Pagani's Restaurant, W. After an excellent *menu* and the loyal toast Mr. C. H. Watson proposed the health of the chairman (Mr. M. J. Railing), and, in responding, Mr. Railing said that the company had come through the troubles of the past year in a highly satisfactory manner. He warned his audience, however, that the way was not yet clear and there was a need for hard work and a thorough understanding of his job by every individual. A concert followed, given by the "Harrovians," under the leadership of Mr. J. W. Haynes.

The annual staff dinner of Messrs. Ferranti, Ltd., was held on March 18th at the Midland Hotel, Manchester. The chair was occupied by Dr. S. Z. de Ferranti in the absence, through illness, of the chairman of the company, Mr. A. W. Tait. In a speech, Dr. Ferranti emphasised the need for reducing costs of production to enable British manufacturers to compete with the foreigner and so reap the full benefit of the increased demand for electrical products which was anticipated. Mr. Arthur Ellis, in proposing the toast of the company, referred to the large extensions nearing completion at Hollinwood and to Dr. Ferranti's keen interest in every department. He congratulated Dr. Ferranti on the honour about to be conferred on him. Mr. Vincent de Ferranti responded on behalf of the company. Mr. R. W. Cooper, a director of the company, proposed "Our Guests," on whose behalf Mr. W. Chamberlain responded. The toast, "The Chairman," was proposed by Sir B. Longbottom. Dancing and musical items followed.

For Sale.

Rotherham Corporation Electric Supply Department has for disposal 300 second-hand d.c. meters. The City of Bristol Health Department has for disposal a generating set, switchboard, storage battery, &c. Bedford Electricity Department invites offers for a 1,000-kW turbo-alternator set, with condenser, pumps, &c. Belfast Corporation Electricity Department invites offers for one Babcock & Wilcox water-tube boiler. Rushden and District Electric Supply Co., Ltd., has for disposal three surplus generating sets, &c. Wellingborough Electric Supply Co., Ltd., invites offers for surplus steam dynamos, Babcock boilers, chain grate boilers, condensers, &c. Shell-Mex, Ltd., has for disposal surplus generating plant now running at Shell Haven. Yorkshire (West Riding) Electric Tramways Co., Ltd., invites offers for two 320-h.p. Diesel engines, coupled to two Dick, Kerr generators, &c., booster, and travelling crane. (See our advertisement pages to-day.)

Book Notices.

To those concerned with railway electrification, a publication under the above heading, by Mr. R. H. Wright, of the Association of Engineering and Shipbuilding Draughtsmen (price 2s.), should prove of interest. It is a general consideration of the main problems involved in power distribution, transformation, and control for railway electrification. The progress made, both at home and abroad, to the present time is outlined, and the author speculates on the likely developments of the immediate future.

"The Anglo-American Year Book" (pp. 490). The American Chamber of Commerce in London. Price 15s. net.—The latest edition of this directory and guide retains the features which have made it so useful in previous years. Of particular interest is the section including the names, &c., of 7,000 companies engaged in Anglo-American trade.

"Radio for the Million." Vol. 1, No. 2. Pp. 48, illustrated. London: Mullard Wireless Service Co., Ltd. Price 1s.—This quarterly publication includes blue prints and diagrams and other useful information in article form. Copies are obtainable, free of charge, from the Editor, 63, Lincoln's Inn Fields, or by filling in a coupon obtainable from local dealers.

"The *Transactions* of the South African Institute of Electrical Engineers." Vol. XVIII, Part I. January, 1927. Price 2s.—In this issue are given the proceedings of the annual general meeting of the Institute, held at Johannesburg on January 27th this year. The valedictory address of the retiring president, Mr. V. Pickles, took the form of a review of the Rand Power Co.'s experiences from the year 1923 up to May, 1926, when the Witbank generating station was put in commission.

Standard Telephones & Cables, Ltd., has sent us a copy of a brochure produced for the occasion of the visit to the company's Hendon factory of the Prime Minister of New Zealand (Mr. J. G. Coates). This publication illustrates and describes the 5-kW broadcasting apparatus which the company has made for Wellington, N.Z.

"The *Journal* of the South African Institution of Engineers." Vol. XXV, No. 7, February, 1927. Price 2s.

"The North American Company" (pp. 58, ill.). New York: The Company.—This is a handsome brochure describing the growth of the company's subsidiaries since its incorporation in 1890. These companies serve about 900,000 consumers over large areas of the United States, and have a combined capital of about $70,000,000.

The Hart Accumulator Co., Ltd., has produced a "Nearest Garage Guide" for London. This contains the addresses, telephone numbers, &c., of theatres, music halls, hotels, restaurants, public places of interest, &c., in London, and by a system of references indicates the nearest garage and gives particulars of the facilities available thereat.

"Constructive Suggestions." Pp. 38; figs. 28. London: British Thomson-Houston Co., Ltd.—This booklet, No. A.G. 220, contains very full instructions for the home construction of "Resistor" 2, 3, 4, and 5-valve sets and amplifiers, utilising the new B.T.-H. resistance-capacity type B.8 valve. Complete detailed wiring diagrams, panel-drilling dimensions, and lists of components required, are included.

"*Journal* of the Institution of Electrical Engineers." Vol. LXV. March, 1927. London: The Institution. Price 10s. 6d.

"Technologic Papers of the U.S.A. Bureau of Standards." Vol. 21, No. 330. Resistance of conductors of various types and sizes as windings of single-layer coils at 150 to 6,000 kilocycles (5 cents).

"The *Journal* of the Royal Technical College, Glasgow," No. 3, contains articles recording the results of some of the research work carried out by the staff and senior students. Amongst these are some investigations in electrolysis and photoelectricity, combustion, and losses in nozzles. The journal contains 180 pages, and is admirably produced.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.		Price Mar. 22nd.	Fortnight's inc. or dec.
a	Acid, Oxalic	per lb.	5¾d.	...
a	Ammoniac, Sal	per ton.	£60	...
a	Ammonia, Muriate (large crystal)	,,	£52	...
a	Bisulphide of Carbon	,,	...	...
a	Borax	,,	£25	...
a	Copper Sulphate	,,	£25 10s.	...
a	Potash, Chlorate	per lb.	4d. to 4½d.	...
a	,, Perchlorate	,,	5½d.	...
a	Shellac	per cwt.	£13 10s.	...
a	Sulphur, Commercial	,,	£9 10s.	...
a	,, Roll	,,	£9 10s.	...
a	Soda, Chlorate	per lb.	3¼d to 3½d.	...
a	,, Crystals	per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ...	per lb.	4d.	...
	METALS, &c.			
b	Aluminium, Ingots...	per ton.	£107 to £112	...
b	,, Wire	per lb.	1/6 to 2/-	...
b	,, Sheet	,,	1/3 to 2/9	...
p	Babbitt's Metal and Anti-friction Metal—			
	Grade I	per ton net.	£274	...
	Grade II	,, ,,	£190	...
	Grade III...	,, ,,	£98	...
c	Brass (rolled metal 2" to 12" basis)	per lb.	9¾d.	...
c	,, Tubes (solid drawn) ...	,,	11½d. to 11¾d.	...
c	,, Wire, basis	,,	9⅝d.	...
c	Copper Tubes (solid drawn) ...	,,	1/0½	...
c	,, Bars (best selected) ...	per ton.	£86	...
c	,, Sheet	,,	£86	...
c	,, Rod	,,	£86	...
d	,, (Electrolytic) Bars ...	,,	£63 2s. 6d.	...
d	,, ,, Sheets ...	,,	£145 10s.	...
d	,, ,, Wire Rods	,,	£73 2s. 6d.	...
d	,, ,, H.C. Wire	per lb.	9½d.	...
f	Ebonite Rod	,,	2/3 to 2/6	...
f	,, Sheet	,,	2/3 to 2/6	...
n	German Silver Wire	,,	2/2	...
h	Gutta-percha, fine	,,	8/-	...
h	India-rubber, Para fine	,,	1/5½	¾d. dec.
l	Iron Pig (Cleveland No. 3.) ...	per ton.	122/6	...
l	,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g	Lead, English pig	,,	£29 15s.	...
g	Mercury	per bot.	£20 10s.	£2 10s. to £2 15s. inc.
e	Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e	,, ,, medium	,,	4/- to 8/-	...
e	,, ,, large ...	,,	10/ to 20/- & up.	...
p	Phosphor Bronze, plain castings	,,	1/3½	...
p	,, ,, drawn bars & rods	,,	1/3	...
p	,, ,, rolled strip & sheet	,,	1/2¾	...
p	,, ,, wire...	,,	1/3½	...
o	Platinum	per oz.	£23	...
d	Silicium Bronze Wire	per lb.	10¾d.	...
r	Steel, Magnet, in bars	,,	7½d.	...
n	Tin, Block (English)	per ton.	£312 10s. to £313 10s.	£2 10s. inc.
n	,, Wire, Nos. 1 to 16	per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd
g James & Shakespeare.
h Edward Hill & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

In their weekly report, dated March 19th, Messrs. James Forster & Co. stated:—"The lead market will probably continue to sag until a fresh wave of buying by consumers develops, when a sharp recovery from present values should be seen. The Board of Trade returns for February, 1927 (including manufactured lead) were:—Imports, 30,137 tons; exports, 1,660 tons; leaving for home absorption, 28,477 tons."

Lighting and Power Notes.

Bradford.—New Transformer Station.—The Electricity Committee is to provide a district transformer station in the Haworth Road district at a cost of £5,000.

Brighton.—Inquiry.—An inquiry was held at the Town Hall on March 15th and 16th by Col. T. C. Ekin into the application of the Peacehaven Electric Light and Power Co., Ltd., for a Special Order authorising it to supply electricity in the parish of Telscombe and part of the parish of Piddinghoe. The application was opposed by the Newhaven Rural District Council, the East Sussex County Council, and the Peacehaven Ratepayers' Association.

Bromley (Kent).—Transfer of Undertaking.—The Town Council has arranged to purchase the undertaking of the Bromley (Kent) Electric Light and Power Co., Ltd., for £135,000 under the terms of the option without resorting to arbitration. Pending the transfer, the Council has given its approval to extensions of mains at an estimated cost of £5,124.

Bury St. Edmunds.—New Plant.—The borough electrical engineer, Mr. S. E. Day, has submitted a recommendation to the Town Council to increase the plant at the electricity works at an estimated cost of £15,000. The matter has been referred to the Electricity Committee for consideration.

Canada.—Ontario.—A report has been issued by the Ontario Department of Mines giving details of hydro-electric development for the supply of power to the metallic mines of Northern Ontario. The first installation was made in 1905, and the development during the past 20 years has been at the average rate 6,636 h.p. a year. The Northern Canada Power Company has at present a surplus of about 10,000 h.p., but this will shortly be absorbed by extensive mining operations in the Rouyn mining district of Quebec. The twelve power systems of Northern Ontario have an aggregate capacity of 131,170 h.p. The total amount of power now used in mining is 83,000 h.p., of which the gold mines take 46,350 h.p., nickel and copper mines 28,850 h.p., and silver mines 7,800 h.p.

Cleethorpes.—Electricity Supply.—At a recent meeting of the Urban District Council it was reported that the Electricity Commissioners were prepared to sanction the raising of a loan for buildings, cables, &c., in connection with the electricity scheme for the district as soon as the agreement between the Council and Grimsby Corporation had been approved by them.

Continental.—Germany.—The Association of Electricity Works of Berlin has issued a statement showing that the output of the 388 generating stations in Germany in 1925 was 12,000,000,000 kWh, of which 61 per cent. was produced by the 24 largest works, each of which is responsible for over 100 million kWh per annum.

The Waggon und Maschinenbau Gesellschaft, of Corlitz, has recently completed a 22,000/27,000-kW turbine running at 3,000 r.p.m. at a vacuum of 96 per cent. A feature of the machine is the division of the low-pressure portion into four separate compartments within a single casing. The company is at present constructing a high-speed turbine of a capacity of from 30,000 to 33,000 kW with a 95 per cent. vacuum at the exhaust steam outlet.

Italy.—Work has commenced on the construction of a large new hydro-electric station at Cardano, which, it is claimed, will be the largest of its kind in Europe. The plant, which will have an annual output of 500 million kWh, will utilise the water of the River Isarco, which will be conveyed to the station by means of a tunnel 10 miles in length, the available head being about 570 ft. Five sets of 50,000-h.p. turbo-generators are to be installed for the supply of power to the provinces of Lombardy, Veneto and Piemonte, and three sets each of 10,000 h.p. to furnish the power for the electrification of the Bolzano-Brenner railway.

Switzerland.—The municipal central electricity station at Lugano is to be extended by the addition of a new 3,000-h.p. Diesel engine in order to meet the increasing demand for electricity in the district. The contract for the new engine has been placed with Gebruder Sulzer, of Winterthur, who constructed the existing 2,300-h.p. engine at the Lugano station.

Glasgow.—Progress during February.—The Corporation electricity manager states that under the Department's scheme 116 houses were wired in February, making the total to date 3,352. Agreements under the 10 years' hire-purchase scheme numbered 72. The number of applications for the hire of appliances was 296, making the total to date 14,575.

Gravesend.—Proposed Change-over.—The Corporation has applied for consent to change over its system of electricity supply from d.c., 3-wire, 460 and 230 V, to a.c., 3-phase, 50 cycles, 4-wire, 400 and 230 V.

Grimsby.—Extension of Supply.—The borough electrical engineer (Col. W. A. Vignoles) has submitted a report to the Electricity Committee on the provision of an electricity supply to the Cleethornes Council. He recommends the laying of a cable from Ribly Street sub-station to Park Street, and one from the power station to Car Lane. These would be joined by two similar cables to be laid by the Cleethorpes Council in its area. A sub-station at Old Clee is also proposed, the estimated cost of the whole scheme being £10,200.

Hawarden.—Electricity Extensions.—The Rural District Council has under consideration a scheme for extending its area of electricity supply so as to include Ewloe, Aston Broughton, Bretton, Penyffordd, and Sealand, at an estimated cost of £28,675, and application is to be made for sanction to a loan for this purpose.

Hull.—Electricity Supply.—The Corporation has received inquiries from Withernsea and Hornsea regarding an electricity supply for these areas, and has replied suggesting that the authorities should communicate with the Central Electricity Board, asking if it would be prepared to sanction the necessary transmission line.

India.—Salsette (Bombay).—The electrification of Salsette, which was first proposed in 1916, has now been approved by the Government of Bombay. According to *Indian Engineering* arrangements have been completed with the Andhra Valley Power Supply Co., Ltd., to purchase electricity in bulk at Dharavi receiving station, whence it will be conveyed by a h.p. underground cable to Bandra for distribution and thence to Santa Cruz *via* Khar in the first instance. The area of supply granted under the licence includes, in addition to the above centres, the townships of Ville Parle, Juhu, Varsova, Andheri, the Military Cantonment of Wakola, Kurla, Ghatkopar, Vikhroli, and the whole of the island of Trombay. Energy will probably be available at Bandra, Khar and as far north as Santa Cruz before the conclusion of the current year. The work of construction is to begin before next monsoon.

Japan.—Electrical Development.—Work on the construction of a steam power station at Tsurumi by the Tokyo Electric Light Co. will commence shortly. The station will have a capacity of 70,000 kW, and the cost is estimated at 15,000,000 yen.

The Imperial Government Railways are erecting a power station at Shinano-gawa, at a total estimated cost of 79,210,000 yen, of which 62,600,000 yen will be for the station building and plant, 11,100,000 yen for transmission line, and 5,400,000 yen for sub-station building and plant. The first section of the scheme is to be completed in 1932, and the second section in 1935.

Llanfairfechan.—Electricity Scheme.—The Urban District Council has adopted an electricity scheme prepared by Mr. Price F. White, of Bangor. It is proposed that a bulk supply of electricity shall be obtained from the North Wales Power Co. The total cost of the scheme is estimated at £11,700.

London.—Shoreditch.—The Electricity Committee has decided to extend mains at a cost of £9,534, to lay services to consumers' premises at a cost of £3,600, and purchase prepayment meters at a cost of £4,600.

Islington.—The Electricity Committee has received sanction to the borrowing of £22,000 for mains, services, transformers, and meters.

Lowestoft.—Loans.—The Electricity Committee has recommended to the Town Council that application be made for sanction to loans totalling £20,800 made up as follows:—Mains, £3,000; meters, £2,000; services, £5,000; feeder cables, £10,800.

Middlesbrough.—Electricity Scheme Rejected.—The Electricity Commissioners have rejected the Corporation's application for sanction to erect a power station instead of purchasing a supply from a power company. The Corporation asked for sanction to borrow £141,346. According to the *Manchester Guardian*, the Commissioners state that they are not satisfied that the Corporation would be in the position to give a supply of electricity adequate in quantity and regularity to meet the present and prospective demands of its consumers at a cost not greater than that at which it could give a supply if it obtained a supply of electricity from the Cleveland and Durham County Electric Power Co., and express the opinion that the price of the bulk supply should be fixed at £2 7s. per kW per annum, and 0.3d. per kWh, on conditions set out in a letter, for a reasonable term of years with provision for quinquennial revision, and ask the Corporation to endeavour to agree with the Power Company the appropriate terms and conditions under which the arrangement is to be made. If the parties are unable to agree upon the terms they will fall to be settled by the Commissioners.

Northern Ireland.—Warrenpoint (Co. Down).—The Urban District Council is inviting tenders for the electric lighting of the town.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Hastings.—The increase of 12½ per cent., made owing to the coal strike, has been removed.

Isle of Wight.—*Isle of Wight Electric Light and Power Co., Ltd.*—The temporary increase of ½d. per kWh is withdrawn.

Slaithwaite.—Loan Sanctioned.—The Urban District Council has received sanction to the borrowing of £6,250 for mains and services, and £1,000 for meters.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The Bourton-on-the-Water Electric Light and Power Co., Ltd., authorising it to supply electricity in the

parish of Bourton; the Leicestershire and Warwickshire Electric Power Co., for the supply of electricity in the rural district of Castle Donington, and parts of the rural districts of Ashby-de-la-Zouch, Loughborough, and Shardlow; the King's Lynn Corporation, to extend its area of electricity supply so as to include certain parishes in the rural districts of Freebridge Lynn and King's Lynn; and the Northampton Electric Light and Power Co., Ltd., to supply in the boroughs of Brackley and Buckingham, the rural districts of Crick, Middleton, Cheney, Brackley, Buckingham, and Winslow, and certain parishes in the rural districts of Daventry, Brixworth, Oxenden, Towcester, and Ampthill.

Tarvin.—Electricity Supply.—The Electricity Commissioners have decided to grant the application of the Chester Corporation to supply electricity in the district and not to proceed further with the application by the Gwynedd Trust.

United States.—Electrical Development.—A large hydro-electric scheme on the Saluda River, ten miles west of Columbia, South Carolina, has been undertaken by the General Gas & Electric Corporation, involving an initial expenditure of $20,000,000. The annual output of the plant is expected to exceed 300,000,000 kWh.—*Reuter's Trade Service* (New York).

According to the *Electrical World*, the Standard Gas & Electric Co. is to carry out developments during 1927 at a cost of $61,500,000. The programme includes the extension of the Colfax steam generating station from 190,000 kW to 270,000 kW, and the erection of a hydro-electric power station on the Rouge River, which will have an initial capacity of 15,000 kW and an ultimate capacity of 45,000 kW. This station is expected to be in operation by October next.

The West Virginia Power & Transmission Co. has applied for a licence for the erection of a power station on the Cheat River and tributaries in West Virginia and Pennsylvania. A number of dams are to be constructed, and the scheme provides for the development of 238,000 h.p.

Wellington (Somerset).—Electricity Supply.—The Rural District Council has decided to give its consent to an application by Dr. J. A. Purves, on behalf of the Dulverton Electric Light Co., Ltd., for a Special Order to supply electricity within the Council's area. The supply will be by means of overhead cables.

West Cornwall.—Electricity Scheme.—Plans prepared by the West Cornwall Electric Supply Co., in connection with works in areas for which it is applying for a Special Order were laid before the West Penwith Rural District Council at Penzance on March 10th. It was intimated that the maximum charge which the company proposed to make was 1s. per kWh for a specified minimum number of units. Some objection was raised to the powers proposed to be conferred under the Order for the erection of overhead cables, and it was mentioned that Hayle Urban District Council had also objected to the use of overhead cables on the ground of their unsightliness. The whole matter was referred to a committee.

Whitby.—Correction.—We are informed that reductions in the electricity charges announced in our last issue are incorrect, the following scale is now in operation:—Lighting: 7d. per kWh. Heating and domestic rate: 1½d. per kWh. Power: First 500 kWh, 3d. per kWh; remainder, 2d. per kWh.

York.—Loan Sanctioned.—The Electricity Committee has received sanction to the borrowing of £3,000 for the purchase of transformers.

Tramway and Railway Notes.

Bradford.—Fares.—Following the rejection by the Tramways Committee of a scheme to raise 1½d. tramway fares to 2d. and to reduce long-distance fares to a maximum of 3d., the Committee has now introduced for consideration by the City Council another scheme, involving the increase of the 1d. fares to 1½d., 1½d. fares to 2d., the maximum fare to be reduced to 2d., with the issue of weekly passes at 2s. and 2s. 6d. The city treasurer states that, based on the number of passengers carried last year, the proposed revision would yield a net increase of £10,000 in receipts. At a subsequent meeting of the Corporation a compromise was agreed upon. The penny stages are retained (though some may be shortened), the 1½d. fares will be increased to 2d., and 2d. will be the maximum fare. The longest route is 6½ miles, the present fare for which is 6d. Weekly passes will also be issued.

Burnley.—Transport Finance.—At a meeting of the Town Council on March 16th, the chairman of the Finance Committee expressed dissatisfaction with the position of the transport services. They showed a loss on certain routes, which was serious, and must have a crippling effect. Instead of the surplus on the Tramways and Omnibuses Department for the current year being £18,553, it would only reach £12,027. While giving every latitude to omnibuses as a new venture, the Committee would, if the loss continued, have to consider cutting down services.

Continental.—Germany.—The Ruhr Settlement Union has allocated a sum of 2,000 marks for the formation of an investigation company for the construction of high-speed railways. The question concerns a type of railway somewhat similar to the Langen suspended system which is in use at Elberfeld, although the speed is put at a possible rate of 150 m.p.h.

Dearne Valley.—Tramcars *v.* 'Buses.—According to the *Electric Railway and Tramway Journal*, notices were recently exhibited announcing a fresh scale of fares on the Dearne District Light Railway. Drastic reductions have been made. The fare from Barnsley to Thurnscoe has been reduced from 10d. to 3d. Similar concessions have been made throughout the system, and passengers will be able to travel the whole length of the route, which is about 10 miles, for 3d. The fare from Wombwell to Barnsley has been reduced from 5d. to 2d. The immediate result was the swamping of the cars by passengers anxious to avail themselves of the cheap rate of travel, but the initial enthusiasm of the people for the tramways has now been countered by the Barnsley and District Traction Co., Ltd., reducing its 'bus fares to similar figures.

Gravesend.—Inquiry.—An inquiry was held by the Ministry of Transport on March 15th into the application of the Gravesend and Northfleet Electric Tramways, Ltd., for an Order authorising it to abandon its tramway and to substitute omnibuses or other passenger-carrying vehicles. For the company it was stated that 'bus competition had materially affected receipts, and in 1926 the company's income was £20,000, against which working expenditure of £20,332 had to be met. The tramway track was worn, and the cost of reconstruction was estimated at £165,000, a figure which the company was unable to face. It was not proposed to remove the track, but that at the end of a certain period the material should vest in the Road Authority. The value of the track would compensate the local authority for taking up the lines. For the Northfleet Council it was proposed that after notice of abandonment had been given by the company, it should pay to the Road Authority such sum as might be agreed to cover the cost of taking up the track and reconstructing the road. In any case the company should remove the poles and wires. The Town Clerk said that the Gravesend Corporation was of the same opinion as Northfleet, and he also suggested that the Corporation should be compensated for loss of profit in respect of its electricity undertaking, which supplied power for the tramway undertaking. The Ministry will give its decision in due course.

Irish Free State.—Dublin.—The Dublin United Tramways Co. is taking over the disused Dublin-Lucan tramway line, and is to reconstruct it at an approximate cost of £80,000. The track will be laid above the road surface. The company will also provide an electricity supply for the whole district from Dublin to Lucan.

Japan.—Underground Railway.—It is reported that Messrs. N. Kaneko and G. Takikawa propose to form the Kobe Underground Railway Co., Ltd., with a capital of 20,000,000 yen, for the construction of an underground railway from Sumiyoshi to Suma and from Wakinohama to Suma, both lines passing through Kobe, the total length being 18 miles. The estimated cost of the scheme is 60,000,000 yen.

Railway Electrification.—The Matsuzaka railway between Matsuzaka-machi and Oishi-mura, Miye-ken, a distance of 12 miles, is being electrified at a cost of 300,000 yen.

New Tramway.—An application for permission to construct an electric tramway between Koriyama and Yumoto-machi, Fukushima-ken, has received official sanction. The line will be 23 miles in length, and the cost is estimated at 2,145,500 yen.

Worcester.—Purchase of Tramways.—The City Council has adopted a recommendation of the Traffic Committee to purchase the privately-owned tramways in the city at a cost of £75,000. It is proposed to remove the tramway track and enter into an agreement with the Midland Red Omnibus Co for a 'bus service in the district.

Telegraph and Telephone Notes.

Canada.—Edmonton Automatic Telephone Exchange.—A new automatic telephone exchange has recently been brought into use at Edmonton, Canada, to serve the south district. It was manufactured and installed by Siemens Bros. & Co., Ltd., Woolwich, and is the No. 16 system with an initial equipment of 2,300 lines and ultimate capacity for 5,500. It supersedes an old 3-wire system with push-button ringing, and is the first portion of the scheme in hand to provide Edmonton with a modern fully-automatic system of 100,000 lines.

Hungary.—Long-distance Telephone Communication.—The laying of a direct telephone cable joining Budapest with Vienna, Frankfort, Munich, and other German towns is

nearly finished. The development of the Hungarian telephone system is making great progress, and in about three years all towns and many villages in Hungary will be connected by telephone.—*Reuter's Trade Service* (Budapest).

Japan.—Storm Damage.—The recent earthquake damage is officially regarded as surprisingly low. A snowstorm interrupted communication throughout the country on March 13th and 14th and put out of commission in Tokyo alone 13,000 telephones, and a public outcry will probably result, says the *Financial Times*, as there is complaint of the inadequacy and inefficiency of the system. The Bonin cable was also broken, and cable communication between London and places in Japan beyond Nagasaki was interrupted recently. Both the Great Northern Telegraph Co.'s and the Great Eastern Telegraph Co., Ltd., services were affected.

Long-distance Radio Communication.—New Zealand-South Africa.—Soon after dawn on March 18th New Zealand and South Africa were in direct communication for the first time, when a speaker at the Shag Valley station conversed by Morse signals for over an hour with an operator at Caledon, in the Orange Free State Province. Communication was fairly easy, although little power was used at the New Zealand end. New Zealand amateurs have been trying for years to get into touch with South Africa, but hitherto without success.—*Reuter* (Wellington).

Pacific Cable Board.—Reconstitution.—A Bill introduced in the House of Commons provides that the Pacific Cable Board is in future to consist of seven members—two representatives of the United Kingdom, two of Canada, two of Australia, and one of New Zealand, with a chairman appointed by the Board and agreed on by the Governments, who may or may not be one of the members. The chairman is to receive a salary of £1,000 a year, plus travelling expenses (or more, if the Governments so agree) unless he holds an office of profit under the Crown, and every other member of the Board not holding such office of profit will be paid £300 a year. The Bill consolidates the Pacific Cable Acts of 1901 and 1924, and provides for the disposal of receipts and surpluses and for the application of the reserve fund. It empowers the Board, subject to the approval of the partner Governments, to undertake as agent for and at the expense of the Governments of any parts of his Majesty's Dominions any work in connection with telegraph communication, whether by means of cables or wireless telegraphy, within the sphere of its operations or within the Caribbean area.

Siam.—New Radio Station.—The German Telefunken Co. has obtained the contract for the new wireless station at Bangkok. The three stations which have existed for a number of years have not been capable of transmitting messages effectively to Europe, and it was decided to have a station for short-wave, duplex, high-speed working between Siam and Europe. Tenders were obtained from the leading companies: the Marconi Company quoted £66,153 for the "beam" system and £29,163 for a system of omni-directional communication; the prices, however, were not inclusive. The Compagnie Générale de T.S.F. wanted 213,785 gold dollars, plus 20,000 ticals, plus Customs duty and landing charges; the Telefunken Co. quoted £25,000, which included everything, and secured the contract.—*Reuter* (Bangkok).

Spain.—Madrid-Argentina Wireless Service.—In the course of a Cabinet Council on March 16th a Bill was considered authorising a private company to install a short-wave wireless station to connect Madrid directly with the Argentine. Three conditions, however, are attached to the authorisation: (1) That the service must not be exclusively between these two countries; (2) the company must not have a monopoly; and (3) it must not receive State aid. The Bill will now be handed to the Minister of the Interior for examination by technical experts.—*Reuter* (Madrid).

The Telephone Service.—New Anglo-French Cable.—The rapid development of long-distance telephony has necessitated the provision of new routes of communication, and facilities for trans-continental telephone traffic were increased by the laying on March 16th of a new cable in the English Channel. It is of the paper-insulated lead-covered type, and has the advantage of low electrostatic capacity and leakance, which are characteristics very favourable for efficient speech transmission. The cable is 23½ nautical miles in length, is about 2.6 in. in overall diameter, and weighs 623 tons; it was laid in one length (obviating the necessity of making a joint at sea) between Sandgate, on the English side, and Audresselles, on the French coast. This is the third cable of its kind to be laid by Messrs. Siemens Bros. & Co., Ltd., the previous ones carried out by the company being the Anglo-Dutch cable of 1924, and the Anglo-Belgian cable laid last year.

Year's Progress.—Post Office statistics show that during 1926 119,092 new telephones were installed in Great Britain and Northern Ireland, bringing the total number in use up to 1,477,000. Of the new installations, 41,596 were in private residences, bringing this total to 291,700; the share of the provincial exchanges in this number was 181,530. There were 21,493 call boxes in use at the end of the year; street kiosks with telephones numbered 2,716; of the total number of call boxes, the provinces had 16,807 and London 4,686. The number of new rural exchanges opened was 196, bringing the total to 991. Party-line stations in rural areas numbered 9,958, the year's increase being 204; rural railway stations "on the 'phone" numbered 721, of which 47 were added during the year. During 1926 there were 73,00,000 more calls than in 1925, the grand total of calls for 1926 having been 1,072 million.

West Indian Islands.—Telegraphy.—The report of the Pacific Cable Board for the year ended March 31st, 1926, on the working of the submarine cables and wireless telegraph stations in the West Indian Islands and British Guiana shows that the excess of receipts over expenditure was £6,010, the latter amounting to £39,173. A sum of £21,309 was paid to the National Debt Commissioners during the year in respect of interest on, and repayment of, advances by way of capital for laying and equipping the system; £6,010 (surplus receipts) was available towards meeting this annuity, and the deficiency to be made good by the contributing Governments will therefore be £15,299 for the year under review. Prior to the establishment of the Government system, a subsidy amounting to £26,300 was paid annually to the West India and Panama Telegraph Co., which lapsed in September, 1924, and it is gratifying to the Board that the operations for the first complete year have resulted, even after the payment for amortisation of capital, in the deficiency falling short by £11,000 of the subsidy previously paid. During the year under review no interruptions occurred to the cables and none of the wireless stations was out of commission. The local organisation work was carried out by Mr. W. E. Rockingham (one of the Board's superintendents attached to the Pacific cable system), assisted by Mr. R. G. McLachlan and four other officers who were transferred to the West Indies temporarily, but Mr. R. G. McLachlan has since been permanently appointed to the West Indian system; the work presented many real difficulties. The news service, which is supplied free to the West Indies by the Board, has been improved, and there has been a substantial growth in the traffic since the Board's service commenced.

Radio Notes.

Australia.—New Station.—3DB Broadcasting Co. Pty., Ltd., has been registered at Melbourne, with a capital of £20,000 in £1 shares, for the purpose of opening a "B"-class broadcasting station, to operate from Capitol House, Melbourne, and Amalgamated Wireless (Australasia), Ltd., is equipping a transmitting room on the roof. Two lattice steel towers, 45 ft. high, will be erected on the roof to carry the aerials. The initial power output will be 500 watts and the wave-length 255 metres. Revenue will be derived from advertising, no fees from listeners being allotted to "B"-class stations.

Austria.—Visitors' Fees.—Foreign visitors to Austria whose stay does not exceed three months, and who have with them receiving sets, are not required to pay the usual licence fee of 2s. per month, but a special fee of only 1s. per month. An application form can be secured at any post office, and, on entry into the country, foreigners must deposit a given sum for customs purposes to cover the set, which is reimbursed on leaving the country.

Holland.—Short-Wave Telephony.—Twice within the past few days has telephone communication been established between Holland and the Dutch East Indies. This achievement, it is claimed, constitutes a world's record for long-distance wireless telephony. A musical concert given in Eindhoven was clearly heard by a Bandoeng wireless amateur, and a telegram was received from Dr. de Groot, the head of the Dutch East Indian telephone and telegraph service, declaring that reception on the 30.92-metre wave was excellent, two speeches having been quite distinctly heard at the Government wireless receiving station in Java. As there is at present no wireless telephone transmitting apparatus in Java, the acknowledgments were by ordinary cable, or wireless-telegraphy. The transmitting installation was constructed by Dr. Balthasar van der Pol, the head of the wireless investigation department of Messrs. Philips, of Eindhoven, and Mr. Numans, and was designed for experimental purposes, the Philips' Company having been granted a special licence for this object. The regulation of the frequency is by a vibrating quartz crystal; a valve amplifier and water-cooled Philips transmitting valves are used, and the antenna consists of a single wire attached to a pole only 22 ft. from the ground. An attempt is shortly to be made to secure similar contact with the West Indies.—*Reuter* (Amsterdam).

Sweden.—New High-Power Station.—The new station in Motala, in the centre of Sweden, is expected to begin test transmission towards the end of March, having a power of not less than 30 kW; it is of the same type as Daventry, says *World Radio*, and when opened the Karlsborg station will revert to its real purpose as a wireless-telegraph station, its broadcasting wave (1,305 metres) being taken over by Motala.

Licences.—The number of licence-holders has increased to about 260,000, thus placing Sweden next to England with regard to the percentage of licensees to the population.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—May 10th. Postmaster-General's Department. Telephone relays. (B.X. 3333.)*

May 17. Resistances and reactances. (B.X. 3307.)*

May 23rd. State Electricity Commission. Switchgear and accessories. (B.X. 3285.)*

May 9th. 6,600-V transformers and spares. (B.X. 3331.)*

Sydney.—May 9th. Electricity Department. Station auxiliary switchgear. (B.X. 3338.)*

Beckenham.—April 4th. Electricity Department. Three e.h.p. transformer sub-station switchboards. (March 18th.)

Bristol.—April 11th. Electricity Department. 39 miles (approx.) 3-core, paper-insulated cable. (March 18th.)

Colombia. — Bogota. — April 30th. Ministry of Public Works. Two electric lifts. (A.X. 4433.)*

Edinburgh.—April 18th. Electricity Supply Department. De-aerating plant and boiler feed pumps. (See this issue.)

Grimsby.—April 2nd. Electricity Department. Deansgate balancer set, switchgear and cablework. (See this issue.)

India.—April 5th. India Store Department. 27,000 yd. paper-insulated armoured cable for telephones. (See this issue.)

Kilmarnock.—April 6th. Ayrshire Electricity Board. Two water-tube boilers, with superheaters, economisers, air heaters, mechanical stokers, and coal-handling plant. (March 18th.)

Liverpool.—March 31st. City Engineer's Department. Tramway rails and fishplates, fish bolts, tie bars, and copper bonds. City Engineer, Municipal Buildings, Dale Street.

London.—Holborn.—April 13th. Board of Guardians. Electric lighting installation at the London Road, Mitcham, schools. (March 18th.)

London County Council.—March 29th. Electric lighting installation for Sudbourne Road elementary school, Brixton, S.W. (approx. 136 points). (March 18th.)

Middlesbrough.—April 8th. Electricity Department. 12 months' supply of cables and meters. (See this issue.)

New Zealand. — Wellington.—May 31st. Public Works Department. 50-kVA transformers for the Waikaremoana electric power scheme. (B.X. 3294.)* 50-kVA transformer for Arapuni scheme. (B.X. 3293.)*

June 7th. Railway sub-station equipment, Lake Coleridge electric power scheme. (B.X. 3295.)*

May 4th. General Post Office, Stores Division. Sub-station protectors. (B.X. 3286.)*

June 13th. New Zealand Railways. Machine tools, workshop equipment and overhead electric travelling cranes. (A.X. 4344.)*

June 6th. Six electric locomotives. (A.X. 4355.)* Overhead equipment for the Christchurch-Lyttelton electrification scheme. (B.X. 3301.)*

Plympton St. Mary.—March 31st. Urban District Council. H.p. cables, underground and overhead mains, h.p. and l.p. switchgear, transformers and transformer kiosks. (March 11th.)

Rumania.—Bukarest.—April 2nd. 600,000 porcelain insulators. (B.X. 3314.)*

Southend-on-Sea.—April 9th. Light Railways and Electricity Department. Remote-controlled rotary convertors. (March 11th.) April 19th. 4,000 joint boxes. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Burton-on-Trent.—Electricity Committee. Accepted:—
Switchgear (£189), transformer (£237).—English Electric Co., Ltd.

Cranbrook.—Board of Guardians. Accepted:—
Installing electric lighting at the Institution (£144).—Strange & Sons.

Dewsbury.—Town Council. Accepted:—
Installing electric light at 54 houses on the Ravens Lodge site (£344) and wiring 64 houses on the Thornhill site (£432).—W. Angus.

Glasgow.—Electricity Committee. Recommended:—
Six 1,500-kVA transformers (£6,300).—Metropolitan-Vickers Electrical Co., Ltd. Nine 1,500-kVA transformers (£9,450).—British Electric Transformer Co., Ltd.
Sixteen 400-kVA transformers (£5,691).—Four each from Johnson & Phillips, Ltd., British Electric Transformer Co., Ltd., Ferranti, Ltd., and Metropolitan-Vickers Electrical Co., Ltd.
Four 200-kVA transformers (£890).—British Electric Transformer Co., Ltd.; two ditto (£445).—Metropolitan-Vickers Electrical Co., Ltd.

Tramways Committee. Recommended:—
Cab-tire sheathed cable.—Macintosh Cable Co., Ltd.
Trolley wire.—Thos. Bolton & Sons, Ltd.; and R. Johnson & Nephew, Ltd.
Battery for battery truck.—Hendry Bros.

Government Contracts.—The following contracts were placed by various Government Departments during February, 1927:—

Admiralty Contract and Purchase Department.
Motor alternators.—Newton Bros. (Derby), Ltd.; Mackie and Co., Ltd.
Oil-driven alternators.—W. H. Allen, Sons & Co., Ltd.
Aluminium ingots.—British Aluminium Co., Ltd.
Repairs to armature.—English Electric Co., Ltd.
Batteries and spare parts.—Chloride Electrical Storage Co., Ltd.
Battery spares.—D.P. Battery Co., Ltd.
Electric bells, &c.—Walters Electrical Mfg. Co., Ltd.; W. McGeoch & Co., Ltd.; A. Graham & Co., Ltd.; Engineering and Lighting Co., Ltd.; Bonella Bros.
Electric cables.—Enfield Cable Works, Ltd.; General Electric Co., Ltd.; Anchor Cable Co., Ltd.; Edison Swan Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph & I.R. Works, Ltd.; Johnson & Phillips, Ltd.; Macintosh Cable Co., Ltd.; Siemens Bros. & Co., Ltd.; St. Helens Cable and Rubber Co., Ltd.; Greenwich Cable Works, Ltd.; Standard Telephones & Cables, Ltd.
Clips for electric cables.—Freckleton & Co.; Hawkers, Ltd.; R. & F. Keates; E. Showell & Sons, Ltd.
H.p. air compressor.—P. Brotherhood, Ltd.
Electric overhead travelling crane.—Herbert Morris, Ltd.
Electric table fans.—General Electric Co., Ltd.
Motor-generators.—Newton Bros. (Derby), Ltd.
Feed-water heaters.—G. & J. Weir, Ltd.
Electric light installations.—G. E. Taylor & Co.; Johnson and Phillips, Ltd.
Lampholders.—W. McGeoch & Co., Ltd.; General Electric Co., Ltd.; Rainsford & Lynes; Edison Swan Electric Co., Ltd.
Projector lamps and parts.—Sperry Gyroscope Co., Ltd.
Lanterns, &c.—W. McGeoch & Co., Ltd.; London Electric Firm; Engineering and Lighting Equipment Co., Ltd.; Hawkers, Ltd.
Note magnifiers and tuners.—Radio Instruments, Ltd.
Stoneware troughing and tiles.—Doulton & Co., Ltd.
Switches, &c.—W. McGeoch & Co.; Bertram Thomas; Edison Swan Electric Co., Ltd.; Player & Mitchell; Edwards Bros., Ltd.; Gabriel & Co.; Park Royal Engineering Co., Ltd.; Hawkers, Ltd.; D. H. Bonnella & Son; Tok Switches, Ltd.
Telephone receivers.—S. G. Brown, Ltd.
Aerial wire.—Connollys (Blackley), Ltd.
Copper wire.—W. T. Henley's Telegraph Works Co., Ltd.; St. Helens Cable & Rubber Co., Ltd.; Ward & Goldstone, Ltd.; General Electric Co., Ltd.

War Office.

Air compressor.—Broom & Wade, Ltd.
90 c/m searchlight lamps.—Park Royal Engineering Co., Ltd.

Air Ministry.

Accumulators.—Peto & Radford, Ltd.
Direction-finding receiver.—Marconi's Wireless Telegraph Co., Ltd.
Generators.—W. Mackie & Co., Ltd.; Newton Bros. (Derby), Ltd.
Magnetos and spares.—British Thomson-Houston Co., Ltd.
Receivers.—H. W. Sullivan, Ltd.
Valves.—General Electric Co., Ltd.

Post Office.

Telegraph apparatus.—Creed & Co., Ltd.
Telephone apparatus.—Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Sterling Telephone and Electric Co., Ltd.
Testing and protective apparatus.—Evershed & Vignoles, Ltd.; Phœnix Telephone & Electric Works, Ltd.; Power Equipment Co., Ltd.
Battery stores.—C. A. Vandervell & Co., Ltd.
Cable (various).—British Insulated Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Standard Telephones & Cables, Ltd.; Union Cable Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Loading coils.—General Electric Co., Ltd.; Siemens Bros. and Co., Ltd.
Cords for telephones.—British Insulated Cables, Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.
Wallboards.—Venesta, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; Elliotts Metal Co., Ltd.; Richard Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).
Electric lighting installation at Langham new telephone exchange.—Electric Power Installation Co., Ltd.
Telephone exchange equipment.—Carpet Manufacturing Co., Ltd. (Kidderminster); Borough of Hove Town Council; Newcastle-on-Tyne Corporation; Middlesbrough Co-operative Society, Ltd.: Relay Automatic Telephone Co., Ltd. Midland Bank, Ltd. (Poultry, E.C.): General Electric Co., Ltd. Sub-contractors: W. Jones & Co. for ringing machines. Kensington: General Electric Co., Ltd. Sub-contractors: Newton Bros. (Derby), Ltd., for charging machines; Crompton and Co. for ringing machines; D.P. Battery Co., Ltd., for batteries. Epsom: Automatic Telephone Manufacturing Co., Ltd. Beckenham (Kent): Siemens Bros. and Co., Ltd. Sub-contractors: English Electric Co., Ltd., for charging machines; Crompton & Co. for ringing machines; Hart Accumulator Co., Ltd., for batteries. Fleet (Hants.) and East Grinstead: Siemens Bros. & Co., Ltd. Riverside (Hammersmith), Finchley, East, and Clissold: Standard Telephones & Cables, Ltd.
Telephone repeater-station power plant.—Halesworth, Suffolk: Newton Bros. (Derby), Ltd. Sub-contractors: Hart Accumulator Co., Ltd., for batteries; Ruston & Hornsby, Ltd., for engines. Taunton: Newton Bros. (Derby), Ltd. Sub-contractors: Premier Accumulator Co. (1921), Ltd., for batteries; Ruston and Hornsby, Ltd., for engines.

Crown Agents for the Colonies.

Cable.—Shropshire Iron Co., Ltd.
Carbons.—Kolok Mfg. Co., Ltd.
Casing and tubing.—British Mannesman Tube Co., Ltd.
Fuse.—Bickford, Smith & Co., Ltd.
Telephone and telegraph materials.—Siemens Bros. & Co., Ltd.; Ericsson Telephones, Ltd.; Standard Telephones and Cables, Ltd.
Train lighting materials.—J. Stone & Co., Ltd.
Turbine spares.—Brush Electrical Engineering Co., Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.

Hamilton.—Town Council. Accepted:—
Electric lighting installation at Udston Hospital extensions (£183).—W. Y. McAdam.

London.—Hammersmith.—Electricity Committee. Recommended:—
500 yd. h.p. cable (£194).—Standard Telephones & Cables, Ltd.
Work in connection with the construction of the 36-in. and 40-in. discharge pipes (£3,014).—T. Muirhead and Co., Ltd.

Admiralty.—
Resistance rods.—Edison Swan Electric Co., Ltd.

Metropolitan Water Board.—Recommended:—
Nine mechanical stokers (£2,215).—James Hodgkinson (Salford), Ltd.
Coal-handling plant and bunkers (£1,786).—Hepburn Conveyor Co., Ltd.

Camberwell.—Finance Committee. Recommended:—
Maintenance of electric lighting, heating and power installations at Town Hall and public buildings for the year.—Commercial Telephone and Electrical Co., Ltd.

Islington.—*Correction.*—The name of one of the contractors for the supply of electric lamps for 12 months recorded on page 437 of the March 18th issue is Nelson Electric Co., Ltd., of Merton Park, S.W. (not Milton Electrical Co., Ltd.).

Battersea.—Electricity Committee. Recommended:—
Cable (annual contracts).—Callender's Cable & Construction Co., Ltd.
Electricity meters.—Chamberlain & Hookham, Ltd., and Ferranti, Ltd.
Bitumen.—Dussek Bitumen Co., Ltd.
Transformers at premises of Messrs. Garton & Co., Ltd. (£419), and for Latchmere Road sub-station (£267).—British Electric Transformer Co., Ltd.

Manchester.—According to the *Manchester Daily Dispatch*, a £4,000 contract for a generator and other electrical equipment has been placed by the Corporation Electricity Committee with a Belgian firm, and a question as to why it was not given to a British company will be asked at the next meeting of the City Council. The lowest offer by the British tenderers, which included some in Manchester, competing for the offer, was over £1,000 higher than that quoted by the Belgian concern.

South Africa.—Cape Town.—Electricity Committee. Accepted:—
775 yd. cable (manufactured by Deutsche Kabelwerke A.G.) (£303).—A. Vaux, Ltd.
Four 40-kVA transformers (£263).—Metropolitan-Vickers Electrical Co., Ltd.

Johannesburg.—Union Tender Board.
Dry cells and battery material for the Posts and Telegraphs Department.—British General Electric Co., Ltd., Siemens Bros. & Co., Ltd., and the South African General Electric Co., Ltd.
—*S.A. Mining and Engineering Journal.*

Spalding.—Urban District Council. Accepted:—
38 pumps and electric motors for the new sewage scheme (£7,516).—Pulsometer Engineering Co., Ltd.

Swinton and Pendlebury.—Urban Council. Accepted:—
750-kVA transformer for the Bridge Street sub-station (£568).—Ferranti, Ltd.

Tain.—Accepted:—
Installing electric lighting at the new church hall.—A. Cameron.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Sure Grip shade holders.
Wilson ice cream freezer.

Forthcoming Events.

Physical Society.—Friday, March 25th. Imperial College of Science, S.W. 5 p.m. Ordinary meeting.

Birmingham Electric Club.—Friday, March 25th. Grand Hotel. 7 p.m. "Electricity Supply in the Midland Area." Mr. S. T. Allen.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, March 25th. Newcastle-on-Tyne. 6 p.m. "Pure Science." Sir Richard Glazebrook, F.R.S.

Royal Institution.—Saturday, March 26th. 3 p.m. "Alpha Rays and Atomic Structure." Sir Ernest Rutherford, F.R.S.

Electrical Power Engineers' Association (Northern Division).—Saturday, March 26th. Midland Hotel, Manchester. 5.30 for 6 p.m. Annual dinner.

(Southern Division).—Friday, April 1st. Institution of Electrical Engineers, London. 7 p.m. "Principles of Operation and Modern Application of Automatic Voltage Regulators." Mr. H. E. Angold.

Electrical Supply Commercial Association (Greater London Division).—Saturday, March 26th. Poland Rehearsal Rooms. 7.45 p.m. Dance.

Nottingham Society of Engineers.—Monday, March 28th. Victoria Station Hotel. 7.30 p.m. "Ten Minutes' Papers."

Royal Society of Arts.—Monday, March 28th. 8 p.m. Cantor Lecture. "Some Industrial Applications of Electrothermics." Mr. G. I. Finch.

Institutions of Civil, Mechanical, Electrical, Municipal and County, and Locomotive Engineers (Yorkshire Sections).—Joint delegation. Wednesday, March 30th. Mappin Hall, Sheffield. 7 p.m. "Railways or Roads."

Institution of Production Engineers.—Wednesday, March 30th. 83, Pall Mall, S.W. 7.30 p.m. "The Development of Rustless and Allied Steels." Dr. W. H. Hatfield.

Faraday Society.—Wednesday, March 30th. Burlington House, Piccadilly, W. 3 p.m. Second Experimental Report to the Atmospheric Corrosion Research Committee. Dr. W. H. J. Vernon.

Institution of Electrical Engineers.—Thursday, March 31st. London. 6 p.m. "The Applications of Electricity in Warships." Mr. W. McClelland.

(North-Eastern Centre).—Monday, March 28th. Literary and Philosophical Society, Newcastle-on-Tyne. 7 p.m. "The Number of Tests Required to Establish the Rupturing Capacity of an Oil Circuit Breaker." Messrs. W. B. Whitney, C. E. R. Bruce, and E. B. Wedmore.

(South-Midland Centre).—Wednesday, March 30th. University, Birmingham. 7 p.m. "The Stability of Large Power Systems." Mr. F. H. Clough.

Edinburgh Electrical Society.—Thursday, March 31st. Royal Scottish Society of Art. 8 p.m. "Manufacture of Conduits." Mr. C. H. Walker.

Institution of Mechanical Engineers.—Informal Meeting.—Friday, April 1st. London. 7 p.m. "British Empire and Overseas Trade." Major A. W. Farrer.

Notes.

Retford Electricity Undertaking.

On March 21st the Mayor of Retford, Coun. J. W. Iremonger, officially inaugurated the new electricity undertaking at Retford, which was described in our last issue. At the ceremony, Alderman W. N. Brackett, J.P., chairman of the Electricity Committee, pointed out that the Corporation had been allowed to erect a power station apart from the super stations which were being erected all over the country. A unique feature of the undertaking was the installation of a waste-heat boiler for generation purposes. At a celebration luncheon which followed the opening, Viscount Galway, in proposing the "Retford Electricity Undertaking," said that he hoped the new electricity scheme would bring further prosperity to the town. Mr. A. Hugh Seabrook, consulting engineer for the scheme, supported the toast and said that the new power station was the first where, by harnessing the gas works to the undertaking, the waste heat was turned into electricity for the use of the town. With regard to the elaborate foundation work, it was the first occasion that the particular process had been used, except in collieries and abroad. Even if the town were in the future obliged to take a supply in bulk from one of the great power stations nothing would be wasted. Ald. Brackett, in reply, said that the subject of electricity was first raised in Retford in 1904, and the first clause of a petition presented to the Town Council against the proposal read: "That the electric light is not the light of the future, and is in no way likely to supersede gas either as an illuminant or for heating purposes." The present Order was granted in 1924, and in 1925 the Corporation decided to go on with the scheme. Sanction had been obtained for loans amounting to £51,000, but probably the cost of the undertaking was now in the neighbourhood of £40,000. Ald. Williamson gave the toast of "The Contractors," and Mr. H. N. Bickerton, of the National Gas Engine Co., replied.

In the article on Retford's electricity supply in our last issue we referred to one of the air compressors as being driven by a G.E.C. motor. We are informed by the main contractors for the generating plant, the Electric Construction Co., Ltd., that this is incorrect, and should read "driven by an E.C.C. motor."

Late Legal.

British Thomson-Houston Co., Ltd., *v.* Metropolitan-Vickers Electrical Co., Ltd.

Lords Dunedin, Sumner and Blanesburgh this week continued the hearing in the House of Lords of the appeal: the British Thomson-Houston Co., Ltd., *v.* the Metropolitan-Vickers Electrical Co., Ltd. The question in dispute is whether the Letters Patent of 1912 granted to Emanuel Rosenberg (of which the respondents are legal owners) is valid. Both Mr. Justice P. O. Lawrence and the Court of Appeal found infringement by the appellants, but while the former held the patent to be invalid, the latter declared it to be valid, and the question of validity was therefore taken to the House of Lords. The patent, which, the appellants maintain, is invalid, as being anticipated by the Tesla specification of 1891, is for an invention of improvements relating to synchronous dynamo-electric machines. Their Lordships reserved judgment.

The Electricity of Dust Clouds.

A paper on the above subject submitted at a recent meeting of the Physical Society of London by Mr. G. B. Deodhar, M.Sc., Physics Department, University of Allahabad (India), was taken as read in the absence of the author. Observations on the electrification of various dusts have been made by using a large volume of air at a high speed. In some cases the sign of electrification observed agrees with that found by Rudge. It appears that the electricity developed is of a frictional nature; quantitative estimates show that chlorides of sodium and potassium are equally effective, but sodium nitrate is about 4½ times as efficacious as potassium nitrate. It is shown graphically that, other things being the same, the number of volts developed by blowing increases very rapidly as the size grows less. Dr. P. E. Shaw has recently sent a paper bearing on this topic to the Society. The effects, however, which he obtained are due to the impact of only two like bodies, and in this way the condition of the impacting surfaces can be ascertained and varied at will.

Boiler Explosion Report.

We have received a copy of the report on a preliminary inquiry into the cause of the explosion of a water-tube boiler at the power station of the Merthyr Electric Traction & Lighting Co., Ltd., Merthyr Tydfil, Glamorganshire, in November last, when one of the tubes ruptured for a length of about 12 in. The explosion was caused by the overheating of the tube due to an insufficient quantity of water in the boiler. It is not clear how the explosion could have occurred. Although water showed in the gauge glass, the low-water alarm was blowing 15 mins. before the explosion. The attendant, who blew the gauge glass through and found no water, appears to have been slow in taking the necessary action. It seems probable that when the fire was first lighted the water level was already dangerously low.

Courses for Teachers in Technical Schools.

The Board of Education is making arrangements for short courses to be held in the summer for teachers in recognised technical schools, &c., in England and Wales, including Engineering Science and Electrical Engineering, at Oxford. Teachers who desire to attend any of these courses must make application to the Board of Education as soon as possible, and in any case before April 13th, 1927.

National Coal Resources Survey.

In pursuance of the physical and chemical survey of the national coal resources, which is one of the main aspects of the fuel research work of the Department of Scientific and Industrial Research, a committee has been appointed to deal with the survey of the coalfields of Durham and Northumberland. Committees are already at work in five other areas.

Electrical Association for Women.

At the invitation of the General Electric Co., Ltd., over 80 London members of the above Association visited the Ideal Home Exhibition, Olympia, on March 16th, and they were particularly interested in many of the company's exhibits.

The last of the series of evening lectures, which will be held on April 6th, is to take the form of an informal social evening. A short lecture will be given on women's place in the American electrical industry, after which there will be a discussion on the possibilities of trained women playing a greater part in the domestic electrical development of this country.

The inaugural meeting of the South Wales and Monmouthshire Branch of the Association was to be held at the City Hall, Cardiff, on March 24th, when the Viscountess Rhondda, J.P., was to be appointed as the first president of the branch, and Mrs. Tyler the hon. secretary.

Appointments Vacant.

Chief engineer (£312) for the Greenwich and Deptford Institution and Hospital. Sub-station attendant (79s.) for the Stoke Newington Borough Electricity Department. Engineer for the Red Hill Hospital, Edgware (£5). Draughtsmen and technical officer for illumination work for the Royal Aircraft Establishment. Shift charge engineer for the Crewe Corporation electricity works. Electrical assistants in the Chief Engineer's Department (97s. 3d.) for the L.C.C. (See our advertisement pages to-day.)

Electric Vehicle Parade.

On Saturday afternoon, March 26th, the Commercial Motor Users' Association will hold its annual parade of commercially-driven vehicles in Lincoln's Inn Fields, London. On this occasion there will be a very representative display of electric road vehicles, various types and sizes; about 25 entries have been received. A silver plaque and certain prizes are being awarded in this class by the Electric Vehicle Committee of Great Britain. The judges will be Col. R. E. Crompton, Mr. A. E. McKenzie, and Mr. A. C. Cramb.

Electric vehicles have been entered in the parade by the following firms, amongst others:—Brown & Polson, Ltd.; Carlyle Laundry; Carter, Paterson & Co., Ltd.; Chloride Electrical Storage Co., Ltd.; Hackney Borough Council; Hovis, Ltd.; Liberty & Co., Ltd.; London Wholesale Dairies, Ltd.; Meux's Brewery Co., Ltd.; Savoy Hotel, Ltd.; Watney, Coombe & Reid, Ltd.; and the Willesden Urban District Council.

Research and the Metal Industries.

An exhibition which has been opened to the public at the Science Museum, South Kensington, affords some indication of the assistance given to British metal industries by the research and auxiliary services of an industrial research organisation, the British Non-Ferrous Metals Research Association, which, with the co-operation of the industry through membership of the Association, carries on research work and maintains a highly organised information service. The exhibition is concerned chiefly with eight of the Association's researches, chosen from among 18 major investigations at present in progress. Those selected are typical of the character and wide range of the work which is being done, and the exhibits have been set out to give some idea of the scope of each piece of work and the progress which has so far been made. They include the effect of impurities on the properties of copper, gases in copper castings, the jointing of metals, die casting alloys, and "wiped" plumbers' joints.

A Conference on Dimensions of Nuts and Bolt Heads.

An important conference of makers of bolts and nuts, as well as the engineers who use them, is being convened by the Screw Threads Committee of the British Engineering Standards Association, and will take place in London on Wednesday, March 30th. The object is to discuss the question of the width and thickness of nuts and bolt heads from the standpoint of the practicability of a reduction on the standard sizes ordinarily used.

The Continental countries which have adopted the Whitworth screw thread as one of their standards have been using nuts which are smaller than the British Standard Whitworth, and as the question of arriving at a uniform standard is engaging their attention as well as that of the United States of America, and the B.E.S.A., as the national standardising body in Great Britain, has been invited to participate, the Screw Threads Committee has felt it desirable to make itself acquainted with the wishes of both makers and users concerned. Invitations to send delegates to the conference have been sent to a large number of institutions, trade associations, etc., and any who may be interested in the matter are invited to communicate with the Secretary of the British Engineering Standards Association, 28, Victoria Street, Westminster, S.W.1.

Fatality.

Fred. Green, employed at Sherdley collieries, St. Helens, on March 17th received a fatal electric shock whilst attending to the h.p. switchgear which controls the main shaft pump.

The Electro-Deposition of Rubber.

Writing to *Nature* of March 12th, Mr. S. E. Sheppard states that although rubber is a non-conductor, the deposit of latex rubber particles, with or without other filling material, forms a spongy gel which is still permeated by the intermicellar liquid, which, of course, is an electrolytic conductor. Consequently the electro-deposited rubber is not actually an insulator, but is perfectly analogous to a porous diaphragm electrolytically connected with a metallic anode. Such limitations as exist with regard to the thickness of coating depend mainly on other conditions, therefore, than the formation of an insulating layer.

The subject was referred to on p. 155 of our issue of January 7th, 1927.

B.E.S.A. Publication.

The British Engineering Standards Association has recently issued a new B.S.S. No. 142, 1927, for electrical protective relays. This forms one of a series of specifications for electrical instruments which is about to be issued. The relays dealt with are classified according to the functions they perform, and to the constructional principles involved. Relay contacts are also classified according to their function and mode of operation. The specification proper deals with the limits of current-, voltage-, and time-setting; the rating of the contacts; consumption of the relays; limits of error; and insulation and voltage tests, &c. The specification should prove of great interest to power-station engineers and other users of protective relays, as although it is concise it deals with the specification and performance of relays in a very comprehensive manner. Copies of this new specification may be obtained from the B.E.S.A., Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d., post free.

Manchester Steam Users' Association.

The annual report of the Committee of Management of the Manchester Steam Users' Association shows that for the year ended December 31st, 1926, the revenue of the Association was £41,533, and that after meeting all expenses there was a surplus of £3,627. The total number of examinations of boilers made during the year was 26,045. The fact that the Association has again been able to repeat that during the whole of its existence, 72 years, no preventable explosion has occurred on any boiler which has borne the Association's guarantee and certificate of safety is claimed as a tribute to the thoroughness with which the work of inspection is carried on. During the period under review reports were received of 55 preliminary inquiries held by the Board of Trade under the Boiler Explosions Acts of 1882 and 1890. The membership at the end of the year was 1,717.

I.E.E. Students' Dinner.

The 20th annual dinner of the London Students' Section of the Institution of Electrical Engineers was held at the Imperial Hotel, Russell Square, London, on March 18th, when Mr. E. H. Harwood, chairman, presided. In proposing "The Institution of Electrical Engineers," Mr. S. H. Hart, hon. secretary, thanked the Council for the help which the Section had received from it, particularly with regard to the Students' Continental tour last year.

Dr. W. H. Eccles, in reply, commented on the affection which was shown in all sections of the Institution. The body was making itself felt in all walks of life. The strength brought about by the unanimity of the members was due to the diversity in the representation of all the branches of the industry.

Mr. R. Paul, the Council's representative, in proposing "The Students' Section," impressed upon the Students the necessity of stimulating the imagination. The Council was pleased at the increasing tendency of the Students to take part in the discussions at the meetings. There were now 6,300 Students in the Institution ranks. He congratulated the Section on the high quality of the papers presented at its meetings.

Mr. E. H. Harwood replied, and said that the outstanding feature of the past year's work of the Section was the joint meetings which had been held with the Civil and Mechanical Institutions. It was a good sign that the visits of the Section were always full.

Mr. R. A. Brockbank, vice-chairman, in proposing "Our Guests," heartily welcomed the visitors present, of whom Dr. Eccles was the guest of the evening.

In a breezy reply, Capt. P. P. Eckersley, chief engineer of the British Broadcasting Corporation, pointed out the necessity for the technical and commercial sides of the profession to see each other's points of view. In commenting on the work of the B.B.C., he said that the one thing which would keep British broadcasting to the front was good engineering. He extended an invitation to any of the members to visit the B.B.C. studios and see what was being done.

E.P.E.A. Dinner.

The seventh annual dinner of the London Western Section of the Electrical Power Engineers' Association was held at St. Ermin's Hotel, Westminster, on Saturday last, Mr. W. E. Rogers, chairman of the Section, presiding.

After the loyal toast, Mr. A. C. Stewart, junior vice-president, proposed "The Association." He compared the position of the electricity supply engineer before the advent of the E.P.E.A. with that of to-day, and enumerated some of the advantages that the Association had brought about for its members. The evil of the premium pupil had been greatly reduced, although it still existed to some extent. He warned the members of the danger of becoming slack as a result of the success of the Association, and declared that a properly organised electricity supply industry was now impossible without such a protective body as theirs.

In reply, Mr. A. W. Crompton, president, said that the prestige of the Association had in no way suffered as a result of the history of the past two years. There were now over 4,000 members. The privilege which they had during the general strike of maintaining to some extent law and order gave them the right to criticise the industrial position. A fact that was not fully realised was that, whatever was forthcoming from the Electricity (Supply) Act, the job rested with the technical engineer. If the chemical industry could cover the displacement of its employés, then the electricity industry should also be able to.

In proposing "Our Section and Our Chairman," Mr. E. G. Hildebrand paid a tribute to Mr. Rogers, who replied in a suitable manner.

During the evening musical items were rendered by a number of artistes.

Extensions at Basingstoke.

An interesting ceremony took place recently at the Basingstoke electricity works, when the new extensions to the generating plant were started up. The new equipment includes a 600-h.p. Diesel oil engine, by Messrs. Mirrlees Bickerton and Day, Ltd., directly coupled to a 410-kW generator manufactured by the General Electric Co., Ltd. The engine is of the 6-cylinder totally-enclosed type and runs at 250 r.p.m. The cylinder bore is 17¼ in., and the stroke 20 in. The new plant brings the total capacity of the station up to 1,530 kW. The maximum load recorded to date is 916 kW.

Newton's Bicentenary.

Last week-end the 200th anniversary of the death of Sir Isaac Newton was celebrated by a meeting of scientific and mathematical men at Grantham, his birthplace. Dr. Jeans, secretary of the Royal Society, presided at a meeting at the King's School, where Newton was taught, and declared that he was the greatest man of science that the human race had ever seen. Sir J. J. Thomson delivered an address dealing mainly with Newton's optical work, and Sir Frank Dyson lectured on his work in astronomy, which alone had placed him above all other scientific investigators. Other speakers dealt with Newton's mathematical achievements.

Institution Notes.

Institution of Electrical Engineers.

North-Midland Centre.—The following nominations have been made by the Committee for vacancies arising September 30th, 1927:—Chairman, Mr. J. Edwin Storr; vice-chairmen, Messrs. F. S. G. Hinings and C. Nelson Hefford; hon. secretary, Mr. H. Cecil Fraser; committee (five vacancies), Messrs. H. G. Fraser, W. P. Bramwell, P. Maxwell, R. M. Longman, W. F. Mylan, and L. H. Roberts.

Summer Meeting.—The summer meeting of the Institution will be held at the North-Eastern Centre, in and around Newcastle-on-Tyne, from June 14th to 17th.

Western Centre.—Home lighting was the subject of a lecture delivered by Mr. R. B. Mitchell, of Glasgow, to the members of the Institution at the University College of the South-West, Exeter, on March 14th. He stated that there were eight million unwired houses in Great Britain; if each required on an average nine lights (taking £10 as the average cost of wiring), an expenditure of 80 million pounds on installation work alone would be involved, leaving out of account altogether the extra plant which would be required at the power stations. Notwithstanding the fact that between 60 and 70 per cent. of the homes of Great Britain were within the areas of electricity supply undertakings, data showed that only about 14 or 15 per cent. of them were wired.

South-Midland Wireless Sub-Section.—The fourth meeting of the Wireless Sub-Section of the Institution of Electrical Engineers (South-Midland Centre) was held at Birmingham on March 16th, when Mr. C. Robinson, B.A., lectured on the "Characteristics of Audio-frequency Amplifiers used in Telephonic Repeaters." The lecture was preceded by a visit to the Birmingham Post Office telephone repeater station in Hill Street, where members spent an interesting time inspecting various sections of the plant. Tea was partaken of at Birmingham University, where the meetings are held.

Institution of Chemical Engineers.

Examinations for the Associate Membership of the Institution will be held in June and July next. Particulars can be obtained from the hon. registrar, Mr. C. S. Garland, Abbey House, Westminster, S.W. (See our advertisement pages to-day.)

Our Personal Column.

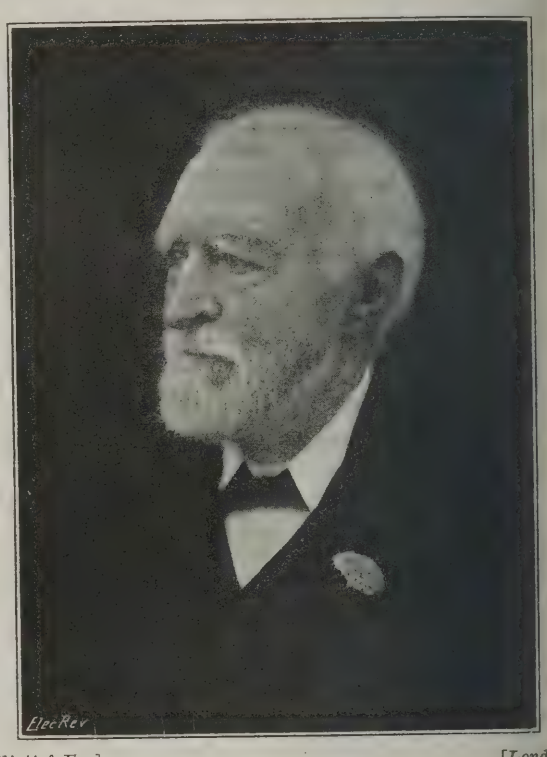
Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Reference was made to the illness of Mr. James Taylor at the meetings on Monday last of the British Insulated Cables, Ltd., and the Midland Electric Corporation for Power Distribution, Ltd., of both of which companies he is chairman. Sir Arthur Stanley, who presided in his place at the former company's meeting, stated that Mr. Taylor underwent a serious operation in November, and was now in the south of France. Mr. Sinclair, who acted as chairman at the Midland Electric meeting, said that Mr. Taylor was expected back in this country in a few weeks. The hope expressed by both speakers that he will shortly be able to resume his active interest in the affairs of the businesses with which he has so long been connected will be shared by a large number of Mr. Taylor's friends in the electrical industry.

Mr. L. A. Horsfall, of Ing Lees, Marsden, has resigned his position as manager of Messrs. E. Brook, Ltd.'s, Leicester office, and has taken over the sole representation in the Midlands of the B.E.N. Patents, Ltd., 96-98, Victoria Street, S.W.1.

After 26 years' service with the Manchester Corporation Tramways Department, Mr. F. E. Handy, electrician, and latterly general sheds foreman, retired last week. Mr. Handy has seen service with the Vancouver and New Westminster Tramways and the Hamilton and Barnsville Railway Company, and was foreman of the Stoke-on-Trent Tramways from 1898 to 1901.

The Electrical Review sends its greetings and hearty congratulations in advance to Mr. George Offor, of Peak Hill, Sydenham, who, on Wednesday next, March 30th, reaches the great age of 100 years. In the days of his youth—some twenty years ago—Mr. Offor was a frequent and much esteemed contributor to our pages, and he was able to climb over difficult stone staircases with a spirit and energy which filled many a younger man with envy. We reproduce the accompanying photograph from our Jubilee Issue of November 17th, 1922, where, on p. 704, a brief account of Mr. Offor's electrical record was given. He has as full a knowledge of anybody of early electric lighting legislation and finance in this country, counting among his other offices that of membership of Lord Thurlow's Committee appointed to consider the amendment of the Electric Lighting Act of 1882. When Mr. Offor reached his eightieth birthday electrical friends gave a dinner in his honour. Since then electricity supply has



Elliott & Fry] [*London*

Mr. George Offor,
who celebrates his 100th birthday on March 30th.

made wonderful strides, and we wish the centenarian of the electrical industry years of happiness and health in which to witness the acceleration of the pace of progress which is now being recorded.

Mr. W. Preston, M.P. for Walsall (who, as our readers know, is prominently associated with the electrical industries) was given an enthusiastic welcome home by hundreds of his constituents at Walsall Town Hall on Monday last week. Mr. Hurst, chairman of the local Unionist Association, presided, and referred to the illness of Mr. Preston while he was in South Africa. Mr. Preston, he said, went to South Africa not only for his health, but also to try and improve the trade of the town. Mr. Preston said that if manufacturers would get into personal touch with our own people in the Colonies they would have a reception they little dreamt of, as the Colonies were out to do big business with English manufacturers.

Bedford Corporation Electricity Committee recommends the appointment of Mr. N. Fleming, now assistant, as station superintendent, at a salary of £520 per annum, and the promotion of Mr. A. Wilson, charge engineer, to assistant station superintendent, at a salary of £360 per annum.

The marriage took place recently at Grimsby of Mr. H. director of Pye & Co., Ltd., wireless manufacturers, Cambridge, and Miss Jennie Milson.

Mr. Henry Rowe, of Messrs. H. Rowe & Co., electrical engineers and importers, of Melbourne, Australia, is expected in London early in May, and he asks that firms requiring representation in Australia will communicate with him at The Electrical Review.

The appointment of Mr. John Reeve Brooke as secretary to the Central Electricity Board is announced. For the past two years Mr. Brooke has been secretary of the Ministry of Transport. The offices of the Board are to be at No. 1, Charing Cross, S.W.1.

The Associated Municipal Electrical Engineers has drawn the attention of the Battersea Electricity Committee to the fact that the electrical engineer (Mr. F. A. Bond) is not being paid in accordance with the agreed scale. The Committee accordingly recommends that Mr. Bond's salary should be raised from the present figure of £1,300 to £1,349.

Obituary.—Sir John Turney.—The death occurred on [arch 17th of Sir John Turney, of Nottingham. Sir John, ·ho was 88 years of age, was chairman and managing director ? a prominent industrial concern in the city. His connec·on with municipal affairs dates back to the year 1873, when e entered the Nottingham Town Council, and he was the first ıairman of the Electricity Committee.

Mr. E. F. Carson.—In the same issue our contemporary ·corded the death of Mr. Edwin F. Carson, labour agent for lessrs. Balfour, Beatty & Co., on their Lochaber water-power ·heme. Mr. Carson was motor-cycling home from Fort ;illiam when he ran into a man. He was thrown from his ;achine and sustained a fractured skull.

Mr. J. Thomson.—*The Times* reports the death of Mr. John homson, sole partner in the firm of Provand & Cairns, elec·ical engineers, Glasgow, as a result of a motor accident. He as driving the car at night and instead of running upon a ·idge over the River Strae, swerved to the side, and the car ıshed down a steep bank into the river.

Mr. M. J. L. Calli.—The death has taken place, at the age of 58 years, of Mr. M. J. L. Calli, who for upwards of 30 years had been on the staff at the electrical works of Messrs. Newton, of Taunton.

Mr. A. A. Dudley.—The death took place recently at the age of 57 years of Mr. A. A. Dudley, who had held the position of engineering superintendent of the Wolverhampton District Electric Tramways, Ltd., and for 37 years had been connected with the system in the South Staffordshire area.

Mr. W. J. Copsey.—The death is announced at the age of 50 years of Mr. William James Copsey, who was formerly assistant engineer at Grantham for the Urban Electric Supply Co. Latterly he had been with Messrs. Harrison & Co., electrical engineers, Newark-on-Trent.

Wills.—Sir A. S. Haslam, of the Haslam Foundry and Engineering Co., left (according to the *Financial Times*) estate valued at £1,640,000.

The late Sir Wilfrid Stokes left £55,467 gross and £35,186 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Northern Radio and Electrical Factors, Ltd.—Private mpany. Registered March 10th. Capital, £2,000 in £1 ares (1,000 7½ per cent. cumulative participating preference d 1,000 ordinary). Objects: To carry on the business of ·ctrical, mechanical and general engineers and contractors, anufacturers and factors of and dealers in electrical or her apparatus, radio instruments, wireless apparatus, &c. ıe directors are:—Mrs. E. Tempest, 22, Oak Lane, Manning·m, Bradford; G. W. Tempest, 22, Oak Lane, Manningham, ·adford, electrical engineer. Qualification, £1. Solicitors: W. Butterfield & Co., 12, Devonshire Street, Keighley.

Wand & Mitchell, Ltd.—Private company. Registered ırch 14th. Capital, £500 in £1 shares. Objects: To carry the business of dealers in wireless in all its applications, ·ctrical outfitters, dealers in electrical appliances, motor rriers, dealers in motor cars and accessories, &c. The first ·ectors are:—S. Wand, 369, Bury New Road, Higher oughton, Manchester; H. Michaelson, 239, Waterloo Road, ghtown, Manchester (both permanent, subject to each hold· five shares). Registered office: 239, Waterloo Road, High·wn, Manchester.

East Suffolk Electricity Distribution Co., Ltd.—Regis·ed as a public company on March 17th, with a nominal pital of £50,000 in 30,000 preferred ordinary shares of £1 ch and 40,000 deferred ordinary shares of 10s. each. The ofits available for distribution in any year are to be applied, st, in paying a cumulative dividend at 7 per cent. per num on the original preferred ordinary shares, secondly, paying a further dividend not exceeding 3 per cent. for ch year on the same shares, and, *pari passu*, with such ·ther dividend in payment of a sum of like amount by y of dividend for such year on the deferred ordinary shares, d, thirdly, in payment of any balance of such profits to · holders of the deferred ordinary shares. The objects · to carry on the business of an electric light and power mpany in all its branches. The subscribers (each with e share) are:—W. Mitchell, 24, Twyford Road, Ilford, sex, clerk; A. J. Clark, 114, Barrington Road, N.8, icitor's clerk; and five other clerks. The directors are to mber not less than three nor more than seven. The easury is to be represented by one director. The Power velopment Co., Ltd., may appoint two directors. Except aforesaid, the directors are to be appointed by the scribers. Qualification (except Treasury director, alternate ectors and managing director (if any), who require none), 50 shares. Solicitors: Ashurst, Morris, Crisp & Co., 17, rogmorton Avenue, E.C.

Wireless Piano Players, Ltd.—Private company. Regis·ed March 16th. Capital, £6,600 in 6,000 8 per cent. cumu·ive participating preferred shares of £1 each and 6,000 erred shares of 2s. each. Objects:—To acquire, perfect, d commercially exploit an invention or process for the ·ctro-magnetic reproduction of wireless reception by the no and other similar instruments, &c. The subscribers :—L. E. Read, 93, Fairfax Road, Hornsey, N.8, solicitor's clerk; R. J. Mole, 28, Avenue Road, Kingston-on-Thames, Surrey, solicitor's clerk. The first directors are to be appointed by the subscribers. Qualification, £100 shares or stock. Solicitors: Denton, Hall & Burgin, 3, Gray's Inn Place, W.C.1. Registered office: 17, Victoria Street, S.W.1.

Junit Manufacturing Co., Ltd.—Private company. Registered March 16th. Capital, £2,000 in £1 shares. Objects: To acquire the business now carried on at 2, Ravenscourt Square, Hammersmith, as the "Rexo Engineering Co."; to adopt an agreement with H. T. Logan, and to carry on the business of mechanical, electrical, radio and general engineers, founders, smiths, machinists, tool makers, metal and wood workers, &c. The subscribers (each with one share) are:—L. J. R. King, Glen Cottage, Upper Warlingham, Surrey, incorporated accountant; J. T. Chalk, "Fairview," Upton Road, Bexley Heath, Kent, engineer. L. J. R. King signs documents as director. Qualification, £1. Solicitors: Godfrey Warr & Co., 85, Gracechurch Street, E.C.3. Registered office: Napier House, 24-7, High Holborn, W.C.1.

Official Returns of Electrical Companies.

Farndons Electric, Ltd.—P. H. Stone, of 47, Temple Row, Birmingham, ceased to act as receiver or manager on March 7th, 1927.

Electric Fans, Ltd.—Debenture dated February 25th, 1927, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder:—S. J. Flatau and B. Freedman, both of 6, Conduit Street, W.1.

East India Tramways Co., Ltd.—Capital, £125,000 in 15,000 preferred, 35,000 ordinary, and 75,000 deferred shares of £1 each. Return dated December 8th, 1926. 7,476 preference, 33,433 ordinary, and 75,000 deferred shares taken up. £7,489 paid on 7,476 preference and 7 ordinary shares, and including £6 paid on 24 preference shares forfeited. £108,426 considered as paid on 33,426 ordinary and 75,000 deferred shares. Mortgages and charges, nil.

Edward Deane & Beal, Ltd.—Capital, £60,000 in 20,000 preference and 40,000 ordinary shares of £1 each. Return dated December 30th, 1926. 20,000 preference and 20,009 ordinary shares taken up. £9 paid. £40,000 considered as paid. Mortgages and charges, £6,250.

D. Hulett & Co., Ltd.—Capital, £5,000 in £1 shares. Return dated November 11th, 1926. 4,420 shares taken up. £320 paid. £4,100 considered as paid. Mortgages and charges, nil.

Hall Telephone Accessories, Ltd.—Capital, £30,000 in £1 shares. Return dated December 16th, 1926. All shares taken up. £6,501 paid (being £1 per share on 2 and 10s. per share on 12,998 shares). £17,000 considered as paid on 17 000 shares. Mortgages and charges at date of return, nil. Since registered: Debenture dated January 6th, 1927, to secure £25,000.

Harry Morser & Co. (Wireless), Ltd.—H. E. F. Connolly, of 12, Nutley Lane, Reigate, was appointed receiver on March 3rd, 1927, under powers contained in debenture dated November 30th, 1925.

Pickvance, Ltd.—Capital, £5,000 in 2,000 preference and 3,000 ordinary shares of £1 each. Return dated January 3rd, 1927. 600 preference and 1,002 ordinary shares taken up. £650 paid on 450 preference and 200 ordinary shares. £952 considered as paid on the remainder. Mortgages and charges, £1,650.

Peacehaven Electric Light and Power Co., Ltd.—Capital, £20,000 in 15,000 preference shares of £1 each and 20,000 ordinary shares of 5s. each. Return dated November 8th, 1926. 14,038 preference and 16,052 ordinary shares taken up. £17,909 18s. 1d. paid, leaving £141 1s. 11d. in arrears. Mortgages and charges, nil.

Davis Electrical Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926. 677 shares taken up. £377 paid. £300 considered as paid. Mortgages and charges, nil.

Brookhirst Switchgear, Ltd.—Capital, £550,000 in £1 shares. Return dated December 27th, 1926. 126,002 shares taken up. £30,502 paid. £95,500 considered as paid. Mortgages and charges, £25,000.

Western Telegraph Co., Ltd.—Capital, £3,500,000 in £10 shares. Return dated December 9th, 1926. 311,895 shares taken up. £2,339,650 paid. £779,300 considered as paid. Mortgages and charges, £818,675.

Venezuela Telephone and Electrical Appliances Co., Ltd.—Capital, £280,000 in 140,000 ordinary and 140,000 preference shares of £1 each. Return dated December 21st, 1926. 103,091 ordinary and 103,091 preference shares taken up. £149,676 paid on 46,585 ordinary and 103,091 preference shares. £56,596 considered as paid on the remainder. Mortgages and charges, £140,300.

Bullers, Ltd.—Capital, £400,000 in 20,000 ordinary and 20,000 preference shares of £1 each. Return dated December 31st, 1926. 15,593 ordinary and 15,000 preference shares taken up. £150,070 paid on 7 ordinary and 15,000 preference shares. £155,860 considered as paid on 15,586 ordinary shares. Mortgages and charges, £217,800.

Southern Electric Free Wiring Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 29th, 1926. 1,510 shares taken up. £1,510 paid. Mortgages and charges, nil.

Delagoa Bay Development Corporation, Ltd.—Capital, £166,300 in 267,400 ordinary shares of 10s. each and 130,400 preference shares of 5s. each. Return dated December 7th, 1926. 267,400 ordinary and 68,400 preference shares taken up. £105,800 paid on 177,400 ordinary and 68,400 preference shares. £45,000 considered as paid on 90,000 ordinary shares. Mortgages and charges, £231,100.

Davies, Kent & Stewart, Ltd.—Capital, £3,500 in 2,500 preference and 1,000 ordinary shares of £1 each. Return dated December 28th, 1926. 1,974 preference and 1,000 ordinary shares taken up. £2,974 considered as paid. Mortgages and charges, £1,050.

W. G. Cannon & Sons, Ltd.—Capital, £3,000 in £1 shares. Return dated December 31st, 1926. All shares taken up. £9 paid. £2,991 considered as paid. Mortgages and charges, nil.

British Brown, Boveri, Ltd.—Capital, £50,000 in £5 shares. Return dated November 25th, 1926. All shares taken up. £21,250 paid (being £2 10s. per share on 8,500 shares). £7,500 considered as paid (being £5 per share on 1,500 shares). Mortgages and charges, nil.

Implitico, Ltd.—Capital, £3,000 in £1 shares. Return dated December 20th, 1926. All shares taken up. £3,000 paid. Mortgages and charges, nil.

City Notes.

Marconi's Wireless Telegraph Co., Ltd.

As mentioned in our last issue, the annual meeting took place on March 13th. Senatore Marconi presided, and there was a very large attendance of shareholders. The proceedings, which lasted about five and a-half hours, were at times interrupted, but in the end the report was adopted, and the proposals of the board for reducing the capital by £1,625,019, were also carried. The chairman devoted the greater portion of his speech to the technical progress which the company was making. Discussing the "beam" system, he said that it had distinct advantages over the old system, and, moreover, many of those advantages were not possessed by any other method of long distance-communication. The capital expenditure was lower; the stations could be operated with a comparatively small amount of power; the speed of working was limited only by the mechanical limitations of the sending and receiving instruments; the stations could be used for wireless telephony; each circuit could be efficiently utilised for the simultaneous transmission and reception of telephonic as well as telegraphic messages without any mutual interference between the services; and it could be used for *facsimile* transmission and, probably, also for television. The Canadian service, he stated, was handed over to the Post Office for official tests in October of last year and had since been opened to the public and had been working well for four months. The Australian service had been under test by the company during recent weeks, and the previous day the Secretary of the General Post Office had stated that the Australian station had satisfied the conditions of the contract. They had also received a telegram from the Australian company to the effect that during the seven-day tests the average estimated capacity of the service was over 140,000 words per day each way, representing over three times the existing total cable traffic between this country and Australia. Referring to the present position of the company, he said that they had passed through a most trying and critical period. He frankly admitted that many of their difficulties had come about in consequence of past mistakes, but others were caused by circumstances beyond anyone's control. In conclusion, he said he wished to make it quite clear that in the event of the proposals of Mr. Nordon's committee being carried, he could follow no other course but to tender his resignation from the board, and, in consequence, also decline to accept the position of president of the company. With regard to his agreement as technical adviser to the company he regretted to say that in the event of such proposals being approved, he would endeavour to have the agreement terminated at once. The Right Hon. F. G. Kellaway, the managing director, seconded the motion in a long speech, in which he dealt in great detail with the report of the investigating accountants and gave particulars of the losses amounting to a total of nearly £6,000,000 which had been written off. Dealing with the course of events since he became a director he said that at his instigation a committee of directors was formed to control the policy and finances of the company, and one of the first decisions of that body was to put a stop immediately to any further investments of the money in any concerns not properly connected with the company's business. He maintained that in regard to the issue of 500,000 new shares at 27s. 6d. each in February, 1925, on the information before it at the time, the board was fully justified in making the issue at that price. Subsequent events had shown that that information was based upon too optimistic a view of the position of the company at the time, but looking back he could not admit that any precaution was not taken which any reasonable body of business men could have taken. The proposals of the board had the support of Sir Gilbert Garnsey and their own accountants; of the four members of the advisory committee; of the Irish shareholders' association; practically the whole Press of the country, and they had, he said, received proxies representing nearly 1½ million shares. If the report was carried the following new members would join the board on the suggestion of Sir Gilbert Garnsey and a member of the advisory committee:—Lord Inverforth, Major-Gen. Sir Frederick Sykes, Lord Wester Wemyss, Sir Charles Barrie, K.B.E., and Mr. F. R. S. Balfour. In the discussion which ensued speeches were made by Sir Gilbert Garnsey, who gave it as his opinion that given a continuance of good management the company could look forward to a prosperous future by Dr. O'Beirn, of the Irish Shareholders' Committee, supporting the proposals of the Board; and by Mr. Nordon, of the English Shareholders' Committee, who asked the shareholders to reject the report. On a show of hands, the report was adopted by a large majority, whereupon a poll was demanded by Mr. Nordon. This was taken immediately, with the result that the resolution was declared carried by 1,586,532 votes against 320,076. The retiring members of the board were re-elected, and Messrs. Kemp, Chatteris, Nicholls, Send and Co., and Messrs. Price, Waterhouse & Co., were appointed joint auditors.

Telegraph Construction and Maintenance Co., Ltd.

The Earl of Selborne presided over the annual meeting on March 17th, and in moving the adoption of the report (which was dealt with in our last issue, p. 445), said it was satisfactory that in a year of such exceptional difficulties they had been able to present such good results and maintain their usual dividend. At the last general meeting he referred to several important contracts which they had in hand. All of those had been successfully carried out, and in spite of the serious dislocation of trade and delay in deliveries they were able to complete the contracts within a short period of the specified dates. Referring to the position of submarine telegraphy at the present time, they had the fullest confidence in the future of the industry, despite the competition of wireless, be it telegraphic, telephonic, or photographic. A study of the map of the world showed that all great commercial centres were now so well linked up by submarine cable routes that there was little or no fear of any one place being entirely cut off from telegraphic communication. Almost all of these cables were of the ordinary type, but in the last year or so a development of the "loaded conductor" had increased the carrying capacity of a cable by four or five times, and it became evident that if such cables offered no practical difficulties, a revolution in submarine telegraphy was at hand. It was chiefly with that new development that their works had been occupied during the year under review, and three of those cables had been laid in the North Atlantic, one in Australian waters, and one in the Pacific. The load

able had fully justified the confidence which they placed n it and its efficiency had been proved beyond doubt. So ar they might congratulate themselves that such definite nd important progress had been made, but they must remem- er that since the loaded cable was equal in capacity to several rdinary ones, fewer cables might be required in future, nless there was a material increase in telegraph traffic. t was not, however, the experience of the world that im- rovements in machinery or in methods of production defeated heir own ends; every improvement in the means of pro- uction led to increased demand. How to take advantage of hat improvement was the problem of the future for the ubmarine telegraph companies, and it was one which would ndoubtedly be solved by the very able controllers of the able-owning companies. They must, however, expect some elay before the old systems were replaced by the new, for nsiderable expenditure was involved not only in the loaded ables themselves, but also in the research work needed efore full advantage could be taken of their high speed apacity. Their new cable ship *Dominia* was delivered in June st year, and in the recent successful laying of the long ection of the Pacific cable (about 3,500 nautical miles) etween Vancouver and Fanning Island, for which she was pecially built, she fully justified their confidence in her esign.—Mr. Colin F. Campbell seconded the motion, which as adopted after a short discussion.

Westminster Electric Supply Corporation, Ltd.

The annual meeting was held on March 16th, Lord War- ave, P.C. (chairman) presiding. In moving the adoption of e report and accounts, the chairman said that the accounts d had to be prepared in accordance with the London Elec- icity (No. 2) Act, 1925. They had transferred to the London ower Co., under the terms of the above Act, the generating achinery at their Horseferry station, for which they had ceived payment. The whole of the generating portion of e Westminster Company's undertaking had thus passed to e Power Co. The Central Co. had also transferred the hole of its works at Grove Road, together with its main nsmission lines, to the Power Co., for which payment had en made. The result had been that the Central Co. was le to capitalise a sum of £225,000, which had been divided ually between the St. James' and Westminster Companies. is had been brought into their free reserves and formed rt of the £503,746 which was capitalised by the company t year. They had also repaid the loans to the two parent mpanies. The balance of profit for the year was £137,077, hich was sufficient to pay the preference dividend and the linary dividend at the standard rates, leaving a balance of ,502 to be carried forward. At the moment they could t say whether any or all of this sum was available for tribution to the shareholders. Owing to the restrictions hich were in force during the general strike their output s sensibly reduced, but, nevertheless, last year it was over 00,000 kWh in excess of the previous year.

Underground Electric Railways of London, Ltd.

The annual meeting took place on March 15th, Lord Ashfield hairman and managing director) presiding. The chairman, moving the adoption of the report and accounts, first dealt h the associated companies whose accounts and meetings ve already been reported in previous issues. He made par- ular mention of the improved position of the Associated uipment Co., which had paid a dividend of 8 per cent., free tax; and to the North Metropolitan Electric Power Supply , from which a dividend of 10 per cent. had been received. e 'bus undertaking had maintained its position, but the ditions under which the tramways operated remained bad. accordance with his usual custom, Lord Ashfield then ceeded to review the whole question of London's traffic. reiterated the need for co-ordination of the various ser- es, and expressed the inability of the railway companies extend their systems further until more equitable treat- nt was accorded them. Further underground railways e urgently needed. Underground railways by themselves ld not be made to pay; they could only pay as integral ts of a complete system. In conclusion, the chairman rred to the income bonds, which were a burden on the pany's finances, and said that in any future scheme for raising of capital particular attention would be given to matter.

Charing Cross Electricity Supply Co., Ltd.

he report for the year ended December 31st last shows t the gross earnings of the West End Undertakings were 3,241, and there was a total available of £142,162. Interest debenture stock and sinking fund contributions absorb ,184, and the preference and standard ordinary dividends paid, leaving £468 to be carried forward. The connected on the West End mains is now 31,235 kW, of which 05 kW represents lighting.

he City Undertaking shows gross earnings of £329,911 an available balance of £212,086. Debenture and loan rest, &c., require £150,675, and after paying the preference ordinary dividends £411 is carried forward. The con- ed load is 37,587 kW, of which 13,294 kW is lighting. er the London Electricity (No. 2) Act, the Bow generating on has been leased to the London Power Co., and both West End and City undertakings now purchase electricity in bulk from that company. As a result of this, the figures for 1926 are not comparable with those of previous years. The Act provides that in 1971 the whole of the company's under- taking as existing at June 30th, 1925, shall be transferred, free of charge, to the London and Home Counties Joint Elec- tricity Authority. In accordance with that Act, a sinking fund "A" has been set up to provide for the repayment of the shareholders' capital in 1971, and a further sinking fund "B" has to be instituted to deal with capital expenditure incurred since June, 1925; any balance not so provided for will be paid by the Joint Authority upon transfer. £460,800 of the reserves has been capitalised and issued to shareholders as bonus shares; the ordinary capital now stands at £1,036,800, and the standard dividend is 1s. 7.57d. per share. A reduction in charges was made at the beginning of last year, and the consumers have benefited to the extent of over £55,000. In spite of the adverse effect of the coal dispute, the directors feel justified in paying the standard dividend, although the carry-forward is thus reduced to a nominal amount. Meet- ing: March 30th.

International Automatic Telephone Co., Ltd.

The accounts of this company were dealt with in our last issue. The report now to hand says that notwithstanding the indus- trial difficulties of the past year, the results compare favour- ably with those of 1925, and an increased return from invest- ments is reported. Following the annual meeting on April 8th, an extraordinary meeting is to be held for the purpose of considering certain proposals. One of the conditions origin- ally attached to the ordinary and preference shares was that Messrs. Theodore Gary & Co. (U.S.A.), who were responsible for securing important contracts for the company, on condi- tion that they continued to hold 10,000 deferred shares, should have the option of purchasing all or any of the preference or ordinary shares at the respective prices of 21s. 6d. and 30s. per share. The option on the ordinary shares was removed in 1925, and it is now proposed to cancel the option on the 170,338 issued preference shares. A provisional contract has been arranged with Messrs. Garv & Co. whereby they will instead have an option to subscribe for 170,338 unissued pre- ference shares and 200,000 preference shares to be created, at the price of 21s. 6d. per share. The shareholders will be asked to ratify this agreement and sanction the increasing of the preference capital from £200,000 to £400,000.

Arbroath Electric Light and Power Co., Ltd.

Mr. George Balfour, M.P. (chairman) presided at the recent annual meeting of the company, and in moving the adoption of the report (which showed a profit of £5,441) said that the local rates paid by the company for the year were equivalent to almost ½d. per kWh sold, and if the amount paid in income tax were added, the rates and taxes item was equivalent to approximately two-thirds of a penny per kWh. It was of no use talking about cheapening supplies by linking up stations when they were faced with an average of .66d. per kWh for local rates and taxes. The only heritable subjects owned by the company which should be ratable were the buildings of a ratable value of a few hundred pounds. The balance over this amount was merely a super tax on the industry which the consumer had to pay. He (the chairman) was associated with the Grampian Co., and negotiations had taken place with their directors for a bulk supply and possible transfer of the generating station to the Grampian Co., which would use it as a small subsidiary steam reserve station. The Grampian development was necessarily held in abeyance until the new legislative proposals of the Govern- ment assumed final shape.

Newcastle and District Electric Lighting Co., Ltd.

The annual meeting was held on March 17th, Colonel F. R. Simpson presiding. Moving the adoption of the report and accounts, the chairman said that a further amount of £4,360 of second debentures had been redeemed, and loans had been reduced by £2,973. During the year a large amount had been spent on cables and sub-stations for the supply of elec- tricity to new consumers. The demand continued to grow, and a considerable increase in the rate of expansion was anti- cipated. £18,000 had been provided from profits for depre- ciation, making the amount written off £206,000. Dealing with rates and taxes, he said that the steady increases in rates equalled a dividend payment of 1 per cent. on the com- pany's shares. Taking the lighting restriction due to the coal stoppage into consideration, the increase in total receipts of £1,236 might be considered satisfactory. Commenting on the new Electricity Act, he anticipated that it would be some considerable time before it caused any changes to be made in the Newcastle district.

British Electric Transformer Co., Ltd.

After meeting manufacturing costs and administrative ex- penses, the net profit for the past year is £63,202, and to it is added £8,950 brought forward, making £72,152. It is pro- posed to distribute this as follows:—To reserve, £10,000; to depreciation reserve, £5,000; preference dividend, £31,500; dividend of 5 per cent. on the ordinary shares, £16,250; carried forward, £9,402. The report records the death of Mr. George Berry, director and manager, and the appointment of Mr. F. E. Berry to the dual position. Meeting: March 29th.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The profit for the year ended December 31st last amounted to £576,421, as against £701,671 for 1925. After providing for debenture interest, &c., depreciation and contingencies reserve (£75,000), and plant renewal and improvement reserve (£25,000), and adding £41,517 brought forward, there remains £313,225. It is proposed to pay the balance of the preference dividends, and distribute 5 per cent. for the year on the ordinary shares, leaving £15,990 to be carried forward. The connections to the company's system rose from 626,689 to 657,451 h.p. The capital expenditure during the year amounted to £413,656, principally upon the high- and low-pressure distribution systems. A normal service was maintained throughout the period of the industrial disturbances, but the company's output and revenue were badly affected, while working costs were considerably increased. The company adopted the policy of using the cheapest class of English coal in preference to foreign coal of better quality at enhanced prices. Since the termination of the coal dispute the output has considerably increased as compared with the corresponding period of last year. Meeting: Newcastle, March 29th.

Llanelly and District Electric Supply Co., Ltd.

The annual meeting was held last week, Mr. A. H. Beatty, O.B.E. (chairman), presiding. In moving the adoption of the report and accounts, the chairman said that the year had started well, and had showed promise of increasing the earnings until the time of the general strike and the prolonged coal stoppage, which had resulted in an almost total cessation of work at the collieries and industrial works in South Wales for nearly nine months. Under the circumstances an account showing a trading profit of £30,548 was not an unsatisfactory result. The company's revenue was chiefly derived from electricity supply, and although the number of consumers had increased from 1,920 in 1924 to 2,730 in the year under review, the actual energy sold had decreased by over 3,000,000 kWh, as compared with the year 1924-25. On the traction side the number of passengers had decreased by over 500,000. The electricity supply business continued to show satisfactory progress, and the 5,000-kW set installed two years ago would shortly be fully loaded. Application had been made to the Electricity Commissioners for permission to install another 5,000-kW set.

St. James' and Pall Mall Electric Light Co., Ltd.

The report for 1926 shows a net profit of £75,573. An interim dividend at the rate of 10 per cent. was paid on 40,000 £5 ordinary shares, and it is now proposed to pay a final dividend of 1s. 3.3d. per share on 640,000 £1 ordinary shares, making up the standard dividend fixed in the London Electricity (No. 2) Act, 1925. A balance of £17,773 remains to be carried forward. The report records the death of Mr. Walter Leaf, the chairman of the company, and the appointment of Mr. C. P. Sparks to the board in June last. The extension of the company's tenure granted by the above-mentioned Act rendered unnecessary the retention of the sinking fund established under an agreement with the London Electric Supply Corporation, Ltd., and the fund has accordingly been divided between the companies. Meeting: April 5th.

Folkestone Electricity Supply Co., Ltd.

The accounts for the past year show a profit of £39,176, to which is added £1,499 brought forward, making £40,675. After meeting debenture interest, preference dividend, &c., it is proposed to allocate £9,013 to depreciation, £7,000 to the reserve fund, and £5,000 to the employés' superannuation fund. A final dividend of 6 per cent., free of tax (making 10 per cent. for the year, tax free) is recommended on the ordinary shares, leaving £1,498 to be carried forward. The whole of the £10,000 employés' co-partnership shares have now been allotted. It is proposed to offer to existing shareholders (at par) 40,000 new ordinary shares in the proportion of two new shares to every five at present held.

Salisbury Electric Light and Supply Co., Ltd.

The annual meeting was held on March 15th. Mr. C. J. Woodrow (chairman) presided, and presented the report for 1926, which showed a balance of £8,084. The directors recommended a final dividend of 6 per cent., free of tax, making 10 per cent. for the year. £400 was transferred to reserve, and £184 carried forward. The chairman said that the installation of the new boilers and generating plant, with the necessary buildings, had been delayed by the coal dispute, but the work was now nearing completion. Mr. F. E. Gripper had retired from the board owing to ill-health, and the vacancy had been filled by the appointment of Mr. C. H. Jones.

Oxford Electric Supply Co., Ltd.

With a balance of £2,075 brought forward, the amount available in respect of the past year is £50,120. After meeting debenture and other charges, a dividend of 7 per cent. is declared on the ordinary shares, of which 2½ per cent. has already been paid, leaving £32,289 to be carried forward. The report states that the directors have again been obliged to incur heavy capital expenditure to meet the growing demand. Negotiations are in progress with the City Council for the suspension of its purchase option for a period of 42 years from 1932. This, it is stated, would enable the company to reduce its charges and raise necessary capital for extensions. It is hoped that a satisfactory result will shortly be reached.

Clyde Valley Electrical Power Co.

The directors' report for 1926 shows a balance of prof of £226,700, to which is added £67,424 brought forwar making £294,124. After meeting the preference dividends ar transferring £90,000 to the contingency fund, it is propose to pay a final dividend of 5 per cent. on the ordinary capit (making 8 per cent. for the year) and to carry forward £50,12 The construction work at the Falls of Clyde has proceede during the year, and it is expected that the plant will l in operation in time for the winter demand. During t period the company's supply was extended to Bridge of We Carluke, Helensburgh, Kirkintilloch, Lanark, and Vale Leven. The undertaking of the Kilmalcolm Electric Lightin Co., Ltd., the share capital of which is owned by the compan has been completely reorganised. The old steam generati station has been closed down and a full supply for all purpos is being given at more favourable rates. Meeting: Glasgo March 30th.

Waygood-Otis, Ltd.

The annual meeting was held on March 16th. The cha man, Mr. Henry C. Walker, who presided, said that duri the past year several important contracts had been co pleted, notably those in connection with the Morden exte sion of the Underground Railway. The extensions and alte tions to their works were nearing completion, and they n had a factory second to none in London. He was pleas to say that, with the rare exceptions of calling upon t Otis Elevator Company, of New York, as they had power do, all their lifts were British built with British labour a materials.

Waste Heat and Gas Electrical Generating Stations, L

The report for the past year shows a net profit of £24,0 as compared with £27,019 in 1925. To this is added a amount of £14,272 brought forward, making £38,296. T directors recommend a dividend of 8 per cent. for the ye of which 1½ per cent. has already been paid, leaving a bala of £12,696 to be carried forward. The dividend for 1925 v the same. The output from the company's stations was c siderably reduced; they were closed down from May to Dece ber, but all but one are now in operation. Meeting: To (Friday).

Windsor Electrical Installation Co., Ltd.

The profit for the past year (including £5,765 brou forward) is £11,910. From this £4,000 is transferred depreciation, renewal and reserve fund. A final dividend 6 per cent. is declared (making 10 per cent. for the ye together with a bonus of 4 per cent. This leaves £6,31 be carried forward. The directors propose to capita £25,000 of the reserve and issue it to existing shareholde in the form of 7 per cent. cumulative preference shares £1 each, without payment, in the ratio of one new share each two at present held. The new shares will rank dividend as from January 1st, 1927.

Woking Electric Supply Co., Ltd.

The balance on the past year's working is £33,750, and v an amount of £1,729 brought forward there is avail £35,479. After meeting debenture interest, preference di dends, &c., £8,000 is allotted to depreciation and renew £5,000 to reserve, and £5,000 to change-over account. A di dend on the ordinary shares of 10 per cent., free of tax, i be paid, and £1,474 is carried forward. The revenue incre from £60,701 to £67,143. The death of Mr. H. W. Bow (a director) is recorded, and the report states that his son, A. H. Bowden, has been appointed to the board.

Slough and Datchet Electric Supply Co., Ltd.

The profit for 1926 (including £6,163 brought forward £20,662. This is allocated as follows:—Depreciation, ren and reserve fund, £5,500; directors' fees and tax, £1,00 final dividend of 6 per cent. (making 10 per cent. for year), together with a bonus of 4 per cent., leaving £ to be carried forward. It is proposed to increase the ca by £50,000 (to £125,000) in ordinary or preference sh During the year £17,231 was spent on capital account, chief item being mains, £11,735.

British Aluminium Co., Ltd.

The profit for the past year, including the balance bro forward, was £304,644. From this £50,000 is put to depr tion reserve, £100,000 to general reserve (making £650, and £10,000 to staff benefit fund, leaving £144,644. After ing the preference dividend and a final dividend of 6 per (making 10 per cent.), a balance of £26,567 is carried forw For 1925, in addition to the same dividend, a bonus of 2 cent. was distributed.

Ericsson Telephones, Ltd.

The report for the past year records a reduction in the profit from £66,174 to £44,599, after meeting taxation, de ture interest, depreciation, &c. A balance of £22,2 brought forward, making £66,858. It is proposed to off £6,475, stamp fees on new capital, to transfer £1 to general reserve (against £65,000), and to pay a div of 8 per cent. on the ordinary shares, leaving £22,217 carried forward. Meeting: March 30th.

British Insulated Cables, Ltd.

The annual meeting was held on March 21st, Sir Arthur Stanley, G.B.E., presiding in the absence, through ill-health, of the chairman, Mr. J. Taylor. After referring, with regret, to the death of Sir J. S. Harmood-Banner (vice-chairman), Sir Arthur said that the past year had been a good one for the company, although the profits had decreased as compared with the record attained in 1925. The investments had been increased by £129,812 to £780,165, and a recent valuation showed them to be considerably above the balance-sheet figure. Owing to the general strike, the works were closed down for nearly a fortnight, which, of course, combined with the coal dispute, had an adverse affect upon the year's trading. He hoped that henceforward harmony would exist between the company and its employés. The profit-sharing scheme which had been in operation for many years had been fully justified. The company had recently secured, in the face of keen competition, an order valued at about £700,000 for the electrical equipment (overhead system) of the main line of the Great Indian Peninsula Railway; a large contract for the equipment of the suburban lines of that railway had already been carried out. The Cable Makers' Association had secured a high grade of quality in the products of its members, and had standardised British cables. Its work had been of great value. Now a serious attempt was being made to bring certain companies, including the British Insulated, into closer contact. These companies would collaborate more completely than in the past and, although remaining autonomous, would work together in such a way as to ensure, as far as possible, a community of interests. Information would be interchanged upon the subjects of manufacturing processes and costs, the purchasing of raw materials, and research. Each company was already spending large sums upon research; co-ordination of effort would result in the saving of expense and better results. The principal object of that closer association was the lowering of costs in order to meet foreign competition at home and abroad which had recently increased to a large extent. If the negotiations were successful the result would be of benefit not only to the shareholders of the companies, but also to the buyers and users of electric cables; in addition, an increased export trade would mean more employment. The chairman then reviewed the year's accounts, which were dealt with in our issue of March 18th (p. 444), and dealt with the company's investments. Those investments, he said, had been made primarily in the trading interests of the company, and they had been amply justified. British Government and other securities had increased by over £120,000. The Midland Electric Corporation, in which a considerable interest was held, had paid a dividend and bonus of 15 per cent. for 1925, and the same rate was again recommended. The concessions of the Electric Supply Co. of Victoria expired in about four years' time, but negotiations were in hand with the authorities for their extension. The report and accounts were adopted.

Pinchin, Johnson & Co., Ltd.

Speaking at the annual meeting last week, the chairman (Mr. E. Robson) said that the paying of a 30 per cent. dividend during a troubled year was a matter for congratulation. The company was in a strong position, and its strength had enabled it to recover very rapidly from the effects of the general strike. Its success was due to a combination of up-to-date plant, technical skill, and efficient marketing. The directors were asking for authority to create 300,000 new ordinary shares; 240,000 of those were required in connection with the acquisition of the business of Messrs. Docker Bros. The report and accounts were adopted, and subsequently the increasing of the capital was approved.

Yorkshire (West Riding) Electric Tramways Co., Ltd.

The coal dispute had a serious effect upon the company's business, the net income falling from £39,955 in 1925 to £28,875 last year. Adding £574 brought forward, the available balance is £29,449. After paying the preference dividend and reserving £11,103 for renewals, &c., a balance of £4,166 is carried forward. A dividend of 5 per cent. was paid on the ordinary shares for the preceding year.

English Electric Co., Ltd.

There was a deficit of £78,590 for 1926 after crediting £74,098 brought forward. The directors are accordingly unable to pay the balance of the preference dividend. The prospects for the current year are stated to be better, the unexecuted orders brought forward being much in excess of those brought forward from 1925. Meeting: March 30th.

Stock Exchange Notice.

Application has been made to the Committee to allow the following to be officially quoted:—

North Metropolitan Power Station Co., Ltd.—£850,000 5 per cent. guaranteed debenture stock, 1957, and partly-paid scrip.

Tyneside Electrical Development Co., Ltd.

The profit for the past year amounted to £4,064, and to it is added £744 brought forward, making £4,808. It is proposed to pay a dividend of 10 per cent. on the deferred ordinary shares (against 6 per cent. for 1925); to transfer £500 to general reserve; and carry forward £809.

Chelsea Electricity Supply Co., Ltd.

A final dividend of £6 1s. 3d. per cent. has been declared on the ordinary shares (1s. 2.55d. per share). This with the interim dividend of 4½ per cent., makes up the standard rate for the year.

Brompton and Kensington Electricity Supply Co., Ltd.

It is proposed to pay a final ordinary dividend of 10.7d. per share; this, with interim distribution of 5 per cent., makes up the standard dividend for the year.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The directors have declared a final dividend of 5s. per share, free of tax.

Eastern Telegraph Co., Ltd.

The directors have declared a final dividend of 2½ per cent., free of tax, on the ordinary stock, making 10 per cent. for the year, as in 1925.

Rangoon Electric Tramway and Supply Co., Ltd.

A final dividend of 1 rupee 4 annas per share is recommended on the old ordinary shares, and a dividend of 14 annas per share on the new shares.

Thos. W. Ward, Ltd.

An interim ordinary dividend of 2½ per cent., free of tax (as in 1926), has been declared.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

The directors recommend a balance dividend of 1s. 3d. per share on the ordinary shares.

Anglo-Portuguese Telephone Co., Ltd.

A final dividend of 4 per cent. is recommended, making 7 per cent. for the year.

Mid-Cheshire Electricity Supply Co., Ltd.

A dividend of 3½ per cent. has been declared on the ordinary shares out of a net profit of £7,436.

Metropolitan-Vickers Electrical Co., Ltd.

The directors have again declared a dividend of 8 per cent. upon the ordinary shares.

Alley & McLellan, Ltd.

The directors are unable to declare a dividend on the ordinary shares for the past year.

Stocks and Shares.

Monday Evening.

The Stock Exchange financial year ends with March 25th, and it cannot be said that the House is concluding its fiscal twelvemonth in a particularly happy frame of mind. There seems to be a lot of stock about for which a permanent home is wanted, its present holders not being sufficiently ready, or strong enough, to keep it. Nevertheless, the purely investment markets are tolerably firm. The industrial sections are held back by uncertainties as to what may be proposed in the Budget. The news from China is a depressing factor. The Balkans appear to be getting busy again.

The Marconi meeting is now ancient history. The decisive majority given to the directors by the shareholders in support of the board's scheme is evidence of a desire to let the dead past bury its dead and to allow the company to go ahead under reorganised conditions of capital such as will bring within sight the early payment of a dividend. Now that the heat, the dust, and the acrimony have died away, the company can settle down to business. Expectation canvasses the possibility of a 10 per cent. dividend on the 10s. shares, to be declared, it may be, within the next few months. If it be complained that a 10 per cent. dividend would give a very modest yield on the present price of 17s. 6d., namely, 5¾ per cent., the answer is that this rate ought to be increased as the company gets fairly into its stride.

The Metropolitan Electric Supply Company provided a pleasant surprise by declaring a final dividend at the rate of 12 per cent., on the whole of the ordinary share capital, making 8 per cent. for the year. This is equal to 12 per cent. on the old capital, an increase of 1 per cent. over the 1925 dividend. The market had not expected any change, and the price of "Mets." rose 2s. to 27s. Like the County of London Electric Supply Company, the Metropolitan has a wider area than that over which the other London undertakings work, and this consideration is regarded as justifying a hope of higher dividends, after 1931, than the 7 per cent. standard rate laid down in the Act.

London Electrics have improved to 24s. 6d. on announcement of a final dividend, which makes £8 8s. 7d. per cent. for 1926 on the present ordinary share capital. Last year the dividend was 10 per cent. on the smaller capital. Prices of other shares in the London group are firm. Kensingtons have strengthened to 25s. 6d.

The provincial electric supply shares are hard, on the atten-

tion being paid to them as offering more scope than the London list does. Had it not been for the effects of the coal stoppage, the companies would undoubtedly have done very well in 1926. As it is, the general result must be accounted good in the circumstances. The Clyde Valley pays 5 per cent. final, making 8 per cent. for the year, the same as before: the profits are, naturally, lower. Midland Counties are mounting quietly, and have more than recovered the dividend taken off the price a fortnight ago. Lancashire Electrics advanced to 25s. 6d. Folkestone Electrics at 43s. 9d. are nearly ⅛ up.

The Yorkshire (West Riding) Electric Tramways, as already announced, has passed its dividend for 1926, against 5 per cent. paid for 1925. The report points out that the company operates in the heart of the West Yorkshire coalfield, and, consequently, the full effect of the miners' strike was experienced. The shares are quoted at about 8s. 9d. On the other hand, Yorkshire Electric Power are a good market at 29s. 6d.

Tube stocks yielded part of their recent strength, because Lord Ashfield's speech at the meeting of the Underground Electric Railways of London was less definite than had been expected on the subject of traffic restriction. It would appear as though a good deal of work has yet to be done before anything like a cut-and-dried scheme can be formulated in regard to the division of competition. His Lordship dealt with the efforts that the Board is making for repayment of the 6 per cent. tax free income bonds. If these could be extinguished, by redemption, and replaced by some less expensive form of security, the £1 ordinary shares would stand a better chance, and it is this factor that maintains the shares at their present price. There are very few dividend-paying shares which offer so low a current yield as £1 18s. 9d. per cent. on the money. The reduction in the price of petrol is expected to benefit the company to some extent.

Reference was made last week to the dividends of 10 per cent. declared upon Automatic Telephones, and International Automatic Telephone ordinary and deferred. Hopefulness has looked for more, in the case of the last two, but prices are maintained. Internationals being 43s. and 41s. 3d. for the ordinary and deferred respectively. The company's report shows an advanced profit, though the improvement is less sensational than that of a year ago. The American house which held the controlling interest, Messrs. Theodore Gary & Co., have offered to cancel their original option to buy 170,000 International Telephone preference at 21s. 6d., exchanging for this the right to subscribe, also at 21s. 6d., for an equal number of new preference shares to be created for that purpose.

Telephone Manufacturing shares are dull, and the price has sagged to 6s. 9d. There seems to be no resistance offered to a long stream of small sellers. The American Telephone and Telegraph Company publishes a remarkable report showing net earnings for last year of 137 million dollars, out of which dividends totalling 86½ million dollars have been paid. The company had, at the end of last year, 399,121 stockholders, the average holding of whom was 26½ shares. Its capital is 1,077 million dollars; it owns 17½ million telephones. A touch of human interest is added to the report by the statement that although the telephone is one of the greatest inventions of the age, the inventor, and the original backers, never made a great fortune from it. There have not been many telephone fortunes, the directors remark, though they might have added that shareholders in their own company have done extremely well out of original investment in its stock.

British Aluminium have had rather a sharp drop, to 45s., upon the dividend announcement, making 10 per cent., against 12½ per cent. a year ago. Of the latter, 2½ per cent. was declared specifically as bonus, but the price had been raised to a level at which 10 per cent. offers a very meagre return, and it promptly shed half a crown. English Electrics fell further, to 10s. 6d. General Electrics shed the ninepence they gained last week. Siemens have fallen 1/16 to 27s. 6d.

Declines are marked against Enfield ordinary at 3¾, Metropolitan-Vickers, Johnson & Phillips, and British Thomson-Houston preference at 22s. 3d. British Electric Transformer preference rose to 18s. 9d. on the report. All the arrears are now cleared off, and a 5 per cent. payment on the ordinary shares is declared. The company made a net profit last year of £63,200 on its issued share capital of £625,000, of which £300,000 is in preference and £325,000 in ordinary shares, all of £1 each.

The Newcastle-on-Tyne Electric Supply Company was expected to do poorly in 1926, and the reduction of the dividend to 5 per cent., after 7 per cent. in 1925, has aroused no surprise. The profits are substantially down, but the report is not at all a bad one, and the drop in profits should prove to be no more than temporary. Ericsson Telephones pays 8 per cent. on the ordinary, the profits being a good deal lower than those of 1925. In the foreign tramways group, Brazilian Tractions have gone back 3½ after their pyrotechnical jump. Mexican Utilities are mostly higher, and the market in them continues very hard. British Columbia Electric Railway stocks have further rallied. Rumours that are as yet too irresponsible for repetition serve to keep up the prices of Anglo-Argentine Tramways. The company's traffics are fair, and nothing has been heard of late concerning the threatened opposition from a "Tube" in Buenos Ayres. These two factors may have encouraged the support that has raised both preference issues to 3¼.

Babcocks at 52s. 6d. have not changed, but iron and steel shares are lower as a whole. The rubber market is tame and rather uninteresting; the produce is steady: business in the share market has become quiescent.

Share List of Electrical Companies.

	£	Dividend. Nom.	1924.	1925.	Price Mar.21 1927.	Rise or fall.	Yield p.c.
Home Electricity Companies.							
Bournemouth and Poole	1	14	14	60/9	—	4 12 0	
Brompton Ordinary	1	10	10	25/-	—	5 12 0	
Charing Cross Ordinary	1	15	15	25/6	—	5 9 10	
do. do. ½ Pref.	1	4½	4½	17/-	—	5 6 0	
Chelsea	1	12	12	25/-	—	5 12 0	
City of London	1	15	15	2⅞	—	... ...	
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4	
Clyde Valley	1	8	8	30/-	—	5 6 8	
County of London	1	15	15	28/-	+3/-	5 0 0	
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4	
Edmundson's Ordinary	1	7	8	26/3	—	6 2 0	
do. 7% Pref.	1	6	7	28/-	—	6 1 9	
Elec. Supply Corporation	1	10	10	30/6	—	6 11 9	
Kensington Ordinary	1	15	15	25/6	+1/-	5 9 10	
Lancs. Light and Power	1	7½	7½	25 6	+6d	5 17 8	
London Electric	1	10	10	24/6	+6d	5 14 3	
do. do. 6% Pref.	5	6	6	5 7/16	—	5 10 4	
Metropolitan	1	11	11	27/-	+2/-	5 3 8	
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10	
Midland Counties	1	5½	6	22/6	+6d	5 6 8	
Newcastle-on-Tyne Ordinary	1	7	7	22/-	—	4 0 9	
do. 5% Pref.	1	5	5	17/6	—	5 14 3	
do. 7% Pref.	1	7	7	24/-	—	5 16 8	
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0	
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1	
St. James' and Pall Mall	5	17½	17½	25/6	—	5 9 10	
South London	1	15	15	24/6	—	6 3 0	
South Metropolitan Pref.	1	7	7	1¼	—	6 8 0	
Urban Ordinary	1	4	7	25/6	—	5 9 10	
do. 6% Pref.	1	6	6	20/6	—	5 17 1	
Westminster Ordinary	1	15	15	25/6	—	5 12 0	
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	—	7 6 4	
Yorkshire Elec.	1	8	8	29/6	—	5 8 4	
Home Rails.							
Central London Ord. Assented	Stock	4	4	70	—	5 14 4	
Metropolitan	"	5	5	63	—1	4 15 8	
do. District	"	3½	3½	59	—2	5 18 8	
Underground Electric	£1	Nil	Nil	15/6	—1/-	1 18 9	
do. do. Income	Bonds	6	6	101	—	*5 18 10	
Telegraphs and Telephones.							
Anglo-Am. Tel. Pref.	Stock	6	6	100	—	6 0 0	
do. Def.	"	1½	1½	23⅞	—	6 6 0	
Automatic Telephone	1	8	10	53/3	—	3 15 0	
Chili Telephone	5	5	6	6½	—	4 12 4	
Cuba Sub. Ord.	10	5	5	7	+¼	7 2 10	
Eastern Extension	10	10	10	17⅝	—	*5 13 4	
Eastern Tel. Ord.	Stock	10	10	172½	—	*5 16 0	
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 8 1	
do. do. Pref.	10	6	6	11	—	5 9 1	
Great Northern Tel.	10	22	20	26⅜	—	7 10 0	
Indo-European	25	8½	10	46½	—	*5 7 6	
Marconi	1	10	Nil	17/6	+1/-	... ..	
Marconi-Marine	1	10	7½	23/3	—	6 9 0	
Oriental Telephone Ord.	1	12	12	53/3	—	*4 12 0	
United R. Plate Tel.	5	8	8	8⅜	—	*4 11 8	
Western Telegraph	10	10	10	17	—	*5 17 8	
Home and Foreign Trams, &c.							
Anglo-Arg. Trams First Pref.	5	5½	5½	3½	—	8 9 2	
do. do. 2nd Pref.	5	6	6	3½	—	9 4 8	
do. do. 5% Deb.	Stock	5	5	71½	—	7 0 0	
British Electric Traction Ord.	"	7	8	144½	—1	5 10 9	
do. do. 6% Pref.	"	6	6	109	—	5 10 1	
Brazil Traction	100	4	5	128½	—3½	4 13 9	
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11 9	
do. do. Preferred	"	96/-	136/9	117½	+1	*5 6 3	
do. do. Deferred	"	129/5	8	159	+1	*5 0 1	
do. do. Deb.	"	4¼	4¼	79½	—	5 7 6	
London & Sub. Trac. 5% Pref.	1	2½	Nil	7/8	+3d	Nil	
London United Tram. Deb.	Stock	4	4	51	—	7 16 1	
Mexico Trams, 5% Bonds	—	5	5	21½	—	6 18 6	
Mexican Light Common	100	Nil	Nil	46	+1	Nil	
do. Pref.	100	Nil	Nil	97½	—	Nil	
do. 1st Bonds	—	5	5	71½	+1	6 19 1	
Yorkshire (West Riding)	1	5	—	8/9	—	... ..	
Manufacturing Companies.							
Babcock & Wilcox	1	12	13	52/6	—	4 19	
British Aluminium Ord.	1	5	10	45/-	—2/6	4 9	
British Elec. Transformer Pref.	1	Nil	7	18/9	+6d	7 9	
British Insulated Ord.	1	15	15	68/9	—	4 7	
Brush Ord.	1	10	10	28/3	—	7 1	
Callenders	1	15	15	3⅜	—	4 5	
do. 6½% Pref.	1	6½	6½	23/9	—	5 9	
Crompton Ord.	1	Nil	Nil	10/-	—	... ..	
Edison-Swan	4/-	10	10	10/-	—	4 0	
do. 5% Deb.	Stock	5	5	85	—	5 17	
Electric Construction	1	10	10	31/3	—	6 8	
Enfield Cable Pref.	1	7½	7½	1½	—	6 6	
English Electric	1	5	Nil	10/-	—1/3	...	
do. do. Pref.	1	6	6	13/6	—	...	
Gen. Elec. Pref.	1	6½	6½	28/6	—	5 10	
do. Ord.	1	5	7½	£0,6	—9d	4 18	
Henley	1	16	20	89/3	—	4 9	
do. 4½% Pref.	5	4½	4½	4½	—	5 6	
India-Rubber	1	5	5	1	—	*5 0	
Johnson & Phillips	1	10	17½	2⅜	—⅛	6 13	
Met.-Vickers Ord.	1	8	8	28/9	— 6d	5 11	
do. Pref.	9	8	8	2 5/16	—	6 18	
Siemens Ord.	1	7½	7½	27/6	—1/8	5 9	
Telegraph Construction	12	20	10	29⅜	—	*4 0	

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during February, 1927.

IN studying the foreign trade figures for February and noting decreases in both exports and imports, it should be remembered that the month was three days shorter than its predecessor which, naturally, makes an appreciable difference. Moreover, in the case of the exports, the influence of the submarine cable item once again made itself felt by falling to the extent of £179,000—more than accounting for the fall in the total. The other items in the export list, as a whole, showed a rise of about £16,000, increases and decreases being about equal in number. There was a net fall of £11,000 in the machinery class, although unenumerated machinery showed the largest increase. Comparison with the February, 1926, figures shows that, in spite of the equal length of the months and the fact that submarine cable exports were higher, the total fell by over £31,000. Four items show substantial decreases, *viz.*, insulated wires and cables, "other" motors and generators, non-submarine telegraph wires and cables, and telegraph and telephone apparatus. Against these are set large rises in unenumerated goods and apparatus, unenumerated machinery and submarine cables. The exports for the first two months of the year still make a good showing in comparison with the corresponding period of 1926.

The proportional decrease in imports was greater than the fall in exports, and there was actually only one increase as compared with January—in arc lamps and parts. The two unenumerated classes showed very large declines, amounting to about 25 per cent. in each case. On the other hand, compared with February, 1926, increases were general, there being only two decreases. The result was a rise of nearly £56,000 in the total.

The re-exports, which have shown a falling tendency for a few months, revived a little and were higher than in the preceding month and February, 1926.

The following table shows the distribution of our electrical machinery exports last month and in February, 1926:—

Destination.	Feb., 1926. £	Feb., 1927. £	Inc. or dec. £
European countries	71,057	85,045	+13,988
Japan	13,384	27,979	+14,595
South America ...	48,354	34,609	−13,745
South Africa ...	81,623	131,530	+49,907
British India ...	151,874	94,348	−57,526
Australia	117,618	91,148	−26,470
New Zealand ...	37,255	47,771	+10,516
Canada	19,357	14,866	− 4,491
Other countries ...	50,526	54,987	+ 4,461
Totals ...	£591,048	£582,283	−£8,765

	Exports. Electrical exports for Feb., 1927.	Inc. or dec. as compared with Jan., 1927.	Inc. or dec. as compared with Feb., 1926.	Imports. Electrical imports for Feb., 1927.	Inc. or dec. as compared with Jan., 1927.	Inc. or dec. as compared with Feb., 1926.	Re-Exports. Electrical re-exports for Feb., 1927.	Inc. or dec. as compared with Jan., 1927.	Inc. or dec. as compared with Feb., 1926.
Electrical goods and apparatus (unenumerated)	£210,650	+ £23,.75	+ £51,676	£86 858	−£28,384	+ £7 230	£5 650	− £317	+£1,080
nsulated wires and cables ...	307 319	+ 32.744	− 33,204	52.423	− 8 465	+ 7,412	222	− 1,485	− 434
Flow lamps	38,913	− 4,184	+ 5,761	24 561	− 11,370	+ 8,001	2,091	+ 1,144	− 480
arc lamps and parts	2,795	+ 1,346	+ 1,583	2,797	+ 831	+ 2,682	56	+ 44	+ 35
Batteries and accumulators ...	101.066	+ 12,685	+ 142	33 597	− 13 502	+ 6,589	411	+ 51	− 249
Meters and instruments ...	26,091	− 5,615	− 3,310	16,210	− 5,888	+ 2,414	414	− 184	− 970
Carbons	813	− 226	− 868	5,671	− 1,146	+ 516	25	− 29	− 61
Electrical Machinery—									
Electrical machinery (unenumerated)	349 167	+ 44,311	+ 10,752	97,885	− 32 259	+ 45 851	7,952	+ 1,363	+ 3,233
Railway and tramway motors	47 627	− 52,2 0	+ 559	—	—	—	—	—	—
Other motors and generators ..	185,489	− 21,151	− 20.076	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	7,671	+ 3.316	+ 2,771	9	− 558	+ 3	—	—	− 30
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	45,027	− 8,531	− 16 803	5,172	− 4,555	− 11,124	239	+ 199	+ 210
Submarine telegraph and telephone cable...	24,491	− 178,995	+ 20,442	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	200,243	− 7,568	− 39,080	34,872	− 12,749	− 13,595	5,355	+ 2,875	+ 144
Totals	£1,547,365	−£162.893	− £31,177	£360,055	−£118,045	+ £55,979	£22,415	+ £3,661	+£2,478
Increases and decreases for two months of 1927 ...		Exports: + £315,755			Imports: + £96,885			Re-Exports: − £575	

German Locomotives for Australia.

The Melbourne *Herald* reports that in justification of its decision to buy electric locomotives in Germany, the Victorian Electricity Commission states that tenders were publicly called for three electric locomotives. Only four tenders were received, three being on behalf of German firms, and one from America. No tenders were submitted for the supply of plant of British or Australian manufacture. The lowest tender, that of the Siemens Schuckertwerke Co., of Berlin, was accepted through its agents, Gollin & Co., Ltd., of Melbourne. The Commission's action was endorsed by the Government. The general secretary of the Australian Association of British Manufacturers and their Representatives states, however, that under the guidance of German experts the Commission adopted German standards and, in addition to this, the time allowed was too short to enable British manufacturers to send in tenders.

Australian Ratepayers against American Engines.

The Melbourne *Age* reports that a meeting of the ratepayers of St. Arnaud (Victoria) recently passed a resolution protesting against the local Council's proposal to accept an American tender for a crude-oil engine for the electricity works. It was stated that three British tenders were received, all of them being lower than the American offer, and providing for an engine of greater power.

The British Electrical Development Association.

Annual Dinner.

THE annual dinner of the British Electrical Development Association was held at the Savoy Hotel, London, on March 17th. Sir James Devonshire, K.B.E., who had been elected president of the Association at the annual meeting the same day, occupied the chair; he was supported by a number of distinguished guests.

After the loyal toast, Dr. S. Z. de Ferranti rose to propose the toast of "Co-operative Publicity." He said that the Association's business was to advertise, in a general way, the benefits of electricity to the people. There were many kinds of advertising, from the direct propaganda of the producer to the more subtle methods of the professional man. To-day, advertising was absolutely essential; he was himself advertising his works by speaking that evening. The advertising of E.D.A. was, however, on a higher plane. It marshalled the resources of the industry to bring to the public notice the advantages of electricity; it was a work of education and of national importance. Much as E.D.A. had done, more remained to be accomplished. He thought that manufacturers were not spending enough on co-operative publicity; they should contribute more, even if it meant less individual advertising. The electrical industry was at a turning point. The Electricity Act was now an established fact, and he considered that the Government had done wisely in endeavouring to standardise electricity supply. Wishing the new Central Electricity Board success, Dr. Ferranti said that Sir Andrew Duncan had the great responsibility of bringing the various interests into harmony. It was E.D.A.'s task to educate the people and create the demand. Standardisation would involve great cost, but it would be justified by the benefits which it would bring.

The toast was responded to by the Rt. Hon. C. A. McCurdy, P.C., K.C. (President of the Advertising Association), who said that after examining the whole of E.D.A.'s publicity matter he considered it admirable; he had never seen more effective propaganda. He was greatly impressed by a statement in one of the pamphlets that of seven million houses within reach of electricity supply only 1,400,000 were wired. The experience of other industries proved that such a position could be greatly changed. A very few years ago it was found that the consumption of milk per head in this country was much below that of many other countries. The milk supply industry entered upon an intensive co-operative publicity campaign, with the result that the sales of milk rose to a remarkable extent. Another example was presented by the gas industry, which, by means of co-operative propaganda, had made immense strides in spite of electrical competition. The Indian tea industry had also benefited by that form of co-operation; it had even extended its Indian market. Direct advertising by individuals aimed at getting somebody else's customers; the most fruitful advertising was that which sought to create *additional* customers. The experiences of such dissimilar industries as milk, gas, and tea were striking evidence of the success of that method. All commerce consisted of the exchange of goods. Whatever mistakes were made by statesmen or business men, man would continue to progress, and the exchange of commodities would continue to expand. Although that growth was inevitable it could be quickened by co-operative publicity, and no efforts in that direction would be wasted.

Sir Henry Fowler, K.B.E. (President of the Institution of Mechanical Engineers), proposed the toast of "The Public Service of Electricity." Public service, he said, was the highest ideal of a community or an individual. Electricity was rendering the greatest public service by giving the people light, heat, and power. It would, however, perform far greater services, if it were cheapened. He hoped that the mass production of electricity would lower its price to enable it to go ahead at a greater rate. Coupling with the toast the names of Ald. W. Walker and Mr. W. B. Woodhouse, he said that the former had done good work for Manchester, and was to do more for the community at large as a member of the Central Electricity Board; Mr. Woodhouse had performed great service to the supply industry and the Institution of Electrical Engineers.

In responding to the toast, Ald. Walker said that during the past year, when industry was in a very bad state, electricity had continued to advance. That was due to the growth of the domestic demand, the credit for which was due to E.D.A. For years the electricity supply undertakings had attempted to develop a domestic load individually, but with small success. Now electricity had become a fashion, and that would stimulate the industry in a remarkable manner. Electricity now entered into every minute of the life of the community and the individual; it had even become the nation's principal medium of entertainment. The Association was continually opening up business in new directions, and it did so very cheaply. Referring to the cost of electricity, the speaker said that high prices were generally the result of difficult conditions which the Electricity Act should help to remove. He had no doubt that the Act would eventually lead to a lower average price. In conclusion, he urged electricity supply authorities to set aside more of their profits for the work of E.D.A.—which would result in more profits.

Mr. Woodhouse (Yorkshire Electric Power Co.), who also replied, said that many present had seen the electricity supply industry proceed from poverty to prosperity. The fact that the industry had attracted the attention of all political bodies was a sufficient indication of its present importance. Such distinguished patronage was a compliment to their abilities—not the result of their backwardness. The industry should proceed with caution and commonsense, making sure that every step was a sound one. For that purpose they must depend upon themselves and not rely on political patrons. Rapid progress must leave room for individuality and differences of opinion. He appealed for a free hand for private enterprise. The inception of the industry was due to private enterprise, and in that connection he mentioned the splendid pioneer work of Dr. Ferranti. Through E.D.A. all parties could co-operate in developing the demand; all those in the industry must pursue the ideal of cheap electricity and public service, and they would reap a just reward. The Industrial Councils of the industry (for which Ald. Walker had done a great deal) had taught masters and men to pull together; the companies and the municipalities should profit by their example and co-operate for the public good.

Sir James Devonshire then proposed the toast "Our Guests," stating that such a banquet would be a dull affair without such distinguished guests. He congratulated Dr. Ferranti upon his coming election as a Fellow of the Royal Society, and considered that the Royal Society was to be congratulated as well. He expressed the pleasure of the company at the presence of so many members of the Electricity Board and representatives of the Electricity Commission. He was not yet quite sure of their respective positions. On one page of the new Act the Board was top dog, but on the next it was the bottom dog, and so on. He also referred to the presence of Col. R. E. Crompton and many representatives of municipal authorities.

Sir Andrew Duncan (Chairman of the Central Electricity Board) responded, and said he hoped that if the Board did not meet with the approval of all sections of the industry it would not be barred from their festivities, which appeared to be among the perquisites of the Board. Although the Bill had led to a great deal of controversy, he trusted that the Act would enjoy the hearty co-operation of the whole of the industry. He asked them to feel that the Board was no arbitrary or autocratic. It afforded an opportunity for co-operation, and the work of E.D.A. would supplement and assist the efforts of the Board.

The speeches were followed by an excellent concert provided by Miss Beryl Costello, Mr. Thorpe Bates, the Misses Jacqueline and Joan, Mr. Norman Long, Mr. Cyril Shields, and Mr. Victor Marmont.

The E.D.A. Annual Report.

We have received a copy of the Electrical Development Association's report for 1926, which was presented at the annual meeting last week. This contains a full list of electricity supply members, particulars of sub-committees, &c., as well as a review of the year's activities. Some space is devoted to details of the national campaign. The report is available to any electrical undertaking which cares to make application for it to the Association.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Simple Junction Box.

We have received from Messrs. Sefton-Fiddian, Leage and Co., Bush Lane House, Bush Lane, Cannon Street, London, E.C.4, a sample of their patented "Bonfix" junction box which they have recently designed and introduced. It is intended primarily for use in bonding metal sheathed cables used on internal wiring work. It consists of two parts only, the base, which is the essential bonding element, and a suitable cover made to fit over projecting clips on the base, securing slots being provided. Stamped out from the base are four

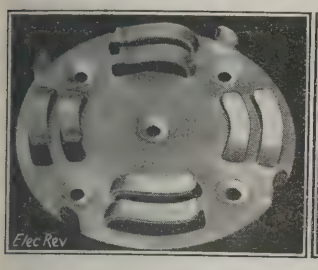


Fig. 1.—"Bonfix" Box Base.

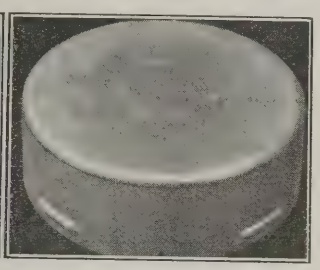


Fig. 2.—The Cover.

double spring clips which accommodate the ends of the cable sheath, and, it is claimed, effect efficient bonding. The base is of heavily tinned brass. The device should prove extremely simple to install, and no screws or other accessories to the box are required. Figs. 1 and 2 show respectively the base and the cover. It will be seen that adequate fixing can be obtained from five different points. The clips are designed to accommodate single, twin, or 3-core flat cables of conductor sizes up to 3/.036. Ample provision is made in the depth of the cover for the use of porcelain connectors. The box can be equally well used in connection with systems employing cabtire or other sheathed cables for their efficient mechanical security. Provision is made at the back of the base to keep it away from the wall, thereby ensuring against condensation troubles.

An Improved Electric Hair Dryer.

Although designed primarily for the treatment of hair, the new "Ideal" dryer, recently introduced by Messrs. Falk, Stadelmann & Co., Ltd., 83, Farringdon Road, London, E.C.1, is claimed to be suitable for being put to many other uses in the home, including, *e.g.*, therapeutic treatment and photography. The apparatus embodies four improvements, as a result of which distinct advances are claimed on the old models.



Fig. 3.—Driving Unit.

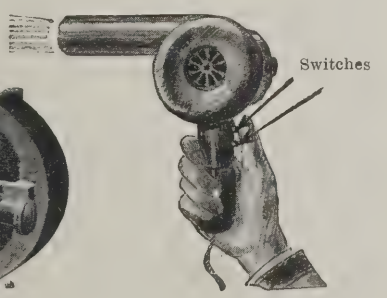


Fig. 4.—Ideal Hair Dryer.

The switches are fitted conveniently in the handle so that they can be manipulated by the thumb of the hand in which the machine is held, leaving the other hand free, fig. 4. The air vane is of a new design with six blades which increases the normal output by nearly 30 per cent. By means of an improved intake the atmospheric noises are greatly reduced. The driving unit, fig. 3, has been greatly simplified, aid is assembled without screws. The dryer is arranged for connection to any ordinary electric lamp holder, and hot or cold air is obtainable by the simple operation of a switch.

A Battery Maintenance Outfit.

A number of special repair outfits for use in connection with battery maintenance have been introduced. Among these is the "Segis" battery outfit, which has lately been put on the market by Messrs. S. Guiterman & Co., Ltd., 35-36, Aldermanbury, London, E.C. The output consists of a full-size hydrometer, a large celluloid funnel with an air vent, four large lead-coated battery clips, a large tin of anti-corrosive battery terminal grease, and an 8-oz. "Testrite" battery filler, all contained in a stout wood case with a hinged cover. The same firm is also handling the "Simplicit" acid pump, which has a conical plug for inserting in the neck of the usual acid carboy, and is operated after the fashion of a pipette scent spray, provision being made for regulating the flow or rate of discharge from the carboy into the battery as required. The whole is constructed of acid-proof materials and is designed to trap the drippings and prevent leakage and waste by overflow. The outfit includes 4 ft. of heavy overflow or delivery tube, and a nozzle end for inserting in the cell openings.

A Feed-Water Impurity Indicator.

The Crockatt Simplex Patent Electric Salinometer, fig. 5, has recently been produced by Messrs. W. Crockatt & Sons, Ltd., 62 and 64, Darnley Street, Glasgow, S.1, for the detection of salt or other impurities in boiler feed water. Its operation is based on the varying conductivity of dilute solutions of electrolytes according to the impurity content, provision being made for the conductivity variation due to changes in temperature. The instrument consists of three essential parts, the detector or electrode cell, the temperature compensator, and the indicating or recording instrument. The detector is

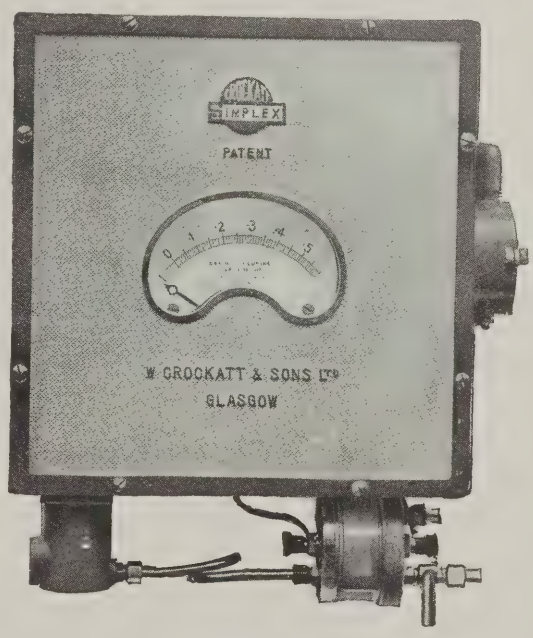


Fig. 5.—Indicating Instrument.

of glass, secured in a gunmetal case, and fitted with platinum electrodes specially designed for obtaining accurate readings. The temperature compensator comprises a gunmetal pocket, containing the thermometer bulb, through which the test water flows on its way to the detector; the rise or fall of the mercury operates a series of contacts which correct the instrument reading for changes of temperature. The indicating instrument, fig. 5, contained in a cast-iron case, is of the moving-coil type, and has a 6-in. dial. A ¼-in. bore copper pipe connects the water system and the thermometer pocket, and from this the water passes through the detector and then to waste or back into the feed system. A watertight switch on the right-hand side of the case provides for the necessary electrical connection.

The instrument is claimed to be extremely sensitive, the standard Admiralty type reading from 0 (pure water) to 0.5 grains of chlorine per gallon, with a temperature range of 80 deg. to 120 deg. Fah.; the usual commercial range is from 0 to 5 grains of salt per gallon. To meet the case where it is desired to take the readings from a number of points, the multi-point instrument has been designed. In this a number of detector cells are used in connection with one indicating instrument only, interlocking change-over switches being fitted so that any cell can be connected to the instrument, and a reading of the salinity taken. Indicating lamps are permanently in circuit to show the presence of salt.

The "Ideal Home" Exhibition.

A Review of the Electrical Features of this year's show at Olympia, London.

(*Concluded from page 455.*)

Standard Telephones & Cables, Ltd.

A very comprehensive range of domestic electrical exhibits is shown on this stand. One appliance which is commanding a great deal of interest is the "Standard" vacuum sweeper. An outstanding feature of this is the "Vac-Mop," an attachment which is specially designed for cleaning polished surfaces. It is arranged so that the cotton duster or mop can be removed at any time for cleaning and replaced. An important point about the sweeper is that all the appliances and tools can be fitted from the front of the machine. The motor is so arranged that there is very little vibration on the handle. The motor switch is in a convenient position on the handle, so that the forefinger of the right hand can manipulate it with ease. Another feature of the exhibit is the "Standard" washing machine. This is of the alternate rotary type, and the clothes are contained in a perforated zinc cylinder, which is put into action by a simple switch. The wringer has rubber-covered rollers, and is capable, it is claimed, of taking a full-sized blanket. The wringer and the clothes washer can be operated simultaneously. The "Standard" ironing machine, fig. 8, is interesting many of Olympia's visitors. A small switch on the right controls the roller and the ironing shoe. In order that the operator may use both hands for guiding the material, a knee switch is provided. An excellent range of domestic table appliances, including coffee percolators, tea infusers and toasters, is also shown.

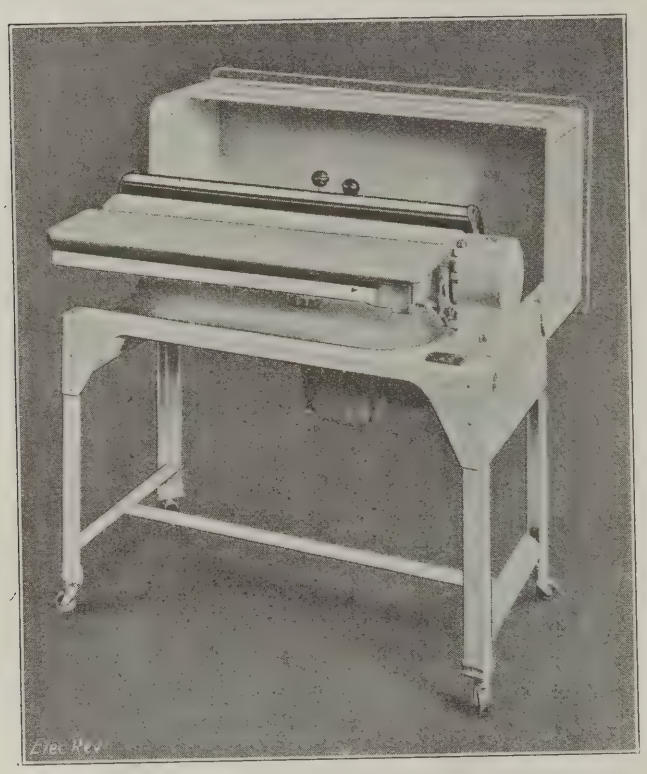


Fig. 8.—An Electric Ironing Machine.

General Electric Co., Ltd.

This company's stand accommodates probably the largest electrical exhibit in Olympia. It is arranged in two sections, one in full view of the visitors from the main floor, and the other comprising demonstrating rooms which are furnished properly so as to give the desired atmosphere for displaying the electrical apparatus. The general exhibit includes cookers, fires, hair dryers, kettles, suction cleaners, refrigerators, toasters, washers, wringers, and so on, all representing the latest developments of the company. The "Magnet" electric wizard (Electrical Review, February 11th, 1927, p. 211) is attracting a great deal of attention from the public, continuous demonstrations being given of its many uses. Another feature of the apparatus shown on this stand is the "Batchelor's" grill. This neat appliance will, it is claimed, perform most of the cooking requirements of one or two people as effectively as many of the larger types of electric cookers will do them for an average family. The demonstration portion of the exhibit includes a reproduction of a modern bathroom, completely equipped electrically to illustrate how the adoption of the electrical idea conduces to comfort, convenience, and hygiene in this important apartment of the home. Hot water is supplied, both to the bath and wash basin, from an electric calorifier, controlled by a thermostat. Over the wash basin is an electrically heated mirror, and conveniently placed beside this is a wall plug to which a small electric shaving pot may be connected. To add to the personal comfort of the occupier during shaving operations, a novel type of lighting unit over the mirror provides a good light without glare. The main lighting is provided by a central "Superlux" bowl. A towel rail and a bath-gown rail are both electrically heated by means of concealed immersion heaters. The equipment is completed by an electric hair dryer and an electric vibrator. In the company's reception room on the stand, which is designed to represent a modern dining-room, a feature is the artificial sunlighting effect from a full-size window, the exterior of which is equipped with "Osram" lamps. The interior lighting is effected by four specially mad inverted wood corner brackets fixed at about a third of th way down the wall, and the result is very pleasing. An all electric kitchen accommodates the usual G.E.C. apparatus fo cooking, washing, cold-storage, and so on.



Fig. 9.—G.E.C. Stand at Olympia.

Dignity is given to the general exhibit by the inclusio of two imposing life-size figures in bronze of a Frank and Saxon—the original Vikings—which were cast many year ago for the Royal Opera House, Paris. Fig. 9 shows thes figures; the lamps are, of course, electrical. A point wort mentioning is the roof of the stand, where from the gallery on sees a huge map of Great Britain bordered by the company trade mark and the words, "The home of quality produ tion" and "Buy goods made in Great Britain."

British Thomson-Houston Co., Ltd.

A very effective and spectacular display is housed on th stand to popularise Mazda lamps. In the foreground, th familiar Mazda clock cut-out, reproduced to a very large scal is picked out by spotlights while the clock face itself is illun inated from behind. To the rear of this tableau a number cubicles representing rooms in the home, are equipp with appropriate B.T.-H. fittings for the purpose of demo strating under actual working conditions the many types a sizes of Mazda lamps, including the latest development—th Pearl Mazda.

Thorn & Hoddle, Ltd.

On this stand is shown a comprehensive range of sm electric generating plants, including the "Pelaphone" equi ment, in addition to a display of lighting fittings of the exhi tors' own manufacture.

Delco Light Co.

An interesting array of automatic electric lighting pla designed particularly for country houses, in addition to au matic electric pumps and Delco-Light battery sets, is to seen on this stand.

Telephone Development Association.

This exhibit is laid out to remind the visitor of the advantages of the telephone service. A very interesting feature of the display is the "Burovox" loud-speaking telephone system which has been installed at Scotland Yard and some important business houses and theatres in the country. The system consists of a small microphone, a number of loud speakers, and the necessary master switch, or, if required, the switch can be combined with a loud speaker as one unit. The loud speakers can be hung up in the required compartments or rooms, or they may be obtained in table-stand form. In connection with this exhibit the Association is running a competition. Each visitor to the stand is given a number, and the holder of a winning number drawn each day will be entitled to the first year's rental of a telephone, installed free at any private residence situated within 1½ miles from an existing exchange.

Frigidaire, Ltd.

At this stand may be seen a wide range of Frigidaire apparatus designed to meet the requirements of all commercial interests concerned with the production and preservation of foodstuffs. The equipment includes cabinets in varying models, and display counters, butchers' caterers, and so on.

Electrolux, Ltd.

Varying designs of the "Electrolux" refrigerator are shown at this exhibit, and also the actual refrigerating unit is displayed without its necessary housing or cabinet.

Other Exhibitors.

Among the other electrical exhibitors are Messrs. Freezone, Ltd., who are displaying their home refrigerator and hygienic larder; Hammond Bros. & Champness, Ltd., electric lifts; Duncan Watson & Co., "Apex" and "Rotarex" domestic electrical appliances; Clarkhills, Ltd., electric water heater; Spenser's Silverlite, electrically-driven gas generator; B.I. Syndicate, Ltd., "Astro" reflectors; Mechanical Refrigerator Co., Ltd., automatic electric refrigerators; Sheringham Daylight Co., Ltd., "Sheringham" synthetic daylight lamps; Ransomes, Sims & Jefferies, Ltd., electric lawn mower; British Home & Office Telephone Co., Ltd., intercommunication telephone system; Electric Appliances Co., Ltd., the "Eureka" electric cleaner; A. W. Gamage, Ltd., small electrical domestic appliances; British Vacuum Cleaner & Engineering Co., Ltd., electric vacuum sweepers; Hurley Machine Co., various electrical domestic appliances; Tellus Super Vacuum Cleaner, Ltd., the "Tellus" cleaner; Electrolux, Ltd., refrigerator; A. Delval, the "Laun-dry-ette" electric washing machine; Radio Vacuum Cleaners, Ltd., the "Vacuette"; Betax Mfg. Co., Ltd., small domestic apparatus; S. C. Johnson & Son, Ltd., electric floor polisher; Gen Labor-Saving Device Co., Ltd., the "Ohio" electric vacuum cleaner; and others.

We learn that the fountain court in the main hall, to which we referred in our issue of March 11th, was manufactured by Mr. G. W. Robinson, who also made the electrical fountain on the *Smallholder* stand in the new hall.

What is Electricity?

"When we read that 'In the beginning God created the heavens and the earth' we know, within the limits of human knowledge, that the first thing made was electricity;" protons and electrons are right and left-handed, having the nature of screws, and are suggested to be simply permanent loops on vortex threads of a vortex sponge ether; the vortices are possibly spiral.

By Prof. W. M. THORNTON, O.B.E., D.Sc., D.Eng., M.I.E.E.

(*Résumé of* Faraday Lecture *delivered before the* Institution of Electrical Engineers.)

RECENT research has shown that the atoms of the universe are spinning groups of electrical charges, minute planetary systems, each with a mass of positive charge as a nucleus about which electrons of negative charge revolve in orbits, each of which corresponds to a line in the atomic spectrum, visible or invisible.

With slight modifications, Newton's law of gravitation holds for farthest stellar systems of immense magnitude and for the smallest atoms: the telescope tells us that the vast interplanetary regions are empty of matter, which spaces find their counterpart in the hollow interior of the atom, swept clear of intruding electric charges by the outer electrons revolving in their orbits a hundred million million times a second; giving out light, under certain conditions, oscillating at the same high frequency. Light is an electrical phenomenon, visible electrical radiation, requiring an oscillation of electrical charge to produce it, and a receiver (the eye) to observe and record it. Since light of a kind identical with that we can make has been received from atomic vibrations in stars so far distant that it has taken a million years (travelling at a speed of 186,000 miles a second) to reach us, we can infer that the electricity in the most distant parts of the universe is the same as that of which our own world is made.

The Nature of Electricity.

Though the nature of electricity as a dual entity may be still unsolved, we know a good deal about it: it is not in the strict sense material, but a kind of sub-matter. Charges have in their electromagnetic behaviour directly opposite characters and for this reason only can they be said to be opposite in sign. There are nearly 25 billion electrons to the inch; protons are still smaller, but are 1.850 times heavier than electrons. When we ask for a pound of bread, or of butter, or tea, we really ask for a pound of electricity in the form of these commodities. There are known to be 92 possible atomic elements of matter, a few of which have still to be discovered; each of them normally contains equal numbers of positive and negative units of electricity. To account for this equality both must have been made simultaneously by the same act, a definite creation. The electricity in the universe is an incredibly vast store of energy: there is enough energy in one pound weight to raise a hundred million tons of cold water to boiling point, or to give 16,000 million horse-power for one hour. The proof of this statement is one of the most solid achievements of the theory of relativity.

Electricity must be made from the ether, there is nothing else to make it from; since in the formation of the charges work is done, and it can only be by compression, tension, or twist, it is necessary to find which was first used. The ether streams through the earth without resistance, the planets do not appear to be in the least affected by their motion through it: it is therefore impossible to apply force to it by ordinary matter, but it can be twisted by electricity in motion, for around every electric current there is a magnetic field, right-handed about a positive charge, left-handed about a negative charge. A magnetic field is a circulation in the ether resembling a fluid "vortex," and can be shown by discharge in a vacuum tube; spiral nebulæ are also evidence of vast spins, or twists, of the ether so large that in some of them the solar system would be lost.

Their electromagnetic behaviour is the strongest evidence that protons and electrons have the properties of screws, of opposite sign, right- and left-handed, respectively; when the motion stops the twist relaxes, the magnetic field ceases. The ether is fine grained, that is, has a structure, first suggested by Lord Kelvin to be that of a vortex sponge, a perfect tangle of extremely small hollow threads of the fluid ether spinning around their centre lines. This view has been supported by very strong evidence, by leading scientists, and it is now suggested that the screw forms of protons and electrons are simply permanent loops on vortex threads of such an ether; they are permanent, for the two sides of the loop are held together by their common circulation just as an electric loop is held together at the crossing point by its magnetic field.

How the Electricities Were Made.

If a great spin were given to a portion of such an ether, half of its spinning threads would be spun tighter, and the other half untwisted; but when a thread is twisted sufficiently a right- or left-handed loop forms, according to the relative

direction of the original spin of the filament and of the superposed twist. Such loops on a vortex thread are permanent, and have all the properties of the electric charges; when moved they produce circulation around their line of advance, in this way accounting for the magnetic field around a moving charge—since the loops are right- and left-handed, their magnetic fields are opposite in sign, but the loop twisted tighter is smaller than that opened out; therefore one electric charge is smaller than the other, and so the proton is smaller than the electron. The smaller offers more resistance to motion than the larger, for it is more difficult to get a fluid stream through a small orifice than a large one; thus the proton is much more difficult to move than the electron, being 1,850 times more massive.

The Electricities Combine to Form Matter.

There is evidence that the ether is not an incompressible fluid, and that its filaments are short and varying in section, though each in itself has the same circulation, for the protons and electrons all have the same electrical charge; that is, have the same strength, or associated movement, around their centre lines. Imagine these filaments continually joining up and breaking apart as they get too long for stability, in perfect confusion, each retaining its intrinsic energy of spin. No filament has a definite end, or beginning, but its motion is, as it were, trumpet-shaped at each end; when two filaments on which permanent loops have been formed approach, their ends, which have the same direction of circulation, coalesce, but the longer filament so formed is no longer unstable: the two parts when joined form an atom, or part of an atom. If there are only two, one of each, we have a hydrogen atom; the next highest, the helium atom, is much more complex, and the scale of complexity rises rapidly according to clearly-defined laws.

The ether itself is an insulator, that is, it contains no free isolated electric charges, but it transmits electric waves by the rocking motion communicated to its filaments by the oscillation of an electric charge in an atom, in which case the waves are short; or by electrical oscillations on conductors (forming, for example, the aerials of radio systems) when the waves may be miles long; in every case, X-rays, light, or radio, the mechanism and velocity of transmission are the same. A charge in its motion drags the adjacent filaments in contact with it around as it passes: they at once relax to their old position, but because their motion has magnetic energy, they overshoot and oscillate, handing on the motion to the next filaments at the speed of light. To have this high frequency the ether behaves, because of its intrinsic spinning motion, as a very rigid medium with an extremely high coefficient of elasticity.

Matter in Motion.

Electricity in motion produces magnetism. Since all matter is electricity and contains equal quantities of each kind, matter moved through space does not give rise to any external magnetic effect: the two kinds counteract one another, but when the motion takes place in a magnetic field, the resultant force on all the positive charges which form matter is in one direction, sideways to the motion; that on the negative charges is in the reverse direction, and the charges therefore separate a little and the body is said to be polarised. If it is an insulator, the polarisation is proportional to the velocity of movement; if a conductor, it is also proportional, but only one charge (the negative) can move. All the positive charge is anchored in the nuclei of atoms and cannot move bodily, but in metals and similar substances a great number of negative charges are free to move about like molecules in a stream, and when such a body is moved in a magnetic field there is a piling up of negative charge at one end of the conductor—resulting in what is called the open-circuit voltage. When the ends of the conductor are joined, a stream of (negative) electrons passes through the external circuit and back into the wire forming a completely closed path, the motion of the conductor through the magnetic field causing it to act as an electron pump, or dynamo. The work done in causing the electric charges to stream along in this way is not dissipated (or only a small portion of it) in the machine, but is handed on to the external circuit.

[The lecture, which has been delivered before crowded audiences in London and at eight local I.E.E. Centres, some of which were joint meetings with other societies, was illustrated with lantern slides and effective demonstrations.—Eds. Elec. Rev.]

Electric Lamps and Valves.

An indication of the nature of some of the problems encountered by manufacturers who seek a reduction of empiricism in process operations: efforts to solve them lead to fundamental questions which science has so far failed to answer.

(*Abstract of Lecture delivered before the* Royal Society of Arts.)

THE Hall of the Royal Society of Arts in John Street, Adelphi, has not often been more crowded than on the occasion of the lecture with demonstrations and experiments, given on Wednesday, February 16th, by Mr. C. C. Paterson, Director of the Research Laboratories of the General Electric Co., Ltd., at Wembley.

The first part of the lecture related to the change that has come about in the manufacture of incandescent lamps during the past decade, hand manipulation having largely given way to mass production; there is still much hand work in the manipulation of the filament, but the bulk of the processes is carried out automatically. Ten years ago the output of ordinary incandescent electric lamps during the final stages of manufacture was at the rate of three per operator per hour; to-day it frequently touches 25 per operator per hour. The total world consumption of lamps at the present day is about 600 millions per annum, of which this country manufactures and consumes about 30 millions. This might sound a small proportion, said Mr. Paterson, but in itself it was a large quantity, and one which would clearly be increased very greatly in the future.

The valve, thermionic or otherwise, was subject to the antagonistic efforts of those, on the one hand, who, for the sake of efficient production and standardisation, desired to limit the number of types to a minimum and, on the other hand, of those who found in the many possible variations of design an opportunity to obtain interesting results in combination with the many possible variations in wireless receiving circuits. Hence, where the production engineer could plan for the lamp in terms of hundreds of thousands of a type, he must, in the case of the valve, be content with tens of thousands. The resulting difference in efficiency of production was considerable, but at the present stage of development it was probably inevitable.

The paper briefly surveyed some of the materials involved in lamp and valve making, after which detailed consideration was given to the vacuum, the transmitting valve, and the filaments of both lamps and valves. With regard to the vacuum, the importance of removing the last traces of gas was stressed, it being explained that in gasfilled lamps, and before gas-filling took place, every possible trace of water vapour must be removed, because it acted in relation to the gasfilled lamp filament as cancer did in the animal body and caused alternate local growths and wastage. In ordinary transmitting valves, gas present caused wastage of the filament through bombardment by the gas molecules, and in dull-emitting transmitting and receiving valves, it poisoned the filament surface with a contaminating gas layer through which the electrons could not pass. The first step towards the removal of the last traces of gas was a thorough understanding of the nature, the origin, the quantity and behaviour of the residual gas, because it was the action of the residual gas with which they were most concerned: it was not possible to get rid of all the gas; some remained even in the highest vacuum.

Apart from minute accidental leaks, the gas which was liable to give trouble was that which came from the glass and from the metal electrodes. The glass gas consisted chiefly of water vapour and carbon dioxide in not very unequal proportions, whilst the metal gas was mainly carbon dioxide and hydrogen. In the practical evacuation of lamps there was not usually any trouble through the spoiling of the vacuum by gas from metal, because the total surface of metal was relatively small. It was therefore only necessary to consider seriously the glass gas. It would be easy to evacuate every lamp by long pumping with a good diffusion pump, simultaneously heating the glass, so as to leave it in as gas-free a condition as possible. That, however, would be far too slow and expensive a process and altogether unsuitable for economical mass production. Research workers had, therefore, studied the conditions for the holding of gas down on to glass surfaces with a view to using this phenomenon to the best advantage. The result of this work had been that the capacity of the surface for gas could be enhanced by the con-

densation on the glass of any vaporised solid material, such, for instance, as that of the filament metal itself, or of a coating of any suitable material the vapour of which would condense on the glass. In the case of lamps it was essential that that layer of condensed vapour should be transparent, and phosphorus vapour mixed with cryolite answered the requirements well, the amount of phosphorus used being just sufficient not to colour the bulb, usually coated on to the filament before the latter was mounted. It could also be sprayed on afterwards. After mounting, the bulb was evacuated to as low a pressure as possible by the vacuum pumps, under heat, and sealed off. On heating the filament the phosphorus was immediately vaporised and condensed on the inside walls of the bulb as red phosphorus. Simultaneously, a large number of the gas molecules adhered to the surface and were mixed up with the phosphorus layer. During the condition of violent ionisation existing during the operation, the molecules of red phosphorus on the surface of the layer were subjected to electronic bombardment which converted some of them to white phosphorus, which tended to vaporise again, and then to recondense as red phosphorus on the surface, burying more gas molecules in the layer and presenting always a fresh surface to which gas molecules could attach themselves. The major part of the process was all over in a second or so, but so long as there was any electronic bombardment of the surface it would continue. If, during the life of the lamp, gas tended to be freed, ionisation would increase and so would the process of "clean-up," so that every lamp had its own automatic safety device in the invisible phosphorus layer on the inside surface. This picture, said the lecturer, was simple, but it was to some extent speculative because certain factors were not yet clear. They did not know, for instance, what part was played by the ionisation of the gas molecules themselves. They did know, however, that ionisation was necessary for the "clean-up," although molecules did not go to the walls in an ionised condition.

In the case of thermionic valves of relatively small size, transparency of the deposited layer did not matter, and vaporised magnesium was generally used. This caused the well-known mirror-like appearance of the inside of the bulb of most wireless valves.

Discussing the difficulties encountered in the manufacture of large transmitting valves, and the danger of using large areas of glass which approached the temperature at which there was an apparently continuous evolution of gas from the glass, it was pointed out how the designer had the choice of doing away with glass altogether for large valves, or of restricting its use to those parts where electrical insulation was needed, but which could be kept at a low temperature. On account of its insulating properties, its non-permeability at normal temperature to gas, and its mouldability, glass (or its pure form, silica) was the best material available for that part of a valve where the electrodes were held and where current had to be led from outside the evacuated enclosure to the inside. Metal, however, said Mr. Paterson, was clearly the best material for those parts where great heat energy had to be dissipated and the only means of carrying it away was by water or another form of intensive cooling. Therefore, the water-cooled valve had been developed, the great step forward in connection with which—made originally in America—was the large glass-to-metal joint for connecting the glass ends to the metal centre. The glass-to-metal joint was an established item in the technique of this industry and might have considerable future applications. Such joints had been proved to withstand a pressure of 100 lb. and more at the centre.

The final part of the paper discussed in some detail the more or less well-known features, to engineers, of the manufacture of tungsten filaments, and related the work that had been done towards obtaining filaments of one long crystal instead of a large number of crystals. Here, again, speculation was involved in their knowledge of the crystal structure of filaments and their relation to the properties of the lamp filament after it had become incandescent. Experiments had indicated the nature and trend of research in this direction, but the large question of the ultimate strength of different types of filament and their relative ability to withstand the stresses to which they were liable to be subjected in use, had to be left for want of time. It was pointed out, however, that the properties required in tungsten filaments for valves were very different from those required for lamps. The extraordinary coincidence was noted that the very ingredient, thoria, which for years had been used by lamp makers to restrain grain growth in filaments, should be the one material above all others suitable for contributing an entirely different property, *i.e.*, that of emitting electrons. The "dull-emitting" property of tungsten filaments depended upon the maintenance of a molecular layer of thorium on the surface of the tungsten. This continually evaporated and was constantly replenished from the thoria contained, it was believed, mainly in the grain boundaries of the tungsten metal. This thorium layer facilitated the emission of electrons because one of its specific qualities was to offer a lower resistance to the passage of the electrons than an equivalent layer of tungsten molecules. The layer was readily contaminated by minute traces of oxygen containing gases and vapours, hence the importance of a high vacuum and an agency always at hand to deal chemically with the objectionable molecules. So far, however, as the metallurgy of the filament was concerned, the object was to secure such a grain structure as would afford rapid and plentiful diffusion of thorium to the surface of the metal. The difficulties of the technique and study of this work, continued Mr. Paterson, must be borne in mind; many of the filaments under consideration were of the order of only 0.02 mm. diameter, a size which had the same relation to an ordinary sewing needle as the diameter of the needle had to the wrist of the person using it.

The paper was an attempt to indicate the nature of some of the problems which were forced upon the manufacturer who sought to reduce the amount of empiricism in his processes. The efforts to do so had led very quickly to fundamental questions to which science had not yet given an answer, or, at best, only a partial one. An effort was being made to force the pace in these fields of study for which, in certain ways, the technique of the lamp maker, when used in the laboratory, had unique advantages.

During the course of the lecture a series of interesting experiments and demonstrations was carried out. Among the exhibits was a large incandescent lamp made with the object of seeing to what extent size could go. It was a 10-kW lamp giving 25,000 c.p., and when lighting it Mr. Paterson warned the audience not to look directly at it. Another lamp was shown to illustrate the type of incandescent lamp now used in lighthouses. This was a 3-kW lamp, whilst for comparison there was a 100-volt gasfilled lamp. There was also exhibited a specimen of the large water-cooled valves which are now used at Rugby, Daventry, and elsewhere for wireless transmission, as well as an extra-high-voltage rectifier for 150,000 volts. A 50-lb. weight was hung upon a metal-to-glass joint, referred to in the paper, and the joint held easily. Dr. Smithells, one of Mr. Paterson's colleagues, then put the joint on two chocks and put all his weight upon it without breaking it. Other experiments were in relation to the heating effects upon filaments.

Sir Oliver Lodge, proposing a hearty vote of thanks to Mr. Paterson, recalled the exhibition in this country of the first electric lamp by Swan, who, at the time, had said he thought it would make a real lamp in time. It seemed incredible that the advances shown by Mr. Paterson to have taken place since that time should have happened within his (Sir Oliver's) lifetime. Those who had been accustomed to work in university laboratories must have felt green with jealousy when they realised the opportunities, the staffs of brilliant workers, and the money available in connection with the research laboratories of our great manufacturing companies. He congratulated the General Electric Co., Ltd., on possessing the services of Mr. Paterson and his assistants, and Mr. Paterson on the General Electric Co., because it was only possible to go ahead at the tremendous rate Mr. Paterson had shown was feasible when one had commerce at one's back.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

A Handicap to Electrical Progress.

In your issue of to-day's date I notice a letter headed "Handicap to Electrical Progress." In the letter Mr. I. Fawcett states that there is only one conclusion to be arrived at from the fact that gas consumers in Leicester have to pay a lower deposit than electricity consumers, but I think that there is another logical conclusion, namely, that a consumer, having been accustomed only to gas supply, realises the cleanliness and convenience of electricity for lighting, heating, and cooking purposes, and as a consequence the consumption naturally increases.

This, of course, leaves out the question of the reduction in the doctors' bills due to the reduced poisonous content of the atmosphere, and possibly in the near future a reduction in life insurance premiums, due to the longer possible duration of life, apart from any tragic suddenness, of which we see so many instances in the newspapers day by day.

Anticipating a larger consumption, the Council will naturally ask for an increased deposit.

T. A. Kerr.

Electricity Works, Trafford Park.
March 18th, 1927.

The Wireless Receiver as a Load.

It is indeed remarkable that in a booklet published by the Association which is trying to increase the uses of electricity, no mention whatever should be made of the wireless receiver, although there is, as the newspapers have long realised, no better headline than "Broadcasting," and there is no electrical apparatus in the house either costing so much, or used so regularly, as the wireless receiver. Why, then, is it so generally ignored by the supply authorities, when it is actually a most useful potential load?

At present, in 99 cases out of 100, the accumulators are charged at a centre with power, probably at the power rate, making a profit for the contractor and using the supply at the time which least suits the station.

In the hundredth case the user charges his own battery—at the lighting rate—for one or a couple of nights per week. It costs him less, his battery lives twice as long, and it is a useful load to the station, apart from the extra life of the carpets!

As a manufacturer who has over 50 receivers running off the mains, I can state quite definitely that with an apparatus costing not more than £5 fitted, any wireless receiver can be run off the mains at a total cost of 1½d. to 2d. per day to the consumer, including h.p. and l.p. (which compares very favourably with the cost of batteries; at the same time it will increase the station revenue by about 1d. per day.

This is, of course, the d.c. figure. The a.c. first cost is higher, but the running figures are the same, or slightly less.

Actual experience of many receivers working off the mains shows that accumulator charging costs are halved as a minimum, accumulators last 2½ years or more as against less than 12 months when charged outside, and, the greatest saving to the user, valves last very much longer.

Apart from this, there is a constant and ample supply of h.p. and no battery crackling.

Surely one penny per day per receiver (as a night load only) is useful to "the chiefs."

Ernest J. Baty.

Luton, *March 18th*, 1927.

The Salaries of Engineers.

Those who have written on the above subject in your columns in the previous two or three issues, are quite right in the severe blame handed out to the Institution of Electrical Engineers. The National Union of Scientific Workers, which was mentioned by your first correspondent, is equally guilty of neglecting to attach due importance to the financial interests of its members. I suggest that both these institutions would greatly increase their usefulness by appointing committees of young engineers to investigate the whole matter of remuneration. The older and more influential members, being permanently in receipt of comfortable salaries, devote themselves to academic interests, neglecting even to study the financial positions of their own employés.

Although I agree to this extent with previous correspondents, I must say that engineers themselves are somewhat to blame in submitting to the treatment meted out to them. They have a very justifiable grouse, but are too lethargic to take steps to get it rectified. That lethargy, however, does not extend to their sphere of labours, for no body of men is more efficient or conscientious.

A great share of blame, however, lies on the employers. They wilfully pay their technical staffs immorally low salaries, knowing full well that this class of employé, at present, has no means of obtaining redress. Some time ago, I saw the statement by a competent authority that the adult human being had a capital value of £12,000. On a basis of 50 years' purchase, without interest, this amounts to £240 per year. This figure should be a *basis* salary for every decently educated person in the country, adjustments being made for the nature of the work being done by the individual, and for the size of his family. This view is not merely a Utopian one, but is sound business, and on some such lines the solution will eventually be found.

Yet Another.

March 14th, 1927.

Your "Poor Blighter" letters should possess an important interest for those who are in a position to deal with the matter at issue.

There is no doubt that the question of engineers' salaries is very largely wrapped up with the question of "supply and demand." This is, it would seem, quite a wrong basis on which to settle the salary question, even as it is wrong to immediately increase the price of a commodity because there is a temporary shortage of that commodity.

Whilst this basis is retained, and the works and colleges are turning out annually an ever-increasing number of young men who have in their studies attained a high standard of engineering knowledge, it would seem that some scale providing a suitable minimum salary should be enforced upon those employers who, under the present wage or salary system, are acting much in the same way as did the "war profiteers" throughout the great "European Upheaval," all of which simply points to a degradation terrible to contemplate, and of which modern industrial history gives too many examples.

As evidence of the deplorable condition of the labour market so far as concerns skilled technical work, may I cite a recent instance which came to my knowledge, of a vacancy for a junior in a small generating station. Among the 72 applications for this unimportant post were, I understand, the following:—Two B.Sc.'s (Eng.), one Whitworth exhibitioner, one qualified for Assoc. Membership of the Civils, and seven A.M.I.E.E.'s. Among the remainder, most of whom were reasonably worthy applicants, were two with 1st Class B.O.T. marine engineer certificates. The wage for this job was 40s. per week—the job was waiting for a youth.

This is a pointer, and indicates to my mind a rather sad state of affairs, and much would seem to be necessary of achievement, so far as the electrical industry is concerned, before these mostly unemployed qualified men are found their proper work in the world.

The general opinion is, I am afraid, that matters are becoming worse year by year, and who can wonder at it when one reads in the newspaper of a prominent electrical engineer consultant, and M.I.E.E. (till a few years ago, a monument of enterprise in the electricity supply business) engaging himself (probably for a suitable fee, for most consultants, I am told, have the money sense reasonably developed) to the National Gas Council, for the express purpose of opposing a municipal application for a Provisional Electricity Order.

One reads also of electrical consultants who specialise their efforts among the gas concerns throughout the country, some of which have, more or less successfully, been persuaded to take up the supply of electricity.

It may be urged in the wider interests that in some localities no alternative existed, but in an equally large number of cases it would appear that in the long run, such combination of interests (*i.e.*, gas and electricity supplied by the same authority from the same roof, under one management) does not favour the electrical industry, especially where, as in the majority of cases, the gas manager suddenly has to apply himself to the study of elementary electrical engineering, as a result of his being appointed "electrical and gas engineer."

Something has to be done, and the sooner the question of engineers' salaries (I refer to those outside the membership of the E.P.E.A.) is faced in a reasonable way, the better and more enthusiastic will service be rendered, and the produce of that service increased.

Here then, perhaps, the I.E.E. may find food for thought, for anything that is inimical to the interests of the electrical industry and the proper status of those engaged within it should arouse their attention, and bring forth their corrective and helpful influence.

P. W.

March 7th, 1927.

Your numerous correspondents on the above subject seem to miss the most important aspect of the question, namely, the fundamental economic law of supply and demand. As long as our technical institutions are allowed to turn out trained engineers in hundreds per annum irrespective of the state of the labour market, there will always be a considerable surplus for employers to draw upon, with the consequent deplorable remuneration of those who are already employed.

Some method similar to that adopted by America, of allowing only a certain quota of immigrants to enter each year, appears to be necessary to the engineering profession if the status of engineers is to be raised.

One of your correspondents, speaking for the Society of Technical Engineers, hopes to attain this desirable state of affairs by registering engineers by act of Parliament, so that by some mysterious means the salaries of engineers would rise automatically. He draws the analogy of the British Medical Association; but the latter is more or less a homogeneous body with a common object, whereas a registered body of engineers would consist of both employers and employés whose aims would cancel one another.

It is, of course, no simple matter to restrict the production of engineers now that matters have reached the present deplorable state, but one can always attempt to persuade parents seeking a career for their sons to place them where they are much more likely to lead a civilised existence.

They might do worse, for example, than apprentice them to a grocer, fishmonger, or publican. There is always the prospect of a seat on the local Council or in the House of Commons, and with their lack of knowledge of the elements of electricity they may even attain a position on the Central Electricity Board.

M.Sc.

March 18th, 1927.

Faults in Flexibles.

In calling attention to the above matter you are doing good service.

In my experience too little care is *taken* in the selection of a suitable flexible cord, particularly for portable electrical appliances and pear switches.

The danger with a faulty cord is not a short circuit, as the circuit fuse usually takes care of that; what usually happens is the following:—Owing to insufficient mechanical strength, the strands gradually break until continuity is maintained by a few wires only, which heat up; arcing occurs as the strands intermittently make contact, causing the rubber and/or the textile covering to smoulder, and if not promptly checked a fire may result.

In order to overcome these risks my firm introduced, a few years ago, a flexible cord named "Feraflex," incorporating with the copper wires several fine steel wires; over the insulation of these strands is woven a fine asbestos yarn which would effectively stifle any tendency to spark or flame; the conductors are twisted together, and to prevent kinking are braided over the twist with polished cotton or silk. This cord, used with electric irons, table lamps, vacuum cleaners, and other portable appliances, has been very successful; it is neat in appearance and unobtrusive.

Unfortunately, with the craze for cheapness, the flexible cord largely used is the cheap foreign make with a thin film of rubber, which constitutes a positive danger.

For pendant lights the 20-mil pure rubber insulation flexible with conductors of not less than 23/36 will be found safest.

The so-called "workshop flexible," with the conductors under a compounded braiding, is not, in my opinion, a desirable or safe cord to use.

S. A. Laird,
London Manager, Ward & Goldstone, Ltd.

London, *March 15th,* 1927.

Electric Cookers in Housing Schemes.

I am anxious to obtain information upon the following subjects with reference to the installation of electric cookers in houses erected by the local councils:—

(1) Have they proved satisfactory?
(2) Under what conditions are they fixed—such as initial charges and price per unit?
(3) Are the consumers satisfied as regards the cost of installation and also the price per unit?
(4) Type of stove used?

Thanking you and your readers in anticipation.

H. A. Woods.

London, *March 16th,* 1927.

Parliamentary News.

[By Our Special Parliamentary Correspondent.]

Private Bills.

The Farnham Gas and Electricity Bill has been read a third time in the House of Commons, and the North Metropolitan Electric Power Supply Bill has been read a second time.

Rugby Wireless Station.

On March 14th, Viscount Wolmer, Assistant Postmaster-General, informed Sir F. Wise that the cost of the Rugby wireless station, including the site, buildings and plant, was about £480,000.

Broadcasting.

On March 15th, in reply to questions by Sir H. Brittain, the Postmaster-General said that the rule governing the use of wireless receiving sets in hospitals was that a single licence covered the installation of any number of receiving sets for general use in the main building; but separate licences were necessary for sets installed in other buildings, for example, in the private residential quarters of members of the staff. He was always prepared to give consideration to any case in which a strict application of the rule appeared to work harshly.

Asked by Sir H. Brittain how many cars were made use of throughout the country for the detection of the source of oscillation caused by wireless sets, Sir W. Mitchell-Thomson said that one car was in use at present. A second car was on order.

Viscount Wolmer informed Mr. Day that five persons had been prosecuted for using wireless transmitting apparatus without a licence. A conviction was obtained in each case, and the penalties ranged from a fine of £4 to a fine of £10, in addition to £5 costs. In two of the cases the apparatus was confiscated.

Ultra-Violet Ray Treatment.

On March 17th, Mr. Day asked the Minister of Health whether his notice had been drawn to the refusal of the Public Control Committee of the London County Council to amend its massage licence to include ultra-violet ray treatment under medical supervision, on account of the potential danger to the amateur and inexpert; and whether he would consider the introduction of legislation to restrict the sale or use of such apparatus to persons with medical experience only.

Mr. Chamberlain said he had no information as to the fact stated in the first part of the question, and he was not aware of any necessity for legislation of the kind suggested.

The Hastings Electricity Order.

Application was made to the Special Orders Committee of the House of Lords on March 15th, by the Hastings and St. Leonards Gas Co. for a further inquiry into the Hastings Electricity (Extension) Special Order, 1927, to consider a claim for the insertion of a clause affording protection to ratepayers against any loss which might be incurred by the Corporation in the supply of electricity in the extended area.

For the Gas Co. it was stated that the Order proposed to extend the area of the Corporation for the supply of electricity to include the borough of Rye, the urban district of Battle, the rural districts of Hastings, Rye and Battle, and the parish of Ninfield, in the rural district of Hailsham. The Gas Co. supplied gas in the borough of Hastings and various outlying places, including some of the parishes and places comprising the added area for the supply of electricity by the Corporation, and it was also one of the largest ratepayers in the borough. It alleged that its property, rights and interests would be injuriously affected by the Order. During the proceedings on a 1924 Bill the Corporation had stated that its electricity undertaking was working at a profit, and at that time it was affording a supply in bulk to Bexhill from a new power station. The price of that supply was an uneconomic one. It was admitted at a local inquiry held in 1925 that at the time of the promotion of the 1924 Bill the Corporation had in mind the extension of area now proposed. It appeared at that inquiry that the scheme of the Corporation would not be self-supporting; it was admitted by the Corporation that there would be a loss during the first few years. The Gas Co. pointed out that quite apart from any question of loss in relation to the proposed extension of area, there was a deficiency at present of some £23,000 on the working of the existing electricity undertaking. It was admitted at the inquiry that within five years the capacity of the existing generating station would only be sufficient to meet the needs of Hastings coupled with the supply to Bexhill, even if there were no added area. Therefore, with the added area, further capital expenditure on that generating station would be necessary at an early date.

A statement submitted to the Committee on behalf of the Hastings Corporation said that when the Corporation applied for the Order the Gas Co. had lodged objections, and the Electricity Commissioners had caused a local inquiry to be held. After full consideration the Commissioners had determined to grant the Order without the insertion of the protective clause now asked for. The Order was submitted to the Minister of Transport for confirmation, and after an inquiry had been held into the memorial of the Gas Co., the Minister had confirmed the Order without the insertion of the clause. Committees of both the House of Lords and the House of Commons had refused to insert the clause in the Corporation's 1924 Bill. The Corporation was convinced that within a comparatively short time the scheme would not only be self-supporting, but would be a profitable undertaking. The Corporation's figures had been accepted, both by the Electricity Commissioners and the Minister of Transport.

The total amount received from the rates by the electricity undertaking was £35,232, all of which was received earlier than 1920. Since April 1st, 1921, the undertaking had transferred in aid of rates £12,140, leaving a net deficiency of £23,092. As against this deficiency there must in fairness be set off the reserve fund of the undertaking, which at March 31st, 1926, totalled £25,904, and at the same date there was an unappropriated profit to the credit of the undertaking of £6,731. Certain ratepayers who appeared at the original local inquiry in addition to the Gas Co. had not pursued their opposition either before the Minister of Transport or Parliament. Finally, the Corporation submitted that the petition disclosed no substantial grounds for complaint; and that the subject matter of the Order had been so dealt with in departmental inquiries that further inquiry was unnecessary.

The Committee decided that further inquiry was not necessary.

Legal.

Southern Counties Electric Light and Power Supply, Ltd.

Mr. Justice Romer, in the Companies' Winding-up Court, on March 15th, had before him the petition of Mr. Percy Green, of Leamington Spa, a judgment creditor, for an order for the compulsory liquidation of the Southern Counties Electric Light and Power Supply, Ltd.

Counsel for the petitioner said he was substituted for a previous petitioner last week, and the petition had had to be amended and filed, but the affidavit verifying that had not yet been sworn. He therefore asked for the petition to be adjourned for a week.

Mr. Bischoff said he appeared for the original petitioner. He was paid a cheque for the amount of his debt and costs, and the petition was adjourned to see if the cheque would be cleared. The cheque had been cleared, but it was not accepted as payment, although the money was in hand pending the result of the petition. If an order was made it would be returned as having been paid since the commencement of the winding-up.

Mr. Hecksher said he represented a judgment creditor who was in the same position, and he was also holding the proceeds of a cheque which he had received until a decision on the petition had been given.

His Lordship adjourned the petition for a week.

Theft of Electricity.

At the Castle Eden (Durham) Police Court, on March 19th, John G. Cutter, a Minor of Thornley, was prosecuted at the instance of the Weardale Coal Company for the theft of electricity, the property of the company. It was stated that the company supplied electricity to the defendant's house, and upon inspection it was found that the meter had been short-circuited, rendering it ineffective. The company believed that this state of affairs had lasted for some time. A fine of 40s. was imposed.

Reviews.

The New Electricity Act. By W. S. Kennedy, LL.B. Pp. 142. London: Ernest Benn, Ltd. Price 6s. net.

The author of "The Electricity (Supply) Act, 1919," has lost no time in preparing a similar "popular exposition" of the new measure from which so much is expected. His explanatory analysis of the Act, published in our issues of January 14th and 21st, was necessarily restricted to its leading features: in this book he has endeavoured to translate the cumbrous phraseology of the Act into more comprehensible and readable English, and to explain briefly what the Act means to the man in the street. He does not, however, profess to give a detailed exposition of the Act, nor does he comment on its working. The book deals with the Act under seven divisions, taking the sections in order, with separate *résumés* of the provisions relating to arbitration, and the relations between the Board and the Electricity Commissioners, which, in some respects, are "rather anomalous." The remainder of the volume (60 pp.) is occupied with the complete text of the Act, and the index.

The Electricity (Supply) Act, 1926. By T. J. Sophian. Pp. vi+62. London: Sweet & Maxwell, Ltd. Price 4s. 6d. net.

This is a publication in separate form of an extract from Chitty's Annual Statutes, 1926, and is intended for the guidance of those who have occasion to study or refer to the Act. It consists in the main of a reprint of the Act, with a subject index, and numerous footnotes referring to previous Acts, cross-references to sections of the 1926 Act itself, excerpts from Acts partly repealed or modified, and explanatory comments. A prefatory note contains the memorandum presented to Parliament on the introduction of the Electricity (Supply) Bill, explaining its objects and origin.

The Electricity (Supply) Act, 1926. By E. J. Rimmer, B.Sc., M.Eng., and G. Read Allen, M.C. Pp. v+206. London: Solicitors' Law Stationery Society, Ltd. Price 12s. 6d. net.

This volume contains a table of statutes relating, however remotely, to electricity supply, with references to the pages on which they are cited, an introduction briefly reviewing the Electric Lighting Acts as a whole, with extended reference to those of 1919 and 1922, and a summary of the main provisions of the Act of 1926, which occupies 45 pages. A useful table shows the sanctions which the Board must obtain before it can exercise certain of its powers; this occupies three pages. It is pointed out that the powers and duties of the Electricity Commissioners have been extended, not diminished, by the new Act; their control in technical matters remains complete, many of the powers of the Minister of Transport have been delegated to them, and their authority has been strengthened; the changes in their powers and duties are set out in five pages. All the provisions of the Act relating to prices, charges, and valuation have been brought together under one heading.

There follows a complete reprint of the Act of 1926, with explanatory notes, cross references, references to other Acts, and comments. An appendix gives the text of the Electricity (Supply) Acts of 1919 and 1922, and a full subject index occupies 18 pages. Both of the authors are engineers as well as barristers-at-law, and have given attention to the engineering as well as the legal aspects of the Act.

The Electricity (Supply) Act, 1926. By J. C. Dalton, A.M.I.E.E. Pp. xviii+152. London: Butterworth & Co. Price 10s. 6d. net.

This is a supplement to "Will's Electric Lighting," 5th edition, and to those who are familiar with that invaluable work no more need be said. It is self-contained, as far as possible, but cross references to the parent book are given. A table of Statutes occupies seven pages, and a table of Cases is given. The history of the Act of 1926 is briefly outlined, and the Weir Report is summarised; the author then devotes separate chapters to the Central Electricity Board, schemes, the position of undertakers and others in relation to the Board, other provisions of the Act, and the consumer, after which the text of the Act, fully annotated with critical and explanatory comments and references, occupies 94 pages. A very complete subject index is provided. The contents of this book bear evidence of an exhaustive study of the Act and of its relation to previous Acts and existing conditions, involving untiring industry and a profound knowledge of the law of electricity supply. It is a worthy supplement to "Will's Electric Lighting"—and that, perhaps, is as high a compliment as the author and publishers could wish for.

Polyphase Induction Motors. By R. D. Archibald, D.Sc., M.I.E.E. Pp. vii+88; figs. 46. London: Chapman and Hall, Ltd. Price, 5s. net.

The growing importance of the induction motor amply justifies the appearance of a small work for the use of those who, without wishing to take up the problem of the design of this machine, are desirous of obtaining a sound knowledge of the principles of its construction and of its operating characteristics. Dr. Archibald's little book is evidently intended for such readers, it is generally non-mathematical in character, and will teach those interested in the elements of the induction motor, most of what they ought to know. It is difficult, in the limited compass which the author has allowed himself, to make a judicious selection of the many aspects of the whole subject which are of general interest. It is possible to criticise the selection which has been made, on the ground that to the majority of operating engineers a fuller discussion of the subjects of speed control and methods of starting would have been of greater interest than a detailed treatment of the conditions existing in the magnetic circuit of the machine. The general structure of the book is such that it is perhaps more useful as an introduction to a more complete study of the induction motor, than as a handbook for the use of the general electrical engineering reader.

The first chapter of the book is devoted to an elementary explanation of the principles of the operation of the polyphase machine, the production of a rotating field, and general details of construction. Chapter II deals with the circle diagram in its approximate form, its derivation, application, and construction from the results of open- and short-circuit tests. The author then proceeds to considerations of the distribution of the magnetic flux, the meaning of dispersion co-efficient, its approximate calculation from design data, and from the circle diagram. A chapter then follows, which gives detailed calculations relating to an actual machine, which serve to illustrate the foregoing work. The final chapter deals with operating characteristics, methods of starting, and speed control, the treatment of the last subject being rather sketchy. More space might well have been devoted to the discussion of the speed-torque characteristic; an investigation of the simple equation connecting these two quantities is very instructive.

There are a number of examples for solution at the end of the book, with answers, and also an index. The work will be found useful for those intending to proceed to a more extended study of the induction motor.

Makers of Science: Electricity and Magnetism. By D. M. Turner, M.A., B.Sc. Pp. xv+184; figs. 65. Oxford University Press. London: Humphrey Milford. Price, 7s. 6d. net.

This small volume is not confined exclusively to biographical sketches of the great outstanding personalities who have left their impress on the development of electrical science, but gives, in addition, brief outlines of the principal contributions which they have made to this development. Beginning, really, with Petrus Peregrinus in the thirteenth century, the author deals in chronological order with the work of Gilbert, of Colchester, and that of each of his successors who have carried the torch of science up to our own times. It is a fascinating record, and one which will bear reading over and over again because of the personal and human element with which the author has invested it. It would seem invidious almost to select one or more of those, whose work is dealt with here, for illustrative purposes; but the manner in which the contributions to science by Faraday and Maxwell have been treated is all that one could expect within the limits to which the author has restricted himself.

The field covered includes electrostatics, the electric current, electromagnetism, electromagnetic induction, the development of electrical theory, electrolysis, the conduction of electricity through gases, and the electrical constitution of matter. In the last chapter we are brought right up to the work of J. J. Thomson, Bragg, and Moseley, on the connection between electricity and matter; but, in the words of the author, "if we ask 'what is electricity' we are left with an unanswered question." It is somewhat surprising to find, however, no reference to the work of Eddington or of Jeans in the sphere of astrophysics, and the bearing that such work is having on our knowledge of the constitution of matter and of its relation to radiation, but probably it is of too recent a date to admit of its incorporation in the book.

An introductory chapter on the need for a History of Science is furnished by Dr. Charles Singer. There are 65 illustrations throughout the text, including a number of portraits; that of Faraday is particularly good. We heartily recommend the book as one which will be appreciated by the layman as well as the student of science.

Rotary and Motor Convertors. By E. F. Smith. Pp. xii+233; figs. 57. London: Crosby, Lockwood & Son. 1926. Price, 7s. 6d. net.

The scope of this book is considerably wider than is indicated by the title, the author having written it for the information of operators and attendants, who have had no educational grounding in the elements of electrical technology. The work therefore contains an outline, in simple non-mathematical language, of the principles of direct-current generators and motors, of alternating currents, the effects of inductance and capacity, and of the principles of the a.c. generator. Mr. Smith has set himself a difficult task, in endeavouring to cover this ground as an introduction to the main subject, especially as he has deprived himself of the assistance of elementary algebraic symbolism. It is difficult to say how far

the previously uninstructed reader will benefit by a study of this preliminary matter. It is generally very clearly written, and little has been omitted which is of real importance. Those who are not averse to some hard thinking, will probably succeed in obtaining a working knowledge of the basic principles, which will enable them to understand very fairly, the operating characteristics of the rotary convertor. We think, however, that most of those who have been able to follow the author's explanation of vector diagrams, would have been able to understand the derivation of the numerical voltage relationships in 2, 3, and 6-phase circuits. These should have been proved, and the numbers $\sqrt{2}$, $\sqrt{3}$, and so forth, used instead of 1.73 and 1.41. It is stated on p. 95, that in paralleling a polyphase generator it is necessary to synchronise on one phase only, the author should have pointed out that, although this applied to normal operation, the phase rotation must be checked when the machine is paralleled for the first time.

Turning to the treatment of the subject matter of the book, we find that this is dealt with in a very clear and practical fashion. After considering the basic principles of the rotary convertor, the author proceeds to describe the usual methods of voltage control. A little fuller treatment of the reactance method might have been given. The variation of power factor necessary in normal working, depends not only on the normal variation of the voltage required, but also on the value of the series reactance; this is not made sufficiently clear on p. 127. Methods of starting are very fully considered, three chapters being devoted to this subject. These are very good, and the author gives as clear an explanation of the self-synchronising of a convertor, as is possible, without the aid of mathematical analysis. We see no reference to the use of a double winding for the stator of a starting motor. An interesting chapter deals with static balancing, and with inverted running. Transformers for rotary convertors are then considered in an elementary way, and the various connections for phase conversion are clearly worked out. The final chapter deals with the principles of the motor convertor, with notes on starting, static balancing, and inverted running.

We can recommend this book without hesitation to those for whom it has been written, and we think that all engineers who are not specialists in the design or operation of rotary convertors, will gain much useful information by a perusal of its pages. Should a subsequent edition be called for, a chapter on the automatic control of rotary convertors might well be added.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

20,586. "Alternating-current motors." J. Sousedik. August 16th, 1924. (238,569.)

21,509. "Manufacture of metals and alloys in the electric furnace." D. Crosse. August 27th, 1925. (266,658.)

23,664. "Acoustic apparatus." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). September 22nd, 1925. (266,395.)

23,876. "Switching mechanisms for use in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). September 24th, 1925. (266,399.)

24,525. "Method of ensuring electrical contact between electrical conductors." H. Martin. October 1st, 1925. (266,403.)

26,794. "Synchronised asynchronous machines." J. V. Eclancher. May 1st, 1925. (251,587.)

28,425. "Electric heat radiating and distributing apparatus." A. F. Berry. November 11th, 1925. (266,421.)

28,543. "Insulating high-tension electric currents." O. Y. Imray (Akt. Ges. fur Anilin-Fabrikation). November 12th, 1925. (Convention date not granted.) (244,068.)

29,145. "Electric street-lighting equipment." Horstmann Gear Co., Ltd., H. G. Horstmann, E. H. Horstmann, A. Horstmann, and F. O. Horstmann. November 19th, 1925. (266,426.)

29,235. "Electric oscillators." W. H. Wilson. November 19th, 1925. (266,428.)

29,375. "Intermittent electric current interrupter for use with vehicle-direction signals." G. F. Rayner (Winooski Electric Manufacturing Co., Inc.). November 20th, 1925. (266,431.)

29,498. "Interlocking cover for electric cables." J. Bruce and Rom River Co., Ltd. November 23rd, 1925. (266,433.)

29,514. "Installations for electrically lighting, heating, and ventilating railway and like vehicles." J. Stone & Co., Ltd., and A. H. Darker. November 3rd, 1925 (266,434.)

29,583. "Directional radio signalling systems." Standard Telephones and Cables, Ltd. (Western Electric Co. Inc.). November 24th, 1925. (266,440.)

29,698. "Sound reproducing and amplifying devices." A. G. Griggs and C. Meuwsen. November 24th, 1925. (266,450.)

29,717. "Electric control systems." Igranic Electric Co., Ltd., and H. Abbink-Spaink. November 25th, 1925. (266,452.)

29,743. "Electric lighting and power plants." Austin Lighting Co. and C. B. Walker. November 24th. 1925. (266,452.)

29,892. "Voice operated relay systems." Standard Telephones and Cables, Ltd. (Western Electric Co. Inc.). November 26th, 1925. (266,458.)

29,893. "Automatic and semi-automatic telephone systems." Standard Telephones and Cables, Ltd. (Western Electric Co., G. C. Hartley). November 26th, 1925. (Cognate application 31,713/25.) (266,459.)

29,896. "Telephone systems." Siemens Bros. & Co., Ltd., and H. E. Humphries. November 26th, 1925. (266,460.)

30,206. "Protection of electrical circuits." A. M. Baroni, N. Pancotto and G. Rogora. November 30th, 1925. (266,471.)

30,259. "Thermionic valve and like circuits." Soc. d'Etudes pour Laisons Téléphoniques et Télégraphiques à Longue Distance. December 1st, 1924. (243,765.)

30,260. "Amplifying or detecting relays." Soc. d'Etudes pour Laisons Téléphoniques et Télégraphiques à Longue Distance. May 4th, 1925. (251,588.)

30,325. "Lamp-shade holder." British Thomson-Houston Co., Ltd., W. H. Wade, F. M. Cocksedge, and H. C. Wheat. December 1st, 1925. (266,475.)

30,345. "Thermionic devices." S. L. Price. December 1st, 1925. (266,476.)

30,600. "Form of valve for wireless transmission and reception." A. T. Masterman. December 3rd, 1925. (266,480.)

31,136. "Train-control systems." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. December 9th, 1925. (266,485.)

31,746. "Appliance for the application of radiant energy in the form of light or ultra-violet light in medicine and the sciences." A. A. King. December 16th, 1925. (266,489.)

32,445. "Electrostatic devices." M. Graham, A. Graham (executors of E. A. Graham, deceased), and W. J. Rickets. December 23rd, 1925. (266,491.)

33,011. "Electric storage batteries or electric accumulators." Fuller's United Electric Works, Ltd., and S. C. Whaite. December 31st, 1925. (266,497.)

1926.

621. "Systems of controlling electric motors for starting synchronous machines." Crompton & Co., Ltd., and H. O. Burge. January 8th, 1926. (266,504.)

2,290. "Diaphragms for telephones, talking-machines, and the like." R. French. January 26th, 1926. (266,513.)

2,511. "Automatic voltage-limiting means." International General Electric Co., Inc. January 29th, 1925. (246,855.)

2,683. "Electric motor control systems." C. E. Carpenter. January 29th, 1926. (266,518.)

6,361. "Tuned radio-frequency receiving circuits." Lovejoy Development Corporation. December 15th, 1925. (263,077.)

7,587. "Loud speakers for wireless receiving apparatus." F. M. T. Reilly. January 6th, 1926. (Cognate applications, 13,812/26 and 20,359/26.) (Divided application on 347/26.) (266,543.)

7,634. "Electric ovens, particularly for dental purposes." W. Hoberg. August 26th, 1925. (Divided application on 239,213.) (266,544.)

7,636. "Ignition apparatus for internal combustion engines." W. R. Lambert (G. Walters). March 19th, 1926. (266,545.)

7,987. "Protective systems for metal-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. April 6th, 1925. (250,216.)

8,002. "Electric water heaters." S. D. White and W. B. Scourfield. March 23rd, 1926. (266,550.)

8,882. "Electric lamps." Howes & Burley, Ltd., and A. Barlow. April 1st, 1926. (266,553.)

9,303. "Sound-reproducing and transmitting apparatus." W. J. Rickets. April 8th, 1926. (266,555.)

9,397. "Electric pianofortes." H. Wade (Mills Novelty Co.). April 9th, 1926. (266,556.)

11,554. "Electric batteries." E. R. Gill. May 1st, 1926. (266,565.)

14,855. "Joints for high-tension electric cables" Pirelli & Co. July 11th, 1925. (255,033.)

16,594. "Transmission and reproduction of views, scenes, or images by wires or wirelessly." J. L. Baird. September 1st, 1925. (Divided application on 21,846/25.) (266,591.)

16,988. "No-volt release switches or circuit breakers." A. M. Bridger. July 7th, 1926. (266,593.)

18,511. "Incandescent lamp for automobile headlights." N. C. Austin. July 24th, 1926. (266,601.)

18,835. "Electric driers." Halliwell-Shelton Electric Corporation. February 25th, 1923. (266,604.)

18,846. "Train-control systems." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. December 9th, 1925. (Divided application on 266,485.) (266,605.)

19,022. "Regulating systems for dynamo-electric machines." British Thomson-Houston Co., Ltd. August 11th, 1925. (256,949.)

19,127. "Method of, and apparatus for testing electrical insulators." A. O. Austin. July 31st, 1926. (266,608.)

19,914. "Electric welding apparatus." E. G. Budd Manufacturing Co. August 15th, 1925. (256,981.)

20,061. "Train-control systems." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. December 9th, 1925. (Divided application on 266,485.) (266,611.)

21,129. "Reproduction of sound." A. Poulsen and A. C. G. Petersen. September 3rd, 1925. (257,920.)

22,656. "Controlling apparatus for electrically driven machines specially applicable to washing machines." British-American Laundry Machinery Co., Ltd. (American Laundry Machinery Co.). September 14th, 1926. (266,623.)

22,662. "Glareless lamps." J. M. Stewart. September 14th, 1926. (266,624.)

24,185. "Radio transmitters." Telefunken Ges. für Drahtlose Telegraphie. October 1st, 1925. (259,225.)

26,202. "Generation of electrical oscillations." Dr. A. Esau. November 10th, 1925. (261,351.)

27,322. "Railway signalling systems." International General Electric Co., Inc. October 31st, 1925. (260,627.)

27,771. "Oscillating electric fans." H. W. Gilbert, H. C. E. Jacoby and A. E. Jabet. March 22nd, 1926. (Divided application on 263,003). (266,638.)

30,290. "Holders for tubular electric lamps." H. Friedeberg. December 3rd, 1925. (262,424.)

31,008. "Regulatable resistances." Siemens & Halske Akt.-Ges. December 8th, 1925. (262,778.)

31,463. "Electric seam-welding machines." R. Mack. December 28th, 1925. (263,783.)

1927.

1,886. "Identification label for insulated conductors." H. Bokelmann and H. Gastrow. February 26th, 1926. (266,655.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 16th :—

Pervana. No. 473,957. Class 8. Electrical transformers for use in connection with radio-telephony and telegraphy.—Radioland Co., Ltd., 65, Houndsditch, E.1.

Goldstream. No. 477,523. Class 8. Apparatus for use in radio-telegraphy and telephony.—Julius Axelrad, 25, Mornington Crescent, N.W.1.

Leonardian. No. 477,391. Class 13. Lead tee boxes or service branch boxes for electric cables.—T. L. Watkins, 52, Oxford Street, Kidderminster.

Esboilith. No. 474:891. Class 50. Casein in sheets and rods for industrial purposes, electrical fittings, &c.—Ellenberger & Schrecker, 94, Burgegnstrasse, Frankfort. (British representatives: Sir Joseph Causton & Sons, Ltd., 8, Portugal Street, Lincoln's Inn, W.C.2)

Megalon. No. 476,276. Class 50. Insulating substances (electrical).—Thomas De La Rue & Co., Ltd., 110, Bunhill Row, E.C.1.

Turbax. No. 476,740. Class 50. Electrical insulating materials composed of textile fabrics and synthetic resin or other similar substances compressed into a homogeneous product and made into sheets, rods, tubes, and mouldings.—Dacier, Ltd., 15 and 16, Jewry Street, E.C.3.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALSCOTT (Salop).—Sugar beet factory; Perry & Co., Ltd., contractors, Bow, London.

AUSTRALIA (Granville, N.S.W.).—Factory, for the Goodyear Tyre & Rubber Co. (£300,000).—*Reuter's Trade Service* (Sydney).

AYR.—Police Offices; the Chief Constable.

AYRSHIRE.—Additions to Davioshill Hospital; medical superintendent.

BARROW-IN-FURNESS.—Secondary school (£35,000) for the borough E.C.; director of education.

BIRMINGHAM.—Extensions, Cripples' Institution; Cripples' Union.

BOLTON.—Branch library, Moorfield estate; Borough Librarian. 50 houses, Kingscourt Avenue and other streets; Leigh Bros., Ltd.

BOURNEMOUTH.—Central store, Commercial Road; F. W. Woolworth & Co., Ltd. Warehouse, Malmsbury Park Road; William Dibben & Sons.

BRIGHTON.—Alterations, 157-162, Western Road; Boots (Chemists), Ltd.

BRIGG.—Schools (£13,000 to £15,000), for Lindsey E.C.; director of education, Lincoln.

BURY ST. EDMUNDS.—Schools (£24,000), for the borough E.C.; J. H. Wakefield, secretary. Housing scheme (18), Grove Park, for the T.C.; borough surveyor.

CHESTERFIELD.—Hotel (£9,000); T. S. Wilcockson, architect.

COTFORD (Taunton).—Nurses' quarters, Somerset and Bath Mental Hospital; A. W. Caley, clerk.

DONCASTER.—Additions to municipal offices at 53-54, Hall Gate; B. E. Ford, estates surveyor, 3, Priory Place.

DURHAM.—Additional housing scheme (122), for the T.C.; borough surveyor.

EASTBOURNE.—Additions, Pier Hotel, Cavendish Place; J. Bodle, Ltd. Additions, Claremont Hotel, Grand Parade; B. Stevens, architect. Alterations, Burlington Hotel, Grand Parade; P. D. Stoneham, architect.

FARNBOROUGH (Hants.).—Housing scheme (39), High Street, for the U.D.C.; J. E. Hargreaves, architect, Town Hall.

FIFESHIRE.—Extensions at Cupar Beet Sugar Factory (£85,000); the Manager. Secondary school at Dunfermline for Education Authority; Clerk, Education Authority, Kirkcaldy.

FRIMLEY (Surrey).—Housing scheme (50), for the U.D.C.; surveyor.

FROME.—Housing scheme (48), Keyford, for the U.D.C.; surveyor.

GLASGOW.—Hall, Alexandra Parade, for Martyrs' Christian Bond.

GRANTHAM.—Extensions to George Hotel, for Lord Dysart. Central schools, for Kesteven E.C.; C. B. Metcalfe, county architect, Sleaford.

GRAVESEND.—Electric light installation, Sanatorium; borough medical officer of health. Houses (114), for the T.C.; the Calway Construction Co., Ltd., builders, Marlow, Bucks.

GREENOCK.—Extension of the Royal Infirmary; secretary.

HALIFAX.—Modernising electric light system, Stannery Congregational Church; Rev. Keyworth Lloyd-Williams, pastor. Private hotel, café, and shop premises, near Shibden Park, Stump Cross; G. B. Oddy, architect, Ward's End Chambers.

HARROW.—Wesleyan Church, North Harrow (£5,175); trustees.

HASTINGS.—Garages and showrooms, The Green; Callow and Callow, architects.

HORNCHURCH (Essex).—Factory, Hornchurch Road, for the Art Metal Construction Co.

HOYLAKE (Birkenhead).—Cottage Hospital extensions (£10,618); William Fleming & Co., builders, Neston.

HULL.—Wesleyan Church, Newland (£16,250); trustees.

IRISH FREE STATE (Cork).—Development of Cork Harl ou (£150,000); Harbour Board.

KIRKCALDY.—136 houses for Corporation (£60,920); burg surveyor.

LANCASHIRE.—Bridge improvements (£80,000); county su veyor.

LEEDS.—Shopping centre, off Stainbeck Lane; Carr Manc Estate Co., Ltd.

LINCOLN.—Secondary schools (£25,000), and elementar school, Skellingthorpe Road (£8,500), for the city E.C. director of education.

LONDON (East Ham, E.).—Tuberculosis dispensary, Barkin Road; medical officer of health.

(Ilford, E.).—School, Barkingside (1,100 places), and exter sions, Stevens Road Schools (800 places), for the boroug E.C.; Adam Partington, clerk.

(Romford, E.).—Houses (46), Seymour Road, for Warrine and Herd.

(Highgate, N.).—Electrical installation, ten blocks of flat Holly Lodge Estate, Makepeace Avenue; Central Londo Building Co.

(N.W.).—Restoration of Regent Square Presbyterian Churc (£10,000); trustees.

(St. Pancras, N.W.).—5 blocks of tenements, Somers Tow area; borough engineer.

(Lewisham, S.E.).—60 houses, Cranston Road Estate; Clou and Tysoe, Ltd.

(Woolwich, S.E.).—Schools, Eltham Housing Estat (£37,084), for the London E.C.

(Westminster, S.W.).—Reconstruction, Westminster Circu lavatories (£17,750); City engineer.

(Fulham, S.W.).—Buildings, Peterborough Road; H. N Barnes, Ltd.

(Merton, S.W.).—Housing scheme, Whatley Estate (100 for the U.D.C.; G. Jerram, surveyor.

(Streatham, S.W.)—Housing estate development, Elmfiel Estate; D. P. Hayworth.

(King's Cross, W.C.).—Extensions, Royal Free Hospita Governors.

LLANTARNAM (Mon.).—280 houses; U.D.C. surveyor.

LOUTH.—Schools, Monk's Ryke Road (£19,000), for Lindse E.C.; director of education, Lincoln.

LUTON.—Girls' schools, with electrical work, for Beds. E.C S. C. Parrott, architect, 9, George Street West.

MAIDENHEAD.—Houses (55), Boyn Hill, for the T.C William Creed & Co., builders.

MALVERN.—School of Art and Technical School, Albe Road; Worcestershire Education Committee.

MOFFAT.—Wing at Cottage Hospital; the medical superi tendent.

NORTHFLEET.—Additional 52 houses, for the U.D.C.; su veyor.

OXFORD.—Extensions, Eagle Ironworks, Walton Well Road W. Lucy & Co. Additions, works, Arthur Street, Oxfor Electric Co., Ltd.

ROTHERHAM.—Church, Lord Street; Lieut.-Col. J. H Knight, architect.

SHEFFIELD.—Wesleyan Church, West Street (£12,000) trustees.

SOUTHAMPTON.—Wesleyan Church, St. James Roa (£19,700); trustees.

STOCKPORT.—Kinema, Wellington Road South, for Thom Blower, 12, Lowfield Road.

SUTTON (Surrey).—Additional 34 houses, for the U.D.C surveyor.

WELLINGTON (Salop).—Housing scheme (30), Orleton Lan site, for the U.D.C.; William Walker, surveyor, Walke Street.

WEST MELTON (Yorks).—Houses (108); Frederick Bat builder, Doncaster.

WEYMOUTH.—Additions Nurses' Home, Weymouth Ho pital, Melcombe Avenue; Crickmay & Sons.

WORCESTERSHIRE.—Smallpox Hospital; medical officer Health.

YORK.—Housing scheme (74), Tang Hall Estate, for the T.C. F. W. Spurr, city engineer.

The

Electrical Review

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THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

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Contents:

	PAGE
Alleged Thefts of Electricity	501
The Future of the Fair	502
Scientific and Industrial Research	502
Registered Contractors	503
London's Electricity Supply	503
Electricity Supply at Ealing (*illus.*)	504
Canadian and United States Electrical Trade (*illus.*)	507
Metal Patterns and Electricity, by J. Edgar	509
An Electric Welding Job, by C. H. S. Tupholme (*illus.*)	510
Hand-Operated or Automatic? by Robert Marsden	510
Electrical Power Engineers' Association	511
Legal	511
Business and Industrial Notes	512
Lighting and Power Notes	517
Tramway and Railway Notes	518
Telegraph and Telephone Notes	519
Radio Notes	519
Contract Information	520
Forthcoming Events	521
Notes	521
Institution Notes	525
Our Personal Column	525
Financial Section—	
New Companies Registered	526
Financial Section—*continued.*	
Official Returns of Electrical Companies	527
City Notes	527
Stocks and Shares	529
The Electrical Exports of Germany	531
London's Electricity Supply in 1924-25	532
The Telephone Service	533
A New Type of Tramway Controller (*illus.*)	534
New Electrical Devices, Fittings and Plant (*illus.*)	535
A Small Hydro-Electric Plant (*illus.*)	536
Electric Furnaces in Non-Ferrous Metallurgy, by Donald F. Campbell	537
Pulverised-Fuel Firing, by E. Kilburn Scott	538
Scientific and Industrial Research	539
Parliamentary News	540
Correspondence—	
Faults in Flexibles	541
The Charges for Packages	541
A Meter Problem	542
The Salaries of Engineers	542
The Register of Contractors	542
Published Specifications	543
Trade-Mark Applications	543
New Work for Contractors	544

Alleged Thefts of Electricity.

THE fact that cases or, at any rate, reported cases of alleged thefts of electricity are comparatively rare, may often be a reason for believing that the practice of stealing current from the mains is not very common. But it is a probability or difficulty against which those who supply electricity must continually be on their guard; and the necessity for vigilance increases not only with the number of consumers, but with the extension of supply to persons who, in these days of popular electrical pursuits, are acquiring sufficient knowledge to enable them to "dodge the meter."

A recent case decided in Scotland, which was noted in these columns a week or two ago, seems to indicate that some change in the law may be necessary if electricity undertakers are to be adequately protected. A man was charged with altering the index of a meter under his custody and control with a view to fraudulently preventing it from duly registering the quantity of electricity supplied. There was evidence to show that the meter in question had been tampered with.

In the language of the Sheriff who tried the case: "It was discovered that the pointer of the third or 'hundreds' dial on the index had been forced backwards, so that it did not synchronise with the pointers of the second and fourth dials. On the index plate a scratch was seen which was apparently made by the instrument used to force back the said pointer." The learned Sheriff then went on to say that as the meter had at all material times been on the premises of the accused, who was the only person who stood to benefit by the alteration of the index, it might be a natural inference that he made the alteration. But he then pointed out that, the evidence being purely circumstantial, a conviction could only follow if the circumstances should lean, not merely naturally to the inference that the accused was guilty, but so conclusively that no reasonable person could refuse to draw it. As he felt it conceivable that the malice or mischief of some other person who obtained access to the meter

had caused the alteration, he felt he was unable to convict on this ground.

Pausing here, there can be no doubt that the learned Sheriff made an accurate statement of the criminal law as it applies not only in Scotland, but also in England. A usual example of an "irresistible presumption" which is given by those who teach the law is this: "If a man is seen coming out of a public-house wiping his mouth with the back of his hand, there is an irresistible presumption that he has had a drink." Whether the learned Sheriff was right in deciding that the presumption of guilt did not arise, is another matter, upon which another tribunal might differ from him; but the case as formulated against the renter of the meter did not stop there. The prosecution relied on the final paragraph of Section 38 of the Gas Works Clauses Act, 1871, upon which the complaint was made. It reads: "The existence of artificial means for causing such alteration or prevention, or for abstracting, consuming, or using electricity of the undertakers when such meter is under the custody or control of the consumer, shall be *primâ facie* evidence that such alteration, &c., as the case may be, has been fraudulently, knowingly, and wilfully caused by the consumer using such meter." While recognising the force of this provision, the learned Sheriff pointed out the obvious fact that the prosecution had not proved the existence of any "artifice or device," as, *e.g.*, a bypass or short circuit. Consequently this clause did not throw upon the accuser the burden of disproving anything. In the result the charge was held "not proven." Curiously enough, reliance upon this final paragraph in Section 38, so far from increasing, may have done something to lessen the chances of securing a conviction in this particular case. The criminal law is at all times very jealous of the principle that every charge shall be proved against the accused person. He need say nothing: the whole of the facts must, as a rule, be established by affirmative evidence led against him. In certain cases, however, the onus of proof is shifted. Thus, on a charge of "receiving," it is sufficient to prove that a man is in possession of stolen goods. He must then explain affirmatively how they came into his possession. So in the case under notice, certain things are roundly declared to be *primâ facie* evidence against the accused, and the very fact that the statute says "this particular thing" (*i.e.*, the presence of a short circuit) *shall be primâ facie* evidence, raises the presumption that no other "particular thing" (*i.e.*, the actual reversal of the meter and the scratch on the dial) shall be *primâ facie* evidence. As the lawyers say, *Expressum facit cessare tacitum.*

Enough has been said to justify the view that the decision in the case before us was right and in accordance with law. Yes; but what law? The provisions of an Act of Parliament adopted from an earlier measure intended to regulate the supply of gas, and passed in the year of grace 1899! Notwithstanding the experience of nearly three decades, it never seems to have occurred to anyone that the machinery for preventing fraud in relation to the supply of electricity might be overhauled and improved. Let one suggestion suffice. What honest man would suffer if it were enacted that: "The fact that any meter shall have been opened otherwise than by or with the authority of the undertakers while such meter is in the custody or control of the consumer, shall be *primâ facie* evidence that such alteration or prevention, &c. (*as the case may be*) has been fraudulently, knowingly, and wilfully caused by the consumer using such meter"? The Legislature last year rushed through Parliament an Act which *may*, in the long run, enure for the benefit of those who supply and consume electricity, and which *must* be fraught with considerable outlay. Would it be too much to ask them to introduce one small reform which *must* assist the detection of fraud, and is almost certain to involve little or no expense? But there is little *kudos* attaching to a one-clause Act of Parliament!

The Future of the Fair.

We notice an editorial in *The Times* Trade and Engineering Supplement regarding the future of the British Industries Fair. Our contemporary discusses a point which has been considered in our own pages and in many conversations that have taken place during the last year or two. Recognising that the London part of the Fair has now outgrown the accommodation available at the White City, the writer mentions as possible alternatives the building of a Fair Hall at a cost of £500,000, the scattering of various sections in separate buildings, thus making a number of decentralised little exhibitions, the preparation of additional buildings at the White City, or removal to the Crystal Palace. Some of these we would dismiss without further thought—especially the last. In our view there are two other alternatives which may offer a better solution. One is that, if part of the Fair must be continued in London, the allocation of trades be revised so that some sections that are related to the character of the exhibits for which Birmingham Section has now become thoroughly established, may be removed there. Wireless apparatus and the other things that interest the electrical, engineering and allied trades may be quoted as a typical class which would be more at home in the Midlands, and would enable some firms either to avoid dividing their displays or to be in their natural atmosphere and environment. Our other suggestion may be regarded as a sweeping one. There is abundance of site accommodation available at Birmingham. If new buildings have to be erected, why not there? Could not the whole undertaking be removed to this one centre?

Scientific and Industrial Research.

The annual report of the Department of Scientific and Industrial Research, which is abstracted elsewhere in this issue, contains much interesting reading. The Department has now been in existence for ten years, and the work accomplished during that period is reviewed by the Advisory Council, with pardonable self-satisfaction; it is held that we are witnessing to-day an "industrial revolution" fully comparable with that which followed the Napoleonic wars—"a revolution from haphazard empirical methods to those of scientific control and direction. Our industrial research policy must be directed to help British industry to make this inevitable change." It is gratifying to learn that the Council observes many signs of a change in the attitude of manufacturers towards research; many industrial firms are rapidly developing their scientific organisations, and establishing large research laboratories where funds permit—but still it is urged that the value of a continuous policy of research and scientific development is not yet fully realised. The country must learn that progress can be more efficiently secured by scientific methods than by the costly process of trial and error.

Much of the work of the Department is described as "helping industry to help itself"; this, we believe, was the original purpose of the "Million Fund," which was placed at the disposal of the Department exactly ten years ago. The intention of the Government, as expressed by Lord Crewe (Electrical Review, December 8th, 1916, p. 641), was to devote to the work "a very large sum, estimated to cover the needs of the next five years, on a scale which would enable them to spend four or five times as much on industrial research alone as the whole scheme had previously received." "Besides the lump sum above-mentioned, an annual vote would be provided to cover the expenses of the Department, to assist researchers and societies that were carrying out researches, and non-remunerative research."

That the Department has exercised strict frugality in releasing its hoarded funds will be realised when we state that the balance of the Million Fund at March 31st, 1926, was £429,984; its average annual outlay from this trust fund has therefore been about £64,000—less than one-third of the rate anticipated in 1917—and the Fund which was expected to cover five years' needs has

already lasted for nine and is still going strong. In view of the declared importance of stimulating industrial research and the urgent need of funds for that purpose, we think the Department might well adopt a more liberal attitude towards research associations of proved efficiency. It is true that according to the Advisory Council the electrical industry is in a particularly healthy position with regard to research in general, but for this it owes little to the Department, which proposes to withdraw its financial support from the Electrical Research Association after September, 1930, although the operations of that admirable Association are hampered by lack of funds. As regards the support of "pure scientific research," which is the father and mother of all industrial progress, the Department is lavish of protests of its kindly feelings towards it, but apparently limits its financial aid in general to those "pure" researches which have a direct relation to industrial research and a "practical aim"—a distinction from "industrial research" without a material difference.

Registered Contractors.

Further progress was reported at this week's annual meeting of the Board of the National Register of Electrical Installation Contractors. Apart from the routine business, discussion centred around two points—wiring rules and the "small" man. With regard to the former, it was stated, unofficially, that the E.C.A. had adopted an abbreviated set of rules. This, no doubt, had reference to the abridged version which the I.E.E. Wiring Rules Committee commissioned the E.C.A. and the Association of Supervising Electrical Engineers (*née* N.A.S.E.) to produce jointly. Col. Crompton gave it as his opinion that the I.E.E. Rules, as they stood at present, were far too complicated for the ordinary contractor, and therefore could not be enforced by any body; they were, however, useful as recommendations and might possibly be considered as such eventually. Several members drew attention to the danger that compulsory regulations would seriously deplete the Register, but Mr. Cash was not unduly perturbed at that. He thought that such a "purge" would probably be all to the good of the better contractors, who would be able to stand increased registration charges.

Dealing with the question of the "small" man without proper, separate, business premises, Mr. Cross (Newcastle) thought that the Executive was not strict enough in its requirements regarding business qualifications. Mr. Purse, however, pointed out that the "small" man was not necessarily a bad contractor. This is certainly true if such men do not over-reach themselves, and in endeavouring to do too much pay too little attention to the quality of their work. Mr. Purse was ready with a remedy for this, stating that the cancellation of registration was a far more effective check than non-registration.

As opposed to this view of the small man, Mr. Shaw (Manchester) drew attention to the fact that many big firms had not become registered. The Committee was thus asked to attend to both ends of the contracting scale: to exercise extra discretion in registering small men, and to exert pressure upon the large firms to join and add to the prestige of the scheme.

London's Electricity Supply.

For the last time, the London County Council has issued its useful report on electricity supply in the London area, which, commencing with the County alone in 1901, has increased in scope until, since 1919, it has covered the whole of the London and Home Counties Electricity District, embracing a population of over eight millions. The extraordinary complexity of the electricity supply situation in that area of 1,797 square miles is well illustrated by the coloured map which accompanies the report; although there are considerable portions of the area in the north-east and south which, thinly populated, have no supply of electricity, there are no fewer than 89 authorised distributors in the District. Nowhere else in the world can there be found a "crazy patchwork" such as this, the product of misguided legislation, which deliberately aimed at segregation and decentralisation—the antithesis of modern views and of the course of natural development.

We abstract the report elsewhere in this issue, and will comment on it later; but we take this opportunity of complimenting the London County Council upon the good service which it has rendered to the public by the compilation of these excellent reports, for which it deserves the hearty thanks of the electricity supply industry.

The Central Electricity Board.



Elliott & Fry] *[London.*

Seated left to right:—**Sir James Devonshire, K.B.E., Sir Duncan Watson, Lt.-Col. The Hon. Vernon Willey, Sir Andrew Duncan (chairman), J. R. Brooke, C.B. (Secretary), Frank Hodges.**

Standing:—**W. K. Whigham, Sir James Lithgow, Bart., Alderman W. Walker, M.I.E.E.**

Electricity Supply at Ealing.

Abandoning the generation of electricity in favour of a bulk supply has modernised the system, involving the change-over of some 14,000 consumers' installations within three years of commencing to build the large new bulk-supply distributing station in Pope's Lane.

In order to modernise its electricity undertaking in conformity with the Electricity Commission's ruling, the Ealing Corporation decided to scrap its old steam-driven a.c., 40-cycle generating plant and has built in its stead a large bulk-supply distributing station in Pope's Lane.

In the new transformer-station buildings (fig. 1) accommodation is provided for the technical staff, and extensive workshops, meter test room, &c., and storage room for apparatus which is to be hired out to consumers, power to do so having been exercised some years ago, but remaining in abeyance during the war period. Special attention has been devoted to ventilation, which is assisted by electric fans, and lighting and heating are electric throughout: all the water for the lavatories and various mess rooms is heated electrically also, different makes of apparatus having been installed for comparative purposes. That portion of the buildings in which the electrical plant is housed has been made fireproof; the roof is formed of concrete slabs in steel framework, covered with slate, and all metal throughout the buildings has been thoroughly earthed; scrap 0.25 sq. in. copper cable has been utilised for this purpose, carried down to the water-bearing stratum and coiled therein to form numerous "earth plates."



Fig. 1.—New Bulk Supply Distributing Station at Ealing.

The cost of the scheme has been enhanced somewhat by the fact that the Electricity Commissioners fixed the location of the 6-acre site of the new station in close proximity to one of the main cable routes of the Metropolitan Electric Supply Co., Ltd., from which the Corporation purchases 50-cycle, 3-phase electricity in bulk at 20,500 volts. It is instructive, too, to note that had the Commissioners maintained their original intention of specifying 3-phase distribution, the cost of the scheme would have exceeded £500,000, whereas considerable economy has resulted from the adoption of the arrangement outlined diagrammatically in fig. 4, which enables single-phase distribution to be carried out from "A" and "B" phases. Cost has also been influenced by the following facts:—The Metropolitan Co., in virtue of its statutory powers, has a right (which it declines to modify) of varying its pressure 12.5 per cent. above the declared voltage, whereas the Corporation is bound not to exceed a voltage variation of 4 per cent., and consequently it became necessary to provide booster regulating transformers, which have cost very nearly as much as the main transformers.

The Metropolitan Co.'s portion of the e.h.p. switchgear (supplied by the British Thomson-Houston Co., Ltd.) controls the bulk supply for the Ealing district as obtained either from Ironbridge (Hanwell) or Acton. It is designed to withstand a working voltage of 33 kV, as this increase of voltage is contemplated by the Metropolitan Co. at a later date. The e.h.v. apparatus is accommodated in separate cubicles, which are subdivided into the requisite number of compartments to ensure fireproofness. The cubicles are constructed of moulded-stone slabs and are divided vertically, the oil circuit-breakers and main isolators being assembled on one side of the partition, with the busbars and the remainder of the apparatus on the other side (fig. 2) and the sheet-steel doors are locked by "Castell" locks that have a different change number for each equipment: this method of locking is relied upon in lieu of any definite mechanical interlock.

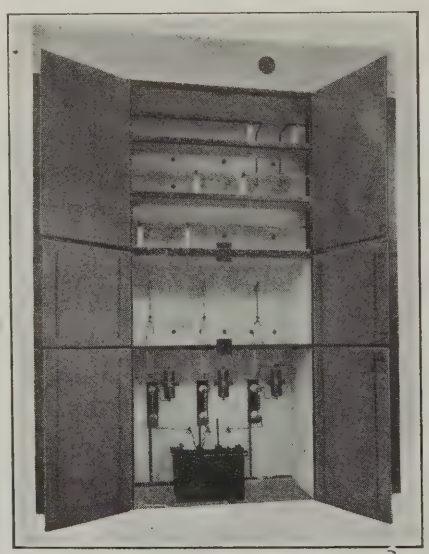


Fig. 2.—E.H.P. Bus-bar Cubicle.

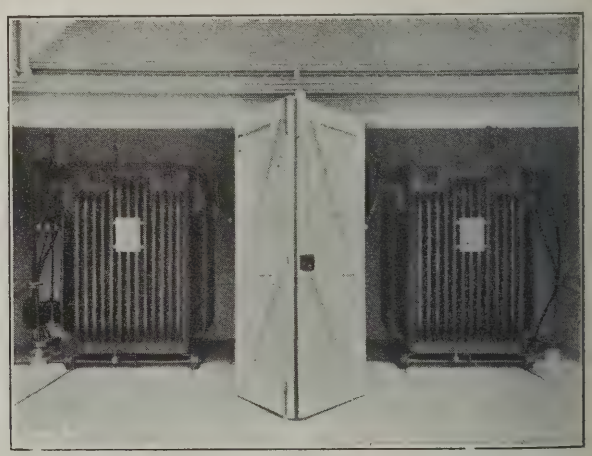


Fig. 3.—Main 20,500-volt Transformers.

An important feature is the lay-out of the metering

equipment. The busbar current transformers are located in the bottom cell of the cubicle on the breaker side; each transformer is connected in series with its respective busbar, a single-pole isolator being placed on each side of it to afford complete isolation. To maintain continuity of supply to the consumers' equipment during such isolation, each transformer can be short-circuited by another isolator.

Each 20-kV control panel is totally enclosed in a steel surround (fig. 5): the oil-immersed circuit-breakers are of the OMI/A1 type and have a normal rating of 300 amperes at 33 kV. The Merz-Beard protective system has been applied to both ends of these feeders.

The main transformers, fig. 3 (made by the British Electric Transformer Co., Ltd., as well as the boosters) are housed in separate brick cubicles outside the main station buildings. Twelve 750-kVA, single-phase, 20,500/2,600-volt transformers are being Scott-connected to form eventually six 1,500-kVA banks, giving a 2-phase, 4-wire supply at 2,600 volts; each phase passes through a regulating transformer to a 2-phase, 4-wire switchboard (fig. 8).

The present equipment consists of four complete sets of transformers of 1,500 kVA capacity each; the two limbs of each set are in separate oil-tight tanks, and constitute interchangeable limbs for Scott working. They are equipped, in addition, with externally-operated tapping switches on the e.h.p. side to compensate for $2\frac{1}{2}$, 5, $7\frac{1}{2}$ and 10 per cent. increase of the primary voltage, the secondary pressure meanwhile being kept constant at 2,400 volts.

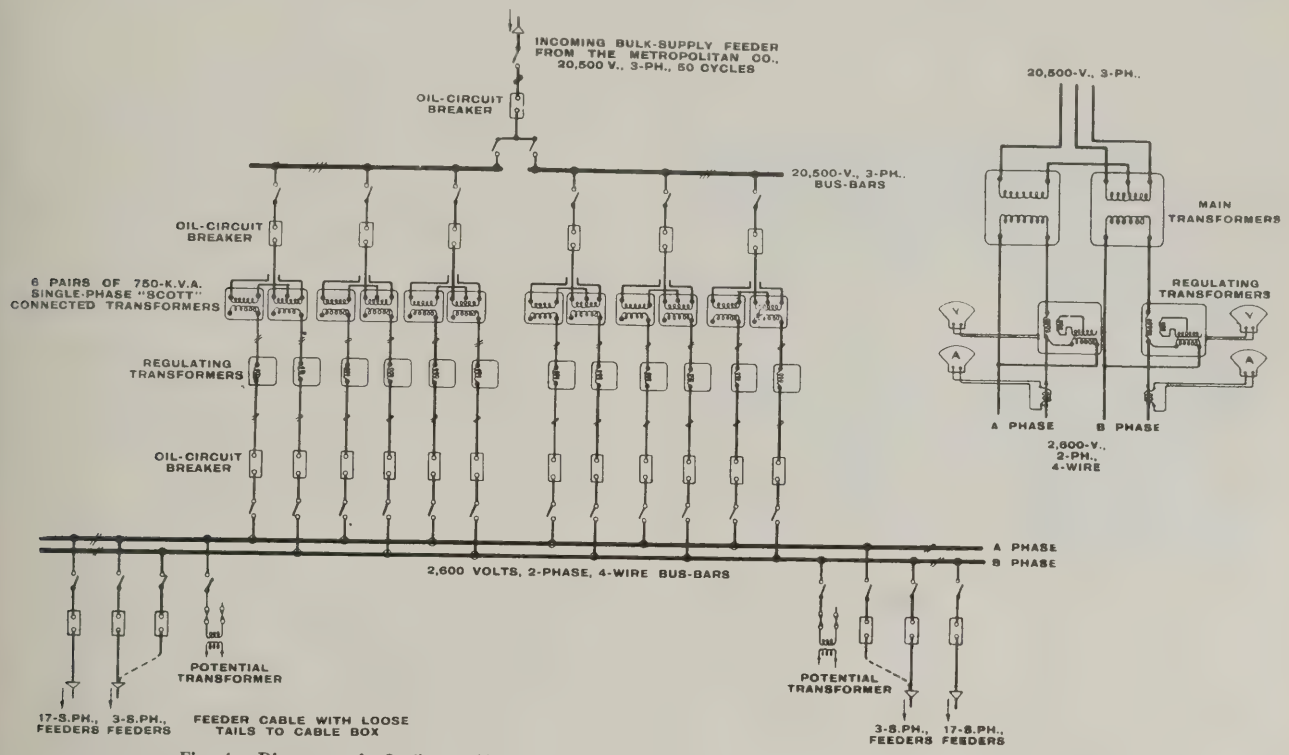


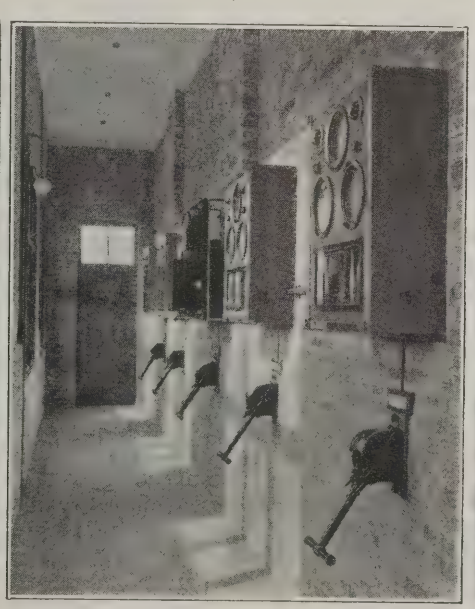
Fig. 4.—Diagrammatic Outline of Transformer Connection Scheme; 3-phase incoming, single-phase outgoing.

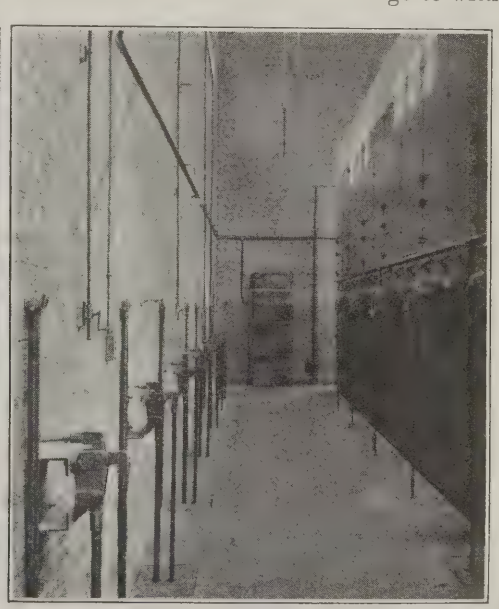
The single-phase regulating transformers (fig. 8) are equipped with hand-operated regulating switches and capable of giving a plus or minus $12\frac{1}{2}$ per cent. boost to the line in ten $1\frac{1}{4}$ per cent. steps either way. All the transformers are of the Berry radial pattern, oil-immersed and self cooled.

The main transformers have braced windings to withstand possible short-circuit stresses, and the end turns are reinforced to withstand line surges; the main insulation consists of Bakelite Micarta cylinders between the winding, and the disposition of the coils is such that cooling oil is in actual contact with every turn. Each boosting transformer consists of two limbs mounted one on top of the other in the same tank, the boosting volt-



Fig. 5.—E.H.P. Feeder Control Panels.





Figs. 6 and 7.—Control Gear and 20,000-Volt Switch Cubicles.

age in the main feeder being controlled both in magnitude and polarity by means of regulating switchgear attached to the tanks.

The guaranteed efficiencies for the entire transforming plant are 98.25 per cent. on full load, 98.4 per cent. on three quarters and half load, and 97.8 per cent. on one quarter load.

The Corporation's switchgear installation, which formed the main part of the contract, was carried out by the English Electric Co., Ltd. It includes the main incoming supply feeder and 6 complete 3-phase transformer equipments, all for 20,500 volts: also 60 sets of single-phase equipment, as follows:—12 trans-

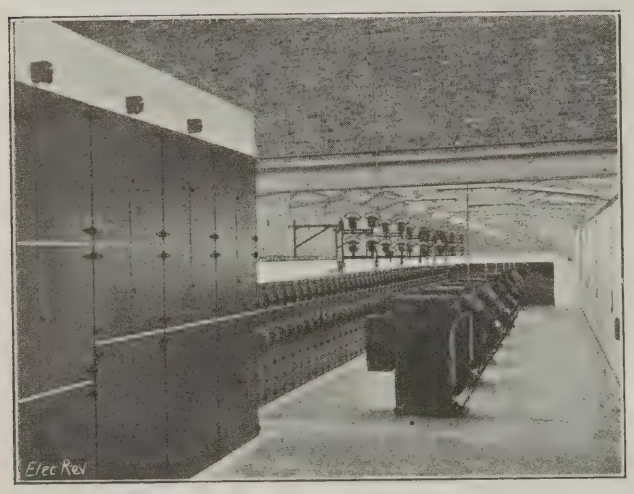


Fig. 8.—General View of Station Interior.

former control equipments; 17 feeder equipments on phase "A" and 17 on phase "B"; 6 feeders, each with 2 switching equipments for connection to either phase "A" or "B"; 2 potential transformer metering equipments, one on each phase. The general scheme of connections (fig. 4) shows that the 3-phase, 3-wire, 50-cycle incoming supply feeds through an oil-immersed circuit-breaker equipment on to the two halves of a single set of 20,500-volt, 3-phase busbars, sectionalised by means of a double set of isolating switches in the incoming feeder equipment, so that at times of light load one half of the bars can be made dead for inspection, &c., whilst the supply is maintained through the other half. In addition, there are six swinging brackets, each carrying a set of paralleling and load-regulating ammeters and voltmeters, one set for each transformer group. The method of connecting these voltmeters is somewhat novel (fig. 4 inset), the connections having been taken from tappings on the shunt windings of their associated regulating transformers to enable a considerable saving to be effected in potential transformers.

Both the high- and low-voltage switchgear is contained in stone cellwork cubicles. The 20,500-volt oil circuit breakers are manually operated, the control portion being divided by a brick wall from the cellwork, as shown in figs. 6 and 7: the former shows the control handles mounted on the brick wall with the instruments in sheet-metal cases above; the latter shows the back of this wall, the operating rods, and cellwork.

These breakers are of class O.K.B., size O (600-ampere), with a rated rupturing capacity of 350,000 kVA (at 25,000 V). Three single-pole switches are united by means of Oldham couplings, and the phases are separated throughout by stonework barriers, the opposite side of the 20,500-volt cubicles being visible in the foreground of fig. 8, which is a general view of the interior of the station, showing the 60 single-phase equipments along the far end, and some of the regulating transformers can be seen along the centre; the main transformers are outside the right-hand separating wall of the building. All the 2,600-volt single-phase feeder equipments are also housed in stone cellwork with barriers between phases; a closer view of this gear is fig. 9, which shows the equipments for the two phases and one of the transformer banks. It will be noted that the isolating switches in the upper compartments are operated by a removable handle, padlocked covers over the handle openings preventing unauthorised operation. Each single-phase equipment is controlled through two single-phase oil circuit breakers coupled together: the couplers' carrying capacity is 800 A, each with a breaking capacity of 150,000 kVA (at 6,600 V), whilst the feeder switches' carrying capacity is 400 A each, with a breaking capacity of 75,000 kVA (at 6,600 V).

The breakers are of the spring-tank type, the patented feature of which design is that the oil in the tank reaches the level of the bottom of the top frame, which projects inside the tank, the latter being suspended on springs combined with the tank bolts to allow the necessary cushioning action on opening circuit. The absence of an air cushion is claimed to prevent the formation of an explosive mixture within the tank, any gases formed on opening being allowed to leak out around the sides of the top where it projects into the tank.

A simple system of overload and leakage protection has been applied on the 20,500-volt side, with reverse-power protection on the transformer equipments on the 2,600-volt side; simple overload protection is provided for the single-phase outgoing feeders. Cables inside the station were supplied by Messrs. Siemens Brothers and Co., Ltd., and all outside cabling is being carried out by the Corporation's staff.

In conclusion, it may be recorded that £200,000 has already been sanctioned for the conversion scheme. It was unfortunate that the scheme was initiated prior to the Electricity (Supply) Bill, 1926, becoming an Act of Parliament, for the Corporation thereby became ineligible for financial assistance from the State electricity authorities.

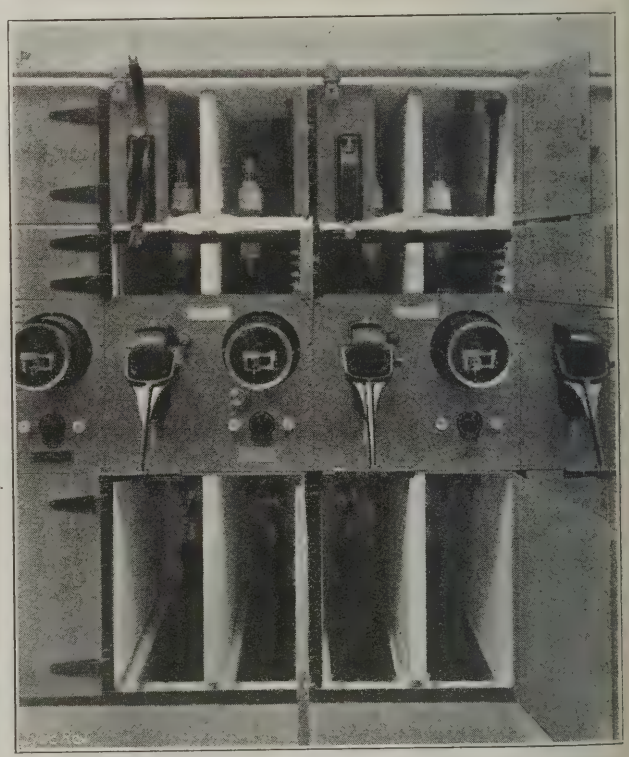


Fig. 9.—Single-phase, 2,600-V Feeder Equipment.

Finally, it is a pleasure to express our indebtedness to Mr. J. Douglas Knight, chief electrical engineer to the Ealing Corporation, who has been solely responsible for carrying out the scheme, for permitting his new station to be inspected and described, and to the manufacturers concerned for the photographs of the plant reproduced above.

A noteworthy feature is Mr. Knight's expressed appreciation of the manner in which the main contractors, the English Electric Co., Ltd., carried out the work, and the spirit of co-operation shown both with him and with the sub-contractors.

Canadian and United States Electrical Trade.

Customer and Competitor.

In the Electrical Review of January 21st an article was published showing the trend of the electrical trade in some of our chief oversea markets. In the succeeding issue a review of Great Britain's imports and exports of electrical goods during 1925 and 1926 was given. Both these articles were illustrated by graphs. It is now proposed to survey the electrical trade of Canada and the United States. The former cannot be considered as one of our chief markets,

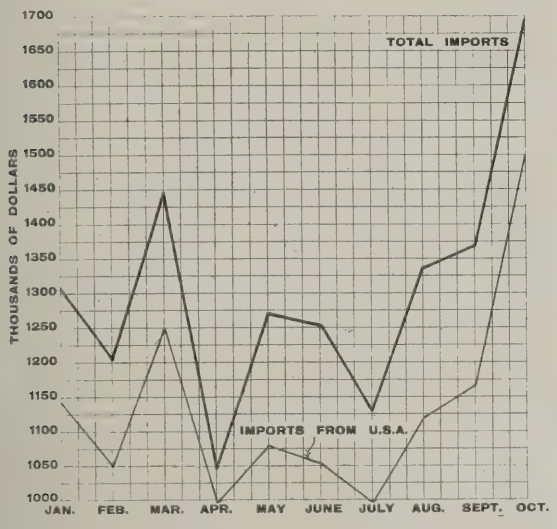


Fig. 1.—Canadian Electrical Imports, 1926.

although, as will be seen later, there are in certain directions better prospects than may generally be supposed. In some classes, *e.g.*, domestic appliances and ignition apparatus, Canada seems likely, however, to rival Great Britain. As to the United States, she stands as a strong competitor. The present article includes curves showing the course of Canada's electrical import and export trade in aggregate and in the classes of goods of outstanding interest to this country, and also the course of United States exports.

The upward curve of imports of electrical apparatus

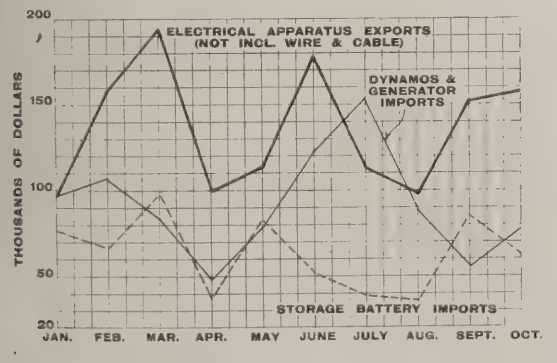


Fig. 2.—Canadian Imports and Exports, 1926.

into Canada should inspire British manufacturers with fresh efforts to capture a larger share of this trade, most of which, it will be seen, goes to the United States. One serious disability under which our makers still suffer is the long prevailing practice of submitting most of the electrical equipment intended for use in the Dominion to the tests of the Chicago Underwriters' Laboratories. But the concern which is virtually the largest buyer of electrical plant in Canada, *viz.*, the Ontario Hydro-Electric Power Commission, has power to pass equipment, and in this circumstance British firms have good prospects of consideration. This subject has been discussed again and again in these pages, and we refrain from further comment in this article as we shall be dealing somewhat fully with the latest developments in the situation in our next issue.

Mr. F. W. Field, H.M. Trade Commissioner in Canada, mentions in his report that hydro-electric developments offer an outlet for a fair amount of machinery and supplies of British manufacture. The

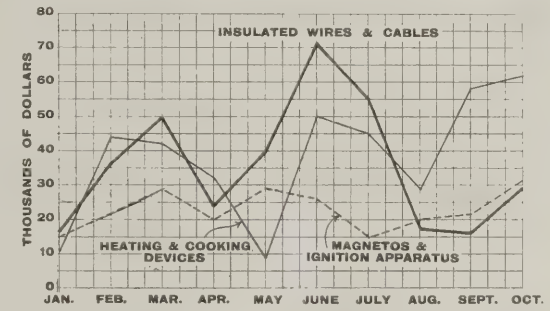


Fig. 3. Canadian Electrical Exports, 1926.

waterwheel type of a.c. generators, he says, represents the principal demand in electrical rotating machinery. Some units up to 6,000 kVA are of the horizontal type, but most of the machines from 500 kW to 50,000 kW are of the vertical type. These alternators are mostly in two frequencies, namely, 25 cycles or 60 cycles. They are all three-phase, and the standard voltages are 2,400, 6,600 and 13,200. With regard to transformers, the Trade Commissioner says that there is a good demand for various sizes from 1 kVA to 20,000 kVA, mostly single-phase. The large transformers are of the oil-immersed, water-cooled type, and the small transformers are mostly oil-immersed, self-cooled. The frequencies are 60 cycles and 25 cycles, and the standard voltages range from 2,200 to 220,000. In transformers for voltages up to 66,000, the competition from local manufacturers is very keen, and there appears to be little reasonable chance of making a profit under pre-

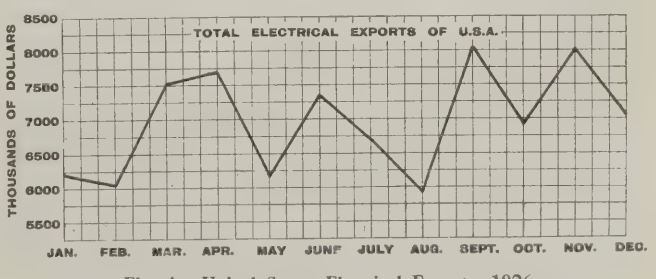


Fig. 4.—United States Electrical Exports, 1926.

sent conditions. The City of Winnipeg recently received tenders for 5,000 kVA 60-cycle transformers, including freight, duty, sales tax and oil in accordance with very strict specifications and conditions at a price less than $2 per kVA.

On the subject of motors, Mr. Field points out that most of those purchased are of the squirrel-cage

induction type for frequencies of 25 and 60 cycles. They are all three-phase, and the standard voltage is 550. Larger motors are supplied when desired for 2,200 V. A number of the pulp mills use self-starting synchronous motors of about 2,500 h.p. at 225 r.p.m. There is also a moderate demand for synchronous motors in other industrial plants. For d.c. motors, the demand is limited. Tramway equipments are purchased from time to time by the various street railway systems.

Finally, the Trade Commissioner remarks that as most of the power development is hydro-electric, the demand for steam turbine generating plants is limited. A few plants are in operation in the prairie provinces where little or no water power is available. In this section, however, the population is relatively small, and until water powers throughout Canada, within commercial distances, are developed to their capacities, there will not be a great demand for steam-generating plants.

From the charts relating to Canadian import and export trade in electrical apparatus (figs. 1, 2 and 3),

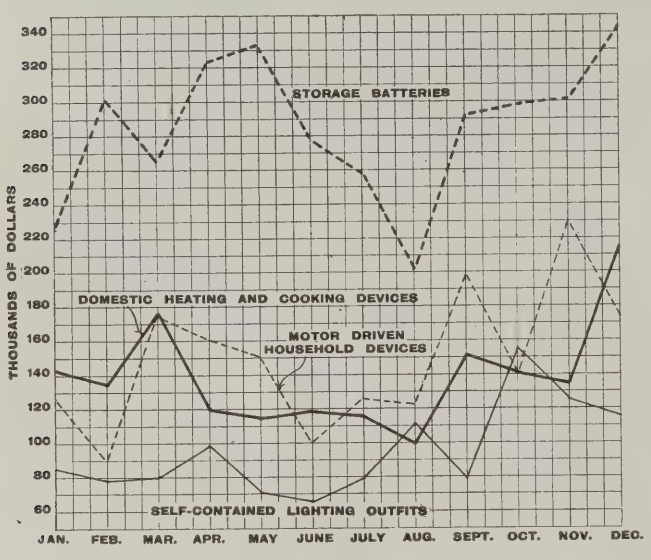


Fig. 5.—United States Electrical Exports, 1926.

it will be seen that the value of the imports of dynamos and generators in some months has not been far removed from the total value of the exports of electrical apparatus as a whole. Among imports, storage batteries are an important item, while on the export side, heating and cooking devices and ignition apparatus loom large.

The statistics of American exports of electrical machinery and apparatus for last year (fig. 4) show an increase of 14 per cent. in the total as compared with 1925. The detailed figures for the two years were published in our issue of March 18th (p. 447), and the list shows many notable increases; at the same time there were several large falls. So far as the classes shown in fig. 5 were concerned, there were rises in the exports of storage batteries, motor-driven household devices, domestic heating and cooking devices, self-contained lighting outfits and stationary motors (1 to 200 h.p.). In the cases of radio apparatus, a.c. generators (2,000 kVA and over) and ignition apparatus (fig. 6), there were decreases.

In view of the great progress made by British manufacturers in recent years in the design and execution of switchgear, notably for high voltages, it is interesting to examine the records of American exports of this class, and to compare them, as far as possible, with those of British exports. The United States figures are as follows:—

United States Exports.

	1924.	1925.	1926.
	£	£	£
Switchboard panels, except telephone	432,000	461,000	438,600
Switches and circuit breakers over 10 amps.	450,000	485,000	523,600
Total ...	£882,000	£946,000	£962,200

Although no statistics of British exports of control and switchgear in 1926 are yet available, owing to lack of detail in the classification adopted in the monthly returns, a striking advance is shown between 1923 and 1925, as will be seen below:—

Great Britain's Exports.

	1923.	1924.	1925.
	£	£	£
Switchboards, other than telegraph and telephone	103,000	91,000	88,010
Control and switchgear	522,000	945,000	1,360,000
Total ...	£625,000	£1,036,000	£1,448,000

It is reasonable to assume, in view of the large increase in the total exports of electrical goods generally in 1926 (see page 150 of our issue of January 28th), that there was a further increase in those of control and switchgear also in that year.

The total sales of apparatus and accessories produced by the American radio industry last year amounted in value to about 500 million dollars (say 100 million pounds), an increase, as compared with the previous year, of over one hundred million dollars, or 20 million pounds, although exports were lower. Business at Christmas was reported to be extraordinarily favourable, partly on account of the introduction of new and improved models and partly owing to the spread of broadcasting generally. The development of the American radio industry has been relatively more rapid than that of motor-car manufacture. As in the latter industry, the demand for the necessary raw materials has created unusual activity in a number of other branches of manufacture. For example, there has been a substantial increase in the demand for both hard and soft wood for making the boxes for the apparatus and the packing cases for their dispatch. Competition is very keen among manufacturers, whose

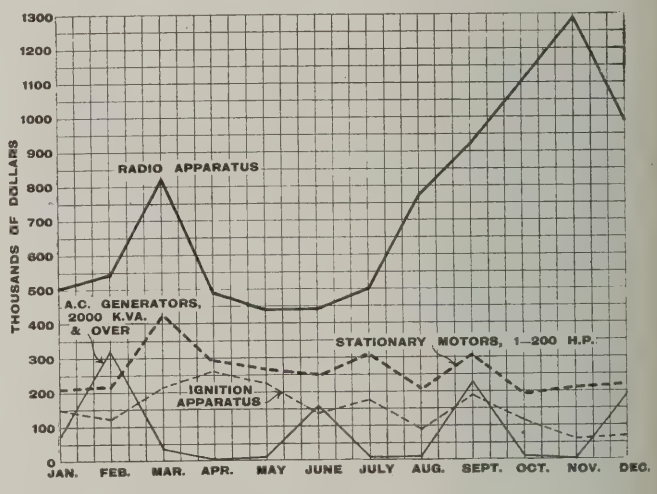


Fig. 6.—United States Electrical Exports, 1926.

profits are limited by the circumstance that the retailers often make 30 to 40 per cent. on certain kinds of apparatus and accessories.

A recent issue of *Commerce Reports* contained preliminary statistics of United States electrical exports during January. The total value is given as $7,711,883, as compared with $7,146,977 in January, 1926. Generally speaking, the increase was due to larger shipments of the lighter electrical equipment; in the heavier classes, such as generators, transformers, motors and transmission and distribution apparatus, there was a decline. The highest individual rise occurred in the case of storage batteries, from $226,363 to $346,520. The radio apparatus group recorded a rise from $499,699 to $611,660. Electric lamp exports also showed a large gain. The greatest decrease was in the item "switchboard panels, except telephones," which fell from $511,687 to $84,643. Other large decreases occurred in the cases of stationary motors, motor accessories and parts, electric locomotives, instruments and domestic heating and cooking devices.

Metal Patterns and Electricity.

Recent improvements in metal pattern-making indicate that the use of electro-deposition and electric heating is advantageous, leading to economy and greater accuracy.

By J. EDGAR.

DURING the last two or three years the art of patternmaking has advanced considerably, and it is generally agreed that for repetition work, metal patterns have advantages over the wooden variety.

Electricity's part in the construction and use of metal patterns is that they are now sometimes made by electro-deposition, and that they are heated by electricity before being used. By electro-deposition, metal patterns are made very accurately, owing to the fact that there is no shrinkage involved: since such patterns are exact duplicates of the original in size, shape, and finish, it is obvious that machining, filing, and scraping operations are practically all eliminated. Patterns can be made of copper, brass, nickel, or any other metal, or combinations of metals (for example, a nickel surface with a copper backing).

The method of procedure is similar to that used in electro-typing. Casts of wax, plaster of paris, or any fusible alloy are taken of the desired pattern to be reproduced; the casts are made with a conductive material on the impression surfaces (in the case of wax, or plaster of paris, graphite is used to make the conductive surface) and contact wires are inserted in the casts to make connections in the plating tank and to the conductive surface of the cast. Suitable insulation is provided to prevent the metal from spreading on to the non-conductive surfaces; the casts are then placed in the appropriate plating solutions, and allowed to remain therein until the desired thickness is obtained. The casts are afterwards taken from the bath and the metal deposits removed, and backed up by some suitable alloy, such as white metal, to give strength, if necessary. The partings are then checked very closely and machined or ground off, if required, from which point onwards the procedure is identical with the old method.

The deposition process can be used for making split patterns mounted on both sides of a plate, split patterns mounted on cope and drag plates, split patterns mounted on one side of a plate, cope, and drag plates when the patterns and plate are cast integrally. Where cast-aluminium match plates are used, cope and drag plates can be very easily substituted by this method. Patterns to be gated can be made in halves and sweated together. This process includes core boxes.

When moist moulding sand is rammed up around a cold metal pattern, a thin film of moisture collects on the surface of the pattern, so that when it is withdrawn from the mould there is a tendency for some of the sand to adhere to it; this causes a roughening of the surface of the mould, so that it will not yield a clean smooth casting. For many classes of work it is essential that the castings be clean and smooth, and therefore means must be used to overcome the tendency of the sand to stick to the pattern. There are two ways of preventing this trouble: one is to dust a parting compound over the pattern, and the other is to heat the pattern.

If a parting compound is used, it must be applied frequently, at least for every second or third mould, which takes a certain amount of time; furthermore, it may be done carelessly, with the result that parts of the mould may not be covered, in which case imperfect moulds will result. Imperfect covering of the mould would be especially likely to happen in the case of intricate patterns, or patterns with surfaces nearly perpendicular to the plane of the mould, to which surfaces the compound might not readily adhere. Proper heating of the pattern, however, ensures that all parts are equally prepared to prevent the sticking of particles of sand, and eliminates the time required for applying the compound.

The gas flame and paraffin torch are frequently used for heating patterns, but electricity has been successfully used, and it is rather surprising that it has not been developed and employed more generally. Some years ago one large foundry adopted the following method: a steel-clad type of heater was used, and the electricity was obtained from an ordinary lamp socket through a flexible cord which was attached to the pattern carriage. In moderately cold weather the heat was used intermittently as the need for it arose, but in extremely cold weather the heat was applied continuously while the pattern was in use. The capacity of the heaters was 600 watts at 110 volts, and the temperature to which the patterns were heated was approximately from 32 to 37 deg. C.

Standard steel-clad heaters of the narrow type, which was in the form of a long flat strip, approximately 20 in. long, $1\frac{1}{8}$ in. wide, and $\frac{1}{2}$ in. thick, were laid in grooves cut in the face of a cast-iron plate which formed the top of the carriage. The heater terminals projected downward through holes drilled through this plate, and were wired to a plug socket on the side of the carriage. The upper surfaces of the heaters were perfectly flat and flush with the upper surface of the plate, so that when the pattern plate was laid on the top of the carriage, the heaters were in contact with it. With the pattern plate in place and fastened with suitable bolts and screws, the assembly was similar to the construction of a modern electric iron—the heating elements being firmly clamped between two metal plates so that the heat of the elements would be transmitted by conduction to the working surface. This enabled the heaters to operate at a relatively low temperature, and made the surface of the pattern quickly responsive to the application of the heat.

Some of the pattern carriages were equipped with electric heaters mounted in the space below the pattern plate, but not in contact with it, so that the heat was transmitted to the plate by radiation instead of conduction. This method was not so efficient in the utilisation of the heat, and resulted in a slightly greater power consumption and lower heating; but it was otherwise satisfactory. It is a cheaper method of installing the heaters, and in some cases it may be the most practical method.

The same type of electric heaters can be successfully used on a moulding machine. As in the case of the radiator patterns, the method of applying the heaters consists essentially in arranging and supporting them so that they will be in contact with the under side of the pattern plate below the thickest part of the pattern.

An Electric Welding Job.

Extensive repairs to the cast-iron casing of a generator which had been dropped and badly damaged.

By C. H. S. TUPHOLME.

AN interesting repair job has recently been carried out on the cast-iron casing of a 6,000-V generator which was inadvertently dropped from a height of 150 ft. whilst being transported across a river. The casing, which is ¾ in. thick, increasing to 2½ in. at the face where the end covers are bolted on, was broken and cracked in many places, as shown in fig. 1. To save the cost of a new housing, it was suggested that the generator might be repaired by electric welding, and this process was resorted to.

The welder found that the casing had sprung about 1/16 in. where it was cracked. He had all the cracks grooved out to a width of about 1 in. by ¼ in. deep, and then, utilising the bolt holes round the rim for fixing specially made clamps, pulled the casing back into its original position. The face of the groove on each side of the crack was spotted and built up until a V had been formed with the crack in the centre.

When the metal had cooled, the fractures were connected up with short runs, the whole job being completed without a single crack appearing in the welding. The clamps were then removed and the crack was welded up where it continued down the face of the rim. All the fractures were similarly treated, many broken pieces of the bottom of the casing having to be first fitted into position.

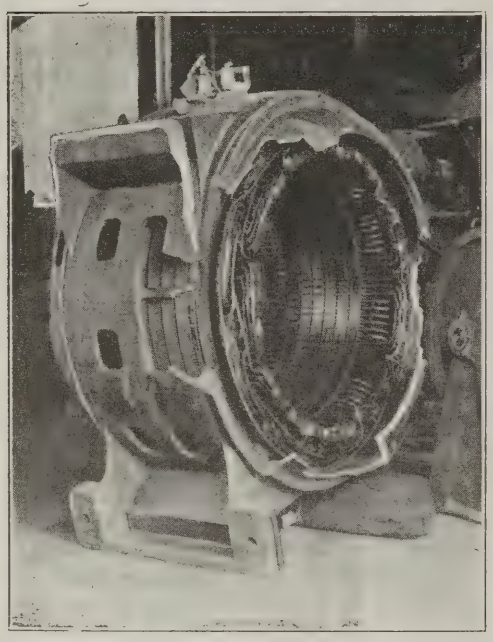


Fig. 1.—Damaged Generator.

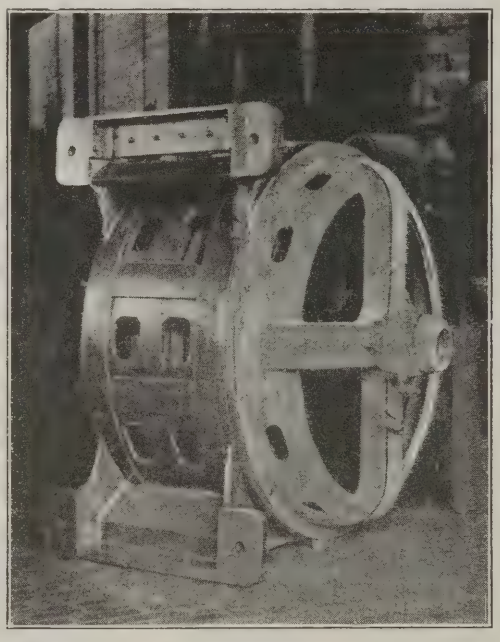


Fig. 2.—Repaired Machine.

Two of the feet had been broken off, and a large piece of the casting between them had fallen in the river and was lost. This repair was carried out by studding a piece of angle-iron, 6 in. by 6 in. by 1 in., to the casing, between the feet, and then welding it up. It was then studded to the legs and the whole welded together.

The job took 7½ days to complete and resulted in a thoroughly successful repair. Electric arc welding was adopted, and Quasi-arc electrodes, 360 ft. of No. 10 and 575 ft. of No. 12 cast-iron, and 300 ft. of No. 10 and 150 ft. of No. 12 mild-steel were used. The completed job is shown in fig. 2, and the generator has been in successful operation ever since the repairs were effected.

Hand-Operated or Automatic?

A consideration of the three principal types of motor control equipment with regard to the duties which they are required to perform.

By ROBERT MARSDEN, M.M.A.E.

THIS is a question with which every prospective purchaser of electrical equipment is confronted. No doubt the cost of automatic control gear prevents many from considering the countless advantages which it possesses if correctly applied.

Switchgear can be divided into three distinct classes:—1. Hand-operated; 2. Semi-automatic; and 3. Fully-automatic.

In the first class comes the simple starter familiar to most people, and generally fitted with a "hold-on" coil which allows the handle to return to the "off" position if the supply fails. Drum controllers are another form of the simple starter, but are arranged for hard wear and heavy duty. Between these two, on the direct-current side, comes the heavy-duty type, which is an ordinary starter built on more robust lines and generally incorporating a magnetic blow-out coil over the first starting contacts, with carbon tips to take any sparking that may arise during operation. Where "inching" is necessary, it is always advisable on either a heavy-duty type or drum controller of over 3 h.p. capacity to have a single-pole contactor to make and break the circuit; otherwise the ordinary contacts will soon be burnt and cause endless trouble. The plain starter is too well known to need its duty defining. If the motor is required to start against a heavy load, always use a heavy-duty type starter. For instance, in starting up a machine with a heavy flywheel, like a compressor or guillotine, the weighty flywheel will not speed up in about 7-10 seconds, which is the rating for ordinary starters of the smaller sizes. If one of these is used, the resistance will never stand the abnormal heating for long.

On the alternating-current side, if a high-torque squirrel-cage motor cannot be used, then the same applies to the rotor resistance of a slip-ring motor equipment. Where frequent operation is required, and the drum controller can be conveniently mounted, this makes quite a good job and is the best that can be given without resorting to automatic control in some way.

This, then, leads to the semi-automatic type of switchgear, which is at the present time undoubtedly becoming the most popular. This gear is arranged so that, by means of push buttons or a master switch, the motor can be inched, started, and stopped. If any speed variation is required, this is set by a hand-operated regulator, and once set, the motor always runs up to that speed when the start button is pressed. This type of control is largely used in the driving of printing machinery, paper-making plant, lathes, con-

veyors, &c., and should be installed wherever continual quick starting and stopping is required.

The final class is the fully automatic control, which is self-explanatory. Everything is automatic and can be operated by the usual remote-control devices. Lifts, hoists, rotary newspaper and magazine presses, big planer equipments, pumps that have to maintain a constant supply, automatic pressure plants, &c., all call for this type of control. Wherever anything big has to be driven, automatic control is essential, so that a man can keep his eyes on the machine and not endanger either himself or the plant by concentrating upon starting up and setting the running speed by hand.

A growing feature in connection with automatically controlled equipments is the application of dynamic braking. This is achieved by putting a resistance across the armature of the motor after the current has been cut off, and as the inertia of the machine being driven tends to keep the armature revolving, a current is generated. The less the ohmic value of this resistance, the greater the flow of current; the armature being thereby heavily loaded, it quickly comes to rest. This electrical braking is very powerful, and care should be exercised when testing out a new equipment. The resistance should be arranged with three or four tappings, so that a correct adjustment can be made. As this braking is purely automatic, it will be appreciated how valuable it is in saving time by stopping in a few seconds a machine which might otherwise run on for some considerable time.

Another important feature, well worth incorporating with a machine controlled by push-buttons or a master-switch, is an ammeter. This is often regarded as an unnecessary expense, but not infrequently it has proved the very thing that has prevented disaster. The current consumption of a motor, as shown by the ammeter, is a positive indication of the behaviour of the machine that is being driven.

It should always be borne in mind that it is false economy to use any but the best makes of automatic control gear, as invariably this type of control is used in conjunction with expensive machinery working on an output basis, and, with gear of inferior quality, breakdowns are almost inevitable and will cause serious delays and resultant losses.

Electrical Power Engineers' Association.

Annual Dinner of Northern Division.

THE eighth annual dinner of the Northern Division of the Electrical Power Engineers' Association was held at the Midland Hotel, Manchester, on March 26th, under the chairmanship of Mr. T. Riley, Burnley.

After the loyal toast, Lt.-Col. Sir Joseph Nall, M.P., proposed "Success to the Association," which, he said, represented an industry that had shown vast expansion and of which the highest hopes were entertained. They had now reached a settled stage in legislation, and, working on sound lines, the E.P.E.A. was assured of success.

Mr. A. W. Crompton, president of the Association, responded. He regarded the co-operation between the staffs of electricity supply stations and the manufacturing concerns as of the utmost value, and was glad that their scheme for the training of engineers was completed.

Mr. R. R. Telford, vice-president, proposed "The Electricity Supply Industry," and suggested that the publicly owned stations had done much to help the development of the manufacturing side of the industry. The electricity supply industry had shown that it was possible to pay high wages and obtain good results. In Sheffield in 1913 coal was 6s. per ton and the wages of firemen 25s. per week, and it was cheaper to run an inefficient steam engine than to obtain power from the public supply authority. But now coal was 30s. and firemen had £3; and it was found cheaper and better to depend on electricity. The tramway authorities were dependent on the electrical industry to maintain the fight against other means of transport; and tramways gave electrical engineers a very desirable load at times when the industrial demand slackened.

Response was made by Ald. W. Walker, M.I.E.E., member of the Central Electricity Board. He said that while other industries were depressed the electrical industry continued to prosper increasingly. Electricity had become fashionable among the women. Many undertakings were prospering because they had brought home to the housewife the advantages of electricity in the house and home.

Referring to the Central Electricity Board, Ald. Walker said it had not yet commenced to function. The members had just got to know each other. Parliament had been greatly concerned with electricity in 1919, 1922 and 1926; it should now leave electricity alone and let those in the industry get on with the job of producing energy for the community. Comparisons were frequently made with what had been done in other countries; but the conditions were often different, and were not comparable. The new Board would assist in the development of electricity supply and seek to give every part of the country which was ripe for the development a supply at a cost which would bring it within the economic possibilities of the industries within the area. It would not be possible to give an abundant supply to every district within a short number of years; but he believed it would be possible to bring about adequate supplies in many areas at an early date, and also an average reduction of price.

Professor B. Mouat Jones, principal of the Manchester College of Technology, in proposing "The National and District Joint Boards," commended the scheme of training which had been devised, but doubted the value of new examinations where such tests were already provided.

Response was made by Mr. W. J. H. Wood, borough electrical engineer, Bolton.

Mr. A. C. Wright, chairman, Manchester Section, proposed "The Ladies and Guests," replies to which were made by Mrs. H. C. Lamb, wife of the Manchester Electricity Department's manager and engineer, and Ald. J. W. Longley, Bradford.

Legal.

X-Rays, Ltd.

Mr. Justice Tomlin, in the Chancery Division on March 22nd, sanctioned the reduction of the capital of X-Rays, Ltd., from £75,000 to £24,265 2s., by reducing the £1 preference shares to 5s. each and the ordinary shares to 6d. each.

Mr. May, who appeared for the company, said the petition was adjourned from last December. His Lordship then said that the preference shareholders, whose rights were altered by the petition, did not appear to have had the opportunity of voting on the resolution for confirming the reduction of capital. These meetings had now been held and were unanimously in favour of the reduction. The company was formed in 1908 for the manufacture of all kinds of electrical apparatus, especially in connection with X-rays.

Southern Counties Electric Light and Power Supply, Ltd.

In the absence of any opposition, Mr. Justice Romer, in the Companies' Winding-up Court, on March 22nd, made an order for the compulsory liquidation of the affairs of the Southern Counties Electric Light and Power Supply, Ltd., on the petition of Mr. Percy Green and another, creditors.

Counsel for petitioners said the petition stood over so that the necessary affidavit verifying the petition could be sworn, but the gentleman who intended to do so had died. The affidavit had, however, been sworn by his representative.

His Lordship was informed that although the company did not oppose the petition, a director, the secretary, and the company's solicitor were actually in Court.

Wareham Electric Supply Co., Ltd.

The affairs of the Wareham Electric Supply Co., Ltd., were again before Mr. Justice Romer, in the Companies' Winding-up Court, on March 22nd, on the petition of a shareholder, Mr. William E. Weston, of Hounslow, that the company should be wound up compulsorily.

Mr. Wilfred Hunt, for the company, said the petition was first before the Court on February 2nd, and it had been standing over to enable the company to file evidence in answer to the petitioner's very long affidavit. Mr. Hunt said there was a charge of fraud. In view of the complicated nature of the matter and the mass of documents involved there had not been time to answer the petitioner's affidavit, and he asked for a further adjournment for fourteen days.

Mr. Galbraith, K.C., said he appeared for Mr. Edwards, who was the voluntary liquidator until that was put an end to in 1923, since when he had had nothing to do with the matter. But it was a case where, he thought, witnesses would have to be cross-examined.

Mr. R. J. Willis, for the petitioner, said he was anxious to have a full investigation, and he wanted to see the company's affidavit. He had been very careful to put into the petition only such things as could be proved by documents.

His Lordship, in granting the adjournment asked for, directed the attendance of witnesses for cross-examination if necessary, and said he hoped they would be able to dispose of the case at the next hearing.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Easter Holidays.

We wish to draw our readers' attention to an announcement appearing in our Advertisement Supplement, stating that the issue of the Electrical Review for Friday, April 15th (Good Friday) will be published on the morning of Thursday, April 14th. All editorial and other matter intended for that issue should be sent in earlier than usual. New copy and blocks for advertisements must be received at 4, Ludgate Hill, E.C.4, by the morning of Wednesday, April 6th, but "Official Notices" and "smalls" can be received up to 5 p.m. on Monday, April 11th.

The E.D.A.-E.L.M.A. Campaign.

Rapid progress has been made during the past week or two and, according to the last official report, on March 26th there were 122 circles; 105 demonstration houses had been run; nearly 4,000,000 pieces of literature had been circulated; 1,501,000 competition booklets had been disposed of; and about 85,000 ballot papers had been received. At the present rate it was anticipated that the number of papers received would reach 100,000 before the close of the competition. So great has been the interest created by the demonstration houses that it is fairly certain that they will continue right into the summer. Builders and furnishers have proved most anxious to co-operate in the displays. A great demand for booklets is coming from schools as a result of a special effort made in that direction. During last week demonstration houses were opened at Bermondsey, Whitley Bay, and Malton. In the case of the first-named the average daily attendance has been about 800. Houses were to be opened this week at Heaton (Newcastle), Saltburn, and West Hartlepool. The last-named is the second to be opened in the town; the other was the first of the campaign demonstration houses.

Sir Harry Hatt, chairman of Bath Electricity Committee, speaking at a dinner of the Bath Electric Circle on March 24th, said that he hoped to see electricity within the reach of everybody at reasonable rates. He did not think that that would have been possible without the powers granted by the Electricity Act. He did not think that the Corporation would do much wiring itself, but even if it did the contractors would get the appliance business. The successes of the undertaking and the contractors were bound up together.

On March 25th a dinner was held by the Exeter and District Electric Circle. Mr. W. Brock, proposing the chief toast, said that the Exeter Electricity Committee, of which he was a member, was desirous of doing everything possible to assist the contractors and all in the electrical business. Although it was often urged that the Committee should do more advertising for business, the view taken was that this should be left to the contractors themselves. The Corporation had always laid down firmly the rule that it would do no trading. The chairman (Mr. H. D. Munro, city electrical engineer) said that the Circle's area extended from Dawlish to Exeter. There were great things ahead in the electrical world, and with the problems that would have to be solved in the near future, it was as well that electricians should discuss matters among themselves. Mr. L. G. Holt, responding to the toast of "The Manufacturers," visualised Exeter as a super station of the South or South-West. He stated that more persons entered the all-electric house in Exeter, promoted by the Circle, than in any town in the country.

The North-East Coast Area Circle recently organised a slogan competition for children. In view of the difficulty of judging, it was decided by the committee to divide the prize money into four prizes of £2 and six of 10s. After the slogans had been judged, it was discovered that the son and daughter of Mr. J. H. Parker, borough electrical engineer of West Hartlepool, had been awarded prizes. When acquainted with this fact they declined to accept the prizes, and requested that the money should be divided among the other four winners, making their prizes 15s. The slogans showed great merit.

An all-electric house arranged by the Southern East Anglia Circle was opened at Ipswich on March 19th. Every room of this dwelling is electrically equipped in a very thorough manner, the furnishing and decoration having been carried out by a local firm. At night the building is floodlighted. The members of the local Circle are the Corporation Electricity Department, the East Anglian Electric Supply Co., Ltd., Colchester Corporation, Bury St. Edmunds Corporation, the Orford Electric Light & Power Co., Ltd., the General Electric Co., Ltd., Caliender's Cable and Construction Co., Ltd., Metro-Vick Supplies, Ltd., and the following contractors:—Wood & Co. (Ipswich), Mann, Egerton & Co., Ltd. (Ipswich), Bullard & Co. (Ipswich), A. W. Fisher (Ipswich), C. C. Pudney & Co. (Bury St. Edmunds), R. J. Bates & Co. (Bury St. Edmunds), and H. G. Tumilty (Dovercourt).

The E.D.A. Report.

There are a number of interesting points in the report of the British Electrical Development Association for 1926, to which brief reference was made in our last issue. The summary of membership includes 278 electricity supply undertakings (150 municipal, 14 London companies, 14 power companies, 96 provincial companies, and 4 Colonial undertakings); there are also 234 manufacturers, 1,155 contractors (including Scottish members) and 70 wholesalers, making a grand total of 1,737, showing an increase of 116 during the year. The revenue was received from the various classes in the following proportions:—Supply undertakings, 56.5 per cent.; manufacturers, 41.4 per cent.; contractors, 1.8 per cent.; and wholesalers, 0.3 per cent. The analysis of expenditure shows that a very good proportion of the funds was spent in actual propaganda work. The administrative expenses (including 12 per cent. for salaries, wages, and emoluments for special services) only absorbed 18 per cent. of the total. The largest item was "advertising towards the public, display publicity, and general Press work"—60 per cent., but the remaining 22 per cent. was also mainly spent in various publicity channels. The films owned by the Association now number 12, the latest being a 900-ft. film dealing with electricity's contribution to smoke abatement. The sales of literature during the year brought in £7,218, an increase of 130 per cent. over 1925; this, of course, included campaign literature. Other matters dealt with in the report are the Association's relations with other bodies, including the Electrical Association of Women; the Campaign; the Ideal Home Exhibition; the Electric Vehicle Committee, &c.

The Manufacturers' Agents' Association.

The council and annual general meetings of the Manufacturers' Agents' Association of Great Britain and Ireland were held on March 8th. Mr. H. Gledhill, of Messrs. Haes, Gledhill & Co., the chairman of the London Council, presided, and spoke at some length on the progress of the Association and its increasing usefulness since its inception in 1909, when from a mere handful its number has reached well over 1,000. The following councillors were re-elected for the ensuing year: Messrs. Gledhill (chairman), W. Poole (hon. secretary), A. W. Chastel (hon. treasurer), F. Martin (London hon. solicitor), L. Hazell, A. G. Leach, S. Artaud, L. Hudson, S. Boys, W. R. Stone, E. E. Taylor, J. N. Steele. There being one or two vacancies on the Council, members who were willing to give their services and attend one meeting a month were asked to send in their names to the secretary. Mr. J. Joy was asked to succeed Mr. J. H. Snow as president.

The British Industries Fair, 1926.

The recently-published official figures show that the loss on the London Section of the 1926 British Industries Fair was only £2,089. This is considered satisfactory, especially having regard to the fact that the Fair is not run for profit-making.

New Italian Companies.

Among the concerns recently organised in connection with the electrical industry in Italy are the Società Illuminazione Elettrica Vetture, Milan, capital 60,000 lire; La Società "Isola" per la Fabbricazione di Isolanti Elettrici, Milan, capital 50,000 lire; La Società Industria Apparechi Termo-Elettro Sanitari, Milan, capital 30,000 lire; La Società "Adma" per Costruzione e Commercia di Apparechi Elettrici e di Usa Domestico, of Genoa, capital 10,000 lire; and La Società Industrie Meccaniche ed Elettrotechnici, Milan, capital 20,000 lire.

Public Service Salesmanship.

In a recent article upon "Salesmanship in Public Utility Undertakings," Mr. F. W. Goodenough, C.B.E., chairman of the Incorporated Sales Managers' Association, says that the idea still prevails that the provision of tramways, electricity, gas, and other public services, is different from selling food, clothing, &c. It is, however, as essential for the providers of such services, whether monopolists or not, to advertise as it is for the ordinary manufacturer and supplier. Moreover, good salesmen are required, and it is the duty of public utilities to adopt progressive business methods. The bestowal of the sole right to perform a certain service in an area carries with it an obligation to serve all the members of the community within that area in the best possible way. If the service is not advertised it is not used as much as it might be. Consequently the standing charges are higher in proportion to the turnover, which leads to a higher price than is necessary. Employés of public utility undertakings should be taught to be salesmen, not officials. The confidence of the public should be fostered, and complaints should be treated as opportunities for the exercise of tact, sympathy and understanding, and not as nuisances. The golden road to true success is "service."

Ball-Room Lighting.

A scheme of ball-room lighting which has recently been installed at the Majestic Hotel, St. Annes-on-Sea, is very attractive and novel. It aims at portraying the daily journey of the sun across the heavens (*pace* Galileo). Suspended from the domed and frescoed ceiling are six "G.E.C." hexagonal pendants in gilt-colour metal work with silver-plated sprigs carrying crystal drops and 36-in. marble-tinted vellum parchment bowls, each containing six orange, twelve blue, and nine



The Ballroom of the Majestic Hotel, St. Annes.

red, 60-W "Osram" colour-sprayed gasfilled lamps, each colour being wired on a separate circuit, with one 300-W white lamp in the centre. As a dance begins, the light dims to the cold pallid hue of early dawn, then slowly, scarcely perceptibly, there is a brightening which displaces the chill atmosphere and soon floods the hall with brilliant noonday sunshine. Then another change takes place, and gradually the light fades slowly to the crimson glow of sunset. The cycle is then repeated. These effects are obtained by the use of a three-way dimming device which can either be used mechanically to provide a succession of changing and intermingling colours, or locked in position to give any set colour. The fittings were specially designed by the Fittings and Fixtures Department of the General Electric Co., Ltd., to the instructions of their Manchester branch. The electrical contractors were Messrs. G. Wilkinson (Arnside), Ltd.

British Trade Exhibition at Melbourne.

The date of opening of the British Trade Exhibition at Melbourne has been fixed for February 23rd, 1928; it will be open for six weeks. The exhibition will be confined to goods made in the British Isles (not the Empire).

The Future of the Engineering Industry.

Speaking as chairman at the recent annual meeting of Cammell, Laird & Co., Ltd., Mr. W. L. Hichens said he was not one of those who thought that all we had to do was to sit still and wait for orders which were to come in abundance. The crop would not be a heavy one, and we would not secure our proper share unless we made special efforts to do so. The situation was certainly better—mainly owing to the accumulation of orders during the past year—but foreign and domestic competition was very keen, and in some branches prices were considerably cut. We could not compete on price in certain directions without a concerted effort to reduce costs all round. He was convinced that that could be done, and done without lowering the standard of living in this country. The worst possible way of meeting our industrial problems was with easy-going optimism which imagined that trade was going to improve automatically.

Lighting a Book Factory.

The lighting of the works illustrated herewith was carried out by means of "Siemens" equipment. The main building of the Greycaine Book Manufacturing Co., Ltd., Watford, has a length of 625 ft., and is 108 ft. wide. The installation consists of 60 "R.L.M." reflectors correctly spaced along each of the bays. "Siemens" gasfilled lamps are used with the



Lighting at a Large Book Factory.

reflectors, and well-distributed illumination of high value is obtained. We are informed that the company (which specialises in very cheap editions) turns out about 60,000 books a day. Twenty tons of paper enters one end of the building daily, and emerges at the other end in the form of books.

Swedish Electrical Exports.

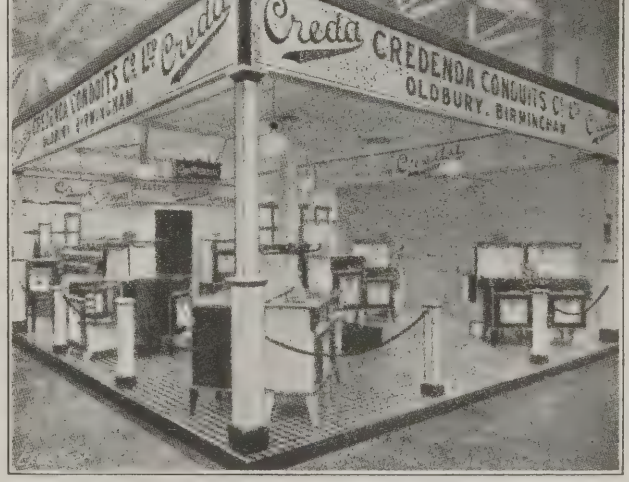
The *Swedish Economic Review* (the organ of the Swedish Board of Trade) states that during 1926 the exports of electrical machines were valued at 27,360,000 kr. (£1,500,000), as compared with 21,026,000 kr. (£1,155,000) in 1925. At the same time the exports of telephone and telegraph apparatus rose from 7,010,000 kr. (£385,000) to 7,437,000 kr. (£400,000).

Anglo-German Industrial Discussions.

The Times, recalling the conference between German and English industrialists, in October last, says that the German representatives are anxious that the discussions should be resumed, and Mr. P. J. Hannon, M.P., one of the hon. secretaries of the movement, has been requested to extend an invitation to all the British delegates at the Broadlands conference to be the guests of Dr. Duisberg, the chairman of the Federation of German Industry, at his chateau at Leberkusen, near Cologne. The period suggested for the conference is April 29th to May 2nd.

Credenda Apparatus at Birmingham.

The Credenda Conduits Co., Ltd., has sent us a view of its stand at this year's British Industries Fair, Birmingham; this is reproduced herewith. The company's display consisted



The Credenda Stand at Birmingham.

of a wide range of domestic appliances, prominent among which was a new design of cooker. Conduits and conduit fittings were also represented, of course.

Austrian Cable Sales Combine.

Nine of the principal electric cable and wire manufacturing concerns in Austria have decided to organise a joint sales office in that city under the style of the Verkaufsgesellschaft für Isolierte Leitungen.

Wages in the Engineering Industry.

A meeting of delegates of the engineering trade unions was held in London last week to consider the resumption of negotiations for a general advance in wages. It was reported that the demand of the London District Committee for an increase of 3d. per hour had been withdrawn on the previous day in view of the proposed national negotiations. A resolution was passed empowering the chairman (Mr. J. T. Brownlie) and the secretary to communicate with the Engineering and Allied Employers' Federation with a view to arranging a conference upon the subject. It is stated that the Federation will be asked to submit an unconditional offer which will form the basis of discussions.

Australian Electrical Imports.

The imports of electrical machinery into Australia during December last attained a value of £617,000, as compared with £562,000 in the corresponding month of 1925.

Social Events.

The recently-formed dramatic section of the Magnet Operatic and Dramatic Society (General Electric Co., Ltd.) gave its first performance on March 25th at the headquarters of the Magnet Social Club, Erdington, Birmingham. Three short plays were presented—"The Marrying of William," "13, Simon Street," and "Postal Orders," in each of which a gratifying degree of ability was revealed.

The Greater London Division of the Electricity Supply Commercial Association held a dance on Saturday last, at the Poland Rehearsal Rooms, Poland Street, W.1. The attendance did not come up to expectations, but those who were present spent an enjoyable evening, for which the Sylvonia Dance Band was largely responsible. Mr. S. W. Turner, divisional secretary, and those who assisted him in arranging the event were deserving of much better support.

Some 160 members of the Liverpool and London staffs of the Automatic Telephone Manufacturing Co., Ltd., attended the fourth annual dinner which was held on March 18th, at the Exchange Hotel, Liverpool. In proposing the toast of "The Company," Mr. D. Sinclair, who presided, made some interesting references to the very early days of telephony. Sir Max Muspratt, Bt., also spoke. The dinner was followed by a musical programme.

The "Clesco" (County of London Electric Supply Co., Ltd.) Light Operatic and Dramatic Club staged "Highwayman Love," a musical play, at King George's Hall, W.C., on March 17th, 18th, and 19th. The work, which contains many tuneful airs, gave considerable scope to the principals. The chorus and Kneller Hall Orchestra, under the leadership of Mr. Arthur B. Meadows, were in splendid form. Mr. Walter E. Dossett was responsible for the production. Though the whole performance was an example of excellent team work, special mention must be made of Mrs. Lillian Sanders (Isabel, the gipsy girl), and Mr. George Mortlock (Denis O'Neill, the highwayman).

Shockproof Automobile Lamps.

Messrs. Philips Lamps, Ltd., have sent us a photograph of the results of a motor accident caused by a motor-cycle combination colliding "head on" with a motor-car. Although the headlamps of the car were completely smashed, it was found, upon test, that terrific as the impact had been, the two lamps (Philips' automobile type) were perfectly serviceable, even the delicate filaments having stood the shock.

New Chilean Company.

La Sociedad Manufacturera Electrica Curtze, Jara & Cia., Ltda., is the name of a concern which has lately been formed in Santiago, Chile, to manufacture electrical apparatus.

Trade Announcements.

Messrs. E. & W. Shepherdson, electrical engineers, of Morecambe, have transferred their business to 59, Euston Road.

The Automatic Coil Winder and Electrical Equipment Co., Ltd., is moving into larger premises, and its address after April 9th will be:—"Winder House," Rochester Row, S.W.1. The company is installing special plant for the repair of transformers, loud speakers, headphones, &c.

The Brundall & District Service Co., Ltd., informs us that it has just purchased from the Receiver the electrical contracting business of Messrs. E. & C. Gates, Ltd., Arcade Street, Norwich. It proposes, after re-organising, to carry on the business, specialising in country house lighting installations.

Graham Amplion, Ltd., has appointed Automobile Accessories, Ltd., 93-95, Victoria Street, Bristol, its West of England representatives for the "Graham Amplion" public speech and band repeater equipment. Tours by equipped vans are shortly being commenced.

Messrs. Priestley & Ford, Birmingham, are entering the wholesale electrical trade, and their premises at 3, Carrs Lane, are being considerably enlarged for this purpose. They will comprise eventually three floors with extensive storage accommodation, offices, and demonstration rooms.

Messrs. A. Hugh Seabrook & Partners, 146, Bishopsgate, E.C.2, state that they will be glad to hear from electrical manufacturers and contractors who specialise in the electrical equipment of hoists, cranes, drills, &c., in connection with quarries.

The registered offices of the Empson Electrical Engineering Co., Ltd., have been transferred from Victoria Street to 27, Chancery Lane, W.C.2. ('Phone: "Holborn 2344.")

The Regent Cycle Stores, which has a wireless goods department, has removed to 33, Henblas Street, Wrexham.

Messrs. Allens, electrical engineers, of 40, High Street, Watford, have opened showrooms for electrical fittings and wireless sets.

Mr. B. Swaffield, electrical engineer, of Bedford, has removed his business from Queen Street to Lurke Street.

Messrs. Beasleys, Ltd., electrical and radio engineers, opened premises at 174, Mortimer Street, Herne Bay, on March 30th.

Messrs. John Harvey & Son, electrical contractors, of Kimberley Road, Cambridge, are opening an office and showroom at 1, Wheeler Street, Cambridge.

New Catalogues and Lists.

The Marconiphone, Ltd., 210-212, Tottenham Court Road, W.1.—A coloured poster advertising the company's h.t. supply unit for receiving sets, and a leaflet illustrating a handsome window display for "Marconi" valves.

Messrs. Allen-Liversidge, Ltd., Victoria Station House, Westminster, S.W.1.—An illustrated brochure dealing with the applications of acetylene and electric welding to the repair of road transport vehicles.

The Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, E.15.—A large coloured poster (5 ft. by 3 ft. 6 in.) advertising "Hart" batteries for automobile starting and lighting.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—List No. 470, containing illustrations and prices of "Sunnix" dustproof lighting fittings; and an illustrated folder dealing with "A.B.C." electric washing machines, "Sunshine" vacuum cleaners, and Johnson's electric floor polisher.

The Vincent Switchgear Manufacturing Co., Ltd., Sampson Road North, Birmingham.—A pamphlet containing illustrated particulars and prices of "Vincent" circuit dividing fuses.

Mr. J. E. Stott, 15, Clare Hill, Huddersfield.—Illustrated leaflets dealing with the "S-An-S" electric wash boiler, and electric lamps.

Pope's Electric Lamp Co., Ltd., 5, Arthur Street, New Oxford Street, W.C.2.—A leaflet advertising "Pearl Elasta" (internally-frosted) gasfilled lamps.

Messrs. F. T. Murdoch & Co., Ltd., Thompson Street Works, Belfast.—Three illustrated leaflets advertising the company's hoisting and stacking equipment.

Berry's Electric, Ltd., 85-86, Newman Street, Oxford Street, W.1.—A priced and illustrated pamphlet describing the company's new "Hous" switchfuse.

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.—An illustrated booklet telling "The Story of 'Mazda' Electric Lamps," which was distributed at the Ideal Home Exhibition.

Factum, Ltd., 17, Soho Square, W.1.—Price lists of electric lamps, clear, opal, and coloured.

Higgs Motors, Witton, Birmingham.—March-April stock list of a.c. and d.c. motors.

Messrs. Herbert Morris, Ltd., Loughborough.—An illustrated booklet (No. 110) dealing with battery trucks, stackers, &c.

Sky Printers, 20, Church Road, Seaforth, Liverpool.—A pamphlet describing a novel method of "sky writing."

Messrs. E. J. & J. Pearson, Ltd., Firebrick Works, Stourbridge.—A comprehensive catalogue (95 pp.) of the company's fireclay products. The works are described, examples of the company's work are illustrated, and, in addition, a great deal of useful data is included.

Radio Communication Co., Ltd., 34-35, Norfolk Street, Strand, W.C.2.—List B/127—an illustrated description of the company's ½-kW transmitter, &c., for marine communication.

Electrical Utilities, Ltd., Tudor Works, Park Royal, N.W.10.—A priced and illustrated folder dealing with the "Utility" electric radiator fitted with "Globar" elements.

Radio Instruments, Ltd., 12, Hyde Street, New Oxford Street, W.C.1.—An illustrated folder fully describing the "R.I." h.t. supply unit for a.c. mains. Priced. Particulars are also given of the components necessary for the building of battery eliminators for a.c. and d.c. circuits.

Messrs. W. B. Trew & Son, Kingsbury Works, Kingsbury, N.W.9.—An illustrated pamphlet advertising "Tru-Ray" high-frequency electro-medical apparatus. Priced.

Bankruptcy Proceedings.

R. P. Reeves, trading as the Luxray Spotlight Projector Co., late of 5, Says Corner, North Quay, Great Yarmouth, electrician.—The adjourned public examination of this debtor was held on March 23rd, at the Town Hall, Great Yarmouth. The statement of affairs showed liabilities of £1,041 and a deficiency of £954. The debtor had previously failed to attend for his public examination on two occasions. He said that he went to Reading for a year to learn engineering, and returned to Yarmouth in 1919 and obtained a position with a firm of engineers. Then he became an apprentice for five years ending 1925. He invented and patented a projector to throw a concentrated beam of light from a small power lamp. He commenced to trade, and received a contract from

a hospital for £30. His profit on that contract was about £16, and he sold lamps for various companies. He admitted that he owed £100 when he commenced business. Last August he purchased the premises and spent £200 on alterations and an electrical installation, and £40 on office furniture. He employed a traveller as he hoped to find customers in large cities. He had sustained a net loss of £386. The examination was closed.

C. P. Moody (trading as the South-Eastern Manufacturing Co.), Crown Works, Finck Street, Lambeth.—The first meeting of creditors was held on March 21st, at the London Bankruptcy Court. The debtor, who filed his petition on March 7th, states that in March, 1920, he commenced business as a maker of Leclanché batteries. Owing to lack of capital the business fell away, and he endeavoured to secure agencies for other goods. He estimated his liabilities at £800, against assets £67, and in the absence of any resolution the case was left in the hands of the Official Receiver. The cause of the failure was said to be keen competition.

E. W. Kirk, lately trading as the Ace Radio Manufacturing Co., 26, Curzon Street, Derby.—The public examination of this debtor was held on March 22nd, at the Court House, Derby. The statement of affairs showed liabilities of £270, against assets of £16. Debtor stated that his radio business was never really successful, and eventually he sold a patent for a radio coil to a London firm for £75. The coal dispute seriously injured his business, and he closed down. He was now in employment, and offered £2 a week towards his debts. The examination was closed.

S. A. Wardell, electrical engineer, 83, Raleigh Road, Richmond, Surrey.—Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released March 15th.

C. W. Watson, electrical and wireless engineer, 33, Rainhall Road, Barnoldswick, Yorkshire.—First and final dividend of 1s. 0½d. in the £, payable March 25th, at the Official Receiver's offices, 12, Duke Street, Bradford.

E. Temple and Mrs. J. E. Burkett (Westoe Electrical Co.), wireless dealers and electrical contractors, 105, Canterbury Street, South Shields.—Receiving order made March 21st, on debtors' own petition.

S. H. Bardwell (Bennett, Bardwell & Co.), electrical engineer, 22, Church Street, Basingstoke.—Trustee, Mr. H. Ashton, Official Receiver, Midland Bank Chambers, High Street, Southampton, released March 16th.

J. E. W. Archer, watchmaker and wireless dealer, 259, Crookes, Sheffield.—First and final dividend of 1s. 8½d. in the £, payable at the Official Receiver's office, 14, Fig Tree Lane, Sheffield.

T. F. Collier, electrician, 116, Union Street West, Oldham.—First meeting, April 1st, at the Official Receiver's offices, Byrom Street, Manchester. Public examination, April 13th, at the Court House, Oldham.

F. C. Goss, electrical engineer, 32, Windsor Road, St. Andrew's Park, Bishopston, Bristol.—Application for discharge to be heard April 29th, at the Guildhall, Bristol.

S. Purcell, electrical contractor, The Arcade, Goole, Yorks.—Trustee, Mr. B. S. Briggs, Official Receiver, 21, King Street, Wakefield, released March 16th.

Company Liquidations.

Louis Samuel, Ltd., wireless dealers, late 54, Gracechurch Street, E.C.—A meeting of creditors was held on March 22nd, at the Institute of Chartered Accountants, E.C. The chair was occupied by Mr. W. F. Baker, 97, Mortimer Street, W., who had been appointed to act as the liquidator in the voluntary liquidation of the company. The statement of affairs presented showed liabilities of £1,456, of which £989 was due to the trade and £466 to Mr. Samuel. The assets were estimated to realise £220 (net). The company was registered on December 6th last, with a nominal capital of £500, but only two signatory shares of £1 each had been issued. The company took over the business which had previously been carried on by Mr. Samuel. Some creditors had stated that they did not recognise the company, but were looking to the vendor. That might reduce the liabilities to the trade, but it would increase the claim which Mr. Samuel would have against the company. Mr. Baker said that there was no actual agreement with Mr. Samuel, but the goods for which creditors were claiming passed to the company, and Mr. Samuel would have a claim against the company for their value. Since the company had been formed the sales had been £979, whilst the purchases had amounted to £621, and after allowing for all the expenses there was a net loss of £542. Towards the end of February a creditor levied execution, whilst the company was also threatened by the landlord. Mr. A. Samuel, the father of the active director, agreed to lend £100 to the company on the security of a debenture. Mr. Baker said that when he was consulted he advised that it was impossible for the business to be continued. A creditor inquired who "Smarts" of Gracechurch Street were, and Mr. Baker replied that that was the original name adopted for the business, and he understood that the goods had been ordered in that name, but were paid for by Louis Samuel, Ltd. Another creditor asked if there was any connection between the company, and a firm known as "Hamilton"; Mr. Baker said there was not, but he understood that Mr. Samuel started the business by buying certain stock from the liquidator of "Hamiltons." A resolution was passed confirming the voluntary liquidation of the company with Mr. Baker as liquidator, and an advisory committee was also appointed, consisting of the representatives of the Radioland Co., Ltd., Houghton-Butcher, Ltd., and V. Zeitlin and Son. The following are creditors: —

	£		£
East London Rubber Co.	20	Radioland Co., Ltd. ...	166
Ewart Evans, Ltd. ...	90	Reynolds, W. H. (1923), Ltd.	21
Grimshaw, Baxter, and J. J. Elliott	40	S.D.H. Manufacturing Co., Ltd.	31
Houghton-Butcher, Ltd.	104	Scientific Glassware Co.	48
Lever, Eric J.	75	S-T., Ltd.	21
Melbourne Radio Supply	26	Samuel, Louis	466
Mullard Wireless Service Co., Ltd.	22	Wells, Joseph, & Son, Ltd.	47
Radio Communication Co., Ltd.	20	Zeitlin, V., & Son ...	76

John Bell & Croyden, Ltd.—A resolution for the voluntary liquidation of this company was passed at a meeting of creditors last week. The liabilities were stated to be £59,193 and the net assets £34,181, leaving a deficiency of £25,011 so far as the creditors were concerned. The original authorised capital of the company, £150,000, was increased to £175,000, and subsequently reduced to £42,750. Arrangements had been made to sell the business, but it was reported that the proceeds of the sale would not be sufficient to discharge the claim of the first debenture holder. Messrs. P. S. Booth and H. Hackett were appointed joint liquidators with a committee of inspection.

Aster Engineering Co. (1913), Ltd.—Winding up voluntarily. Liquidator, Mr. S. D. Begbie, of Wembley, with powers to enter into an agreement with Arrol-Johnston, Ltd., on terms arranged, and to dispose of the selling rights of the Aster cars to a new company. Meeting of creditors, April 6th, at 50, Gresham Street, E.C. Particulars of claims to the Liquidator by April 30th.

Carpax Co., Ltd.—Particulars of claims by May 3rd to the Liquidator, Mr. J. Wilson, 2, St. James Square, Manchester.

Southern Counties Electric Light and Power Supply, Ltd.—Winding up order made by the High Court, March 22nd.

New Municipal Showrooms.

The accompanying picture is a view of the new showrooms recently opened by Accrington Electricity Department in Whalley Road. Before proceeding with the work the Corporation made an extensive investigation into the schemes carried out by other municipal electricity supply authorities, and the result is the embodiment of all that is up-to-date in the



The New Accrington Showrooms.

design of the premises. As will be seen the showrooms have an extensive window frontage permitting of uncrowded and distinctive displays. It is reported that the new premises have already had a beneficial effect upon the sale and hire of electrical apparatus in Accrington.

Proposed Austrian Tariff Changes.

A number of alterations proposed in certain Austrian Customs duties are set out in the *Board of Trade Journal* dated March 24th. Among the commodities affected are pipes and tubes the duties upon which are, in most cases, to be raised. The duties upon "shaped parts of glass or other insulating material (except hardened rubber or porcelain) for electrical purposes, not equipped, weighing less than 600 gr. each" are increased from 19 and 25 gold kr. per 100 kg. to 140 kr.

A Novel Fire Escape.

Messrs. Merryweather & Sons, Ltd., have recently supplied to the Leicester Corporation a new type of turntable fire escape with which is combined a fire pump. The appliance possesses several novel features, among which are a searchlight and a telephone for communicating from the ground with a fireman at the top of the 85-ft. ladder.

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The Free State Radio Apparatus Duty.

A joint committee representative of the Wireless Retailers' Association of Ireland, the Wireless Society of Ireland, and a number of firms engaged in the radio apparatus trade in the Irish Free State is urging upon the Free State Minister of Finance the abolition of the 33⅓ per cent. *ad valorem* duty upon imported radio sets. It is stated that incalculable harm is being done to the industry by this duty, and if it were remitted the number of licence holders would rapidly rise from the present figure of 30,000 to about 100,000.

For Sale.

Southampton Electricity Department has for disposal a 38-ton per hour disused gravity bucket conveyor, complete with motor, &c.; Dartmouth Corporation invites offers for two 48-h.p., 480-V, d.c. motors, with spares. Mr. H. J. Shaw will sell by auction on April 7th, at 13, High Holborn, W.C., various trade stocks of wireless and electrical goods, &c.; Blackpool Co-operative Society invites offers for surplus electrical plant. (See our advertisement pages to-day.)

Book Notices.

Publications of the Association of Engineering and Shipbuilding Draughtsmen.—"The Craft of Tracing."—A short exposition of what may be considered the accepted methods of tracing; prepared by the National Technical Sub-Committee of the Association Executive. "E.h.t. Switchgear and Breakers." By G. L. E. Metz.—A pamphlet presenting valuable data on the design, primarily of oil circuit breakers, but also in a lesser degree of air circuit breakers, which have been collected. The general duties and the various working conditions and characteristics of the breaker are defined as well as the machine conditions under which it has to operate. The calculation of the rupturing capacity and considerations of the stresses to which the breaker is subjected are features of the work. Copies of each of the above may be obtained from the Association secretary, price 2s. each.

"Municipal Year Book, 1927." Pp. lxxix+900. London: Municipal Journal, Ltd. Price 15s. net.—In the new edition of this year book, several improvements have been introduced; the introductory matter relating to the various towns has been revised, extended, and brought up to date, the rural districts section has been considerably improved and added to, and the names and addresses as well as the principal officials of the various municipal authorities in Northern Ireland and the Irish Free State, are included; hitherto information relating to the six principal cities only has been given. As in previous years, the financial results during the year 1925-26 of electricity, tramway, railless traction, and other undertakings are given, as well as the legislation under which these undertakings have been established and are operated.

"Southampton Docks, 1927" (pp. xliv+147). London: The Southern Railway Co.—This brochure contains very full information regarding the facilities available at the Southampton Docks and sets out the charges for the handling and storage of goods, &c.

A list of "5,000 practical books" has been received from the Popular Mechanics Press, 635, St. Clair Street, Chicago, U.S.A.

"Scientific Papers of the U.S.A. Bureau of Standards." Vol. 21, No. 537, Formula for the inductance of a helix made with wire of any section. (25 cents.) Vol. 21, No. 542, Electric field of a charged wire and a slotted cylindrical conductor. (10 cents.)

"Circular of the U.S.A. Bureau of Standards." No. 17. Magnetic Testing. (15 cents.)—This circular contains a brief discussion on magnetic quantities and characteristics of materials, and outlines the various methods used by the Bureau for the magnetic testing of commercial materials.

"Science Abstracts (A and B)." Vol. XXX. Part 3. March 25th, 1927. London: E. & F. N. Spon, Ltd. Price 3s. each net.

Canary Islands Trade.

In a recent report on the Canary Islands (Department of Overseas Trade: Stationery Office, 1s. net.) Mr. P. Helyar, British Consul at Teneriffe, shows that 39 tons of electrical material was imported during 1925. The origins of this were as follows:—Germany, 19 tons; Spain, 6 tons; France, 5 tons; Belgium, 5 tons; United Kingdom, 4 tons. The total amount of telephone material imported was 78 tons, which came from the following sources:—Norway, 36 tons; Belgium, 22 tons; Holland, 17 tons; Germany, 3 tons.

Electric Power in Industry.

Continuing its series of supplements dealing with the Census of Production, the *Board of Trade Journal* for March 24th contains particulars relating to further branches of industry. In connection with the motor and cycle trades it is shown that in 1924 they had, collectively, generating plant of a capacity of 25,010 kW installed, as against 2,225 kW in 1907. The aggregate power of electric motors installed was 171,696 h.p.; power for 142,101 h.p. was purchased. In the seed-crushing industry the generating plant had a capacity of 15,625 kW (against 1,096 kW in 1907). The aggregate power of the industry's electric motors was 40,964 h.p. (energy purchased for 22,987 h.p.).

The soap and candle trades' generating plant rose from 3,837 kW in 1907 to 18,396 kW in 1924. Although the installed electric motors had an aggregate power of only 19,965 h.p., energy for 9,855 h.p. of these was purchased.

The Canadian Power Industry.

In a review of the expansion of the electric light and power industry in Canada, the Royal Bank of Canada states that the industry now ranks first among Canadian manufacturing industries in terms of capitalisation, with an aggregate amounting to more than $700,000,000, and sixth among the industries in terms of annual gross income, this amounting to well over $100,000,000 a year. As the present installation represents the development of only 10 per cent. of the recorded waterpower, the Waterpower and Reclamation Service has estimated that during the next 20 years the expenditure for new installations will exceed one billion dollars.

The Contractors' Convention.

We have received the provisional programme of the second annual conference of the E.C.A. Allied Associations, which is to be held at Scarborough from June 22nd to 25th inclusive. The first day is to be devoted to a council meeting and a reception by the president (Mr. H. J. Miles). The annual general meeting is to be held on the 23rd at Olympia (Scarborough). After an address of welcome by the Mayor, Mr. Miles will deliver his presidential address, and in the afternoon a paper on "Some Interesting Points on Modern Installation Work" will be read by Mr. R. Grierson (Grierson, Ltd.). A smoking concert will be held at the Grand Hotel in the evening. On the following day (Friday, June 24th), Mr. J. Kirkham (Rawlings Bros., Ltd.) will read a paper on "Estimating and Costing for Electrical Contractors," followed by Mr. H. E. Walker (Walker Bros., Birmingham), whose subject will be "The Electrical Showroom as a Commercial Proposition and its Relation to the Industry." The business proceedings will terminate with a short address by the new president. Friday afternoon and Saturday will be occupied by social functions, excursions, &c.

A folder is being issued giving particulars of accommodation available, registration forms, &c. The conference fee will be the same as last year, *viz.*, 25s., plus 7s. 6d. hotel deposit which will be deducted from the hotel bill. All applications to attend the conference should be addressed to the General Secretary, Mr. L. C. Penwill, 15, Savoy Street, Strand, W.C.2.

Local Exhibition.

BLACKBURN.—At an exhibition in the Public Hall, Blackburn, which was opened on March 29th, by Dr. J. Ramsay, deputy mayor, there was an excellent display of electrical appliances and labour-saving devices. The stand of the British Electric Polisher, Ltd., attracted considerable attention.

Recent Contracts.

MESSRS. RICHARD GARRETT & SONS, LTD., have recently received an order from the Società Imprese Elettriche dell America Latina for six Continental-type low-loading electric trolley-'buses for service in Lima, Peru, by the Lima Light, Power & Tramways Co. A fleet of five Garrett trolley-'buses has recently been supplied to the Nordsjaellands Elektricitets og Sporvejs Aktieselskab, of Kellerup, near Copenhagen. The vehicles are of the latest low-loading type, fitted with standard "Bull" motors and "Garrett" drum-type controllers. These are the first electric trolley-'buses to be put into service in Denmark.

INTERNATIONAL COMBUSTION, LTD., has received a repeat order from the Derby Corporation Electricity Department for an 80,000-lb. boiler complete with drying equipment, "Lopulco" water-cooled combustion chamber, superheaters, economisers, draught equipment, dust-catching apparatus, and stacks. It is claimed that the original installation showed an efficiency of 88.45 per cent., when employing fuel of 9,930 B.th.u. per lb. average calorific value. During a trial conducted by an independent consulting engineer it was established that the boiler plant, when isolated on to a 10,000-kW turbo-generator (with an average load of 3,300 kW), produced electricity at a consumption of 19,100 B.th.u. per kWh.

MESSRS. COCHRANE & CO., LTD., of the Ormesby Ironworks, Middlesbrough, have received official intimation that their tender for the supply of 7,000 tons of cast-iron pipes to the Municipal Council of Port Elizabeth, Natal, has been accepted. The contract was secured against keen French and German competition.

Unemployment.

During the week ended March 14th there was a decrease of 25,360 in the number of unemployed. At that date the total was 1,118,700, as compared with 1,144,060 on March 7th, and with 1,070,843 on March 15th, 1926.

New Australian Companies.

Dux Electric Heaters (N.S.W.), Ltd., was recently registered in Sydney, with a capital of £100,000, to acquire an existing business, the nature of which is indicated by the title.

Another new Sydney registration is the Gloucester Electric Supply Co., Ltd., capital £10,000, to acquire a business of automobile, electrical and marine engineers, &c.

The Country Electric Supply Co., Ltd., capital £25,000, has also been registered recently in Sydney. This company has an agreement with the Murrurundi Council for the supply of electricity in the Council's area, and it will also carry on the business of electricians, electrical engineers and manufacturers, &c.

In Melbourne, Telephones and General Engineering Pty., Ltd., has been formed, with a capital of £100,000.

Trade Marks in Northern Europe.

Delegates of Sweden, Denmark, Norway and Finland are to meet again at Oslo on May 2nd to discuss a basis of common legislation on trade marks in the North European countries. These negotiations were initiated at a conference held at Stockholm last autumn.—*Reuter's Trade Service* (Stockholm).

Prices of Raw Materials.

Messrs. F .Smith & Co. report, March 29th: Copper (electrolytic) bars, £63, 2s. 6d. dec.; ditto ditto sheets, no change; ditto ditto wire rods, £73, 2s. 6d. dec.; ditto ditto h.c. wire, 3/16d., 1/16d. dec.

Messrs. James & Shakespeare report, March 29th: Copper bars (best selected), sheet and rod, no change; English pig lead, £28 5s., 30s. dec.

Messrs. Edward Till & Co. report, March 29th: India rubber, Para fine, no change.

Messrs. C. Clifford & Son report, March 29th:—Babbitts metal and anti-friction metal, Grade I, £268, £6 dec.; Grade II, £186, £4 dec.; Grade III, £96, £2 dec.

Lighting and Power Notes.

Bexhill.—Electrical Development.—The Corporation Electricity Committee has received a letter from the Electricity Commissioners stating that, having regard to the probability that further provision will have to be made in the near future in respect of supplies in the Little Common area, the Council should review the probable requirement of that area with a view to determining the proper course of development. The Committee has recommended that the Commissioners be informed that the electrical engineer has already reported upon this matter, and that it is proposed to go fully into the subject in the early part of next year.

Loan Sanctioned.—Sanction has been received to the borrowing of £5,000 for mains and £216 for switchgear.

Brackley.—Electricity Supply.—The Town Council has been notified by Messrs. Cecil Cooper & Co. that they have applied for sanction to supply electricity in the district. The charges for the first year will not exceed 10d. per kWh for private lighting, 6d. per kWh for public lighting, and 4d. per kWh for power.

Bradford.—Assisted Wiring Scheme.—The Corporation Electricity Committee has approved an assisted wiring scheme for small dwellings. According to the *Yorkshire Observer* the scheme will be limited to 20-point installations. The department will be prepared to wire houses for the number of points required for lighting and for any additional points required for heating. The payments for installations up to eight lighting points, with one five-ampere plug and two ten-ampere plugs, will be £2 down and sixteen quarterly payments, varying according to the installation required. In the case of installations with more than eight lighting points the terms are to be 20 per cent. down, and sixteen equal quarterly payments. These provisions will be subject to confirmation or modification in Council. The wiring will be carried out by registered contractors.

Electrical Progress.—The output of electricity since the beginning of April last is reported to have increased by nearly ¼ million kWh, as compared with the corresponding period of the previous year.

Brigg.—Electricity Supply.—The Urban District Council has requested Messrs. A. Hugh Seabrook & Partners to revise their report on electricity supply, submitted two years ago, and bring it up to date, with a view to taking definite steps in the matter.

Chile.—Electrical Developments.—*Commerce Reports* states that the Sociedad Carbonifera de Marfil has been awarded by a recent Government decree. a 50-year concession to supply the city of Valdivia and adjacent districts with electricity.

Continental.—Finland.—The Niskakoski Rapids, in Northern Finland, capable of developing 25,000 h.p., have been purchased by British investors. It is proposed to erect a power station.—*Commerce Reports.*

Germany.—The Markische Elektrizitätswerke Gesellschaft has recently put into operation a large new steam-operated power station at Finkenheerd, near Frankfort-am-Main, with the object of supplying power to the greater part of the German province of Brandenburg. The site for the station was selected on account of its proximity to lignite mines from which the necessary fuel can be conveniently drawn. The initial generating plant comprises two A.E.G. steam turbo-alternators, with a capacity of 16,000 and 12,500 kW respectively. Two 15,000-kVA, 6,500/52,500-55,000-V oil-cooled transformers have also been installed, these being directly connected up to the generators. A further 30,000-kW set is at present being installed, and the station will eventually have a capacity of from 100,000 to 125,000 kW. The initial steam-raising plant comprises five Babcock & Wilcox and five Steinmuller water-tube boilers, each having a heating surface of 6,996 sq. ft., with 5,166-sq. ft. pre-heaters and 2,152-sq. ft. superheaters. For the plant at present in course of installation four boilers working at a pressure of 40 atmospheres and giving steam at a temperature of 425 deg. C. will be utilised.

France.—The Chamber of Deputies has voted the Bill for the utilisation of the hydro-electric power obtainable from the fall of Kembs (Upper Rhine). The works will include the construction of a lateral canal, and the total expenditure is estimated at 251 million fr.—*Reuter* (Paris).

Darwen.—Inquiry.—An inquiry was held recently by Col. T. C. Ekin, for the Electricity Commissioners, into the application of the Corporation to extend its generating station by the installation of one 2,000-kW set. The Town Clerk said it became necessary some years ago to increase the local generating station or obtain supplies from other sources. Actuated by the high cost of construction at that period, the Corporation decided to purchase in bulk from Blackburn. By a judicious use of that supply, coupled with the town's own production, the joint agreement between the two Corporations had worked satisfactorily. Later it became apparent that the time could not be long delayed before further plant would have to be installed if electricity was to be supplied locally at a commercially practicable rate, and the Electricity Committee therefore framed a scheme showing the relative advantages of installing a 2,000-kW turbo-alternator in substitution for one of its smaller sets, as compared with the continued reliance on Blackburn's supply. Investigations showed that it was in the financial interests of Darwen to generate its own electricity rather than take bulk supplies.

Duntocher (Dumbartonshire).—Electricity Supply.—At a recent public meeting, a deputation was appointed to interview the Clyde Valley Electrical Power Co. with regard to a proposal to obtain an electricity supply for the district.

East Dereham.—Electricity Supply.—The Urban District Council has instructed the Clerk to arrange with the Norwich Town Clerk for the preparation of a draft contract for the supply of electricity to the Council for a period of 21 years on the following terms:—£4 10s. per kW of maximum demand, plus 0.71d. per kWh, Norwich Corporation to lay the main from Wymondham to Dereham gas works at its own expense.

Epsom.—Electricity in Small Houses.—The Town Council has decided to supply electricity to houses on the Horton estate for lighting, heating, cooking, &c., at an annual charge of £3 12s. per house, plus 1½d. per kWh.

Ilford.—Loans.—The Electricity Committee is making application for sanction to loans of £2,000 for wiring installations and £2,000 for the purchase of electrical apparatus to be let out on hire.

India.—Pykara Scheme.—It is understood that the Government of Madras has under contemplation the appointment of a hydro-electric expert to advise it on further progress of the Pykara scheme and to deal with the terms and conditions of the railway electrification. An announcement will be made as soon as an expert is secured.—*Indian Engineering.*

Irish Free State.—Killarney.—At a recent meeting of the Urban Council a letter was read from the Minister for Industry and Commerce, stating that he had received an application from the Kerry Electric Supply Co. for permission to erect electric mains in certain streets of the town of Killarney. The company stated that it had applied to the Council for permission to erect the necessary poles in the streets, but that its request had been refused. The Ministry has requested the Council to state its objections to the company's proposal, and the Town Clerk was directed to reply setting out the Council's objection to the erection of overhead lines in the streets.

Leek.—Electricity in Bulk.—The electrical engineer of the Urban District Council is negotiating with the Stoke-on-Trent Corporation for a bulk supply of electricity. It is proposed to take a supply of from 1,500,000 kWh to 5,000,000 kWh per annum, with a maximum load of 1,500 kW.

London.—Battersea.—Application is being made by the London Power Co., Ltd., for consent to establish a new generating station at Nine Elms.

Poplar.—Sir Andrew Duncan, chairman of the Central Electricity Board, has consented to open the new generating station on April 25th next.

Chiswick Power Station.—The *Financial News* reports that the London and Home Counties Joint Electricity Authority has signed an agreement with the Chiswick Urban District Council to acquire from the Council over 44 acres of the Duke's Meadows on which to erect a generating station. The agreement will be scheduled to the new Bill, which, with the assent of the Standing Orders Committee of Parliament, will shortly be introduced into the House of Commons in substitution for the Bill which failed to comply with the Standing Orders.

Paignton.—Purchase of Undertaking.—The Urban District Council has appointed Mr. J. H. Rider, consulting engineer, to prepare a preliminary report on the proposal to purchase the electricity undertaking of the Paignton Electric Light and Power Co., Ltd.

Plymouth.—Electricity Extensions.—The Corporation Electricity Committee, on March 22nd, approved a recommendation of the electrical engineer, Mr. E. G. Okell, for the provision of a h.p. feeder cable to St. Budeaux in order to meet the increasing demand in the Swilly and St. Budeaux districts and to complete a ring main for the greater security

of supplies throughout the area, in which there are now over 1,870 consumers. It was pointed out that the extension would involve the erection of a sub-station at St. Budeaux and the provision of additional transformers and switchgear at a total estimated cost of £20,996. Application is to be made for sanction to borrow the necessary money. The Committee also authorised cable extensions in 18 streets.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Smethwick, Oldbury, and Evesham.—*The Shropshire, Worcestershire and Staffordshire Power Co.*: Lighting: The surcharge of 7½ per cent. has been withdrawn.

Aylesbury.—The temporary increase of 10 per cent. made to domestic, business, and power consumers, has been removed.

Hornsey.—The 10 per cent. increase to be terminated.

Shipley.—Loan.—The Urban District Council is applying for sanction to borrow £2,500 for the purchase of electrical domestic apparatus to be let out on hire.

South Africa.—Cape Town.—The Corporation Electricity Committee reports that in the immediate future the Council will be laying the Electricity Commission's cables between Glencairn Quarry and the traction sub-station at Glencairn and it is suggested that the opportunity be taken to lay a 11,000-V cable between the Quarry and Glencairn Village. Supply to the far end of Kalk Bay, Fish Hook, and the Quarry depends on a single cable, and there is no doubt that a duplicate supply will have to be provided before very long. The cheapest and most economical way of obtaining this duplicate supply will be to take energy in bulk from the Electricity Commission's 33,000-V transmission system at Glencairn sub-station. By laying the cable now there will be a considerable saving in excavation and handling charges, and in the interim, capital charges on the cable can be covered by supplying Glencairn Village.

Loan.—The Corporation is to raise a loan of £500,000 for electricity purposes.

Southend-on-Sea.—Mains Extensions.—The Town Council has decided to carry out mains extensions, including a supply to Southbourne Grove, at an estimated cost of £3,060, subject to a Special Order being obtained to carry out the extension.

South Shields.—Street Lighting.—The Corporation is considering a scheme submitted by the borough electrical engineer for the conversion of 1,000 street lamps from gas to electric lighting.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The Southend-on-Sea Corporation, authorising it to supply electricity in the urban district of Canvey Island and the rural district of Rochford; the Clacton Urban District Council, to supply in certain parishes in the rural district of Tendring; and the Cleveland and Durham County Electric Power Co., for the amendment of the South Durham Districts Electricity Order.

Stirling.—Electricity in Bulk.—In accordance with the plan for linking up electricity undertakings in Central Scotland, the Town Council, instead of laying down new plant to meet the growing demand, will take a bulk supply from the Scottish Central Electric Power Co., whose cable runs through the town. The agreement is to be for a period of five years. The cost will be £1 2s. 6d. per quarter per kW of the maximum demand, plus 7/10d. per kWh for electricity consumed. The Council is to erect the necessary sub-station, subject to the approval of the Electricity Commissioners.

Stoke-on-Trent.—Electricity Supply.—The borough electrical engineer has reported to the Electricity Committee that the Electricity Commissioners have suggested to the Newcastle-under-Lyme Corporation that the supply for next winter's load should be taken from Stoke instead of installing a new generating set.

The Committee has asked the electrical engineer to prepare a scheme for a supply of electricity to Endon.

Supply to Factories.—A report was submitted to the Committee upon the position with regard to factory supplies, and the electrical engineer was asked to prepare scales of charges, based upon load factor and consumption, with a view to reductions in the price to factories taking large quantities of electricity.

Swansea.—Street Lighting.—At a recent meeting of the Highways Committee the borough engineer reported that he had conferred with the borough electrical engineer with regard to the question of converting public lamps from gas to electric lighting in all streets where public lighting cables had been laid, and the latter had agreed to recommend his Committee to extend the cables in certain streets. It has been arranged to take over 935 of the existing gas lamps in various areas. When the work is completed the whole of the east side of the river, north of Morris Lane, up to Llansamlet, and the whole of the Oystermouth and West Cross district, will be lit by electricity. The borough electrical engineer was further prepared to connect 42 new lamps which it is proposed to erect in the near future principally in the Winchwen and Trallwn area, to the electricity mains. With regard to the public lighting of Ynistawe, it was reported that Messrs. Player & Son had been given six months' notice to terminate the present contract, and that at the expiration of that time the public lighting of this area would be undertaken by the Corporation's Electricity Department. A supply will then b given from underground mains and new and improved lam will be provided if allowance is made in next year's estimat for the cost of the necessary work.

West Midlands.—Plant Extensions.—Mr. S. T. Alle chief engineer of the West-Midland Joint Electricity Authorit in a recent paper before the Birmingham Electric Clu referred to the big developments in progress. He explaine that the area over which the West Midland Authority ha control covered over 1,000 square miles, and extended roughl from Tamworth to the Welsh border and from Stafford t Halesowen; it embraced 60 boroughs, urban and rur districts and parishes. The whole of the generatio would be carried out under one control, and the supplies electricity required by the existing owners of generatin stations would be sold at cost price; in effect, the scheme wa a co-operative movement. Immediate provision had bee made for the erection in sections of a new capital station Ironbridge, and provision would subsequently be made, i anticipation of the growth of demand, for the erection i sections of a further capital station. The Birchills an Ocker Hill generating stations were being extended wit plant to cost £366,000; an order for 33,000-volt, 500,000-kV capacity (and other) switchgear, covering an expenditure approximately £125,000, had just been placed—perhaps on of the largest single orders for switchgear ever placed in and for, this country.

Wolverton.—Opposition to Scheme.—At a public meetin held on March 23rd, a resolution was passed protestin against the use of overhead mains by the Northampto Electric Light and Power Co., Ltd., and the meeting pledge itself to decline the use of electricity unless undergroun mains were used. A copy of the resolution is to be sen to the Ministry of Transport.

Tramway and Railway Notes.

Continental.—Belgium.—A scheme is under considerati for the construction of an electric tramway between Courtra and Mouscrom. The line is estimated to cost about £98,500 of which the Belgian Government would be responsible fo one fourth.

Japan.—Revision of Electrification Scheme.—The Im perial Government Railways have decided to revise the elec trification scheme from the next fiscal year. According t the revised plan only some of the Tokio, Osaka and Kyot suburban lines will be electrified at present, and the electrifi cation of the whole of the Tokaido line has been postponed In connection with the electrification of the Otsu-Akashi line which will be commenced in the fiscal year 1929-30 the I.G.R. is to erect a hydro-electric power station nea Osaka, and a steam power plant as a reserve between Osak and Kobe.

Railless-Car Scheme.—Application has been made by Mr G. Takeuchi, of Shimodate-machi, Ibaraki-ken, for permissio to introduce a railless car service from Shimodate-machi t Makabe-machi, a distance of nine miles, at a cost of 117,00 yen.

Railway Extensions.—The Municipal Assembly of Osak has under consideration four schemes of extensions to electri railways in the city. They include the proposed Japan Elec tric Railway (a rapid transit railway) between Tokio an Osaka, the Sumiyoshi Electric Railway, with a capita of 2,000,000 yen from the city to Kosaka-machi, the Nanka Rapid Transit Railway, with a capital of 10,000,000 yen, fro the city to Sano-machi, and the Hanshin Electric Railway t be extended from Kobe to the city, with a capital of 30,000,00 yen.

London.—Inquiry.—The Ministry of Agriculture held a inquiry recently into the proposed purchase of land at South gate by the London Electric Railway Co. Mr. W. L. Lloy Roberts, for the company, said the land was required fo the development of the tube north of Finsbury Park. I would be an extension of the Piccadilly line. He quoted th recent London Traffic Report suggestion that the railwa should be extended to Wood Green or Southgate. After th company had looked into the matter it came to the con clusion that it could construct such a railway and would pur chase such land with a view to doing so. The assistan secretary and treasurer of the London Electric Railway Com pany said it was proposed to provide sheds for 172 cars.

Underground Goods Railway.—The entire board of th London Goods Railways, Ltd., formed last year to construc underground goods tubes in the London district, has bee reconstituted. According to *Modern Transport*, the new directors are Viscount Elibank (chairman), Colonel B. C L. Jervis, Sir Arnold B. Gridley and Mr. W. W. Paine Plans are being prepared, it is stated, and it is expecte that the enterprise will cost between £20,000,000 an £30,000,000. The original scheme has been revised, and it i hoped that all details will be completed in a few months time.

Telegraph and Telephone Notes.

Australia.—New Radio Receiving Station.—The La Perouse radio receiving station was opened recently by Amalgamated Wireless (Australasia), Ltd. It is capable of receiving messages from Tilbury Docks, London, as well as from the docks in Vancouver and San Francisco, and has also kept in communication with ships fitted with short-wave sets between these terminal ports. It will be the official receiving centre for Sydney, and will be in direct communication with all the "beam" feeder stations in Australia, and will automatically relay the messages received direct into the head office of the company. The same procedure will be followed regarding messages received from the Federal Government stations in New Guinea and the Pacific Islands, which are controlled by Amalgamated Wireless, Ltd. All transmitting will be done from the Pennant Hills centre, about 30 miles distant. The aerial system at La Perouse consists of four 72-ft. tubular steel masts in the form of a square, with one 99-ft. mast in the centre, and land-line connections have been installed between La Perouse and the General Post Office, Pennant Hills, and the head office of Amalgamated Wireless, Ltd.

Spain.—Madrid-Argentina Wireless Service.—At a meeting on March 23rd, the Cabinet approved of the establishment of a public wireless service between Spain and Argentina.—*Reuter* (Madrid).

Turkey.—Automatic Telephony.—We have been requested to state that the automatic telephone exchange at Angora was delivered by the Telefonaktiebolaget L. M. Ericsson, of Stockholm, and not by an American company, as reported some time ago. The network was installed by a private Turkish company.

United States.—New York Telephone Progress.—President J. S. McCulloh, of the New York Telephone Co., reviewing the achievements of his organisation during the past year, says that more than $78,000,000 was invested in 1926 to enlarge its system in New York State, northern New Jersey, and a small portion of Connecticut. Nearly $41,000,000 went for necessary expansion of the system in New York City. A total of 174,200 telephones was added during the year to the system, which now serves over 2,600,000 telephones, of which nearly 1,520,000 are in the five boroughs of New York City. The volume of local calls handled in the company's entire territory increased during the year from approximately 9,568,000 to about 10,288,000 per day. Toll and long-distance calls increased from 773,500 to 881,900 daily.

Radio Notes.

Australia.—Royal Commission.—The Royal Commission on Wireless, which has been appointed by the Government, met for the first time on February 7th, and the first public meeting took place on February 9th in Melbourne. The Commission is hearing evidence in the capital city of each State.

Continental Relays.—Proposed Exchange of Programmes.—Although the B.B.C. receiving plant at Keston relays American stations on Tuesday nights, Continental relays seem to have gone out of fashion in this country; yet it appears that they are finding favour abroad, for the *Evening News* reports that the so-called "rapproachment" subcommittee of the Office Internationale de Radiophonie recently met at Vienna to discuss the exchange of broadcast programmes by wireless link.

Denmark.—Reductions in Licence Fees.—The fee for a receiving licence has been reduced to 10 kr. for crystal as well as for valve sets; it formerly cost about 12s. 6d. for crystal and 15s. for valve sets. *World Radio* says that listeners in Denmark, on February 1st, reached a total of 130,446, of which 64,231 were crystal listeners and 66,215 valve listeners. The licence for receiving apparatus with loud-speaker for use in public places has been reduced from £25 to £10 yearly. The new high-power station will be ready in July.

France.—New Regulations.—All radio stations in France are now under the general administration of the Post, Telegraph and Telephone Service and the Ministry of the Interior. Private stations which receive communications other than private correspondence can be authorised by special agreement, the details of which are to be determined by decree, and after the payment of an "art tax" at rates to be determined. Places which charge for admission are, in addition, subject to an annual tax, which is also to be determined by decree. Private sending stations or receiving and sending stations may be established only by special authorisation of the Ministers of War, Marine, Interior, and the Post, Telegraph, and Telephone Service, with the consent of an interministerial committee. Three national and 18 regional establishments will be set up either under direct Government operation or by special concessionaires; the programmes will be under the charge of special groups approved by Government authorities. For the present it is intended that the Post, Telegraph and Telephone Service shall secure the co-operation of private groups, which will assume the financial burden of operating the large sending stations; a year hence the Government authorities will have the power to enter into contracts with private interests which shall run not longer than to January 1st, 1933, for the establishment and operation of the proposed stations. The concessionaire is to pay a tax, and the capital invested is to receive a dividend not greater than the interest on the advances of the Bank of France to the State, plus 2 per cent.; after charging 10 per cent. to amortisation and payment of dividends, the surplus profits are to be divided equally between the Government and the concessionaire. At the end of the contract period the operating authority becomes the owner of the properties subject to paying the non-amortised capital cost within five years. In spite of declarations by the Government that the new regulations do not contemplate nationalisation, they contain the possibilities of very strict Government control. Private radio equipment of all sorts is to be operated only by special permission; its use may be stopped at any time on the vote of a Government commission. Free access to the markets of the world is limited in the case of both public and private sending stations by the requirement that such equipment "must be as far as possible of French manufacture." A commission of 44 members, 22 of whom are to be Government officials, is to advise on all subjects covered by the decree or delegated to them by the ministers. According to *Commerce Reports*, one of the objects is to "establish a coherent, rational, and powerful" system which can combat foreign propaganda through the dissemination of French ideas.

Greece.—New Stations.—The construction at Athens of a new transmitting station by the Administration of Posts and Telegraphs is actually completed. With a view to choosing its wavelength, the station is now proceeding to make tests. According to *World Radio*, other stations are to be constructed at Janina, Patras, Syra, Zante, and Chio.

Irish Free State.—Cork Station.—The new broadcasting station at Cork of the Department of Posts and Telegraphs, constructed by Standard Telephones & Cables, Ltd., London, has almost completed its tests. It is located at Sunday's Well, and occupies the site of the old prison. Two 120-ft. masts support the aerial, which consists of four wires each 156 ft. long; an earth mat, composed of a network of copper wires, has been buried in the ground covering an area of approximately 20,000 square feet. The station is rated at 1.5 kW, which means that 1.5 kW is given to the oscillators, which in turn deliver 1 kW of unmodulated power to the aerial system, so that with 100 per cent. modulation a "peak" power of 4 kW can be handled without distortion, assisted by the use of a condenser microphone. Standard Telephones & Cables, Ltd., with its associated companies, has constructed some 38 broadcasting stations of a similar size. The frequency of the carrier wave is maintained constant within 0.01 per cent. The power required to operate the complete station is about 9 kW, obtained from the local supply mains and used to drive motor generators. It is hoped that this station will cover the south and west of the Free State, and the *Irish Times* is informed that it is hoped formally to open the station on the 25th proximo. Arrangements are in hand for the fitting up of a suitable studio and necessary office accommodation in the station premises. The wavelength is 400 metres. One programme only will be given from both the Cork and Dublin stations, trunk telephone lines being used to connect the two studios.

South Africa.—New Company.—The African Broadcasting Co. has been registered with a capital of £50,000 to broadcast throughout the Transvaal, and ultimately Rhodesia and Mozambique. According to the *Financial News*, the Government has two directors on the board of the company, which was promoted by Schlesinger.

Spain.—Regional Control.—Two more stations, Radio San Sebastian (EAJ8) and Radio Salamanca (EAJ22) have been taken over by the Union Radio, the object being to endow Spain with a regional service, so as to enable listeners on crystal sets to enjoy a variety of programmes.

United States.—New Radio Law.—The failure of the United States Senate to confirm the nomination of two of the five men selected by President Coolidge to be members of the new Federal Radio Commission has been followed by the President making "recess" appointments of the two men in question, says *World Radio*. The Board is handicapped, since the Deficiency Bill, which authorised $120,000 for salaries and other expenses, failed to pass before Congress adjourned. Mr. Herbert Hoover, Secretary of Commerce, is co-operating with the Commission in its efforts to function. The main problems before the new body just now are overlapping and heterodyning.

Wave Propagation.—Effect of Receiving Aerials.—Mr. R. H. Barfield, of the Radio Research Station, Slough, recently estimated the extent to which a large number of receiving aerials contribute to the absorbing effect of the earth's surface on wireless waves in resonance with them.

Calculation showed that, with a density of aerial distribution such as now exists in an urban district surrounding a local broadcasting station, the energy absorbed by the aerials should be the decisive factor in determining the surface attenuation, and experiments have yielded results that constitute very definite evidence of a critical effect of large magnitude occurring at or near the resonant wave-length, the phenomenon appearing only ascribable to the selective action of the multiplicity of tuned aerials in the path of the waves. Thus, at Slough an increase in intensity of the order of 90 per cent. was observed for a variation in wave-length of only 5 per cent.; while for a wave-length change of 120 metres a total increase of field strength of nearly five to one was obtained; that is, for a given power transmitted, the received power increased more than twenty-fold. It is explained in *Nature* that the hypothesis that this effect is mainly due to the transmitted waves passing in and out of resonance with the aerials in their path is confirmed by the fact that the effect was found to increase in proportion to the distance which the waves travelled over crowded residential districts, and was negligible when the wave path lay almost entirely over open country with only a small residential area round the transmitter; the hypothesis was further confirmed by the fact that the effect was shown not to be peculiar to a given transmitter or receiving site. On the other hand, it seems at first to be contradicted by the fact that the minimum intensity, and therefore apparently the maximum absorption, does not occur at the resonant wave-length, but at a wave-length considerably below: in some cases the minimum had not been reached at 300 metres, below which wave-length experiments have not yet been carried. A brief study of the theoretical side of the problem, however, shows that this is not necessarily the case. The observations on which the above note is based were carried out as part of an investigation for the Radio Research Board of the Department of Scientific and Industrial Research.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—May 10th. Postmaster-General's Department. Telephone relays. (B.X. 3333.)*
May 17th. Resistances and reactances. (B.X. 3307.)*
May 23rd. State Electricity Commission. Switchgear and accessories. (B.X. 3285.)*
May 9th. 6,600-V transformers and spares. (B.X. 3331.)*
July 5th. One 15,000-kW steam turbo-generator and accessories. (B.X. 3369.)*
Sydney.—May 9th. Electricity Department. Station auxiliary switchgear. (B.X. 3338.)*

Ayrshire.—Education Authority. Electric lighting and central heating installations for the addition to Ardeer public school. Mr. J. E. Shaw, clerk, Education Offices, Ayr.

Barnes.—Electricity Department. 1,200 yd. l.p. armoured multiple cable. (See this issue.)

Barking.—May 9th. County of London Electric Supply [illegible] Ltd. Cables and accessories for the Barking power [illegible]. (See this issue.)

[illegible]enham.—April 4th. Electricity Department. Three e.n.p. transformer sub-station switchboards. (March 18th.)

Belfast.—April 7th. Electric lighting and power installations at New Museum and Art Gallery, Botanic Gardens Park. Town Clerk's office, City Hall.

Bolsover.—April 19th. Urban District Council. Cables, boxes, pillars, &c. (See this issue.)

Bristol.—April 11th. Electricity Department. 39 miles (approx.) 3-core, paper-insulated cable. (March 18th.)

Clayton.—April 18th. Urban District Council. E.h.p. feeder cables, l.p. distributing mains, fuse pillars and transformer kiosk. (See this issue.)

Colombia. — Bogota.—April 30th. Ministry of Public Works. Two electric lifts. (A.X. 4433.)*

Edinburgh.—April 18th. Electricity Supply Department. De-aerating plant and boiler feed pumps. (March 25th.)

Grimsby.—April 2nd. Electricity Department. Deansgate balancer set, switchgear and cablework. (March 25th.)

India.—April 5th. India Store Department. 27,000 yd. paper-insulated armoured cable for telephones. (March 25th.)
April 26th. 66-kVA motor-driven alternator sets, transformers, switchgear, &c. (See this issue.)

Kilmarnock.—April 6th. Ayrshire Electricity Board. Two water-tube boilers, with superheaters, economisers, air heaters, mechanical stokers, and coal-handling plant. (March 18th.)

Leeds.—April 7th. Board of Guardians. Electrical wiring of certain blocks and electric bell installation at the Beckett Street Institution. Mr. J. Edwin Storr, consulting engineer, Midland Bank Chambers, 13, Bond Street, Leeds.

London.—Holborn.—April 13th. Board of Guardians. Electric lighting installation at the London Road, Mitcham, schools. (March 18th.)

London County Council. April 12th. Wiring and fittings for electric lighting for Everington Street School, Fulham (approx. 196 points). (See this issue.)
G.W.R. April 21st. Stores, including electrical wires and cables and telegraph ironwork. (See this issue.)

Middlesbrough.—April 8th. Electricity Department. 12 months' supply of cables and meters. (March 25th.)

New Zealand.—Wellington.—May 31st. Public Works Department. 50-kVA transformers for the Waikaremoana electric power scheme. (B.X. 3294.)* 50-kVA transformer for Arapuni scheme. (B.X. 3293.)*
June 7th. Railway sub-station equipment, Lake Coleridge electric power scheme. (B.X. 3295.)*
May 4th. General Post Office, Stores Division. Sub-station protectors. (B.X. 3286.)*
June 13th. New Zealand Railways. Machine tools, workshop equipment and overhead electric travelling cranes. (A.X. 4344.)*
June 6th. Six electric locomotives. (A.X. 4355.)* Overhead equipment for the Christchurch-Lyttelton electrification scheme. (B.X. 3301.)*
Invercargill.—May 21st. Southland Electric Power Board. Transformers. (B.X. 3379.)*
June 15th. 66,000-V, oil circuit-breakers. (B.X. 3378.)*

Plymouth.—April 25th. Electricity Department. Electricity meters, cables, and transformers. (See this issue.)

Southend-on-Sea.—April 9th. Light Railways and Electricity Department. Remote-controlled rotary convertors. (March 11th.) April 19th. 4,000 joint boxes. (March 25th.)
April 19th. 1,400 current limiters. (See this issue.)

Uruguay.—Montevideo.—June 15th. State Electricity Supply Works. 15 transformer sub-station equipments (6,600/220 V, 50 cycles). (B.X. 3371.)*

Wrexham.—April 19th. Electricity Department. One 250-kW rotary-convertor equipment and d.c. switchgear. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—Sydney.—Electricity Supply Committee. Recommended:—
Tungsten-filament electric lamps (£7,955).—Warburton Franki, Ltd.
33,000-V cable and pilot cable (£67,594).—British General Electric Co., Ltd.
H.p. and l.p. cables (£86,344).—Standard Telephones and Cables (Aust.), Ltd.
Outdoor automatic oil switches (£8,800).—English Electric Co. of Australia, Ltd.
Two 1,000-kVA transformers (Spec. 1,082) (£2,129); distribution transformers (Spec. 1,088) (£11,684).—Electrical Plant Manufacturers, Ltd.

MELBOURNE.—Electric Supply Committee. Accepted :—
30,400 yd. fibre conduit (£3,673).—Standard Telephones and Cables (Aust.), Ltd.
110 ornamental street-lighting units (£2,716).—Australian General Electric Co., Ltd.

BRISBANE.—City Council. Recommended :—
94 traction motors: 11 Metropolitan-Vickers Electrical Co., Ltd. (£2,706); 38 made in U.S.A. (£10,055); 45 ditto (65 per cent. made in Australia) (£11,925).—Australian General Electric Co., Ltd.
—*Tenders.*

Bexhill.—Electricity Committee. Recommended:—
Three feeder panels (£216 each).—Bertram Thomas.

Brighton.—Health Committee. Accepted:—
Installation of X-ray apparatus at sanatorium (£326).—Solus Electrical Co.

Dundee.—Electricity Committee. Accepted:—
Two boilers for Carolina Port electricity station (£36,589).—Babcock & Wilcox, Ltd.

Chester.—Corporation. Accepted:—
Supply and fixing of an electrically-driven pump at the junction of Appleyards Lane and Hartington Street (£298).—Pulsometer Engineering Co., Ltd.

Epsom.—Urban Council.
Wiring houses on the Horton site for electric light.—Mr. Pengilly (£2,083, accepted).

Hornsey.—Electricity Committee. Recommended:—
Stoneware troughs.—Doulton & Co., Ltd.
Cables.—Pirelli-General Cable Works, Ltd., and Standard Telephones & Cables, Ltd.
Six 4-way distribution boxes and six 6-way boxes (£324).—Motor Gear & Engineering Co., Ltd.
Extension of Hewittic set at Highgate sub-station (£1,244).—Hewittic Electric Co., Ltd.

Irish Free State.—Controller of Stores (Posts and Telegraphs) :—
Cable turning section and end panel.—Standard Telephones and Cables, Ltd.
Cables.—W. T. Henley's Telegraph Works Co., Ltd.
Heat coils.—Phœnix Telephones & Electric Works, Ltd.
Fuses.—International Electric Co., Ltd.
Telephone plugs.—Ericsson Telephones, Ltd.
Sections, switch, No. 9.—Standard Telephones & Cables, Ltd.

London.—METROPOLITAN WATER BOARD. Accepted :—
Four months' supply of "Siemens" gasfilled lamps.—Siemens & English Electric Lamp Co., Ltd.

LONDON COUNTY COUNCIL.—Education Committee.
Electric lighting installation at Barrett Street trade school.—Alpha Manufacturing & Electrical Co., Ltd.

METROPOLITAN ASYLUMS BOARD.—Installation of electric lighting at Millfields, Rustington, Littlehampton.—Alpha Manufacturing & Electrical Co., Ltd.

STEPNEY.—Electricity Supply Committee. Recommended :—
50 tons pitch (£262).—Smith's Tar Distillery, Ltd.
50 t.c.c. disconnecting boxes (£105).—Universal Electrical Manufacturing Co., Ltd.

Supply of cables for two years :—

W. T. Henley's Telegraph Works Co., Ltd. ...	£38,295
Hackbridge Cable Co., Ltd.	38,477
Macintosh Cable Co., Ltd.	39,057
Standard Telephones & Cables, Ltd.	39,059
British Insulated Cables, Ltd.	39,072
W. T. Glover & Co., Ltd.	39,111
Pirrelli-General Cable Works, Ltd.	39,348
Callender's Cable & Construction Co., Ltd....	39,370
Siemens Bros. & Co., Ltd.	40,175

London Midland & Scottish Railway Co.
Electric lamps for nine months.—Siemens & English Electric Lamp Co., Ltd.

New Zealand.—AUCKLAND.—Electric Power Board.
22,000-V cable from the Penrose sub-station to Auckland (£65,150).—Siemens Bros. & Co., Ltd.
—*Tenders.*

South Africa.—CAPE TOWN.—Electricity Committee. Accepted :—
20 tons hard-drawn bare copper wire (£1,584); 8 tons copper wire (£605).—British Insulated Cables, Ltd.

Recommended :—
Crane (£162); paper-insulated cable (W. T. Glover and Co.'s manufacture) (£197).—Davis & Soper, Ltd.
Transformer (£110).—S.A. General Electric Co., Ltd.
Extensions switchboard, Burg Street (£171).—A. Reyrolle & Co., Ltd.
Two switch panels in connection with the electrification of Brackenfell quarry (£224).—British Thomson-Houston Co., Ltd.

Stoke-on-Trent.—Stores Purchasing Committee. Accepted :—
Electric lamps.—Blackburn, Starling & Co., Ltd.; Barnett, Soans & Gould; Robinson & Hands Electrical Co., Ltd.; H. W. Teeton; Hawley & Ingram; and Potts & Co.

Electricity Committee. Accepted :—
De-aerating plant at central power house (£1,581).—Hick, Hargreaves & Co., Ltd.
Boiler and feed pumps (£1,716).—G. & J. Weir, Ltd.
Supply of cables and laying mains for the year.—Callender's Cable & Construction Co., Ltd.

Tynemouth.—Trade and Commerce Committee. Accepted :—
Wiring fish quay sheds for electricity (£145).—W. W. Ward & Son, Ltd.

Electricity Committee. Accepted :—
Cables (£128).—Edison Swan Electric Co., Ltd.

Forthcoming Events.

Institution of Engineers-in-Charge.—Saturday, April 2nd. Holborn Restaurant, London. 6.30 p.m. Annual dinner.

Salford Technical and Engineering Association.—Saturday, April 2nd. Royal Technical College. 7 p.m. "Electro-Deposition of Metals." Mr. E. J. Dobbs.

Society of Engineers.—Monday, April 4th. Burlington House, W. 5.30 p.m. "Some Aspects of Reinforced Concrete." Mr. G. C. Workman.

Röntgen Society.—Tuesday, April 5th. 32, Welbeck Street, W. 8.15 p.m. Ordinary meeting.

Association of Supervising Electrical Engineers.—Tuesday, April 5th. Junior Institution of Engineers. 7.15 p.m. "Lighting of Small Towns." Dr. J. A. Purves.

Institution of Electrical Engineers.—Thursday, April 7th. London. 6 p.m. "The Number of Tests required to establish the Rupturing Capacity of an Oil Circuit-breaker." Messrs. W. B. Whitney, C. E. R. Bruce, and E. B. Wedmore.

(Wireless Section).—Wednesday, April 6th. London. 6 p.m. "Battery Eliminators," by Messrs. P. R. Coursey and H. Andrewes.

(North Midland Centre).—Tuesday, April 5th. Hotel Metropole, Leeds. 7 p.m. Annual general meeting.

(North-Western Centre).—Tuesday, April 5th. Engineers' Club, Manchester. 7 p.m. Annual general meeting. "The Stability of Large Power Stations." Mr. F. H. Clough.

Women's Engineering Society.—Friday, April 8th. 26, George Street, W.1. 6.30 p.m. "A Business Woman's Trip to America." Miss E. M. Kennedy.

Institutions of Civil, Mechanical, Electrical, Municipal and County, and Locomotive Engineers (Yorkshire Sections).—Friday, April 8th. Great Northern Hotel, Leeds. Joint delegation dinner.

Junior Institution of Engineers.—Friday, April 8th. 39, Victoria Street, S.W. 7.30 p.m. "Electrical Osmosis." Mr. E. Ambrose.

Royal Institution.—Friday, April 8th. 9 p.m. "Early Days in Radio Activity." Sir Ernest Rutherford, F.R.S.
Saturday, April 9th. 3 p.m. "Alpha Rays and Atomic Structure." Sir Ernest Rutherford, F.R.S.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, April 9th. At the School of Mines, Treforest. 6 p.m. "Aerial Wire Ropeways." Mr. J. W. White.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

VITRITE insulating material for lamp caps.

Notes.

The Batti-Wallahs' Society.

On Tuesday last week, at the Hotel Cecil, the Society celebrated its 21st birthday by converting the annual dinner into a dinner-dance, and the experiment proved so popular that it will probably have to be repeated. No outstanding guests of honour were there, but Mr. President A. W. Blake and Mr. Vice-President G. W. Partridge presided over a jolly gathering of some 200, which included a number of ladies and gentlemen famous in the electrical industry.

We recently received a neat little brochure recording the history of the Society, which derived its origin from a suggestion by Mr. L. M. Waterhouse in 1905, that old P. & O. Batti-Wallahs should band together.

Telephone Insurance.

What is claimed to be the first insurance concern in the world specialising in the insurance of private telephone installations against damage and breakdown has recently been formed in Berlin, with a capital of £20,000, and the title of the Tela Versicherungs Gesellschaft für Technische Anlagen.

Illuminated Road Signs.

The accompanying illustration shows day and night views of one of a number of road signs of the Hendon Urban District Council which have been illuminated. Tests carried out at night showed that the illuminated sign could be distinguished easily 500 yards away in clear weather, and 200 yards away in fairly heavy fog. A 20-W red-sprayed



An Illuminated Road Sign: Day and Night Aspects.

"Osram" sign-type lamp is fitted at the apex of the red triangle, and a 20-W squirrel-cage vacuum lamp, with a special vitreous-enamelled-steel dispersive reflector supported by a bracket, is centrally fitted below the base of the triangle in order to direct a beam of concealed light on to the actual character and wording of the sign. A standard G.E.C. 1.5-A time switch controls the lamps, lighting and extinguishing them at predetermined times automatically without any attention except winding once a fortnight. At each winding the switch is reset to operate the lamps at times coinciding with the lighting-up regulations. The installation was designed by the General Electric Co., Ltd.

Faraday House Old Students' Association.

The Association's function this term took the form of a dance, held in co-operation with the Faraday House Rugby Club, on March 18th, and was well supported by old students, who represented practically every branch of the electrical world. Dancing continued until midnight, with a short interval for a humorous entertainment provided by the well-known artistes, Robert Pitt and Langton Marks. Amongst those present were Mr. J. F. Watson, of Messrs. Callender's Cable and Construction Co., Ltd., president of the Association, Dr. Alexander Russell, and Mr. Michael Terry, F.R.G.S., the well-known explorer. This was the Association's first dance, and those present unanimously agreed to make it an annual function.

Service Notes.

Royal Air Force.—The British War and Victory Medals of a large number of ex-officers and ex-airmen still remain to be issued, despite the efforts made to distribute them. The Air Ministry appeals to ex-Service *personnel* entitled to them to apply at once and give the necessary information.

The Air Ministry announces that a considerable number of short-service commissions will be granted in July, and it is prepared to consider applications now from candidates between 18 and 25 who wish to fly. The officer who, after five years' service in the Air Force, reverts to civil life will, if he has taken advantage of the facilities provided for him, find himself well qualified to obtain civil employment. Applications for forms and regulations should be addressed to the Secretary, Air Ministry, Adastral House, Kingsway, W.C.2.

Some Problems in Illuminating Engineering.

The last meeting of the Illuminating Engineering Society, which was held at the Lighting Service Bureau, London, on March 22nd, was devoted to the discussion of a series of problems in illuminating engineering, briefly introduced by various speakers.

The first item was a contribution from Mr. L. M. Tye, who described the lighting of the Greyhound Theatre and Dance Hall at Croydon, as an interesting example of decorative lighting. The installation had to be so designed that the dance hall could be changed over to a theatre or concert hall in 15 minutes. A panelled partition was provided between the dining room and the new interior, so that independent entertainments could go on simultaneously. The interior can also be used for kinema displays, and the system of lighting is both flexible and decorative. The general lighting is indirect, and is furnished by a very large central fitting. A feature is the equipment of this fitting with supplementary Holophane colour-units to be used on festive occasions: special battens, spot-lights, &c., for the stage-lighting are also provided, and the whole equipment forms a striking instance of the use of light to enable the proprietors of hotels to provide attractive entertainments, as well as to dispense meals.

Mr. W. Millner described the lighting installation in the Cathedral of St. Sophia, London, of which an account appeared in the Electrical Review of November 19th, 1926.

The next problem, the lighting of a greyhound racing track, was dealt with by Mr. H. H. Long, who pointed out the difficulty of furnishing adequate illumination and at the same time avoiding glare in the eyes of spectators. This is effected by mounting a series of projectors along the outer edge of the track only three feet above the ground, the beam being in each case slightly depressed and projected inwards on to the centre line of the track, in the direction of the racing.

Mr. J. S. Dow presented a simple problem in railway lighting due to Mr. A. Cunnington (Southern Railway). At a suburban station it had been found that engine drivers found great difficulty in identifying the distant signals when approaching the platform. The trouble was traced to the glare caused by exposed lamps along the platform, and after new reflectors for screening the mantles had been substituted there was no further trouble. Mr. Dow also gave a summary of recent attempts to improve the efficiency of optical lanterns and kinema projectors, raising the problem whether it was possible, by any arrangement of lenses or mirrors, to produce an image brighter than the source of light. It would be observed that this might require the utilisation of only a small fraction of the original light emitted, if the image were small; but possibly there was some fundamental thermodynamic reason why this could not be done.

Mr. L. E. Buckell raised several interesting problems in connection with the use of coloured light, Mr. S. G. Elliott discussed various problems met with on the underground railways, and Mr. G. Herbert described the method of lighting the gardens at the Ideal Home Exhibition. It was announced that the next meeting, in April, would be held at the National Physical Laboratory.

The Shannon Power Scheme.

Mr. McGilligan, Minister for Industry and Commerce for the Irish Free State, speaking on the second reading of the Electricity (Supply) Bill, said that the Shannon scheme was projected to supply electricity to all towns and villages of 500 population and upwards in the State. Actually it would not do so—there was a certain number of small towns left out. Taking the most up-to-date returns, there were 225 towns of 500 population and upwards, and the total was 1,135,000 people. At present there were 20 statutory undertakings, and over 90 non-statutory or unauthorised undertakings. Of the 20 statutory undertakings, five were privately owned, and 15 were under the control of municipal authorities. The five privately-owned served a population of about 109,000, and the 15 municipal undertakings supplied about 502,000 people. Of the 90 non-statutory undertakings, 12 were situated in places of less than 500 population and were left out of the calculations; the 78 remaining were in areas with a total population of some 164,000. Areas of 500 population in the country without electricity supply had a total population of about 264,000. The position with regard to the whole Shannon undertaking was that in about 1929, under ordinary conditions, the annual consumption of electricity in the country would be seventy million units, and the problem was to make that remunerative at the experts' price based on 110 million units.

Appointments Vacant.

Shift engineers for the Newcastle-on-Tyne Electric Supply Co., Ltd. Two shift engineers for the Park Royal Hospital, N.W.10. Junior shift engineer for the Kingston-on-Thames Electricity Department. (See our advertisement pages to-day.)

High-Pressure Steam Turbines.

A steam turbo-plant installed at the Langerbrugge power station of the Centrale Electrique de Flandres (Belgium), by the Brown-Boveri organisation, utilises the high initial steam pressure of 710 lb./sq. in. gauge, superheated to a temperature of 830 deg. F. The present installation, which has been in service for over a year, consists of a 1,750-kW primary turbine, designed for the above inlet steam pressure. In passing through the turbine the steam is expanded down to a gauge pressure of 285 lb./sq. in., and is then led to a 6,600-kW low-pressure set. The operation of this plant has been so satisfactory that an order has now been received for extensions. The output of the new primary turbine will be 6,000 kW, the steam conditions being exactly the same as for the original plant. The new set will deliver steam to three additional low-pressure sets.

In this installation full use is made of the fact that with high-pressure plant the advantages of feed-water heating can be carried much further than with low pressures, and in this case the feed water is pre-heated to about 390 deg. F. By the use of such high-pressure steam the overall efficiency of the plant is considerably increased.

Coventry's New Electricity Works.

Good progress is being made with the preliminary works of the new electricity station which the Coventry City Council is establishing at Foleshill. Levelling and excavations are proceeding on a 53-acre site adjacent to the Oxford canal, by which the works will be served, and there will also be a siding to connect with the Nuneaton and Coventry branch of the L.M. & S. Railway. A contract running beyond £500,000 is being carried out by the British Thomson-Houston Co., Ltd., Rugby, for the buildings and equipment for generating 37,000 kW, and the station will be capable of extension to an ultimate capacity of about 100,000 kW. The cables, &c., are expected to cost another £200 000. In the vicinity of the site was formerly a colliery, which many years ago was closed down in consequence of an underground fire, and has never been re-opened. There is plenty of water in the coal seams, and boring is taking place to reach it, as the new station will require 40,000 gallons per hour for cooling purposes. This supply will be supplemented from a stream which runs through the site, and arrangements may, perhaps, be made for using water from the canal.

Teachers in Technical Institutions.

The annual conference will be held this year at Plymouth, from Friday, June 3rd, to Tuesday, June 7th. The provisional programme includes, in addition to the business of the conference, a number of visits, moorland and sea excursions, and an educational and industrial exhibition in the Guildhall from June 4th to 10th inclusive.

Electric Vehicles in New York.

More than 2,000,000 loaves of bread are consumed daily in the Metropolitan section, it was estimated recently on the completion of the New York Edison Company's survey of bakeries using electric trucks, the results of which were made public at the seventh annual Electric Truck Show in the Company's showroom. The survey showed that fifty bakeries in the Metropolitan district employ a total of 1,271 electric trucks, and that they carry between 1,200 and 1,500 one-pound loaves apiece at every load. Bakeries use more electric trucks than any other single industry in Greater New York, it was found; transportation companies are next, thirty companies employing 797 "electrics"; and the fifty-six provision companies that use 580 "electrics" come third. New York's big stores together employ 571 electric delivery trucks, the last horse in the service of any big store having been ousted a year ago. In Manhattan and The Bronx alone, 352 companies employ a total of more than 3,500 electric trucks.

A miniature 2-passenger electric roadster weighing only 200 pounds, which has a 62-inch wheelbase and will run at ten miles an hour, was introduced to the public at the Show. It is designed for practical service in the city or country. The chassis is of the buckboard type, with ash slats, and the wire wheels are fitted with over-size pneumatic tires. An electric motor similar to the starting motor of a gasoline automobile drives the rear wheel by a gear train. The standard storage battery will drive the car from twenty to thirty miles, depending on the road, on a single charge. Foot pedals are used to operate both the emergency and service brakes, and also the 2-speed motor control. The roadster is equipped with head and rear lights, a standard size electric horn, and a device which cuts off the supply of electric current and locks the emergency brake.

Two double-headed electric fire and "wrecking" trucks, with drivers' seats, steering apparatus, and "wrecking" cranes at both ends (so that they can be run backward or forward equally as well) are to be used for safeguarding the traffic in the new Holland vehicular tunnel, for removing disabled automobiles from the tunnel, and in emergencies of all kinds. They have been specially designed for working in the limited space available in the tunnel, and will carry a crew of seven men in addition to the chauffeur. For fire fighting the trucks will use chemical "foam" apparatus, connected with the tunnel's water supply, with ladders, portable inhalators for resuscitating those overcome by smoke or fumes, gas masks, electric lanterns and searchlights for penetrating smoke, as well as first-aid equipment, &c. In addition, a tower and pump wagon will be used for tending the lights in the tunnel, which will be 12½ ft. above the roadway, and also the lights on the plazas, 24 ft. above the street; it is equipped with a mechanical elevating tower operated by a motor from the storage battery in the truck. It will also carry 250-gallon per minute and 30-gallon per minute rotary pumps for removing the seepage of the tunnel collected in the sumps; the 30-gallon pump also will be electrically operated from the storage battery. A standard 2-ton utility truck will be used for hauling purposes in the tunnel work. The manufacture of the trucks is now being completed by the Commercial Truck Company, Philadelphia.

The Piezo-Electric Effect in Rochelle Salt Crystals.

Although the piezo-electric effect in Rochelle salt crystals cut normal to the *a* crystallographic axis has been studied, the only work on plates normal to the *b* and *c* axes consists of some old measurements by Pockels at room temperature. Plates were cut from a large crystal perpendicular to each of the three crystallographic axes. Electrodes of tinfoil were attached by means of Canada balsam and pressure was applied at 45 deg. to the axes in the plane of the faces on which the charges produced were measured. The changes in the values in the *b* and *c* directions per degree rise in temperature were found to be very far less than in the *a* direction. It was found, moreover, that the electrical anomalies, such as fatigue, hysteresis, and residual charges, were relatively much smaller in the *b* and *c* directions. Although the crystal cut normal to the *b* direction is much less active than one cut normal to the *a* direction, the absence of these irregularities and of the large temperature coefficient just above ordinary room temperature would make the crystal cut in this way more useful in practical applications of the piezo-electric effect. It is still about twenty times as active as quartz.—Joseph Valasek, in *Science*.

A Street-Lighting Tower Wagon.

A somewhat unusual electric tower wagon has recently been put in service by the electrical department of the Lynn Gas and Electric Co., of Lynn, Mass., U.S.A., for the maintenance and trimming of the electric lamps used for public street-lighting purposes in that city. The service extends over an area of 26½ square miles, in which a total of 767 lamps have to be periodically attended to, 268 of the lamps being of the arc type and the remainder incandescent. The arc lamps are suspended at a height of from 19 to 22 ft. above the ground, and the incandescent ones from 16 ft. upwards. Formerly maintenance was carried out with the aid of a horse-drawn tower wagon by means of which a couple of men were able to deal with 35 lamps only in a working day of eight hours, whereas with the electric vehicle sixty lamps are now being dealt with in the same time. The new vehicle is a standard one-ton electric truck fitted with a tower of light steel construction; the platform, in its folded-up and lowered position, is 12 ft. above the ground. The raising and lowering gear of the tower is electrically operated and so arranged that it can be locked at any point up to a maximum height of 17 ft. The platform is mounted on a turntable and is provided with folding sides and also with a folding sub-platform 2 ft. higher than the main one, enabling the two workmen to deal with lamps up to a height of over 19 ft. The chief novelty of the vehicle is the provision of two driving seats, one above the other, with duplex steering wheels and electric speed controllers, the upper steering wheel being 8 ft. above the ground, an arrangement which is claimed to have resulted in the saving of a considerable amount of time, inasmuch as the vehicle can be shifted from lamp to lamp without the driver, who is also one of the lamp trimmers, having to descend from the platform to the main driving seat. Spare lamps, materials, and also the necessary tools are carried in a small van body at the rear of the chassis. As a result of the satisfactory use of the first vehicle, the Lynn Co. has recently ordered a second outfit on similar lines, except that the tower platform will have minimum and maximum heights of 12 ft. 5 in. and 18 ft. 9 in., rendering the use of a sub-platform unnecessary. It will be recalled that at a recent I.E.E. meeting, Mr. H. T. Harrison advocated the use of such vehicles in this country.

Electrical Refrigeration.

The last E.D.A. salesmanship conference of the session was held on March 18th. Alderman Sir Duncan Watson presided, and Mr. N. E. Barber repeated the paper which he recently read at Newcastle (*vide* Electrical Review, February 4th, p. 195). The discussion which followed consisted mainly of questions. Mr. R. Wilson asked Mr. Barber if he had ever known a non-hermetically sealed machine which had caused illness or death through leakages of SO_2. Mr. Harwood emphasised the necessity for silence in operation, particularly in the case of domestic plant. That, he presumed, depended upon the speed of operation. Mr. Hughes asked within what limits automatic control should operate. He also asked what were the possibilities with regard to the use of a vacuum as an insulating medium. Mr. A. H. Morris asked for information as to the relative costs of the various apparatus. He believed the apparatus known as the "ice

stove," which could be heated electrically or by gas, and had no moving parts, was sold at a price far below that of other refrigerators. Mr. W. Ritchie asked by what method Mr. Barber would adapt the average pantry as a refrigerating chamber, and how the cost would compare with that of a self-contained machine.

Mr. Barber said that he had never heard of a death resulting from a leakage of SO_2 or other refrigerant. He agreed that refrigerating machines should run silently, and in this respect the manufacturers of electric motors and drives could help a great deal. A moderate-speed motor was required. The limits of control depended upon the duties put upon the refrigerators. If automatic control were used he believed that, generally speaking, 3 degrees tolerance—say 2 up and 1 below—could be regarded as quite close commercially, and, provided the maximum was within the safe conservation temperature, he did not think it mattered very much if it were 5 or 4. He did not know that the use of a vacuum for insulation purposes had been seriously attempted on a commercial scale. He considered that its use would increase the price. The every-day universal types of machines cost much about the same, taking everything into consideration. The pure absorption machine was quite a cheap machine to make and sell, but not to run. There were a number of automatic and semi-automatic absorption machines of British and Continental makes, but they all suffered from the disability of high running costs. There was not very much difference in the cost of providing an independent refrigerator and that of insulating an existing site. The insulated site was superior from the point of view of utility and thermal efficiency, and, consequently, running cost, but it had to be borne in mind that if a pantry were insulated the insulation was a fixture and became the property of the landlord.

Alphabet-itis.

Electrons, saucy little devils,
Were wont to find their proper levels
When Mr. Hildebrand de Vere,
The great consulting engineer,
Arrived upon the scene to test,
With megger, slide rule, and the rest.
They used to shiver in their shoes;
He'd deal with them just as he chose.

I'm speaking now of early days
Before he fell on evil ways,
When scarcely any of those letters
By which we recognise our betters
Adorned his name: a mere "C.E."
And perhaps an *M.A.O.F.B.*
(Indeed, he hadn't paid his "sub."
As member of the Mustard Club.)

But speedily the craving grew
To add initials to those few
Which once had been his modest pride.
He sought for honours far and wide;
He grabbed a wandering O.B.E.,
And bought a Hollywood degree;
He even added to his hoard
The index letters of his Ford.

His business card became too small
To accommodate it all,
And so he had a folder printed,
And to his clients more than hinted
That they'd find it well worth while
To mount it in a loose-leaf file:
"I haven't half exhausted yet
The glories of the alphabet!"

With each accretion to his name
Electrons shy more shy became;
They shrank abashed, they hardly dared
To show themselves. And when they heard
That he'd become *Sir* Hildebrand,
They said: "It's more than we can stand.
We cannot face this super-man;
His title, and his caravan
Of dazzling letters strike us dumb;
His trailing clouds of glory numb
Our every function!"

And the fact is
The great de Vere has lost his practice:
When he appears the news goes round,
And all electrons go to ground;
Of all his tests there's not one worth
A guinea—for they're all *Dead Earth!*

H.R.T.

Ceiling Fans.

The comparison of ceiling fans on the basis of air displacement is useless unless the measurements have been made under similar conditions. There appear to be practically no data published dealing with such conditions; experiments described in a paper by Messrs. E. Hughes and W. G. White, published in the March issue of the I.E.E. *Journal*, were carried out at the Municipal Technical College, Brighton, for the purpose of determining the factors upon which the measured volume of air depends. In the Electrical Review of January 18th, 1924, Mr. R. O. Kapp gives curves of air velocity measured in four directions at right angles to one another, and suggests that more consistent measurements of air velocity can be obtained by placing the fan at the top of a metal chimney 15 ft. square and 10 ft. high, having an opening about 2 ft. high at the lower end to allow circulation of the air. Such an arrangement, Messrs. Hughes and White maintain, has the disadvantage that the fan is working under artificial conditions and is not allowed to set up the kind of draught that may be peculiar to the design of its blades; the screen eliminates any induced draught, whereas the latter forms a large percentage of the total volume of air circulating normally. The conclusions arrived at may be stated as follows:—

(1) The air velocity decreases rapidly on the outskirts of the draught cone, especially immediately below the blade tips.

(2) The further the plane of observation below the fan, (*a*) the flatter is the velocity curve; (*b*) the nearer to the axis of the fan is the point of maximum velocity; (*c*) the more difficult it is to determine reliably the air velocity on the outskirts of the draught cone, and (*d*) the greater is the volume of air in circulation.

(3) A plane 3 ft. below the blades is the most representative position for taking air measurements.

(4) Calculations from velocities measured at 4-in. radial intervals have been found satisfactory, especially at a distance of 3 ft. below the fan; this distance is recommended as the largest interval consistent with reasonable accuracy.

(5) Owing to the rapidity with which the velocity falls off under the blade tips, it is important to have a rigid support for the anemometer so that its position may be set accurately.

(6) The volume of air circulated by a given fan is greater in a small room than in a large one; and it is suggested that a clear floor area extending 10 ft. in every direction from the axis of the fan should be provided.

(7) The draught is symmetrical in all directions so long as the space in the neighbourhood around the fan is free from unsymmetrical obstables.

(8) The air volume measured 3 ft. below a fan is independent of the height of the blades above the floor so long as that distance is not less than 8 ft.

(9) When the fan is close to the ceiling, there is a reduction in the air volume; but there is no gain from increasing the distance between the blades and the point of support beyond 3 ft.

(10) For a given fan speed, the volume of air is greater the higher the temperature of the room; consequently the room temperature at which air measurements have been made should always be specified.

(11) The quantity of air delivered by a ceiling fan is approximately proportional to the speed, but the spread of the draught is greater the higher the speed.

(12) If the fan be designed for its best operation at about its rated voltage and frequency, an appreciable departure from these values has very little effect upon the efficiency.

(13) With certain types of blades, an improvement in the efficiency can be obtained by tilting the blades upwards; this alteration, however, has the drawback of detracting from the æsthetic appearance of the fan.

Galvanised-Steel as Neutral Conductor.

An interesting problem in connection with the supply of electricity in rural areas has recently been introduced in France, where a syndicate of communes in the West decided to use galvanised-steel for the neutral wire of a l.p. distribution system. One supply undertaking refused to supply the system and the matter was brought to the notice of the local electricity supply control authorities, and, in turn, the French Ministry of Public Works. The opposition of the electricity supply undertaking was of a technical character, it being urged that the security and safety of the distribution system rested entirely on the continuity of the neutral wire, and that with galvanised-steel wire, it being liable to rust after several years' use, there was a risk of fracture at any of the branching points which it would be impossible to detect. The local authorities pointed out that the specification of the installation provided for many "earths" of the neutral wire, and that the regulations required that in all interior installations the neutral should be connected to earth. Under such conditions the accidental rupture of the neutral at one point ought not to bring the distribution system into danger, seeing that there would be numerous earth connections on both sides of the fractured wire. The Ministry adopted the view of the local authorities, pointing out that experience with galvanised-steel wire, particularly in connection with the French telegraph system, and for the past twenty years in rural distribution systems in Alsace-Lorraine, had revealed no troubles that would justify a decision to prohibit the use of such wire. The Ministry therefore saw no reason to reject the proposal to use galvanised-steel wire in the rural system in question, particularly for the neutral line in star-connected three-phase systems. At the same time, the local electricity supply control authorities are to assure themselves that everything will be done from the technical point of view in order to reduce the risk of fracture to a minimum. The decision is regarded as one of considerable importance in connection with the large amount of work that is at present in hand in France in extending the supply of electricity in rural areas, the limited demand necessitating that the cost of installation shall be kept down to a minimum.

New Method of Studying Radio-Waves.

At a meeting of the Académie des Sciences, General Ferrie explained a method of studying the propagation of radio-telegraph waves at a height, which has been invented by MM. Idrac and Bureau. The method consists in suspending a small emission apparatus from two balloons at a height of 14 kilometres.—*Reuter's Trade Service* (Paris).

A Heat-Resisting Porcelain.

Commerce Reports states that a new ceramic material, related to porcelain, that is not damaged by temperature changes, is said to have been developed by F. Behneke, of Lubeck, Handelshof. The inventor states that the material can be heated to 700 deg. *F.*, and immediately immersed in cold water without cracking. It has been stated that it will be extensively used in electric heating devices. The cost of production is but little more than for porcelain. Patents have been applied for throughout the world.

National Association of Supervising Electricians.

Change of Name.—From to-day the new name of the above Association will be the Association of Supervising Electrical Engineers. The new name will more nearly reflect the qualifications and experience of the members and their duties, while it is generally agreed that the designation "electrician" as used in the early days has lost its significance. New rules will also operate from April 1st, under which the qualifications for membership have been strengthened, the number of years' experience for supervising and commercial engineers and foremen having been increased, in the former case to ten years and in the latter case to eight years, with minimum ages of 26 and 24 years respectively. Subscriptions have been reduced and will include the Association's monthly journal. The address of the Association and telephone number remain unchanged.

Meter Engineers' Technical Association.

Annual Meeting.—The first annual general meeting of this Association was held at the Lighting Service Bureau, London, on March 24th, when the result of the ballot for the 1927-28 Council was announced, and the following declared elected:—Messrs. W. E. C. Alliss, E. Fawssett, C. H. W. Gerhardi, J. T. Haynes, E. W. Hill, F. C. Knowles, G. D. Malcolm, E. Mathews, A. Middleton, and G. F. Shotter. Messrs C. B. Green and W. Casson were elected auditors for the ensuing year, and revised rules were confirmed by the meeting.

The hon. treasurer's report for the year ended December 31st, 1926, was adopted; general meetings during the 1927-28 session will be held on Fridays in the fourth week of the month, and commence at 7 p.m. A short, but interesting, discussion on matters arising out of the papers read during the past session was opened by the President, during which many of the members present submitted their views on the various subjects dealt with.

Institution Notes.

Institution of Electrical Engineers.

Informal Meeting.—At the informal meeting held on March 21st, Mr. R. J. Mitchell opened a discussion on "Domestic Electrical Refrigeration," Mr. J. W. Beauchamp being in the chair. Mr. Mitchell showed a number of lantern slides, which illustrated the construction of a popular electrical refrigerator, which he described in detail; and he also briefly outlined the principles of other types. The Act which came into operation at the beginning of this year, prohibiting the use of preservatives in foods, created a huge field for the sale of refrigerating machines, and he suggested that the possibilities of commercial and domestic refrigeration presented a very bright prospect for the electricity supply industry.

North-Midland Centre.—The joint delegation dinner will take place on April 4th; early application for tickets is requested. The annual general meeting will be held on April 5th, at the Hotel Metropole, Leeds, after which there will be a smoking concert. The ballot list for officers and Committee is as follows:—*Chairman*: J. Edwin Storr; *Vice-Chairmen*: F. S. G. Hinings, C. Nelson Hefford; *Hon. Secretary*: H. Cecil Fraser; *Committee* (five vacancies): H. G. Fraser, W. P. Bramwell, P. Maxwell, S. R. Siviour, W. F. Mylan, L. H. Roberts, C. A. Gillin, A. H. Horsfield.

The Institute of Metals.

The Institute expects to register its 2,000th member before celebrating its 20th anniversary next spring. The total is already over 1,800. The next election of members is due to take place on April 13th. Persons then elected will have membership till June 30th, 1928, and an extra copy of the *Journal* for one year's subscription.

The Institute has decided to compile a list of "trade alloys," together with particulars of their composition and uses, as well as the names of manufacturers or agents in Great Britain. Persons interested are invited to forward such particulars to the Secretary.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

It was announced this week that Mr. Archibald Page has been appointed chief engineer and manager to the Central Electricity Board.

We give, accompanying these notes, photographs of Mr. J. R. Brooke, who, as announced in our last issue, has been



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Mr. J. R. Brooke, C.B.,
Secretary to the Central Electricity Board.

appointed to be Secretary to the Central Electricity Board, also of Mr. D. W. Coates, who has been appointed the Board's accountant. Mr. Brooke is the late Permanent Secretary



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Mr. D. W. Coates, C.B.E.,
Accountant to the Central Electricity Board.

of the Ministry of Transport, and Mr. D. W. Coates is a member of the firm of D. W. Coates, West, Grimwood & Co., chartered accountants. He was formerly Financial Secretary

of the Coal Mines Department and Chairman of the Financial Board of the Department. The offices of the Board will be at Trafalgar Buildings, 1, Charing Cross, S.W.1. The Minister of Transport has appointed Mr. C. W. Hurcomb, C.B., C.B.E., Principal Assistant Secretary of the Ministry of Transport, to be Permanent Secretary of the Ministry of Transport in Mr. Brooke's place.

Mr. Neil McLean, chief assistant engineer at the Harrogate Electricity Works, who is stated to have been in the service of the Corporation nearly 30 years, has been appointed borough electrical engineer, in succession to Mr. G. Wilkinson.

Mr. H. T. Tizard, C.B., A.F.C., F.R.S., has been appointed to be Secretary to the Committee of the Privy Council for Scientific and Industrial Research on the retirement of Sir H. Frank Heath, K.C.B., from that office on June 1st next.

The directors and staff of the United Alkali Co., Ltd., entertained their chairman, Sir Max Muspratt, to dinner at Liverpool last week, and presented him with his portrait in oils.

At a recent smoking concert Mr. W. Higgins was presented by his colleagues in the Superintending Electrical Engineers' Department with a gold watch upon his retirement after 46 years' service in Devonport Dockyard.

Increased sales of electric cooking and heating, &c., appliances have led the Birkenhead Town Council to appoint Mrs. McCullough, formerly a demonstrator with the General Electric Co., Ltd., Liverpool, as demonstrator at the showrooms.

Mr. George J. Hollyer, assistant electrical engineer to the Walthamstow Urban District Council, has been appointed borough electrical engineer and manager at Loughborough at £750 per annum, and will take up his new duties towards the end of April.

Mr. Emil Braathan, A.M.I.E.E., draughtsman and technical assistant at the Stepney electricity works, has been presented with an oak timepiece by his colleagues upon his leaving—after 13 years' service—to take up the position of switchgear engineer at the Hackney electricity works. The presentation was made by Mr. W. Young (resident engineer).

A Manchester paper states that Mr. S. J. Watson, chief engineer and manager of the Salford Electricity Department, has accepted the position of chief engineer to the London and Home Counties Joint Electricity Authority. "The resignation of Mr. Watson, who has been at Salford over four years, will probably be submitted to the Electricity Committee this week."

Mr. L. J. N. Kirkby, of Birmingham, has been appointed assistant mains superintendent to Chester Corporation Electricity Department.

The application of Mr. P. P. Wheelwright, borough electrical engineer at Blackburn for a reconsideration of his salary, has been withdrawn.

Mr. H. A. G. Howse, of the engineering department of Standard Telephones & Cables, Ltd., only son of Lady Howse, and the late Sir Henry Howse, was married at Sidcup on March 26th to Miss Elizabeth Helen Clark, only daughter of Dr. James and Mrs. Clark. Mr. Howse was presented with a collection of table silver by his colleagues in the engineering department.

We are informed that Mr. A. W. Empson, who relinquished the management of Empson Centrifugals, Ltd., in June last, has now resigned his directorship. His address is 46, Christchurch Avenue, N.W.6. ('Phone: "Willesden 4269.")

Obituary.—Mr. G. Clay.—The death occurred on March 14th of Mr. Gordon Clay, late secretary-general of the Egyptian State telegraphs and telephones.

Mr. W. R. Mickelwright.—We regret to learn of the death of Mr. W. R. Mickelwright, A.M.I.E.E., managing director of Mickelwright, Ltd., at the age of 42.

Wills.—The late Sir Frederick Green, one of the founders of the "Orient Line" and a director of the United River Plate Telephone Co., Ltd., left £338,066 gross and £321,875 net personalty.

The late Mr. T. W. Broadbent, of Huddersfield, left £5,591 gross and £2,248 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Young Accumulator Co., Ltd.—Private company. Registered March 23rd. Capital, £6,000 in 4,000 10 per cent. cumulative preference shares of £1 each and 40,000 ordinary shares of 1s. each. Objects: To carry on the business of electricians, electrical engineers, manufacturers of and dealers in electrical appliances, apparatus, novelties and specialities, &c. The subscribers (each with one preference share) are:—S. V. Spear, 3, The Close, Hatfield, Herts, insurance broker, A. H. Shaw, 47c, Lewisham Hill, Lewisham, S.E.13, company secretary. The first directors are Sir Frederick W. Young, K.B.E., Lt.-Col. Warwick Wright, D.S.O., T. E. Eachus, O.B.E., S. V. Spear, and S. A. Bayford, D.S.C. (addresses not stated). The said Sir Frederick W. Young shall be permanent chairman and managing director so long as he holds 1,000 ordinary shares. In the event of his resigning office, Sir Frederick W. Young & Co., Ltd., may appoint his successor in office. Qualification of ordinary directors, £10 shares. Managers: Sir Frederick W. Young & Co., Ltd. Secretary: A. H. Shaw. Solicitors: Constant & Constant, Exchange Chambers, 24, St. Mary Axe, E.C.3. Registered office: 101, Leadenhall Street, E.C.3.

Power Holdings, Ltd.—Public company. Registered March 24th. Capital, £100 in 60 7 per cent. cumulative participating preference shares of £1 and 80 ordinary shares of 10s. each. The objects are to form, promote, subsidise and assist companies, syndicates, and partnerships of all kinds, and particularly companies, syndicates and partnerships, to carry on or carrying on all or any of the businesses of electrical and general engineers, and manufacturers and maintainers of plant for the generation, accumulation, transmission and supply of electrical energy for light, heat, power or otherwise; to carry on business as bankers, capitalists, financiers, concessionaires, &c. The minimum cash subscription is seven shares. The subscribers (each with one ordinary share) are:—W. J. Yeoman, 244, Lordship Lane, East Dulwich, S.E.22, clerk; A. J. Clark, 114, Barrington Road, Crouch End, N.8, clerk; and five other clerks. Directors' qualification, £500. Solicitors: Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

Griffin, Harding & Bryant, Ltd.—Private company. Registered March 22nd. Capital, £3,500 in £1 shares (2,000 preference, 1,400 ordinary and 100 founders'). The objects are to adopt an agreement with T. C. Harding, H. F. Griffin, W. Griffin, and W. C. Bryant, and to carry on the business of electrical and radio-telegraphy engineers formerly carried on by them at 1, Park Lane, Swindon. The permanent directors are:—T. C. Harding, 12, Park Lane, Swindon (chairman); H. F. Griffin, 126, Dean Street, Swindon; W. Griffin, 49, York Road, Swindon; W. C. Bryant, 32, Westcott Place, Swindon. All are described as electrical and radio-telephony engineers. Qualification of permanent directors, 100 ordinary shares; of other directors, £1. Secretary: W. Griffin. Solicitors: Morrison and Masters, Swindon. Registered office: 1, Park Lane, Swindon.

Signs of the Times, Ltd.—Private company. Registered March 16th. Capital, £1,000 in £1 shares. Objects: To acquire the business of an electrical advertising expert and installation contractor carried on by A. Longfield, at 150, Moor Street, Birmingham, as "The Signs of the Times Company." The first directors are:—A Longfield, The Hollies, Walmley Road, Penns, Warwickshire, manufacturer; J. H. Dwyer, The Mount, Lapworth, Warwickshire, electrical engineer. Qualification, 50 shares. Registered office: 150, Moor Street, Birmingham.

London and Midland Manufacturing Co., Ltd.—Private company. Registered March 21st. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless apparatus and component parts thereof, electrical engineers, &c. The first directors are:—C. S. Simpson, 86, Woodlands Avenue, Church End, Finchley, N.3, export manager; and G. B. Harold, The Very House, Worplesdon, Surrey, clerk. Qualification, one share. Solicitors: John Hands & Son, 99, Gresham Street, E.C.2.

Warner (Control), Ltd.—Private company. Registered March 18th. Capital, £100 in £1 shares. Objects: To carry on the business of electrical, mechanical and general engineers and contractors, manufacturers and sellers of transformers, radiators, dynamos, motors, and radio instruments, &c. The life directors are:—G. W. Parr, Loampit Hill House, Lewisham, S.E.13, engineer (chairman); E. J. Walker, 3, Chudleigh Road, Brockley, S.E.4, engineer. Solicitors: Rundle and Hobrow, 9, Ironmonger Lane, E.C. Registered office: 10, Bush Lane, Cannon Street, E.C.4.

Warner Trust, Ltd.—Private company. Registered March 18th. Capital, £1,000 in £1 shares. Objects: To carry on the business of mechanical, electrical, chemical, radio, hydraulic, automobile, and general engineers and contractors, &c. The life directors, solicitors, and registered office are the same as given for Warner (Control), Ltd., above.

Gordon Baynton, Ltd.—Private company. Registered March 21st. Capital, £2,000 in £1 shares (700 7½ per cent. cumulative preference and 1,300 ordinary). To acquire the business formerly carried on by the late C. S. Baynton, at 133, New Street, Birmingham, to adopt an agreement with G. Baynton, and to carry on the business of manufacturers of and dealers in instruments for the receiving or transmitting of sounds and signals by telephony or telegraphy by wireless methods or otherwise, electricians, engineers, &c. The subscribers (each with one share) are:—C. W. G. Baynton, 197, Russell Road, Mosley, Birmingham, wireless dealer; H. J. Gittoes, 14, Temple Street, Birmingham, C.A. C. W. G. Baynton is the first and managing director. Solicitors: Wallace Robinson & Morgan, 63, Temple Row, Birmingham. Registered office: 133, New Street, Birmingham.

Martin's, Electricians, Ltd.—Private company. Registered in Edinburgh March 23rd. Capital, £4,000 in 3,700 preferred ordinary shares of £1 and 6,000 deferred ordinary shares of 1s. each. Objects:—To carry on the business of electricians, mechanical and general engineers, dealers in wireless apparatus, &c. The first directors are:—J. Bogie, 15, Swan Road, Kirkcaldy, outfitter; H. W. Mickel, 4, Balwearie Road, Kirkcaldy, stockbroker; W. Gibson, 66, Ava Street, Kirkcaldy, electrical engineer; R. M. McPherson, 23, David Street, Kirkcaldy, stockbroker. Qualification, 100 shares. Secretary: H. W. Mickel. Registered office: 302, High Street, Kirkcaldy.

Official Returns of Electrical Companies.

Hammersley Bros., Ltd.—Issue on March 2nd, 1927, of £100 debentures, part of a series already registered.

Century Cables, Ltd.—Deposit on March 11th, 1927, of deeds of land and factory, buildings in Station Road, Addlestone, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd., not exceeding £10,000.

Nox Electric Lamp Co., Ltd.—Satisfaction in full on March 1st, 1927, of debenture dated May 11th, 1923, securing £662 13s. 4d.

Particulars filed of £15,000 debentures authorised February 24th, 1927, charged on the company's undertaking and property, present and future, the amount of the present issue being £6,000.

J. & W. B. Smith, Ltd.—Satisfaction in full on March 10th, 1927, of debenture dated August 14th, 1924, securing £15,000.

Yale Electric Power Co., Ltd.—Capital, £20,000 in 3,300 preference shares of £1 each and 668 ordinary shares of £25 each. Return dated December 8th, 1926. 300 preference and 668 ordinary shares taken up. £15,300 paid. £1,700 considered as paid. Mortgages and charges, £6,000 debentures to cover day to day bank overdraft at December 8th, 1926, £5,950.

H. Kaplan, Ltd.—Capital, £5,000 in £1 shares. Return dated October 29th, 1926 (filed February 18th, 1927). 4,000 shares taken up. £3 paid. £3,997 considered as paid. Mortgages and charges, nil.

Radio Experts, Ltd.—Capital, £500 in £1 shares. Return dated December 18th, 1926. 200 shares taken up. £200 paid. Mortgages and charges, nil.

Roddis Electric, Ltd.—Capital, £2,200 in 2,000 preference shares of £1 each and 4,000 ordinary shares of 1s. each. Return dated December 31st, 1926 (filed January 22nd, 1927). 1,079 preference and 4,000 ordinary shares taken up. £904 paid on 904 preference shares. £375 considered as paid on 175 preference and 4,000 ordinary shares. Mortgages and charges, nil.

Electracts, Ltd.—W. B. Pearson, of 5, John Street, Bedford Row, W.C.1, was appointed receiver and manager on March 5th, 1927, under powers contained in debenture dated November 25th, 1926.

Midget Lamp Co. (1924), Ltd.—Capital, £2,000 in £1 shares. Return dated November 22nd, 1926. All shares taken up. £2,000 paid. Mortgages and charges, £500.

A. C. Hodson, Ltd.—Capital, £3,000 in £1 shares. Return dated December 31st, 1926 (filed February 19th, 1927). 1,250 shares taken up. £1,250 paid. Mortgages and charges, nil.

Westminster Engineering Co., Ltd.—Capital, £25,500 in 13,000 ordinary and 12,500 preference shares of £1 each. Return dated November 15th (filed December 28th), 1926. 8,560 ordinary and 9,279 preference shares taken up. £14 039 paid on 6,560 ordinary and 7,479 preference shares. £3,800 considered as paid on 2,000 ordinary and 1,800 preference shares. Mortgages and charges, £3,000.

Bury Lighting and Heating Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926 (filed February 19th, 1927). All shares taken up. 18s. per share called up. £832 10s. paid, leaving £67 10s. in arrears. Mortgages and charges, nil.

Secar, Scott & Co., Ltd.—A. J. Kirby, of 7, Drapers' Gardens, E.C., ceased to act as receiver or manager on February 26th, 1927.

City Notes.

Midland Electric Corporation for Power Distribution, Ltd.

In the absence through ill-health of Mr. J. Taylor, chairman, Mr. D. Sinclair presided at the annual meeting last week, and in moving the adoption of the report (*vide* Electrical Review, March 18th, p. 444) expressed the company's regret at the death of the vice-chairman, Sir J. S. Harmood-Banner. After reviewing the accounts, he said that the profit for the year had been reduced by nearly £10,000 by the coal dispute; that was the second time such a disturbance had occurred within six years. It was not until February this year that the sales of energy reached the level of the corresponding month of last year. The company had maintained a supply throughout the whole period. It had been handicapped by the high price and low quality of the coal which it was obliged to use, and only a part of the additional cost had been recovered from consumers. The number of consumers connected continued to increase, and a considerable increase in output was anticipated when trade recovered. It was hoped that the company's generating station would be handed over to the West Midlands Joint Authority during the current year; the company would then purchase its energy in bulk from the Authority (on which it had five representatives). The Authority was proceeding at once with the interconnection of the stations in its area, and plans had been laid for the erection of a large new station near Ironbridge. The latter, however, would not be available for at least three years. To meet the rapidly growing demand, the Authority had ordered 10,000 kW of plant for Walsall and proposed to install a further 10,000 kW at the company's Ocker Hill station. The report and accounts were adopted.

Mersey Power Co., Ltd.

In the course of his speech at the recent annual meeting of the Salt Union, Ltd., the chairman (Mr. G. H. Cox) dealt at some length with the company's chief subsidiary, the Mersey Power Co., Ltd. He said that after six years the company had paid a dividend of 5 per cent. When the company first started it utilised waste heat from a vacuum salt plant and paid handsome dividends. During the war the Government persuaded them to extend their facilities by the employment of steam plant. Since then growth had been rapid and the power station now had a plant capable of providing a continuous load of 24,000 kW, with necessary spare plant. The output had increased from 45,725,000 kWh in 1925 to 50,760,000 kWh last year. During the period of rapid expansion the payment of dividends was impossible, but the undertaking was now in the front rank and the sales and revenue were increasing. Referring to the Electricity (Supply) Act, 1926 Mr. Cox said that it placed very wide powers in the hands of those appointed to carry out its provisions, and unless those powers were wisely used the industry would be hampered rather than helped.

City of London Electric Lighting Co., Ltd.

In their report for 1926 the directors state that they regret that they are still unable to present a balance sheet definitely showing the financial position of the company under the London Electricity (No. 1) Act, 1925, as the L.C.C. has not yet approved the standard price submitted by the company. The directors are only able to show the result of the past year's working so far as it is known, and after paying the standard dividend the balance of the net revenue is held in suspense. After adjustment the capital expenditure at June 30th, 1925, is put at £2,634,514; the amount of free reserves available for capitalisation at December 31st, 1925, was £498,444. Of the latter sum £400,000 has been capitalised and issued as ordinary shares. The standard rate of dividend is now 10 per cent., and this will be paid in two equal half-yearly instalments. During the year considerable price modifications in favour of the consumers were made by the company. Meeting: April 6th.

Metropolitan-Vickers Electrical Co., Ltd.

The report for the past year records a profit of £273,646, and after meeting debenture charges and depreciation (£52,517) and transferring £25,000 to general reserve, there remains £154,674, to which is added £95,058 brought forward, making £249,732. A dividend of 8 per cent. is being paid on the ordinary shares, and £98,052 is carried forward. In spite of the industrial situation, the output last year was only slightly less than that of 1925; this is considered satisfactory. The company secured important contracts, both at home and abroad, and the volume of orders in hand at the beginning of

the year was sufficient, with new orders which will be obtained, to guarantee employment for the factories during the year. The reports mentions the resignations of Sir Vincent Caillard, Mr. L. Chandler, and Mr. Douglas Vickers from the board and the appointment of Sir David Yule, Sir Mark Jenkinson, and Messrs. A. McKinstry and G. E. Bailey as directors. The meeting is to be held on April 5th.

Metropolitan Electric Supply Co., Ltd.

The report for the past year states that since January 1st, 1926, the company has taken its supply in bulk from the London Power Co., which has taken over the Willesden station. The year's accounts are therefore not comparable with those of previous years. The gross revenue was £789,830, and the amount at the credit of net revenue account £253,055. To this is added interest and dividends from investments and allied undertakings making £328,713. After meeting the preference and standard ordinary dividends £13,377 is carried forward. The report recalls that £500,000 of the reserves was capitalised in December last and distributed to the ordinary shareholders in the ratio of one to each two shares held. The meeting was to be held on Wednesday last.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159.

Bell Brothers (Manchester, 1927), Ltd.—100,000 7½ per cent. cumulative participating preference shares of £1 each, 10s. paid, Nos. 1 to 100,000. 500,000 ordinary shares of 1s. each fully paid, Nos. 1 to 500,000.

Brush Electrical Engineering Co., Ltd.—6,558 ordinary shares of £1 each fully paid, Nos. 458,564 to 465,121.

Aluminium Corporation, Ltd.—10,007 new preference shares of £1 each fully paid, Nos. 130,861 to 140,867 (ranking for dividend from various dates).

Bath Electric Tramways, Ltd.

At the annual meeting on March 24th, the chairman (Mr. E. H. R. Trenow) said that at the beginning of the past year substantial progress was shown, but then the general strike and the mining dispute came and affected the company's business, and the net revenue was reduced by £1,981. On account of that the directors considered it prudent to limit the preferred ordinary dividend to 2½ per cent. They thought that when next the company applied for permission to increase fares it would have a good case to present to the Ministry of Transport. The receipts for the current year were, so far, below those for 1926, but that was due to factors which were being removed and was not regarded as of serious moment.

Richmond (Surrey) Electric Light and Power Co., Ltd.

The report for the past year shows that the capital expenditure was increased by £19,572 to £268,115. The amount available (including £2,630 brought forward) is £39,752. Out of this £1,351 is put to sinking fund, £10,000 to depreciation and renewals reserve, £750 to taxation reserve, and £7,000 to general reserve. The directors propose a final dividend of 5 per cent. on the ordinary shares, making 9 per cent. for the year, leaving £2,652 to be carried forward. The amount of energy sold rose from 2,522,274 to 2,713,533 kWh. The report records the death of Sir James W. Szlumper, a director. Meeting: April 7th.

South London Electric Supply Corporation, Ltd.

The amount carried forward from the last accounts was transferred to reserves for capitalisation. The net revenue for the year was £115,291, and from it the following payments are made:—Loan and debenture interest, £6,573; contingency fund, £2,620; taxation reserve, £11,500; sinking funds, £16 901. An interim dividend of 5 per cent. was paid on 260,000 ordinary shares; the number has since been increased to 494,000, by a bonus issue, and a dividend of £5 17s. 6d. per cent. is recommended on these. A balance of £33,874 is carried forward. The amount of energy sold rose from 14,515,019 to 15,202,623 kWh. Meeting: April 5th.

South Metropolitan Electric Light and Power Co., Ltd.

The 1926 revenue account shows a credit balance of £179,884; to this is added £4,011 brought forward, making £183.895. From this debenture interest is paid, £3,807 is carried to depreciation fund, £16,000 to taxation reserve, and £32,085 to depreciation reserve. An interim dividend of 5 per cent. was paid on 250,000 ordinary shares. Since then the number of ordinary shares has been increased to 600,000 by a bonus issue and the dividend on these is 6 per cent. A balance of £52.419 is carried forward. The energy sold increased from 29,653,143 to 30,599,681 kWh. Meeting: April 5th.

Windermere and District Electricity Supply Co., Ltd.

The balance available for the past year (including £1,693 brought forward, and interest and dividends received) is £10,003. Out of this debenture interest is paid. £250 is written off the free-wiring account, £2,000 transferred to depreciation reserve, and £2,000 to reserve fund. The total dividend on the 6 per cent. cumulative preference shares is 8½ per cent., clearing arrears to April 30th, 1915. The 7½ per cent. preference dividend is paid and £2,240 is carried forward.

Keswick Electric Light Co., Ltd.

Out of an available balance of £2,133, £1,500 is devoted to writing off certain sums and reserves, and a dividend of 5 per cent. is paid on the ordinary shares, leaving £222 to be carried forward.

Yorkshire (West Riding) Electric Tramways Co., Ltd.

Sir George E. Leon, Bt. (chairman) presided at the annual meeting on March 23rd, and in presenting the report and accounts (*vide* our last issue, p. 487) referred to the death of his father, the late chairman (Sir Herbert S. Leon). The coal dispute had substantially reduced the company's revenue, and a further adverse factor had been motor-'bus competition. Until the licensing authorities took steps with regard to the latter they could not look forward to the future with any confidence. Nevertheless, the company would be able to weather the storm; already there were signs of a dawning reasonableness among their competitors. They realised that eventually tramways might be superseded by omnibuses, and they were accordingly increasing their motor-'bus business in preparation for that day. The report and accounts were adopted.

London Electric Supply Corporation, Ltd.

In common with the other London companies, this company prefaces its report with the announcement that the accounts have been prepared in accordance with the London Electricity (No. 2) Act, 1925. The profit for the past year was £200,079 (against £202,426). After meeting debenture interest and sinking fund contributions the available balance is £102,677. The preference and standard ordinary dividends are paid and a balance of £1,784 is carried forward. The amount of energy sold rose from 90,905,284 kWh to 131,873,891 kWh. The average receipts per kWh fell from 1.22d. to 1.11d. The meeting was to be held yesterday (Thursday).

Bournemouth and Poole Electricity Supply Co., Ltd.

The balance on the revenue account for 1926 was £141,418, and to this is added £10,076 brought forward, making £151,494. After meeting the debenture interest and special redemption fund payment the reserves receive the following sums:—Depreciation, renewals, &c., £25.000; taxation, £5 000; general, £50,000. A final ordinary dividend of 5½ per cent. is recommended, making 10 per cent. for the year, less tax, together with a bonus of 4 per cent., free of tax. This leaves £9.376 to be carried forward. The sales of energy rose from 9,715,129 to 10,656,342 kWh. Meeting: April 7th.

Para Electric Railways and Lighting Co., Ltd.

The gross receipts for 1926 were £203,902, as compared with £144,015 in 1925, and the net revenue rose from £60,030 to £71,436. After meeting debenture charges and other expenses, there was a credit balance of £27,600. The accrued debit balance is cleared off, £10,000 is transferred to reserve, and £7,785 is carried forward. The improved position is said to be due to the rise in the value of the milreis and the revision of fares which was put into force. Meeting: April 5th.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

The report for the year ended December 31st last states that the accounts have been prepared in accordance with the London Electricity (No. 2) Act, 1925. The connections increased from 25.353 to 27,499 kW, and the energy sold amounted to 12,315.290 kWh. The net profit for the year was £31,259, and after paying the preference and standard ordinary dividends, a balance of £2,134 is carried forward. The meeting was to be held yesterday (Thursday).

Costa Rica Electric Light and Traction Co., Ltd.

The report for 1926 records net earnings in Costa Rica of £27,611 (against £27,808), and the net profit is £9,500 (against £8,906). The balance of net profit has again been placed to the depreciation and renewals account. During the year extensions costing about £30,000 were carried out, and it is anticipated that increased business will result. The meeting was to be held yesterday (Thursday).

Egham and Staines Electricity Co., Ltd.

The net profit for 1926 was £20,247, and after meeting debenture interest, preference dividend, &c., it is proposed to pay a dividend of 5 per cent. on the ordinary shares. During the year over £42,000 was spent on distributors and services; the sale of energy is growing and the extensions made are being rapidly developed. Meeting: April 4th.

Anglo-Portuguese Telephone Co., Ltd.

The report for the past year records a gross income of £166,567, a gross profit of £52,055, and a balance available of £60,364 (including £27,591 brought forward). A final dividend of 4 per cent. is to be paid, making 7 per cent. for the year (against *nil* for 1925) and £20.319 is carried forward. The annual meeting was held on Monday.

Durelco, Ltd.

The report for the year ended September 30th last shows a profit of £155, after writing off a part of the debenture expenses. The combined profits of the company's subsidiaries, before providing for debenture interest, &c., was over £19,000. The total standing to the credit of profit and loss accounts of subsidiaries is £41,740.

North British Aluminium Co., Ltd.

The directors state that the construction of the Lochaber hydro-electric works was retarded last year by the mining dispute, but satisfactory progress is now being made. The annual meeting was to be held yesterday (Thursday).

German Companies.

The *German Telephone Works and Cable Industry Co.*, Berlin, states that larger orders were received in 1926 from the Reich postal authorities for the telephone factory, particularly for automatic installations, while business in individual apparatus and private telephone installations again showed an increase. The greatest high-frequency network in the world is in hand for Finland. The cable factory was satisfactorily occupied. The dividend is 6 per cent. out of net profits of 509,000 marks, as in 1925.

The *Wolfram Lamp Company*, Augsburg, which is closely associated with the Osram Company, reports net profits of 68,000 marks for 1926, as against 62,000 marks in the previous year, the rate of dividend being 10 per cent., as in 1925. At the recent meeting it was mentioned that in the second half of last year the company changed over exclusively to the manufacture of the "N" lamps (new "Osram" lamps), and that the present course of business is satisfactory.

Brown, Boveri & Co., Baden, report a net profit for last year of £51,417, as compared with £43,025 in 1925. Although in the meantime the capital of the concern has been increased from £250,000 to £750,000, the dividend is being raised from 7 per cent. to 8 per cent.

The *Electricity Supply Company*, Berlin, reports net profits of 2,300,000 marks, as compared with 2,080,000 marks in 1925. The dividend is to be raised from 9 to 10 per cent.

The *German Cable Works Company*, Berlin, states that the works were well employed during 1926, and although sale prices reached a very low level, the value of the turnover increased by nearly 50 per cent. over the previous year. Large orders were received from Government departments, and the export trade was also materially greater than in 1925. The accounts show net profits 350,000 marks as against 376,000 marks in 1925, and the dividend remains at 6 per cent.

The *Electro-Works Company*, Berlin, which is now in the possession of the Reich, reports net profits of 5,060,000 marks, as against 5,010,000 marks in 1925, the dividend being maintained at 8 per cent.

French Companies.

A number of French electricity supply undertakings are increasing their capital for plant extension purposes. Thus the capital of the *Société Electrique du Nord-Ouest* is being raised from 56 to 65 million francs; that of the *Société Pyrenéenne l'Energie Electrique* from 30 to 35 million francs; and that of the *Société Union Hydro-Electrique Amoricaine* from 12 to 27 million francs.

Swiss Companies.

The *Schweizerische Gesellschaft für Elektrische Industrie*, of Basle, is declaring a dividend of 8 per cent. on all three classes of shares for the past financial year, as in 1925. A sum of £20,000 is also being placed to special reserve.

The *Oerlikon Accumulator Company* proposes to pay a dividend of 20 per cent. for 1926, as in the previous year. The share capital is to be increased from 2,200,000 to 2,500,000 fr.

Swedish Company.

The *A.B. Elektrolux* reports gross profits of 2,450,000 kr. for 1926, and net profits of 1,018,000, as against 705,000 kr. in 1925. It is proposed to pay a dividend of 10 per cent., as against 8 per cent. in 1925.

British Engine, Boiler and Electrical Insurance Co., Ltd.

An interim dividend of 13s. per share was paid in June last, and after transferring £20,000 to the pension fund, and £10,000 to the contingency fund, there remains a balance of £24,567. The directors recommend a final dividend of 14s. per share.

Parker, Winder & Achurch, Ltd.

The profit for 1926 was £10,407, and to it is added £7,958 brought forward, making £18,365. A final dividend at the rate of 15 per cent. is declared, making 10 per cent. for the year, as for 1925; £5,000 is transferred to reserve, and £9,264 carried forward.

Canadian Light and Power Co.

The report just issued is the first since the company's acquisition by the Shawinigan interests. The revenue was $313,404 gross and $51,716 net. Of the latter sum $32,997 was transferred to sinking fund reserves, and the balance to depletion reserve. The total assets are given as $6,810,987.

Robey & Co., Ltd.

There was a loss of £29,385 during the past year, as compared with a profit of £5,997 in 1925 before meeting debenture interest.

Montreal Light, Heat and Power Co.

A dividend of $0.5 per share has been declared on the common shares for the quarter ended March 31st.

P. & W. Maclellan, Ltd.

The balance to the credit of the profit and loss account for 1926 is £13,608 (against £30,239). The directors state that they cannot recommend the payment of the preference dividend.

Stewarts & Lloyds, Ltd.

The profit for 1926 was £186,911, as compared with £291,119 in 1925. The dividend on the deferred shares is reduced from 7½ to 2½ per cent.

Victoria Falls and Transvaal Power Co., Ltd.

It is reported that the net earnings of the company for the quarter ended December 31st last were £266,311, before providing for taxation.

Direct Spanish Telegraph Co., Ltd.

The board recommends a dividend of 10 per cent. on the ordinary shares, free of tax, for the past year. An interim dividend of 4 per cent. has already been paid.

G. D. Peters & Co., Ltd.

The net profit for the past year was £9,530 (against £7,203). The preference dividend is passed, £12,830 being carried forward.

Tilling-Stevens Motors, Ltd.

The profit for 1926 was reduced from £36,888 to £3,512, and the preference dividend is passed.

Associated Telephone and Telegraph Co.

The usual quarterly dividend of $1.75 per share on the 7 per cent. preferred stock has been declared.

Stocks and Shares.

Monday Evening.

Although business has fallen away to a great extent in the Stock Exchange markets as compared with what it was a month ago, a state of affairs which is deemed to be due to the news from China and the near advent of the Budget, prices are well maintained, and there is a steady flow of investment capital into industrial shares as well as into more gilt-edged securities. In regard to the Budget, there is little doubt but that the uncertainties surrounding its provisions are having the effect of laying a check upon enterprise, or willingness, on the part of those with capital. People want to see how the cat is going to jump before they invest money, or speculate in stocks and shares. It is not anticipated that the electrical industry will be affected in any direct manner. Prices in the manufacturing group are inclined to be heavy, owing to the less optimistic view that is now taken of the next batch of dividends.

The Home Railway market appears to be regaining a little of its past popularity. The public are not anxious to invest money in Home Railway stocks, but prices have reached levels at which they make an appeal to the speculative spirit, and the Undergrounds are doing sufficiently well to warrant the speculative investor taking up Districts and Metropolitans, with Underground £1 shares as a makeweight, so to speak, in the expectation of materially higher prices in two or three years' time. It is generally admitted that some kind of regulation must be imposed for the sake of the travelling public upon transport in London, and this, when it comes, will put a stop to the indiscriminate competition that has barred the way to a proper settlement of the problem. Logically, it is absurd that so much money should be employed in the industry without any return being obtainable from it. Admitting that grave mistakes were made years ago, when the companies were started, the fact remains that the latter have provided, and are still providing, indispensable services, in return for which those people who put up the money to finance them are entitled to some modest income in the shape of dividends. Underground £1 shares are 1s. higher at 16s. 6d.

Most of the London electricity supply companies have now issued their reports, and amongst those which have made their appearance during the past week are Chelsea, Brompton, Charing Cross, London Electric, Metropolitan, and St. James'. The figures are very much what the market had expected them to be, though the Metropolitan has done better than anticipation looked for. The Bournemouth & Poole is repeating its 14 per cent. dividend of last year, though the profit is less than that of a year ago. Richmond (Surrey) Electric Light and Power Company shows an improvement of about £900 at £37,100 in its revenue balance. It will be remembered that the latter company issued, not long ago, a fresh amount of ordinary capital which now ranks for dividend. On the increased capital the dividend is 9 per cent. against 10 per cent. previously. The price of Richmond shares is about 29s. 6d., while Bournemouth & Poole stand at 3 1/32.

It now becomes possible to re-arrange the dividend tables in such manner as will permit the inclusion of the 1926 figures in the majority of cases. There are still some companies that have not announced their figures, but the blanks will be supplied as soon as the companies' declarations are made. As regards the London electricity supply shares, the only com-

pany whose figures cannot yet be included is the Notting Hill. The rest can be set out as follows :—

Company.	Dividend 1926. Per cent.
Brompton & Kensington	8.6275
Charing Cross	8.15
Chelsea	8.875
City of London	10
County of London	7 1/7th
Kensington & Knightsbridge	8
London	8.4285
Metropolitan	8
St. James' & Pall Mall	7.9375
South London	8½
South Metropolitan	8 1/12th
Westminster	8.8

The standard dividend up to and including 1931 on the present increased ordinary share capital is paid by the Brompton, Chelsea, City of London, London, St. James's and Westminster Companies. The Metropolitan's is better than the standard rate, and the South London's 8½ is a shade below the precise 8.5789 per cent., which is the exact standard. To include four places of decimals in the dividend columns of our tables would be as awkward as it would be valueless. Therefore we have given the nearest vulgar fraction to the decimal, without going into minute differences. The yields are calculated, as before, on the basis of the 7 per cent. dividends that will probably rule after 1931. At the risk of being tedious, we would add that in all the London electric supply shares, the actual yields at the present time are higher than those set out in our column, and will continue to be so for the next five years.

South Londons are 1s. higher at 25s. 6d. Midland Electric Corporation Power shares rose ½ to 55s. In the foreign list, Shanghai Electrics receded 1/10 to 37s. 6d. The Shanghai Stock Exchange has taken the unusual course of asking the London Stock Exchange to express its thanks to the British Government for sending troops to protect life and property in that city.

The English Electric report shows that the company made a small profit on trading, but that this was changed into a very unpleasant loss by the various charges. The net profit came to the bagatelle of £10,000, comparing with £195.000 last year and £263,000 in the year before, but interest charges absorb £124,400, and £9,000 was written off expenses of the debenture issue, in addition to which a further £29,500 has to come in as the half-year's preference dividend paid to June, 1926. The deficit carried forward is £78,600. The directors attribute the disappointment to the coal strike and the dislocation of works thereby occasioned. They refer to fierce competition in foreign and colonial markets for heavy electrical and mechanical machinery, but once more the report sounds a note of hopefulness in regard to the future. The price of the preference shares has fallen a shilling to 12s. 6d., and manufacturing shares are dull as a whole. Electric Constructions are lower, and so are Metropolitan-Vickers and India Rubber, though Henleys at 90s. are a little better. British Electric Transformer are a good market, on the resumption of dividends on the ordinary shares with 5 per cent., the first time a dividend has been paid on these for six years. The shares strengthened to 16s. 6d., the preference remaining at about 18s. 9d. The latter receive 10½ per cent. dividend, which includes the six months' arrears due to them. All the arrears have thus been wiped off.

Automatic Telephones are flat at 50s., the 10 per cent. dividend being regarded as anything but encouraging. The yield on the money for some time past has been so trifling as to imply the anticipation of a bonus or share distribution of some kind that would justify the comparatively high figure at which the price ruled. Nothing has happened, however, and this week's drop of 3s. 3d. is the result of selling on the part of the people who are tired of waiting for something better. The current price includes the dividend recently declared. Telephone Manufacturing shares went down to 6s. 6d., but rallied to 7s. International Telephones are two guineas, and the deferred stand at £2.

The Eastern cable quartette is somewhat irregular, Easterns being a point up and Eastern Extensions ¼ down. Marconis are holding their rise at 17s. 6d., and Marconi Marines scored a further improvement at 23s. 9d., Canadians being a firm market at 4s. Interest has been revived in Marconi shares, and a feeling of subdued hopefulness is the principal feature in the situation. The Marine Company paid 7½ per cent. for the last completed year, and an interim dividend of 3¾ per cent. in October, 1926. It is hoped that the final may be 6¼ per cent., to make 10 per cent. for the whole of last year.

British Electric Traction ordinary has receded a point. British Columbia stocks are inclined to be lower. Anglo-Argentines made further improved progress, and Brazilian Tractions have shot up 3 points. The Mexican group is quietly firm. Barcelona Tractions have been moving in consonance with Brazilians, being better at 47. Depression continues to characterise the iron and steel list. Company reports and accounts for 1926 are mostly couched in melancholy vein, as the coal stoppage rendered it inevitable that they would be, and confidence has yet to revive in the outlook for a return to prosperous conditions this year. Rubber shares show hesitation in view of the new electrical treatment said to have been discovered for the lengthening of the life of rubber by giving it a greater resiliency and wearing capacity.

Share List of Electrical Companies.

	Nom. £	Dividend. 1925.	1926.	Price Mar.28 1927.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	14	14	60/9	—	4 12 0
Brompton Ordinary	1	10	8⅝	25/-	—	5 12 0
Charing Cross Ordinary	1	15	8½	25/6	—	5 9 10
do. do. ½ Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	12	8¾	25/-	—	5 12 0
City of London	1	15	10	2¼	—	... ...
do. do. 6% Pref. ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	30/-	—	5 6 8
County of London	1	15	7⅞	28/-	—	5 0 0
do. do. 6% Pref. ...	1	6	6	22/6	—6d	5 6 8
Edmundson's Ordinary	1	7	8	26/3	—	6 2 0
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	30/6	—	6 11 2
Kensington Ordinary	1	15	8	25/6	—	5 9 10
Lancs. Light and Power	1	7½	7½	25/6	—	5 17 8
London Electric	1	10	8½	24/6	—	5 14 3
do. do. 6% Pref.	5	6	6	5½	+½	5 9 1
Metropolitan	1	11	8	27/6	+6d	5 1 10
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary ...	1	7	7	22'-	—	4 10 9
do. 5% Pref. ...	1	5	5	17/6	—	5 14 3
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	—	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	25/6	—	5 9 10
South London	1	15	8½	25/6	+1/-	5 9 10
South Metropolitan Pref.	1	7	7	1¼	—	6 3 0
Urban Ordinary	1	4	7	25/6	—	5 9 10
do. 6% Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	8½	25/- xd	—	5 12 0
Whitehall Elec. Invst 7½% Pref. ...	1	7½	7½	20 3xd	+3d	7 8 2
Yorkshire Elec.	1	8	8	29/6	—	5 8 4
HOME RAILS.						
Central London Ord. Assented ...	Stock	4	4	70	—	5 14 4
Metropolitan	,,	5	3	63	—	4 15 3
do. District	,,	3½	3½	59	—	5 18 8
Underground Electric	£1	Nil	1½	16/6	+1/-	1 16 4
do. do. Income ...	Bonds	6	6	101	—	*5 18 10
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	100	—	6 0 0
do. Def.	,,	1½	1½	23⅞	—	6 6 0
Automatic Telephone	1	8	10	50/-	—3/3	4 0 0
Chili Telephone	5	5	6	7	+½	4 5 9
Cuba Sub. Ord.	10	5	5	7	—	7 2 10
Eastern Extension	10	10	10	17½	—⅛	*5 14 3
Eastern Tel. Ord.	Stock	10	10	173½	+1	*5 15 3
Globe Tel. and T. Ord.	10	10	10	18¼xd	—½	*5 9 7
do. do. Pref. ...	10	6	6	10⅞	—⅛	5 10 4
Great Northern Tel.	10	22	20	27	+½	7 8 2
Indo-European	25	8½	10	46½	—	*5 7 6
Marconi	1	Nil	Nil	17 6	—	... ...
Marconi-Marine	1	10	7½	23/9	+6d	6 6 4
Oriental Telephone Ord.	1	12	12	53/3	—	*4 12 0
United R. Plate Tel.	5	8	8	8¼	—⅛	*4 12 1
Western Telegraph	10	10	10	16⅜xd	—1	*5 19 5
HOME AND FOREIGN TRAMS, &C.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	3 5/8	+1/8	8 6 0
do. do. 2nd Pref. ...	5	6	6	3 5/8	+1/8	9 1 2
do. do. 5% Deb. ...	Stock	5	5	71½	—	7 0 0
British Electric Traction Ord. ...	,,	8	—	143½	—1	5 11 6
do. do. 6% Pref. ...	,,	6	6	109	—	5 10 1
Brazil Traction	100	5	6	131½	+3	4 11 3
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	89½	—	5 11 9
do. do. Preferred ...	,,	6¾	6¾	117½	—	*5 6 5
do. do. Deferred ...	,,	8	—	158	—1	*5 1 3
do. do. Deb. ...	,,	4½	4½	79½	—	5 7 0
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	7/8	—	Nil
London United Tram. Deb. ...	Stock	4	4	51	—	7 16 10
Mexico Trams, 5% Bonds	—	5	5	21½	—	6 18 0
Mexican Light Common	100	Nil	Nil	46	—	Nil
do. Pref. ...	100	Nil	Nil	97½	—	Nil
do. 1st Bonds	—	5	5	71½	—	6 19 10
Yorkshire (West Riding)	1	5	—	8/9	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	12	—	52/6	—	4 19 1
British Aluminium Ord.	1	12½	10	45/-	—	4 9 5
British Elec. Transformer Pref. ...	1	Nil	7	18/9	—	7 9 0
British Insulated Ord.	1	15	—	68/9xd	—1/9	4 7 9
Brush Ord.	1	10	—	28/3	—	7 1 7
Callenders	1	15	—	3½	—	4 5 9
do. 6½% Pref	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	—	30/-	—1/3	6 13 4
Enfield Cable Pref.	1	7½	7½	1½	—	6 6 4
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	8	—	12/6	—1/-	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	1	20	—	90/-	+9d	4 8 11
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	18/9	—1/8	*5 6 8
Johnson & Phillips	1	17½	—	2⅝	—	6 13 4
Met.-Vickers Ord.	1	8	—	28/9	—	5 11 4
do. Pref.	2	8	8	2 7	+⅛	6 11 5
Siemens Ord.	1	7½	—	26/9	—9d	5 12 2
Telegraph Construction	12	10	10	29xd	—1½	*4 2 9

* Dividends paid free of Income Tax.

The Electrical Exports of Germany.

Statistics for 1925 and 1926 Compared.

WITH the publication of the monthly returns, for December, and the twelve months of 1926, of the foreign trade of Germany, some interesting information regarding the progress of the electrical trade of the country is available. As, however, a number of alterations in the classification were made on October 1st, 1925, when the new Customs tariff came into operation, an exact comparison of the results for 1925 and 1926 is not always possible. In the following table are shown the number of dynamos, motors, convertors and transformers of certain specified weights exported during 1926, together with the total weight in double centner (= 220 lb.) and the value in gold marks.

	Number.	Weight. Do. c'tner.	Value. Gold mk. (thousands)
Up to 10 kg.	261,308	4,691	4,974
10 kg. to 25 kg.	23,765	3,934	2,223
25 kg. to 150 kg.	46,194	31,437	8,447
150 kg. to 500 kg.	10,159	27,524	7,038
500 kg. to 3,000 kg. ...	5,072	55,504	11,774
Over 3,000 kg.	791	86,605	13,575

Argentina, Holland, Austria, and Czecho-Slovakia figure prominently amongst the destinations of machines up to 150 kg. in weight; Russia, Italy, Argentina and Brazil are good customers for those from 500 to 3,000 kg., whilst of those over 3,000 kg. 86 went to Argentina, 72 to Italy, 61 to Russia, and 48 to Spain during the period mentioned.

In regard to the following items a useful comparison can be made of the results for the two full years :—

	1925.	1926.	Inc. or dec.
Armatures and commutators—			
Value (Reichsmark) ...	5,554,000	5,106,000	− 448,000
(Double centner)	24,137	16,421	− 7,716
Accumulators, plates, &c.—			
Value (Reichsmark) ...	6,354,000	8,212,000	+ 1,858,000
(Double centner)	40,177	49,778	+ 9,601
To Denmark ,,	6,063	12,998	+ 6,935
,, Finland ,,	1,068	850	− 218
,, Gt. Britain ,,	1,149	1,125	− 24
,, Holland ,,	5,360	6,546	+ 1,186
,, Sweden ,,	14,887	16,386	+ 1,499
Electric cable—			
Value (Reichsmark) ...	35,971,000	54,893,000	+18,922,000
(Double centner)	344,163	471,273	+ 127,110
To Denmark ,,	15,123	3,177	− 11,946
,, Gt. Britain ,,	8,174	11,424	+ 3,250
,, Italy ,,	26,083	1,022	− 25,061
,, Holland ,,	109,686	127,960	+ 18,274
,, Norway ,,	28,864	12,633	− 16,231
,, Poland ,,	24,870	9,844	− 15,026
,, Argentina ,,	34,966	54,039	+ 19,073
,, Spain ,,	*	20,956	—
,, Japan ,,	*	17,497	—
Electric safety and signalling apparatus—			
Value (Reichsmark) ...	6,076,000	5,159,000	− 917,000
(Double centner)	8,967	9,299	+ 332
To Denmark ,,	568	452	− 116
,, Gt. Britain ,,	1,536	4,302	+ 2,766
,, Italy ,,	652	338	− 314
,, Holland ,,	904	705	− 199
,, Austria ,,	637	128	− 509
,, U't'd States ,,	650	*	—
Galvanic batteries and parts and heating elements—			
Value (Reichsmark) ...	10,452,000	10,714,000	+ 262,000
(Double centner)	53,928	53,404	− 524
To Gt. Britain ,,	25,355	27,159	+ 1,804
,, Holland ,,	6,625	6,531	− 94
,, Sweden ,,	6,894	6,074	− 820
Insulating material of asbestos, mica, and micanite—			
Value (Reichsmark) ...	850,000	571,000	− 279,000
(Double centner)	613	492	− 121
To Gt. Britain ,,	93	*	—
,, Austria ,,	*	64	—
Insulating tubes of paper or cardboard—			
Value (Reichsmark) ...	2,508,000	1,873,000	− 635,000
(Double centner)	24,840	17,935	− 6,905
To Russia ,,	3,477	2,155	− 1,322
,, Sweden ,,	4,644	2,810	− 1,834
Telephone material—			
Value (Reichsmark) ...	17,980,000	29,633,000	+11,653,000
(Double centner)	10,052	16,432	+ 6,380
To Holland ,,	725	1,490	+ 765
,, Switzerland ,,	789	749	− 40
,, Japan ,,	1,817	1,267	− 550
,, Italy ,,	*	4,446	—
Wireless material—			
Value (Reichsmark) ...	29,566,000	31,636,000	+ 2,070,000
(Double centner)	31,230	29,021	− 2,209
To Denmark ,,	915	2,811	+ 1,896
,, Gt. Britain ,,	17,640	11,353	− 6,287
,, Holland ,,	1,478	1,854	+ 376
,, Sweden ,,	1,781	2,440	+ 659
,, Japan ,,	1,902	482	− 1,420
Measuring and recording instruments—			
Value (Reichsmark) ...	31,564,000	30,619,000	− 945,000
(Double centner)	39,171	28,333	− 10,838
To Gt. Britain ,,	1,704	1,469	− 235
,, Italy ,,	5,284	5,281	− 3
,, Holland ,,	3,795	3,025	− 770
,, Russia ,,	2,468	1,418	− 1,050
,, Sweden ,,	1,998	1,325	− 673
,, Spain ,,	1,786	1,242	− 544
,, Czecho-Slovakia ,,	1,686	953	− 733
,, Japan ,,	5,371	913	− 4,458
,, Argentina ,,	2,271	2,748	+ 477
Metal filament lamps—			
Value (Reichsmark) ...	25,470,000	20,305,000	− 5,165,000
(Hundreds)	558,205	488,035	− 70,170
Weight (Double centner)	12,676	9,103	− 3,573
To Denmark ,,	30,002	24,396	− 5,606
,, Finland ,,	16,879	11,699	− 5,180
,, France ,,	12,438	7,328	− 5,110
,, Gt. Britain ,,	68,464	86,552	+ 18,088
,, Italy ,,	51,298	32,015	− 19,283
,, Norway ,,	15,950	9,301	− 6,649
,, Austria ,,	25,037	30,072	+ 5,035
,, Russia ,,	31,099	*	—
,, Sweden ,,	35,596	33,829	− 1,767
,, Switzerland ,,	15,157	12,736	− 2,421
,, Czecho-Slovakia ,,	33,933	30,437	− 3,496
,, China ,,	13,214	17,299	+ 4,085
,, Argentina ,,	11,878	20,134	+ 8,256
,, U't'd States ,,	25,536	11,039	− 14,497
,, Brazil ,,	23,362	6,086	− 17,276

* Figures not available.

German Manufacturers' Combine.

With the object of reducing competition, a joint sales office has lately been established in Berlin under the title of the Verkaufs Gesellschaft Elektrotechnischer Spezialfabriken by a number of German manufacturers of electrical machinery and apparatus. Among the firms embraced in the new scheme are the Maffei-Schwartzkopff Co., of Munich and Berlin, the Pöge Elektricitäts Gesellschaft, Chemnitz; Voigt & Haeffner Gesellschaft, Frankfort-am-Main; the Dr. Paul Meyer Gesellschaft, Berlin; the Sachsenwerk l icht-und-Kraft Gesellschaft, Dresden; Dr. M. Levy, Fabrik Elektrischer Maschinen und Apparate, Berlin; and the Lloyd Dynamowerke Gesellschaft, Bremen.

Large German Rectifier Order.

What is stated to be the largest order for rectifiers and rectifier transformers so far placed has lately been secured by Brown, Boveri & Co., Baden, Switzerland—*viz.*, 95 rectifiers with transformers, air pumps and accessories having a total output of 114,000 kW, in connection with the electrification of the Metropolitan Railways of Berlin to convert the 30,000-V, 80-period a.c. supplied by the Berlin municipality to 800 V d.c. The contract also includes the supply of 160 high-speed 3,000-A circuit breakers for the d.c. side of the sub-stations. The rectifiers are notable not only from their mean continuous output of 1,200 kW per unit (1,500 A), but by the required overload capacity. The starting current of a motor coach is 3,000 A during 40 seconds, followed by 300 A during 50 seconds, this process being repeated every 90 seconds. The rectifiers will be located in 40 small sub-stations; these will be built into the arches of the viaducts and feed directly on to the rails. The German State Railway Co. has also divided the contract for thirty rectifying installations for the less important suburban lines between the Allgemeine Electricitats Gesellschaft, the Siemens-Schuckertwerke, and the Bergmann Co., of Berlin.

London's Electricity Supply in 1924-1925.

The L.C.C. Annual Report.

THE last of its annual reports on electricity supply in London (covering the year 1924-25) has been received from the London County Council (P. S. King & Son, Ltd. Price, with map, 5s.). In future the collection of statistics, &c., will be in the hands of the London and Home Counties Joint Electricity Authority. The period covered is the year ended March 21st, 1925, in the case of local authorities, and the year ended December 31st, 1924, for the companies. The area dealt with is 1,797 sq. miles with a population of 8,178,766 (1921 census) and a rateable value of £75,926,030 (April, 1925). The total number of authorised distributors was 89, comprising 44 local authorities and 45 companies. These figures include three local authorities not actually supplying electricity and exclude two purely bulk-supply companies. The first part of the report gives the areas, populations, and rateable values of the districts supplied by undertakers, together with particulars of the Orders authorising supply, &c.

Section (*b*) deals with plant capacity and output. It is shown that generating capacity rose from 758,477 kW to 843,517 kW, an increase of about 11.2 per cent. The local authorities' plant increased from 357,182 kW to 391,037 kW (9.5 per cent.), and that of the companies from 401,295 kW to 452,480 kW (12.7 per cent.). There was a fairly large rise in the capacity of plant installed for transforming bulk supplies, from 131,000 kW to 166,546 kW (27 per cent.); this increase was mainly attributable to the company undertakings. The number of consumers (premises connected) at the end of the respective periods was :—Local authorities, 228,404; companies, 251,984*; total, 480,338. The last figure represented an increase of about 9 per cent. The increases in connections were as follows :—Local authorities to 660,970 kW (8.8 per cent.); companies to 810,224 kW (14.0 per cent.); total 1,471,194 kW (11.6 per cent.). The total maximum demand rose from 550,268 kW to 606,420 kW, and the load factor improved from 21.6 to 22.3 per cent. (local authorities from 23.1 to 23.3 per cent.; companies from 20.3 to 21.4 per cent.).

The next section deals with output and sales. The total amount of energy sold by the municipal undertakings, deducting intersales, was 479,620,308 kWh, as against 426,801,721 kWh, an increase of 12.4 per cent. The companies sales rose by 15 per cent. to 521,679,086 kWh, and the grand total by 13.3 per cent. to 964,924,072 kWh. Of this total traction supply accounted for 50,671,801 kWh, as compared with 46,480,498 kWh in 1923-24.

Financial results are next dealt with. The total capital investment of the municipal undertakings at March 31st, 1925, was £19,232,872, indicating an expenditure of £1,296,146 during the year. (These figure exclude expenditure out of revenue.) The total loans raised amounted to £18,988,370, and 40.31 per cent. of this amount had been repaid or was provided for by sinking fund. The average rate of interest was 4.60 per cent. The revenue from all sources for the year under review was £4,438,174 (as against £4,202,706), while the working expenses were £2,352,188 (£2,221,441), and after meeting rates, taxes, &c., the balance available to meet capital charges was £1,887,915 (£1,782,209). Out of this were paid :—Interest, £526,342; loan repayment, £737,348; reserve funds or capital expenditure, £471,782; making a total of £1,735,469 (against £1,573,620). The net profit was thus £152,446, as compared with £208,589. Nothing was taken from the rates, but 17 undertakings contributed a total of £145,930 to rate relief.

The tables relating to the company undertakings show a total capital expenditure of £28,968,474 at December 31st, 1924, as against £26,253,452 at the end of 1923, an increase of £2,715,022. The total capital called up rose by £1,014,466 to £23,781,563.* Ordinary capital represented 34.5 per cent.† of this; preference capital 27.0 per cent.†; and debenture capital 38.5 per cent.† The average rates of dividend on the ordinary and preference shares were 13.42† and 5.87 per cent.† respectively. The over-all average rate of dividend and interest was 8.11 per cent†, as compared with 8.00† per cent. in 1923. The total revenue for the year was £6,624,761 (against £6,127,194), and the total working expenditure £2,688,010 (against £2,433,369). The amount available for capital charges was £3,901,960 (£3,728,939). Interest and dividends absorbed £1,972,214† (£1,829,602†), and £1,897,270† (£1,638,261†) was transferred to reserve funds or expended on capital works, making a total of £3,869,484† (£3,467,863†). At the end of the year reserve, renewal, &c., funds showed a total of £8,694,886† (£6,986,998†).

Table 7 gives the average rate of interest and dividends paid by the London companies in each of the 24 years from 1902 to 1925. In the last year the total average dividend was 7.97 per cent. (compared with 8.22 per cent. in 1924 and 8.07 per cent. in 1924). The highest rate (16.12 per cent.) was paid by the Notting Hill Co. and the lowest (4.72 per cent.) by the Kensington and Notting Hill joint station. Up to the end of 1925 premiums raised by the London companies on the issue of capital totalled £1,013,022, the bulk of which was transferred to reserve funds. Another table shows the annual capital expenditure of each of the London municipal and company undertakings for the years 1919-1925. The main feature of this is that whereas in 1923-24 the respective expenditure of municipal and company concerns was £1,087,483 and £2,169,714, in 1924-25 it was £1,103,580 and £5,931,695. The large increase in the company figure is traceable to the County of London Co., whose expenditure during 1925 was £3,871,604. St. Marylebone led the local authorities with £165,600.

The next table shows the provision for depreciation or its equivalent made by each of the London undertakings at the end of the year 1924-25 or 1924. In the case of the companies this shows the state of the reserve funds at the end of the year. In one case (the County of London Co.), the amount stood at over £2,000,000, while the City of London Co.'s figure was £1,768,694, and that of the Metropolitan Co. £1,206,864. In the case of the borough councils the total loan repayment is shown. St. Marylebone, with a total capital investment of £2,713,804, is recorded to have repaid (or provided for the repayment of) £834,486. It is pointed out that the real value of this table can only be gauged when a number of factors are taken into account.

As usual, a large section of the report (12 pages) deals with charges for supply. The lack of uniformity in this respect makes fair comparison impossible. No fewer than 22 different methods of charging are in force and comparison can only be made within each class. With the spread of the two-part method, it is not always fair to assume that flat rate charges give a true indication of the level of prices fixed by an undertaking, but it is the only system which is employed by all undertakings. Then, again, the flat rate shown for an undertaking is sometimes merely the first step of a sliding scale; in the case of lighting, at least, a few domestic consumers, we believe, qualify for the further steps. With these points in mind we can examine the flat rate tables. The lighting rates, it is seen, vary between 4d. per kWh in respect of six undertakings (five municipal) to 11d. in the case of two companies. Ninety-three charges shown give an average rate of 6.75d. per kWh. In the preceding year the average of 85 charges was 6.9d. per kWh (min. 4d., max. 1s.). The table giving flat rates for power contains a record of 74 charges (some, again, the first steps of sliding scales). The lowest is 1d. per kWh in three undertakings (two municipal), and the highest is 7d. in the case of two companies, in each instance the first step of a sliding scale. The average rate is 2.81d. per kWh. The last report gave an average of 2.95d. per kWh for 72 undertakings (min. 1d., max. 7d.). Heating and cooking flat rates number 90. In this case a charge as low as ¾d. per kWh is given (Wimbledon, summer quarters), and there were 15 undertakings with a charge of 1d. per kWh (three companies). The highest rate was 6d. (company), and the average of the 90 was 2.07d. per kWh, comparing with 2.2d. per kWh the average of 85 undertakings in the last report (min. 1d., max. 6d.).

Assuming that these flat rate figures afford an indication of price-level changes, the decreases in charges were as follows :—Lighting 2.17 per cent.; power 4.75 per cent.; and heating and cooking 5.91 per cent.

In another section the annual sales of energy by each undertaking are detailed for five years. With the 1924-25 figure is given the percentage increase above the preceding year. The greatest improvement among the municipalities was shown by Bermondsey (31 per cent.); Wimbledon was very close (28 per cent.). In the Metropolitan area, Stepney's sales only rose by 6 per cent., but in the outer area there were three below this. The best showing among the inner London companies was that of the County of London Co. (20 per cent.), but, in outer London, there were several better than this—the Egham and Staines Co. showed an increase of 59 per cent. On the other hand, two of the outer London companies reported decreases (12 and 6 per cent.). The overall increase for all undertakings was 14 per cent.

This concludes the report proper, but there is a valuable appendix bringing the statistics for the companies up to the end of 1925. The information given may be briefly summarised as follows :—Plant capacity at end of year 528,940 kW (generating) and 140,160 kW (transforming); maximum demand 419,739 kW; number of consumers, 214,873*; total connections, 827,341 kW; overall load factor, 21.1 per cent. (max. 25.7, min. 7.7); energy sold, 610,615,295 kWh (traction, 23,540,418 kWh); capital expenditure at end of year £35,417,261; capital called up, £26,428,017; average rate of dividend and interest, 7.95†; total revenue, £7,030,837; working expenditure, £2,735,041; available for capital charges, £4,306,410*; capital charges, £4,287,521*; total of renewal, reserve, &c., funds, £10,338,601*.

* Incomplete totals.

† Calculated on incomplete totals.

The Telephone Service.

Development Statistics relating to the North-East Coast, North Wales, and Birmingham Districts.

ANNUAL reports to the Telegraph and Telephone Advisory Committees (copies of which have been sent us by Mr. J. R. M. Elliott, superintending engineer, Northern District, P.O. Engineering Department) show that during 1926 development in the Northern District was as follows:—

Northern Development.

Newcastle-upon-Tyne.—The gross increase in telephone stations was 4,082; there were, however, 2,229 cessations, making a net increase of 1,853 stations, equal to 5.8 per cent. Of the new services added, an average of 55 per cent. was completed within one week of receipt of the order, and 70 per cent. in two weeks. An analysis of statistics is as follows:—

Exchanges	117
Telephone stations (total)	31,666
Residence rate stations	4,158
Call-office stations	474
Street kiosks	48
New exchanges, rural	23
Rural party-line stations	90
Rural railway stations	1

In the Newcastle area considerable progress has been made with the preliminary work in connection with the introduction of automatic switching, and several new buildings for housing the equipment have already been completed. Similar progress has been made in the Sunderland area. New exchanges were opened at six places during the year, and arrangements made to open others. Switchboard extensions have been made in 21 cases, and conversion of the Newcastle City exchange to modern common-battery working improved operating facilities. The construction of a new exchange at Durham will be put in hand immediately the new premises are ready; the switchboard will be of the latest common-battery type. The introduction of automatic working in the Gateshead area will involve the opening of an independent exchange at Low Fell, and a temporary manual exchange is about to commence operation. In addition, consideration is being given to the provision of new building accommodation for exchanges at 12 places. The number of originating local and fee junction calls for 1926 in the Newcastle-on-Tyne district exceeded 28,800,000 and the trunk calls 2,316,000, in each case an increase on the figures for the preceding year. The number of written complaints from subscribers in connection with the local and junction working was 2.3 per 100,000 calls, and for trunk working 5.6; 69 additional trunk and junction circuits were brought into use. The average speed of answer by telephonists was 5.6 seconds, the percentage of calls answered in 5 seconds was 65 per cent., in 10 seconds 91.2 per cent., and in 20 seconds 99.2 percent., while the average time taken to obtain a reply from subscribers on local and junction calls was 31.4 seconds. The permanent Newcastle repeater station at Kenton will shortly take the place of the temporary station now functioning, and at Catterick another on the same line of communication will be brought into service concurrently. Private branch automatic exchanges in subscribers' offices are growing in popularity, and in the Newcastle district the total number was five. The main-line underground trunks and telegraph lins increased by 2,523 miles to 43,342; and underground local line (subscribers) by 10,850 to 66,666 miles.

Middlesbrough.—The number of telephone stations in use was 11,264, an increase of 750; of the new services added, an average of 50 per cent. was completed within one week of receipt of the order and 70 per cent. in two weeks. A total of 27 new call offices were opened, six in town sub-offices, 9 in rural sub-offices, and 2 at railway stations. The number of street kiosks was also increased by 17 to a total of 37, and three further kiosks were in course of erection; the total number of call offices (including kiosks) was 261. An additional feature recently established in this district by the police authorities was the provision of telephone police boxes at various points in the larger towns; in certain areas they may be used by the public to call the police, fire brigade, or ambulance headquarters, and the total number of such boxes was 7. Improvements in switching equipment were effected in various parts of the area, and in sparsely-populated districts two new rural exchanges were opened, while the establishment of three additional rural exchanges was in hand.

The conversion from manual to automatic switching at West Hartlepool and Hartlepool took place in September, 1926, and the policy of extending underground conductors continued; additional trunk lines were completed and considerable progress was made in the Middlesbrough telephone district in the extensive preliminary work which is necessary in connection with the general introduction of automatic switching. At Hartlepool and West Hartlepool the total of 1,105 subscribers are highly satisfied with the change, and agree that a much superior service is rendered by the new system.

The existing automatic exchange at Marton, which provided for 100 subscribers, is at the present moment in course of extension to provide accommodation for a further 200 subscribers' lines. At Middlesbrough, Stockton, and Linthorpe new buildings for the accommodation of the new automatic exchanges are expected to be completed in the early part of this year. The number of effective trunk calls brought to account for the quarter ending December 31st, 1926, was 287,442, an increase of 3.2 per cent. The number of telegrams received by telephone decreased to approximately 33,000, as against 40,400 for the corresponding period in 1925. The approximate daily average number of originating local calls was 11,990, being an increase of 10.3 per cent.

Midland Statistics.

The abstract of the report which follows (a copy of which has been sent us by Mr. T. Plummer, superintending engineer, North Wales District, deals with the development of the service in the Birmingham area during 1926.

Birmingham.—The area covers 700 square miles and extends from Brownhills on the north to Bidford on the south, and from Kinver on the west to Coleshill on the east. Telephone stations totalled 57,919, representing an increase equal to 9.89 per cent. for the year, which is lower than that for the previous three years, and is doubtless due to the general depression in trade. The appreciation of internal systems in large stores or offices is indicated by the fact that during the past year approximately 1,800 telephones were provided for subscribers already hiring an installation consisting of two or more telephones. Subscribers' private automatic exchanges provided during the year totalled 16 installations, and there are now 813 such stations working in the district; 1,630 stations were installed during the year at private residences, making a total of 9,810. The demand for call office facilities is growing rapidly, and 142 additional call office stations were installed, making the total 642; of that figure 260 are street kiosks.

The number of local calls made in 1926 was 50,600,850, an increase of 17.7 per cent. The number of trunk calls increased by 9.6 per cent. to 3,362,978, and the number of telephone telegrams dealt with was 744,828, which shows a decrease of 5.1 per cent., due partly to the reduction in betting telegrams since the introduction of the tax on betting transactions.

Partly owing to the extensive operations of laying ducts and the drawing-in of cables carried out in 1924-25 there was not so much need for expansion in this direction during 1926; 3,108 miles of wire was brought into use for trunks and telegraphs, 29,828 miles for subscribers' telephones, and 13,728 miles were added in reserve for future extensions under all classes of service, making a grand total of 225,370 miles. Overhead wires erected during the year amounted to 1,548 miles, bringing the total up to 23,817 miles, an increase of 7 per cent: the comparative increase for underground wires was 11.5 per cent. for main lines and 24.3 per cent. for subscribers' lines.

One exchange was opened during the year at Earlswood with switchboard capacity for 60 subscribers, making altogether a total of 76 exchanges in the district. A new exchange will shortly be opened at Northfield, and extensions of equipment at 30 existing exchanges were carried out. The repeater installation was extended by the addition of 80, bringing the total equipment up to 110, and complete precision testing apparatus has been fitted. The average time of answering subscribers' calling signals for the year was 5.6 seconds, 88.2 of the calls being answered within 10 seconds or less, a considerable improvement on that for the preceding year.

The operating staff numbers nearly 800 telephonists and supervisors, in addition to over 100 male night operating telephonists. Over 113 new entrants to the service passed through the Birmingham Operating School (including six for other districts), and 14 telephonists employed by subscribers for their private branch exchanges were trained. The total engineering staff employed in the construction and maintenance of telephone and telegraphs in the district during the year reached 955, in addition to an average of 245 workmen employed by contractors in laying conduits and other work.

North Wales District.

In the Chester, North Wales, and Hanley area during 1926 some 2,939 telephones were added during the year bringing the total to 31,786. The number of effective trunk calls was 3,226,982, or 12.5 per cent. increase; telegrams passed over the telephone totalled 350,000; local effective calls amounted to 13,583,429, or 3.2 per cent. increase; 103 additional trunk and junction circuits were connected. Public call offices and kiosks increased by 53 to 774, and additions to the underground plant cost £68,600. During the year 2,335 miles of wire was brought into use for trunks and telegraphs, 11,107 miles for subscribers' telephones; 495 miles were used from the reserve for future extensions under all classes of service, leaving a balance of 18,590 miles of wire available for this purpose. The gran total of wires for all classes of service existing amounts t 89,142 miles. Overhead wires erected during the ye amounted to 2,846 miles, bringing the total for the combine district up to 60,939 miles, an increase for the year of 4. per cent. Attention may be directed to the comparativ increase of 13 per cent. for the main lines and 28.3 per cen for subscribers' lines underground.

Fifteen new exchanges, making a total of 294 in the di trict, were opened during the year. Extension of switchin equipments were carried out at 77 exchanges, the tot additional accommodation being for 3,250 lines. The ne automatic exchange at Shrewsbury, opened in January, 192 is giving very satisfactory service.

A New Type of Tramway Controller.

The Cam-operated Contactor Pattern introduced by the Metropolitan-Vickers Co.

THE ordinary drum type controller, which until recently was the only type used in tramway work, has, within its limitations, given excellent service. The adoption of more powerful motors and higher car speeds has, however, increased the maintenance cost of control gear and shown the drum type to be already inadequate to meet present-day requirements.

In approaching the problem it is necessary to keep in view certain fundamental requirements: the mode of operation

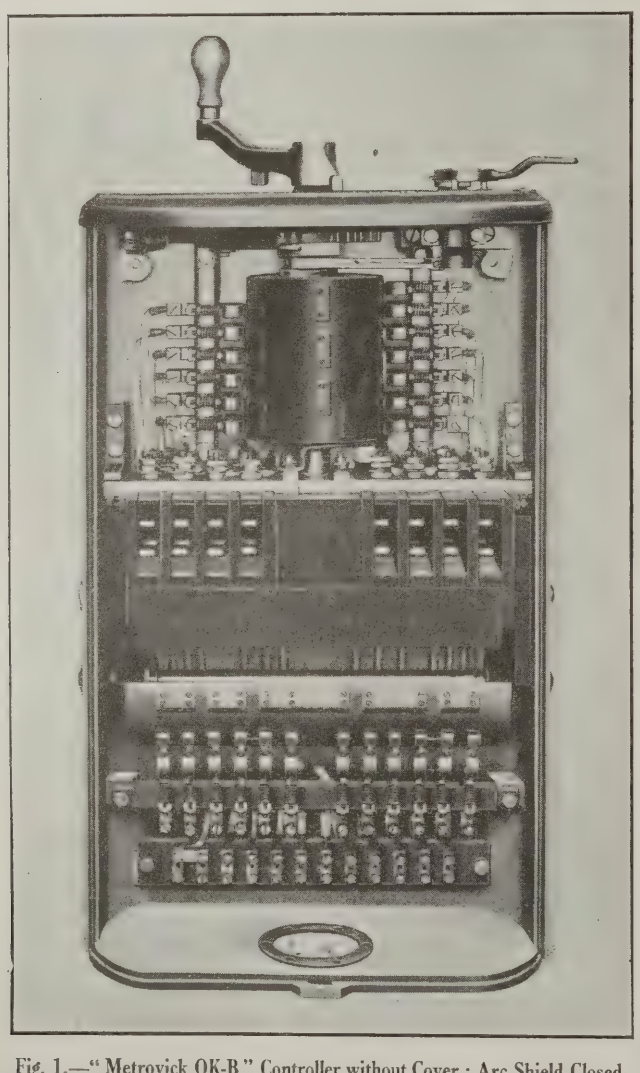


Fig. 1.—"Metrovick OK-B" Controller without Cover; Arc Shield Closed.

must follow closely the present method with which drivers are familiar and, consequently, the position and movement of the control handles must be similar to those of the well-known drum controller. Limitations of size and weight are also important, and the all-important maintenance cost must be satisfactory. An important contribution to the solution of this problem is provided by the recent development by the Metropolitan-Vickers Electrical Co., Ltd., of a tramway con troller in which the hitherto universal drum and finger con tacts have been replaced by cam-operated contactors. Con trollers of the new type have been thoroughly tried out unde severe service conditions, and have both reduced and simplifie maintenance work, and have shown that they are capable o service for which controllers of the drum type would b quite inadequate. Whilst contactors are a new feature i tramway controllers, it is worthy of note that their intro duction has not been accompanied by an increase of cost but by a reduction in size and weight for a given capacity.

In external appearance the new controller is very simila to the ordinary type; its interior is shown in fig. 1. Al current-rupturing is done by eight contactors mounted on horizontal shaft and operated by cast-iron cams clamped upo an insulated steel shaft of square section, the latter bein driven with the aid of cut-steel bevel gears by the mai controller handle; the arrangement of these parts is shown in fig. 2. Power and brake connections are made, withou arcing, by a quadrant arranged horizontally below the con tactors and rotated by mechanism fixed to the camshaft i

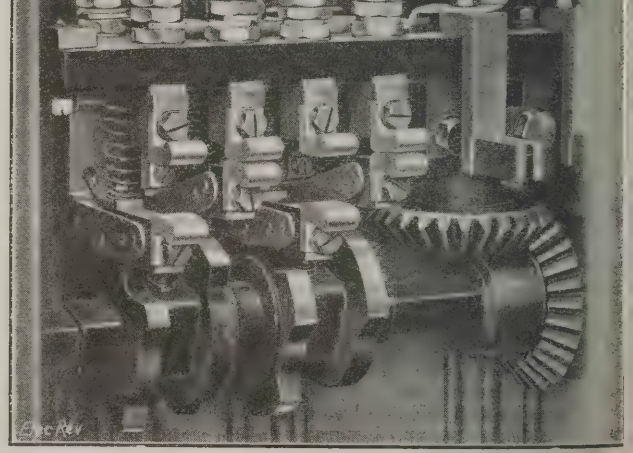


Fig. 2.—Contactors and Cam Mechanism of Controller.

such a way that it is positively held in the power, brake or off positions. The forward and reverse drum is mounte loosely on the control spindle above the contactors; it i constructed of Bakelite, secured to a cast-iron spider, and is operated by a separate handle that is interlocked with the main controller handle to meet all requirements for norma running in either direction. Cutting out a defective moto is provided for by extra positions on the reverse handle Any of the usual combinations of rheostatic and magnetic braking can be arranged for and a notch-by-notch device can be fitted to the main handle if required.

When the arc shield is closed, as shown in fig. 1, the fire proof insulation forms a separate cell-like enclosure for each contactor. Closing the arc shield also carries into position the blow-out coils and core plates; the contacts for the blow-out coils close the main power circuit, so that the controller cannot be used without the arc shield in position. Important advantages are offered by the new design: not only are con tactors in themselves claimed to be more effective than finger contacts for arc rupturing, but the wear on contacts is stil

urther reduced by the more effective arrangement of blow-out evices which is possible with contactors; further, only one

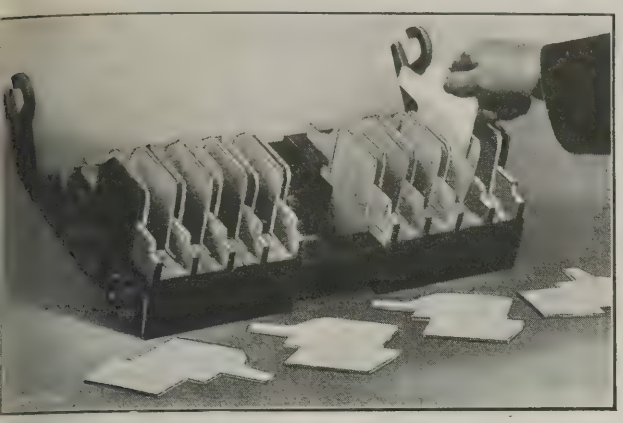


Fig. 3.—Arc Shield, showing Simple Method of Renewing Partitions.

ind of arcing tip is used, the tips do not get burnt at the oint of fixing, and replacements are made more easily and quickly. Fig. 3 shows how the partitions of the arc shield can likewise be renewed with a minimum of trouble. Each partition is held in a slot, from which it may be withdrawn and a new one inserted in a moment, no further fixing being necessary; thus renewable parts are small, simple, few in number, and easily replaced. Accessibility of all parts has been facilitated: the arc shield when swung back can be lifted off bodily, and the contactor and camshafts can be removed by simply slackening their bearings; the terminal board being at the base of the controller, all incoming wires terminate at that level, a much more convenient arrangement than the usual side connections.

The anticipated improvement in operation and reduction of maintenance costs are claimed to have been fully realised in operation in the last three years, during which period some difficulties such as are inevitably met with when introducing a new design have been overcome. Since 1922, when the first contactor controllers were put into service, four hundred have been supplied and are now in successful operation under the severe service conditions of the London L.C.C. tramways, and many others have been installed on other systems. An important order was recently received by the Metropolitan-Vickers Electrical Co. from the Leeds Corporation for tramcar equipment, including three hundred controllers of this type, and a considerable number have been already installed and are operating satisfactorily. Indications are that the advantages of the contactor-type of controller will appeal to tramway engineers.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Small Electric Oven.

Arising out of the article published in our issue of December 31st last, "The Trials of a Housewife due to Trials f Electricity," by May M. Cramp, we have received from he Windsor Electric Range Co., Windsor House, Victoria treet, London, S.W.1, some particulars of its product, the Windsor" electric oven, fig. 1. This is a particularly uitable apparatus for use in the small flat, or where space s limited. It has a low loading, 660 W, and, it is claimed, vill provide for a two-course dinner for four to six persons or a consumption of only ¾ kWh. It is constructed on mass roduction lines, and is suitable for supply pressures from 00 to 250 V. The heating elements are claimed to be par-icularly robust and designed for exceptional durability. Top nd bottom heating are provided, four-fold circuits being



Fig. 1.—Small Electric Oven.

rranged in each case, so that should a coil fail, even during he process of cooking, there is ample heat to continue the perations satisfactorily. The cooking space is 13 in. by) in. by 12 in. Three-heat control is provided. The pparatus was shown at the Exhibition of Inventions, Central lall, Westminster, in October last, and was briefly referred to in our issue of November 5th, 1926.

An Improved Ironclad Switch.

An addition to the range of switchgear of the General Elec-ric Co., Ltd., Magnet House, Kingsway, W.C.2, is the D.B. inor d.p. switch with fuses, fig. 2. It is mounted in a ast-iron case with external fixing lugs, and suitable for 10-A ading at 500 V, or 15-A at 250 V. This device has been specially designed to meet the increasing demand for inexpensive but efficient switchgear suitable for lighting and heating circuits in house-service and similar installations, and also for small power circuits in factories and workshops. The apparatus can be rendered weatherproof by inserting a gasket in a groove in the lid. It is provided with positive quick-make-and-break actions, controlled by a powerful non-corrosive spring which is in compression only during the operation of the switch. The switch blades are of hard-

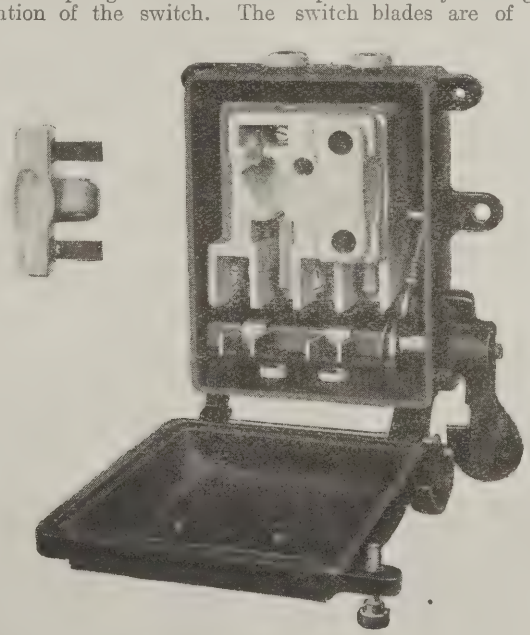


Fig. 2.—Ironclad Switch-Fuse.

drawn copper firmly secured to a square-section steel coupling bar, which is insulated throughout its length by bakelite. The fixed contact blocks are of brass with two clamping screws, and have phosphor-bronze side pressure wings, all the parts being of ample current density. The fuse carriers are fitted with heavy-section brass blades which engage with brass contact blocks having phosphor-bronze side pressure wings. The fuse wire passes through an asbestos tube fixed in the body of the holder, and when in position is situated low down in the deep arcing chamber in the base. There are two cable inlets at the bottom of the case, and two at the top, all being wood bushed. The unit is of liberal design and substantial construction throughout, and complies in every respect with the H.O. Regulations.

Another Internally Frosted Lamp.

Messrs. Siemens & English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, London, E.C.4, inform us that they have recently introduced a new size of "Purlite," internally frosted lamp, of 15-W capacity, to meet the demand for a low-power unit suitable for the usual lighting supply pressures. This is available and suitable for any pressures up to 260 V. "Purlite" gasfilled lamps are now supplied in 40-, 60-, 75- and 100-W sizes, and "Purlite" vacuum lamps for 15 and 25 W.

Machinery Fault-Detecting Apparatus.

What should prove very useful to all engineers in charge of running machinery is the Bin-Aural apparatus which has been developed by the Capac Co., Ltd., 11, Willow Avenue, Barnes, S.W.13, for the audible detection of mechanical faults and comparing the running conditions of various parts. The apparatus consists essentially of a stethoscope, which is used in conjunction with specially designed sound reproducers for internal or external sounds. For internal work the "Tectoscope" is employed; a metal rod is screwed into this, and by applying the free end to the external part of the bearing or other part to be tested, the sound emitted is reproduced in the stethoscope and conveyed by means of specially designed connecting tubes to the ears. By means of a boss, angles may be introduced in the conductor rod, and a special joint serves for various sizes of rod up to ¼ in. section for distance work. It is claimed that with ¼-in. mild-steel rod long runs up to 100 ft. may be satisfactorily employed. For external work the sound is reproduced by means of the "Tectophone"; this carries a small mouthpiece, which is held near the part to be tested. This is particularly suitable for testing gearing for tooth noise; leakages of gases may also be detected in this way. An important feature of the apparatus is the provision for comparison testing, one bearing, or other part, with another. A junction in the tube in this case serves for two "Tectophones" or "Tectoscopes," or one of each. By first applying one only, and then the other in addition, the sound difference can be defined and the running conditions compared.

A Unit-Type Feeder Pillar.

A unit-type feeder pillar is being made by Messrs. Johnson and Phillips, Ltd., Charlton, London, S.E.7, and figs. 3 and 4 show one of a batch of seventeen which have recently been supplied to Pudsey Corporation.

The casting is of ample strength, and the pillar is well ventilated and embodies a patent locking device, consisting of two locks operating together, for preventing unauthorised persons from opening the door. Each way of the actual distribution unit is complete in itself, the cable box, link, and fuses being mounted vertically on a pair of steel rods, and the complete equipment can be removed to facilitate jointing. The cable boxes are designed to reduce the time required to connect up the cable to a minimum, and the porcelains are fitted with stems to avoid the necessity for bringing out the cable tails. No copper castings are used either in the box fittings or in the fuses, a maximum conductivity thereby being assured. The fuses and links are insulated from the steel supporting rods by means of substantial porcelains, no slate or hygroscopic insulating material being used. The porcelain fuse holders have self-aligning contacts, and are fitted with Zena fuse elements which can be rated to "blow" at a current much nearer the normal full-load current than can ordinar

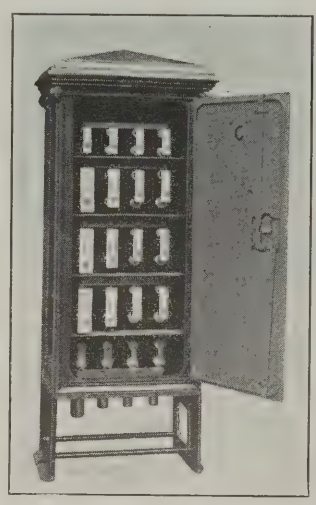


Fig. 3.—Feeder Pillar, Front.

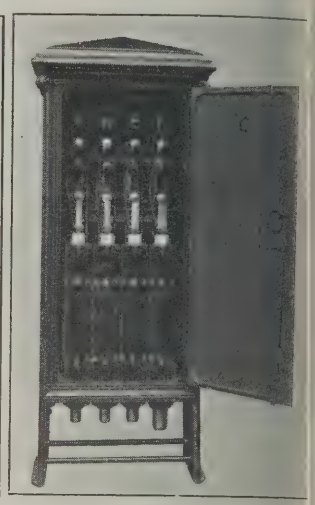


Fig. 4.—Back View.

copper fuse wire. B.E.S.A. clearances are obtained between phases and to earth, and fireproof barriers are fitted between fuses of different polarity. The pillar illustrated is for use on a three-phase, four-wire system, with cables having a fifth core for street lighting service.

A Commutator Lubricant.

We have received a sample of Komm-Glaze, a new commutator lubricant which is to be put on the market by the Ray Manufacturing Co., Fishponds, Bristol. It is prepared in the form of sticks of about ½ in. diameter, and is of a substance closely resembling ordinary candle wax, but smoky in appearance. It is claimed that the use of this lubricant lessens the contact drop, increases the conductivity and the life of the brushes and commutator, and produces a pleasing "copper brown" surface on the commutator. It is guaranteed that the substance will not react or carbonise under any circumstances.

A Small Hydro-Electric Plant.

Electricity Supply to a North Nigerian Tin-Mining Undertaking.

THE Northern Nigeria (Bauchi) Tin Mines, Ltd., is fortunate in having acquired the use of a waterfall some 12½ miles distant from its property for supplying power for the mines, and a hydro-electric station has been established which is now supplying 2,000 kW during the

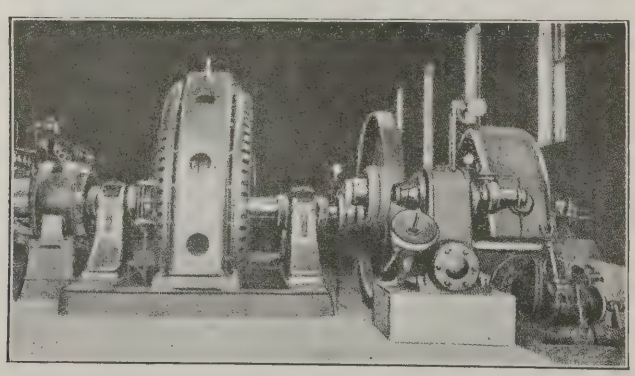


Fig. 1.—500-kW Hydro-Electric Generator.

greater part of the year. The power thus obtained has resulted in a great reduction in the cost of mining, and has enabled the company, without increasing its staff, to double the output of tinstone with highly satisfactory results.

In the power house at Kwall, 700 ft. below the edge of the plateau, there are four generating sets, of which one of 500 kW was supplied by the Swedish General Electric Co., Ltd., and is driven by an Armstrong-Whitworth turbine, fig. 1. Power is generated at 550 V and stepped up to 22,000 V for transmission, over very rough intervening country, to an outdoor sub-station situated at the strategic centre of the property. This is designed for an ultimate capacity of 2,000 kVA, but is equipped at present with two 450-kVA Asea transformers. The supply is here reduced to working pressures of 2,200 V for the large pump motors, and 400-230 V for the small motors and lighting. The lighting supply has proved an important feature of the plant, and has resulted during night operations in a great saving of tin which would otherwise be lost in the tailings.

A further sub-station has since been erected 2½ miles from the main one on an important tin-bearing ground which was previously worked by oil-engine-driven pumps. This houses a 450-kVA Asea transformer.

The climatic conditions on the Nigerian plateau are especially severe for electrical apparatus. In the winter, the air is intensely dry and cold, while in the summer it is the extreme opposite, being humid and warm to an uncomfortable degree. In the dry season, and as a result of mining operations at all times, a great deal of fine sand is blown into the machinery. In spite of these abnormal conditions, however, both plants have given great satisfaction.

Electric Furnaces in Non-Ferrous Metallurgy.

By DONALD F. CAMPBELL, M.A., A.R.S.M.

(*Abstract of a paper read before the* Institute of Metals.)

INGLE furnaces of 4,000 to 10,000 kW are now engaged in smelting pig iron and in the manufacture of carbide, while probably about half a million kW of furnace pacity is engaged in melting metals, to which must be led a million or more kW of generating machinery used for king aluminium and smelting ferro-alloys.

There are a few general principles which seem necessary in design of efficient electro-metallurgical plant. It is essen- that equipment should first satisfy the requirements of metallurgist, and that the electrical engineer should meet demands. The electrical engineer should then be given a hand and allowed to purchase only the very best equip- nt. Numerous failures of electric furnaces are due to metal- gists interfering in electrical equipment, or electrical engi- rs designing unpractical metallurgical appliances, while rchasing departments have not infrequently caused trouble buying inferior equipment for the arduous service insepar- e from metallurgical work. For almost every group of ys an electric furnace of special design is required, and any particular metal, the type of furnace to be selected y depend on the hours of work.

The Ajax-Wyatt furnace is now the standard melting ipment for supplying brass mills. It consists of a cylin- al steel vessel lined with brickwork or rammed refractory terial, below which a transformer is suspended, the secon- y of which is a vertical V-shaped channel arranged so t it passes round the primary winding and iron of the trans- ner. Heat is generated in this secondary circuit and the al is well circulated by electrical forces, so that hot metal onstantly forced out of the secondary, and cooler metal es its place. This mixing effect is due to three forces— ely, convection currents, electric motor effect, and inch " effect.

he electrical design of these furnaces requires care, but allurgically they work with extraordinarily little trouble ne bottoms are properly made and dried. The cost of re- tories may be as low as 1s. per ton melted.

he life of the linings varies from two or three months to or three years, and as the cost of labour and materials ramming the bottom only costs from £30 to £40, it is clear this is not a very serious item on an output of 600 to 0 tons per lining.

nese furnaces are usually run continuously at 60 kW, pro- ng 600 lb. of brass every 60 to 70 minutes, and during ods of idleness the furnace is kept warm with a current sumption of about 8 kWh an hour.

ne power consumption when melting 60 : 40 brass in such a ace should not exceed 220 units per ton, to which must dded the stand-by current consumed during idle hours.

though the efficiency resulting from the generation of the within the metal itself is remarkable, its limitations are ous, as suitable refractory materials have not yet been d to produce linings for metals of high melting point.

considerable economy in the cost of making brass in this ace is due to the accuracy of composition attainable, so the usual margin of copper in excess of the specification be reduced.

the Ajax-Northrup furnace, the newest form of melting pment, the metal is heated by induction in a high-fre- ncy field, wherein there is no need of iron, nor of a ndary of the type used in normal frequency induction fur- s. The furnace itself is of simple construction, consisting of a crucible, round which a spiral inductor coil is wound, the narrow intermediate space filled with zirconite or other heat insulator. Tests showed that 6-cwt. charges ckel-silver containing about 15 per cent. of nickel could be ed in an average time of 1 hour, the average consumption g just under 350 kWh per ton; 4-cwt. charges of cupro- el were melted in an average time of 55 minutes, the age consumption being 448 kWh per ton.

e average life of crucibles in a large number of heats of o-nickel and nickel-silver was 58, which was increased to y patching, but it was found to be doubtful whether the caused by patching was justified by reduced costs. It ires about 4 hours for the crucibles to cool before patch- can be begun, and 6 hours for subsequent drying. The on crucibles is normally about 0.75 in. deep after 60 heats ckel-silver. The conditions of melting in Ajax-Wyatt and hrup furnaces of normal design are not those suitable for ing aluminium and its alloys, which should be melted in uillity.

Experiments are now being made to evolve equipment giving the requisite conditions, but the final form of the most suitable furnace is not yet determined, as all experiments of this type must be made over a long period and on a substantial scale before electric melting can be confidently recommended, and costs of operation and quality of product established.

In some tests in the United States silver was melted at the rate of 10.9 lb. per kWh.

An interesting installation of small units has been erected in Staffordshire to manufacture nickel-iron alloys of exceptional purity to be used for " loading " submarine cables. High-frequency current was produced by mercury spark gaps operated in hydrogen with batteries of condensers for power-factor improvement. Forty-two such units were used and have been operated for many months, both day and night shifts, with satisfactory results.

As compared with " pit fires," this furnace has the advantage of avoiding all contamination from sulphurous fumes and other impurities. Labour costs are reduced, and skilled casters of exceptional strength are unnecessary, while absolute control of heat and complete mixing are obtained. The space occupied by coke and ashes is no longer required, while chimney and furnace repairs are eliminated. Crucible costs are reduced to a fraction of those of pit fires. On the other hand, capital expenditure is considerable, and a skilled electrician is required for rotary machinery. For works operating by day only this furnace has great advantages, though the interest charges are naturally increased by the shorter hours of work.

Discussion.

Dr. H. W. Brownsdon said that from time-temperature curves he had taken while running an Ajax-Wyatt furnace he had found that it required from 50 to 55 minutes to melt the metal, and then a certain amount of superheating was required; the superheating might be 100 deg. or so above the melting point of the metal. He considered the figure of 224 kWh per ton for melting 60 : 40 brass for extrusion billets in a 600-lb. Ajax-Wyatt furnace was reasonable. In the best running conditions he had experienced the metal loss had not been less than 1.1 per cent., and was made up of practically 80 per cent. of zinc represented as oxide. Under average working conditions the loss came out at 1.3 per cent., of which about 1.1 was zinc oxide. It occurred to him that the Ajax-Wyatt furnace needed an arc at the top so that with more heat there the added scrap could be melted more quickly. He considered that there was just as bright a future for the application of electric furnaces to heat treatment and annealing as to melting. In annealing the whole of the energy, except that lost by radiation, could be absorbed into the material, given suitable design, and in an experimental furnace which he had running he had reached the point at which 60 kWh per ton was quite a reasonable current consumption for the annealing of brass; he had no doubt that that could be much improved.

Mr. W. R. Barclay was disappointed that the arc furnace had not received more attention. In arc-furnace melting there were not the same serious troubles as in other electric furnace melting practice with regard to refractories, and there was greater elasticity in choice of refractory materials. Arc furnaces also permitted a certain amount of refining. With proper working the danger of absorption of carbon from the electrodes could be reduced to a minimum. He was not quite sure that purer melting could be obtained with the high-frequency furnace than with any other type. It was remarkable what a high degree of purity could be obtained with the arc furnace, properly controlled. He emphasised the necessity for the close collaboration of the metallurgist and the engineer in design, in order to produce ideal melting plant. The electric furnace gave accuracy of control which was not obtainable with any other type, and the bogie of cost was really not so serious as it appeared to be on paper. One of the great advantages of electrical heat treatment was that one was able to bring the furnace to the work without inconvenience to the operator; when other types of annealing furnaces were used, the cost of transporting material to those furnaces was astounding. In a modern, well-designed, electric furnace one could have a very high standard of insulation, so that a man could work a wire-drawing machine within 2 ft. of a furnace which was annealing the wire at a temperature of 800 or 900 deg., and yet not feel the heat.

Mr. A. Glynne Lobley said that in the Watson furnace, which was English, the electrical portion was out of the way of

the operator, and there was very little fear of breaking the electrodes. He had been faced with the problem of melting aluminium electrically in bulk, and had had to rule out both the arc and the induction furnace. There were several difficulties in the use of the induction furnace for the purpose, including the high conductivity of aluminium, "pinch" effect, and the difficulty with regard to the refractory. He built a furnace using carborundum troughs, with granular carbon as the resistor, and it gave excellent results. Mr. Lobley also referred to a small crucible type of furnace heated by external nickel-chromium resistors. The crucible held 60 lb., the furnace being used for melting aluminium alloys in very small quantities for die casting. The cost of running was rather less than that of the gas furnace which it had supplanted, even though the electric furnace was kept hot all night and used only in the daytime. He had used the star-delta connection for industrial annealing furnaces on 440 V. The dimensions of the smallest furnace were 2½ ft. across and 6 ft. long. In one type of resistor furnace nickel-chromium strip was held in metal supports in such a way that there was no shielding at all, so that hot spots were avoided. The speaker referred to a patented method in which currents of extremely high frequency were applied to bring about surface heat treatment. One could calculate the frequency which was necessary to locate the heating at the surface, and it would be possible to bring about surface heat-treatment where required without having to raise the whole of the material to the required temperature.

Mr. H. H. Hayes quoted figures for a typical week's run of the first Ajax-Wyatt furnaces put down in the Midlands: 98 tons of metal were charged, of which 98.5 per cent. was poured as ingots. The hours of running and melting respectively were 168 and 126. The average consumption per ton of metal charged was 240 kWh, and the total metal irrevocably lost was 2.5 per cent. The supply was at 50 cycles. In a furnace of the same type, but supplied at 25 cycles, the average consumption was 218 kWh per ton. He urged that attention should be given to the design of furnaces in relation to the shape of the articles to be treated. The building of furnaces in the shape of a narrow or shallow trough or tunnel through which straight strips could be pushed or conveyed by conveyor chains would materially increase the efficiency of electrically-heated furnaces.

Mr. Otto Frick said that the problem of finding a suitable lining for non-ferrous metal furnaces did not offer greater difficulties than those already met with and overcome in connection with steel melting, notwithstanding that these difficulties were of a somewhat different character. For brass the problem had been solved already in a reliable and satisfact[ory] way; the lining of the first 120-kW brass furnace in the fact[ory] of A. B. Svenske Metallwerken, Vestersa, Sweden, promise[s] very long life. He described a Frick furnace, which operated [at] 130 kW, in Sweden, and gave perfect satisfaction in all [re]spects, producing 12 tons of brass of absolutely uniform ana[lys]is in 24 hours. Quick transfer of heat and reliable alloyi[ng] were secured without having to rely upon either "pinch" effect or on a V-shaped channel, simply by utilising the rota[ry] movement of the metal in the heating channel well known [to] all users of transformer furnaces. In order to keep the [600] kW, 600 kg., brass furnace hot, from 7 to 8 kW was requir[ed]. The total electrical losses in the furnace and step-up tra[ns]former remained at or below 3 per cent.

Dr. Walter Rosenhain, F.R.S., said that the economy [of] the melting process was not merely a question of the trans[fer] of energy from an electric current generator to the metal; [it] was also a function to some extent of the rate of loss of h[eat] from the container. If the metal container were of an un[de]sirable shape—for instance, a large ring—it was bound to l[ose] heat unduly fast. If it had to be subjected to a very viol[ent] temperature gradient by external cooling, the economy of [the] process would be likely to suffer. The Ajax-Wyatt furn[ace] seemed to be remarkably free from both these defects.

Mr. Campbell, replying to the discussion, said there [were] a considerable number of electric furnaces for annealing [in] this country of which he had experience, some of them be[ing] used for the continuous annealing of wire for submar[ine] cables, in which case it was necessary to work to within v[ery] close limits, and to anneal in an atmosphere of nitrogen. Th[ey] were giving completely satisfactory results. The whole of [the] wire in the Pacific cable, the longest in the world, [was] annealed electrically. Other furnaces of large dimensions h[ad] been erected for the heat treatment of aluminium for [the] Admiralty, and for various other operations of that sort. [In] the arc furnace there was a shallow bath and a large s[urface] area. With the high-frequency furnace he had not expec[ted] efficient refining, because the slag appeared to be cold, but [it] was in fact very hot on the under side, and the speed w[ith] which the metal was brought into contact with the slag [was] enormously greater than in any other furnace. He was c[er]tain that great improvements would be announced before l[ong] with regard to linings. The 600-lb. furnace was suitable [for] brass mills, but there was no reason why larger capacity f[ur]naces should not be used. Within a month or two furnaces [of] from 25 to 30 cwt. capacity would be working. The capac[ity] of the individual furnace depended largely upon the size of [the] shop, the work to be done.

Pulverised-Fuel Firing.

A review of the practice to date in the burning of powdered coal, particularly with regard to its influence on modern boiler design.

By E. KILBURN SCOTT, A.M.Inst.C.E., M.I.E.E.

(*Abstract of a paper read before the* Cleveland Institute of Engineers.)

THE "unit" system of pulverised firing is generally considered the most suitable for applying to existing boilers, including some of the internally-fired type, and it has also a great field for metallurgical furnaces, kilns, and so on. Coal must be dry if it is going to be powdered, because moist coal is difficult to grind, and not safe to store if the free moisture is above 2 or 3 per cent. Coal dryers are usually of three kinds, the rotating tubular type, the vertical type, and the vertical rotating steam dryer.

The first type usually consists of two tubes, one inside the other and upwards of 50 ft. long. The outer tube, which may be 6 to 8 ft. in diameter, is surrounded by a brickwork furnace and has a grate on one side for burning coal to get the necessary heat. The tubes are set at a slight slope from the horizontal, and are rotated slowly, like a cement kiln. The hot gases pass round the outside of the outer tube and then go up the inner tube, the coal being passed along the annular space between them. This type makes a great deal of noise and has the objection of requiring large floor space. The vertical-louvre type dryer is about 10 ft. in diameter and 20 ft. high, and the coal slides slowly down between louvres that permit part of the hot flue gases to pass twice across the path of the coal, and as the gases go through the interstices, they pick up the moisture. The steam dryer is certain in action and the heat can be regulated with great nicety. It consists of a steel casing about 10 ft. in diameter and 20 ft. high, inside of which a number of cast-iron disks are slowly revolved. They are heated with pipes that receive steam from the hollow vertical spindle. The coal is fed in at the top and after making nearly a complete revolution on the first disk is scraped off and pas[ses] down a chute to the next disk, and so on. Steam is bled fr[om] the main at full pressure, and the heat imparted to the [coal] causes the moisture to be carried off by a stream of air t[hat] is induced through the dryer by a fan, which delivers [the] moisture outside the building.

One of the best known grinding mills is the "Raymon[d]" which has its rollers inside a horizontal bull ring, set on a cast-iron base-plate, with tangential openings to allow air to pass inside the grinding chamber. The vertical central spin[dle] carries a number of steel ploughs at its lower end to stir [up] the coal and a spider at the upper end carries the vertic[al] journals of the rollers, of which there are usually four to [six]. Most modern mills are arranged for air separation, that is[, to] say, the fine particles of coal are swept forward by a continu[ous] current of air, which carries them up to a cyclone, where [the] particles of coal are swirled away from the air. When gri[nd]ing coal, the fine powder must be prevented from getti[ng] into the atmosphere, and all joints of machines and pipes m[ust] therefore be kept tight. In order to prevent wear on [the] blades of the air fan by the powdered fuel it is now becom[ing] the practice to place the fan in the return air pipe leadi[ng] to the mill.

In a recent form of feeder, known as the plate type, [the] powdered coal drops on to a cast-iron plate at the bottom [of] the storage bin, in which are two apertures spaced diagona[lly]. An agitator revolves over the top of the plate and the [pul]verised coal passes through the apertures on to a rotor cast[ing] which has fingers that distribute it to a Venturi tube, wh[ere]

meets a current of air. This air is preheated to prevent coal cking by the condensation of moisture. The vertical shaft rrying the agitator and rotor is driven through a worm and orm wheel by an electric motor, the speed of which can be ntrolled from a distant switchboard. The amount of coal n thus be regulated at each burner with great nicety. Plate eders have the advantage of taking less electric power, and ere is practically no chance of the coal "hanging," as was metimes the case with screw feeders.

It is usual for each boiler furnace to be fitted with a conlerable number of burners; a boiler burning 6 tons of fuel r hour may have six or eight. Fishtail burners are now e regular shape, and they are usually set about 2 ft. apart the suspended arch, the flat sides of the burners being at ght angles to the front wall. Owing to the draught of the imney, the resultant flame takes the form of a U, and it is et at intervals in its path by fresh supplies of preheated condary air, which issues from numerous ports in the front all. This secondary air is about 80 per cent. of the total.

When the walls of a combustion chamber are covered with ater tubes it is possible to have higher flame temperatures. ighly preheated air can also be used, and this is provided r a separate preheater. A special form of burner has been signed, having a separate pipe connection for the preheated r and two deflectors to direct this air into the coal and imary air stream at the moment it leaves the nozzle.

Intensive mixing of fuel and air in the furnace is a leading ctor in promoting rapid combustion, for it is necessary to ing the oxygen and carbon together, so that they can come quickly. By this means temperatures of above 2,500 g. F. are obtainable.

In order to get turbulence in the flame, designers are turng their attention to special burners; one of these, the Couch," has the mixture of powdered coal and primary air read outwards by a cone and secondary air jets, which enter om fan-shaped blades, impinge at right angles against the ne of coal, and give it a rotary motion. Experiments have own that up to 35,000 B.th.u. per cubic foot of combustion ace can be liberated per hour by this form of burner.

When powdered coal has to be transmitted for distances der 100 ft., it is usual to employ screw conveyors. For disnces above this pumps or blowers are employed. Powdered al can, of course, be carried in piping along with sufficient r for its combustion, but this is not very safe, and the usual an is to transmit it with only just sufficient air to fluidise e opal, as there is then no chance of back firing.

The Fuller Kinyon consists of a rapidly rotating screw to set e powdered coal in motion, combined with a fan to inject air fluidise it.

At the Ougree Marihage Steel Works, Belgium, a system lled the "Quigley" transmits pulverised coal for 2,300 ft. rough 4-in. piping which follows the contour of the ground, d at one point has a sharp change of elevation of 33 ft.

The increase in the size of boilers led to the Delrick arch, hich has a single layer of firebricks suspended from eel-girder bars. Another form, the Liptak, has two layers refractory bricks, the lower layer being suspended from e upper one, which is in turn suspended from the steel ructure. The refractory shapes or bricks are usually made a mixture containing a high percentage of alumina. A iler now being built for an English power station has water all tubes to take the place of the flat suspended arch, and vo layers of refractory bricks on the top of the tubes to se in the combustion chamber at that point.

The success of the water screen led to the idea of cometely covering the walls, and Mr. Murray, chief engineer, ell Gate power station, U.S.A., introduced the Murray "fin" be, which has strips of steel, 1½ in. wide and ¼ in. thick, welded along each side of the tubes so as to give ample space for them to be conveniently expanded into the headers.

The only backing of the tubes is a layer of asbestos about 2 in. thick.

In addition to water tubes, furnace walls are now also being fitted with steam superheater tubes, through which steam circulates at high velocity on its way from the boiler steam drum to the steam-pipe header. Such tubes are also used for superheating low-pressure steam. With furnace walls so built intensive mixing of the pulverised fuel and the combustion air may be increased to almost any extent, and the whole of the combustion space effectively utilised for combustion purposes.

The new power station at Peterborough is to have the boilers and turbo-generators under one roof without any dividing wall between them, and there are also no coal bins over the boilers, the powdered fuel being transmitted from a separate coal-preparation house direct to the boiler burners. When very high pressures are employed it is important to get the boiler close to the turbine, and this can be easily done when it is fired with powdered coal.

A boiler to give 240,000 lb. of steam per hour at a pressure of 1,200 lb. per sq. in., fired with pulverised fuel, has been recently started at the Lakeside power station of the Milwaukee Electric Light and Railway Co. The two steam drums, each 41½ ft. long, and the mud drum, 40 ft., are made from hollow forgings, machined inside and out. The boiler has 1,602 tubes, giving a heating surface of 28,532 sq. ft. After passing through the h.p. turbine, and becoming reduced to 300 lb. per sq. in., the steam is brought back to a reheater in the wall of the combustion chamber, where the temperature is raised to 720 deg. F. Across the furnace bottom there are 35 water screen tubes, giving a total screen area of 245 sq. ft.

The bin for the pulverised fuel has a capacity of 140 tons, and the fuel is fed by 12 screw feeders, driven by six variable-speed motors through 7-in. diameter pipes to 12 burners. The capacity of the feeders is 35,000 lb. of coal per hour, and the volume of the furnace is 30,100 cubic feet. The primary air has a pressure of 15 in. of water and a temperature of 300 deg. F. The secondary air is supplied through burners and ports in the front wall at a temperature of about 500 deg. F. and a pressure of about ½ in. of water.

The front wall of the combustion chamber is fitted with 70 fin tubes, the total area of which is 420 sq. ft.

The total heat-absorption surface of the boiler is 31,939 sq. ft., of which 3,407 sq. ft., or 10.7 per cent., represents the radiant-heat-absorption surface, not including the front row of the boiler tubes.

A boiler now being experimented with at the works of Messrs. Taylor Bros., Ltd., has its combustion chamber entirely surrounded by water wall-tubes, connected by headers, with the boiler drums at the top and bottom, the combustion chamber square, and the four walls covered with Murray fin tubes. The roof consists of plain tubes that connect the steam drums, and there are also four rows of tubes connecting the mud drums at the bottom.

The powdered coal and air enters the combustion chamber through two burners at each corner near the top. The products of combustion pass between the tubes at the bottom, and the gases turn upwards and pass through the superheater and preheater on their way to the chimney.

Tests have shown that about 40,000 B.th.u. can be liberated per cubic foot of combustion space per hour.

A boiler of this design is being made for the Commonwealth Edison Co. of Chicago, to give 125,000 lb. of steam per hour, 300 lb./sq. in., and two others are being made for the Brighton power station.

Scientific and Industrial Research.

Report of the Department for the Year 1925-6.

LAST week the report of the Committee of the Privy Council for Scientific and Industrial Research for the year 1925-26 was published (H.M. Stationery Office; nd. 2,782. Price 3s. net). It states that the estimated cost the programme of research for 1926-27, and of administraon, amounts to £442,877, as compared with £380,263 for e previous year. During the year Sir Richard Threlfall, r. J. H. Jeans, Sir William Ellis, Sir John Snell, and Sir hn Farmer retired from the Advisory Council on the cometion of their terms of appointment; Prof. H. C. H. Carnter, F.R.S., and Dr. G. C. Clayton, C.B.E., M.P., were pointed members of Council. Commenting on ten years' rk, the Committee endorses the view of the Advisory uncil that in the field of applied research the duty of the epartment is rather to stimulate than to replace private terprise, save in certain directions in which the expenditure of public funds is justified, as in the study of our fuel resources. The fear is expressed that in many cases industry has not investigated the possible applications of new discoveries in pure science likely to lead to new products or processes. Unless research has a practical objective it does not fall within the functions of the Department or, indeed, of industry itself; but industry is undoubtedly concerned with pure research as much as with applied research.

New research associations are being formed and will be assisted. The Committee has adhered to its policy of continuing to assist for a further five years those associations which have done good work, the grants being calculated on a diminishing scale so as to enable the industry gradually to assume full financial responsibility. Amongst other associations whose work has been investigated by independent experts, the British Cast-Iron Research Association has been

offered pound-for-pound grants for three years, and grants at half that rate for a further two years. The Research Association of British Rubber Manufacturers, and the British Refractories Research Association, are also receiving continued assistance. During the year grants to associations amounted to £88,216, and the balance of the Million Fund unexpended on March 31st, 1926, was £429,984. The uncommitted balance of the Fund was £144,647.

Fuel research has been delayed by the difficulties in the coal industry. Several systems of low-temperature carbonisation of coal have been brought to the stage of full-sized construction, and five of these have been tested by the Department. The view of the Royal Commission on the Coal Industry, that a survey of the heat, light, and power requirements of the country was called for, is cordially endorsed. The committee appointed by the Department to examine the Severn barrage proposal has reported in terms sufficiently favourable to justify an extension of the inquiry, and it has been decided to transfer its supervision to a sub-committee of the Committee of Civil Research, which includes members of the original Departmental Committee. The attention given to research as a means of developing the Empire, at the recent Imperial Conference, is mentioned with satisfaction.

The report of the Advisory Council to the Committee surveys the whole field of work covered during the ten years of the Department's existence, and emphasises the necessity of systematic investigation to enable industrial progress to be made; unfortunately, public opinion is not yet fully aroused to its necessity, but there have been many welcome signs of a change in attitude during the past ten years, and more research work is now carried out than ever before. Many prominent industrial firms are rapidly developing their scientific organisations. Greater expansion is necessary and a far greater co-ordination of effort. When an industry consists of a large number of comparatively small and independent firms, these cannot maintain separate research organisations sufficiently large to provide for their needs, nor is it in the general interests of the country that they should do so, for this would involve a great waste of money and effort in the attack of particular problems many times over. There are only two ways out of this difficulty—the formation of large industrial combines, and the encouragement of co-operative research.

Regarding the electrical industry, the Advisory Council says: "The electrical industry not only owes its origin to pure scientific research, but is assisted even now more than any other industry by researches carried out in universities and in Government establishments. Every university encourages the intensive study of electrical science; all the Service Departments spend large sums of money on electrical research, the majority of the results of which are available to industry; the National Physical Laboratory has always had an Electrical Department, and a building and equipment for the special study of high-tension problems is approaching completion. Under the Radio Research Board of the Department investigations have been carried out of direct importance to the electrical industry, and some of the results of the work are already being applied. Grants have also been given to independent investigation for electrical research; in particular, a large grant has been given to the Cavendish Laboratory, Cambridge, for fundamental work on intense magnetic fields. A British Electrical and Allied Industries Research Association has also been formed with the aid of large grants from the Department, and has been engaged for some years now on investigations of general importance to the industry. Finally, in the industry itself there has been a considerable expansion of scientific work since the war. The prominent electrical manufacturing firms have large research laboratories, and we hope that it is only a matter of time before these equal in achievement, if not in size, those of their principal foreign competitors. On the whole, the position is healthy; there is general recognition of the necessity for continuous research if progress is to be maintained independently of foreign countries. The British Electrical and Allied Industries Research Association deserves, however, far greater support from electrical supply companies, for much of its work is of great value to them. To take a comparatively simple instance, the investigations on the safe loading of underground cables, undertaken for the Association at the National Physical Laboratory, have shown the possibility of immediate economies in the electrical supply industry which, according to an independent estimate, are valued at some £250,000 a year. The work of the Association on switchgear and overhead transmission lines is of greater direct importance to supply companies than to manufacturers. We trust that there will be a far greater effort on the part of the supply undertakings to maintain the Association on an adequate financial basis. It will certainly be difficult to justify any continuance of Government grant to the Association after the present grant period ends in September, 1930. As we have said, the electrical industry receives more support in relation to its size and importance from independent and Government research than any other British industry. It has been comparatively prosperous throughout times of great difficulties in other industries, and there is every sign of a continuance of its prosperity for many years. It will only be really healthy when it relies on its own efforts to meet foreign competition, and does not look for further direct support from the taxpayer to aid its scientific development."

Dealing with industries generally, the Advisory Council lays stress on the value of co-operative research in the wid sense, and emphatically records the opinion that the i portance of a steady scientific policy increases in times adversity. The expenditure required to produce results direct industrial importance is trivial in relation to the va of the total output of an industry, and the view is expres that the system of voluntary contributions to co-operat research associations is inadequate; efforts are being m by some associations to introduce some kind of volunt or compulsory levy on raw material, on manufacture, or individual outputs.

In the class of so-called "key" industries, such as t manufacture of scientific instruments and of optical a scientific glassware, the expenditure on scientific and te nical research required to maintain a high standard and c tinuously to introduce improvements is comparatively v high, and these have been helped since the war by a tax imports and by considerable grants of money for scienti research.

Summarising its general policy, the Advisory Council ho that the Department is not justified in spending public fun continuously on work which is for the special benefit particular industries, and which should be carried out by t industries themselves if the results are to be applied efficien and quickly. The duty of the Department in these directio is rather to stimulate than to replace private initiative, a particularly to seek to reduce the gap between new scienti advances and industrial applications. Co-operative resear by means of research associations has been encouraged financial grants over a limited period, and the results sh that this policy has been a wise one. It has led not on to actual achievements which have been applied in industr but it has had a great effect in bringing the leaders of t industry face to face with the need for research, and th encouraging them to provide more directly for scientific wo needed for their own special requirements.

In all the measures adopted by the Department to car out or to promote industrial research, the primary purpo must be to secure the application of scientific knowledge industry. It is one of the most important parts of the D partment's own research organisation to establish utilisati sections for promoting the application of scientific and tec nical information in industry. The same function must discharged by research associations wherever they exis indeed, this function is regarded as being in many cas perhaps the most important function which the resear association can discharge.

A large part of the report is devoted to a summary the work done under the various research organisations of t Department during the year 1925-26, including the Nation Physical Laboratory, the Fuel Research Board, the Eng neering and Physics Co-ordinating Research Boards, the Rad Research Board, and the Illumination Research Committe In nine Appendices particulars are given of the Resear Boards and Committees of the Department, grants to resear workers, aided researches, finance, existing Research Associ tions, research in other parts of the Empire, publications researchers and Government employés, and department publications issued during the year.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Bognor Gas and Electricity Bill.

The Bill promoted by the Bognor Gaslight and Coke C was considered by a Committee of the House of Lords, ov which Earl Russell presided, on March 22nd.

Mr. Rowand Harker, K.C., said that the company supplie both gas and electricity, and the main objects of the Bill we to enable the name of the company to be changed to "Th Bognor Gas and Electricity Co."; to raise additional capita and to extend the limits for the supply of gas and electricit The amount of stock authorised up to the present time wa £104,700, and the Bill authorised £100,000 additional capita and increased borrowing powers.

Originally there were a number of opponents, but agre ments had been reached in most cases. There remained, hov ever, the petition of the Westhampnett Rural District Counc with regard to electricity supply. Part of the area of th rural district was within the existing limits of supply of th Bognor Co., and it was proposed to include further parishe The issue would emerge as to whether the company should b put under the obligation to supply electricity in certain place no matter what the cost would be to the company, irrespectiv of whether that supply would give any proper return on th capital outlay, and irrespective of what the effect of such a obligation would be upon the existing consumers of the com pany. At present there was no supply of electricity i Arundel, but Arundel wanted a supply, and the company wa anxious to give it. The generating station at Bognor wa small, and therefore the company was endeavouring to obtai a bulk supply, through the Chichester Corporation, from th Portsmouth Corporation. A new h.p. main would pas within fairly reasonable distance of certain small township within the Westhampnett Rural District, and if and when th company was satisfied that a reasonable demand for electricit

existed in those townships, it was proposed to tap the main and supply them. The petition of the Westhampnett Council pointed out that for over fourteen years the company had failed to exercise its powers in any of the parishes in the Rural District, although there was a demand. It was suggested that the company should be placed under an obligation to lay mains in the parishes at present within the area of supply within two years from the passing of the Bill. The company had inserted a clause, which it asked the Committee to approve, providing that if, after the expiration of five years from the passing of the Bill, it had not, in the opinion of the Electricity Commissioners, laid suitable and sufficient distributing mains for the supply of electricity in any parish added by this Bill to the existing limits, the local authority or any company or person could apply for powers to give such a supply, and providing for the repeal of the company's powers. That did not apply to the parishes already within the company's limits of supply. Since 1888 the Rural District Council had had power to apply for an Order enabling it to supply in the whole of its district, but it had not exercised that power.

A report from the Minister of Transport pointed out that in cases where extensions of area were sought by Special Order under the Electricity (Supply) Acts, it was usual for promoters to be placed under an obligation to carry out within two years a reasonable amount of compulsory works in the more populous portions of the extended areas, unless justification were shown that such an obligation should not be imposed. Counsel said that a clause had been inserted in the Bill placing an obligation upon the company within two years to lay down distributing mains reasonably suitable and sufficient for the purposes of a general supply of electricity in certain streets in the borough of Arundel. The report also pointed out that an application had been made to the Electricity Commissioners by the Electric Supply Corporation, Ltd., for a Special Order authorising the supply of electricity in an extensive area embracing the borough of Arundel, and some of the parishes it was now sought to add to the area of supply of the Bognor Co. Counsel informed the Committee, however, that the Corporation had not opposed the present Bill, and the Bognor Co. had not heard from it.

After hearing a great deal of evidence, the Committee decided that the parishes of Tangmere, Boxgrove, Eartham and Upwaltham should not be included within the company's limits of supply; that the company should be compelled to lay distributing mains in certain streets in Aldwick and Felpham within two years, and in certain streets in the parish of Clapton within three years. The gas clauses were approved.

Hastings Tramways Bill.

This Bill, which provides for the substitution of trolley vehicles for tramways by the Hastings Tramways Co., was approved by a Committee of the House of Lords last week. There was opposition from the Hastings Corporation, which expressed a preference for motor-buses rather than trolley vehicles. It suggested that the company should withdraw the Bill, on the undertaking that the Corporation would not oppose the preamble of a Bill enabling the company to run buses in Hastings. The company could not accept this, for financial and other reasons.

Colchester Corporation Bill.

This Bill, which proposes to substitute trolley vehicles for the existing tramways in Colchester, was approved by the unopposed Bills Committee of the House of Commons on March 23rd. It was explained by Mr. R. F. Parker, for the Corporation, that the existing tramways were authorised in 1901, and had been running ever since, but the time had come to consider whether they should be reconstructed, at great expense, or whether a more flexible and cheaper form of transport should be substituted. The Corporation had decided to substitute trolley vehicles. The borrowing powers asked for by the Bill are:—For trolley vehicles, £25,800; for electrical equipment, &c., £7,825; for the reconstruction of roads, £9,038; and for the adaptation of buildings for purposes of trolley vehicles, £200. Borrowing powers of £13,000 are also sought for the provision of omnibuses.

Overhead Transmission Lines.

On March 18th Sir D. Newton asked the Minister of Transport what number of applications were made by authorised undertakers for consent to the erection of overhead lines for the years ended March 31st, 1925, and 1926, respectively; and how many such applications had been made for the current year.

Colonel Ashley said that the number of applications received for the year ended March 31st, 1925, was 162 and for the following year 194. From April 1st, 1926, to March 18th, 1927, the number of applications received amounted to 322.

Wayleaves.

On March 18th, Sir D. Newton asked how many local inquiries in respect of wayleaves in connection with the placing of electric lines had been received during the current year; if delay had taken place in regard to inquiries into these matters; and how many officers had been appointed by the Ministry to deal with such questions.

Colonel Ashley said that five applications had been received during the current year. In one case the inquiry was delayed from February 9th to March 4th owing to the death of one of the parties. No official was definitely set apart for this work, individual appointments being made on each application.

Railway Electrification.

During a debate on the second reading of the London, Midland and Scottish Railway Bill on March 21st, a number of members complained of the inadequacy of the travelling facilities in the East End of London, and urged that the company should pay greater attention to the electrification of its lines and to the installation of electrical signalling.

Mr. Fielden, a director of the company, in reply, said that the company had asked its late chief engineer to inquire into the engineering problems in the London district. The question of electrification was one of them. One official was solely engaged in the consideration of schemes for meeting the future requirements of the traffic on the London and Southend sections; progressive electrification was one of them, and alterations and improvements at Broad Street were another. Steps were being taken to avoid delay owing to traffic movements, and additional running lines and facilities were being provided. The company was in process of adopting automatic signalling on the line between Barking and Bow. That work, it was hoped, would be completed by the summer.

Beam Wireless.

On March 22nd Sir W. Mitchell-Thomson informed Lt.-Commander Kenworthy that the "beam" wireless stations erected in this country for the Australian service had passed the seven-day test required by the contract and were about to be taken over by the Post Office. The sending station was at Grimsby and the receiving station at Skegness. The corresponding stations in Australia were at Ballan and Rockbank, near Melbourne; and it was proposed to operate the service between London and Melbourne. Many detailed arrangements had still to be made, and he could not yet state on what date the service would be opened to the public.

Wireless Operators.

On March 22nd Sir W. Mitchell-Thomson informed Mr. Day that the total number of certificates issued to ships' wireless operators during the 12 months ended March 1st, 1927, was 760.

Winding Gear in Collieries.

On March 22nd, Colonel Lane-Fox informed Mr. Paling that about 2,440 collieries had steam and 240 electric winding engines. In the five years 1922-26 58 accidents had occurred, causing injury to persons employed, including 14 deaths; since December 1st five such accidents had occurred, causing three deaths. One of the former, causing injury but not death, and none of the latter, occurred with an electric winder.

Correspondence.

***Correspondents should forward their communications* as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Faults in Flexibles.

When I drew attention to this matter in your columns last year, in connection with a vacuum cleaner, no interest was taken; but at last people realise the dangers involved, not to mention the annoyance. But I notice that Messrs. Ward and Goldstone now recommend "Feraflex." I wrote to them about this at that time, and they then preferred another of their special wires, "anti-shock" flex, as "they did not consider 'Feraflex' altogether suitable." This is a little confusing, as they do not now mention "anti-shock" flex, though I am using it and have had no trouble since.

J. W. Meares.

Guildford, *March 27th*, 1927.

The Charges for Packages.

In your issue of March 18th Mr. W. Eric Jackson, LL.B., writes a very interesting article on this subject. In the second last paragraph, however, he states that the buyer may return the empty packages at the seller's expense. Strictly speaking, this is not the case, for our railway companies will accept empties only if consigned carriage-paid by consignor, and I have never heard of buyers issuing separate invoices to suppliers for the amount of carriage paid on empties returned by them. I shall be glad to have this point explained.

W. Jackson Harris.

Glasgow, *March 21st*, 1927.

In reply to your correspondent, Mr. W. Jackson Harris, I would say that where the delivery charges are to be borne by the buyer, as is usually the case, the cost of returning the empty package may be considered as part of the delivery charges. The seller bears the cost of making the goods deliverable, *i.e.*, packing them, and the buyer pays whatever other expenses are incidental to the process of delivery. Trade

custom also seems to operate in favour of charging the buyer with the carriage on the empty package. The rules of the railway companies do not affect the legal position. If a buyer is entitled to send back packages at the seller's expense he can charge him with what the railway company has charged. The buyer would be legally entitled to do this where the sale was "carriage free." In such cases no expense is to be borne by the buyer, and he can legally debit the seller with any expense incurred in returning empty packages.

W. Eric Jackson.

A Meter Problem.

With reference to the letter by "E.H.K.P.," which appeared in your issue of March 4th, it is somewhat surprising to find anyone expecting correct readings from instruments used with transformers other than those with which they have been calibrated.

If a discrepancy appeared in the readings in the original instance the only correct method of checking this was to install the new instruments with their transformers as a separate unit, leaving the old ones undisturbed.

Connecting up the old instruments, with the new, to the same transformers would probably have the double effect of not only affecting the old but the new instruments as well.

The remedy for the situation is either to recalibrate the old instruments with the new transformers or put the old ones in circuit again.

P. Oaks.

Blackheath, *March 19th*, 1927.

With reference to the correspondence resulting from my letter inserted in the Review of March 4th, may I encroach upon your space with the following information which I have since been successful in obtaining?

The enclosed table has been constructed from figures taken from the meters concerned. A similar set of readings for the portable meter is not available, because the Supply Co. locked that meter in a closed and sealed box. The only information I have been able to elicit is that the readings of the portable meter were fairly close to those of the Sangamo, but less in value.

	Sangamo.	Aron.		Difference.
		Max. demand,		
Week ending.	KWh.	KWh.	KW.	KWh.
11/1/27	—	7,690	178	—
18/1/27	—	8,070	178	—
25/1/27	—	7,750	168	—
1/2/27	10,580	6,860	138	3,720
8/2/27	10,870	6,690	138	4,180
15/2/27	11,110	9,660	209	1,450
22/2/27	9,980	9,270	192	710
1/3/27	10,500	10,060	—	440
8/3/27	10 090	9,760	—	330
15/3/37	9,740	9,460	—	280

It will be noticed that the first reading of the Sangamo is dated 1/2/27, and this is after it had recorded for a full working week. Simultaneously the Aron meter shows a sudden drop in both kWh and max. kW demand indications. Between 8/2/27 and 15/2/27 the cover of the Aron meter was removed, and some adjustment made to its interior, after which the max. kW returned to approximately the original readings, and the kWh approached more nearly to the Sangamo.

In my opinion, the only accurate and satisfactory method of testing the Aron equipment is to install the Sangamo complete equipment (upon its own transformers) independently of any other apparatus, as current transformers are most sensitive to alteration of the time-constant (X to R ratio) of their loads. Moreover, when the company concerned is one of the largest in London, one would expect the methods of its test department to be above criticism; surely it is only reasonable to suggest, when the accuracy of a meter is questioned, that the test should be as perfect as possible. The company has said no more with regard to charging for its presumed loss. I also cannot understand why, when the consumer is charged on a max. kVA basis, the max. kVA meter is ignored, and he is charged according to the indications of the max. kW as indicated by the Aron meter, although the power factor of the system is 0.8-0.85, and, according to a P.F. meter (connected by the company), lagging.

E. H. K.P.

March 19th, 1927.

The Salaries of Engineers.

In spite of the large number of communications already published on the subject of engineers' salaries, I feel bound to add my small contribution to the swelling chorus of protest. A glaring example is furnished by your "Situations Vacant" columns in the issue of March 25th. There we see vacancies advertised for positions as "Chief Engineers" in two workhouse institutions at salaries of such stupendous dimensions that the successful candidates will, no doubt, soon be able to fulfil the requirements necessary to obtain permanent positions as inmates. In this connection, too, it is noteworthy that the amounts which the guardians of these institutions are prepared to pay their employés, are strictly comparable with those which they "give away" to non-workers in the form of relief.

As one of the younger members of the electrical world, I think a word is necessary with reference to the salaries paid college-trained men, just emerging from their studies, blushin under their many academic successes. A rude shock awai them in the form of offers, few and far between, of positio carrying salaries which a well-trained office-boy would reje with contempt.

I think the position may be summed up by adapting t famous words of *Punch*:—

Advice to those about to become engineers:—Don't!

Advice to those who are engineers:—Give it up and t cat burglary.

Embryo.

March 26th, 1927.

In view of the interest of your readers in the scheme of t S.T.E. to raise both the remuneration and status of enginee may I be permitted to add my wee small voice to the chorus

Your correspondent who sums up our trouble as one of supp and demand, is surely right. It is that, and that only. Wh is the position outside engineering?

In those several kinds of businesses, *e.g.*, large distributi stores, hotels, breweries, amusements, silk stockings, &c., th have done well right throughout the general slump in o basic industries, is there any higher general wage and sala standard than obtains in those languishing industries, en neering, shipbuilding, mining, &c.? No, Sirs, we know the is not; salaries and wages are at a dead level throughout i dustry, quite regardless of the prosperity of the particul industry and the ability of its directors to pay high salarie The law of supply and demand inexorably operates. We the present generation are suffering from the unrestricte over-production of population of the last century. Would th there had been a Parents' Association on the lines of o modern Rubber Growers' Association, Tea Growers' Associ tion, &c. Even now, Sirs, our population is still increasing the rate of round about a million every four years, a large pr portion of them, no doubt, destined to be engineers, or shou I say, part-time engineers? What are we going to do with these people? Is the law of supply and demand going operate still more inexorably for our children, grown to eng neers, than even for us?

If the S.T.E. scheme could be realised, no doubt it wou help engineers by limiting their numbers, but only by pushi would-be engineers into other already overcrowded professio with consequent intensified competition between their me bers, with the usual dire results. I must confess myself pessimist, I see no way out—with our present size of pop lation.

Sociologist and Engineer.

March 26th, 1927.

The Register of Contractors

THE annual meeting of the National Register Electrical Installation Contractors was held at t Institution of Electrical Engineers on Mond last, Mr. P. V. Hunter, C.B.E., chairman, presidin The report of the Executive Committee which w presented made mention of a publicity campaign carri out during the year, and it was stated that a furth campaign was being embarked upon. The figures relati to registration showed that since the inception of the schen up to December 31st last there had been 1,173 applicatio Of these, 946 had been accepted, 116 declined, and 17 wit drawn, while 41 were still under investigation. The numb of registrations cancelled and names struck off the Regist was 52, only two cases being on account of bad workmanshi Since the end of the year a further 30 applications had be accepted. Mr. Purse's paper on "Registration," which w read at the Brighton Conference of the E.C.A. Allied Ass ciations, was reprinted and circulated to supply authoritie architects, consultants and others. There are now 86 loc advisory committees with their full complement of thr members, and 20 others are functioning, although not yet t to number. The following undertakings now place their i stallation work with registered contractors only:—Mancheste Hull, Wolverhampton, Bristol, Preston, Croydon, Newpo Cheltenham, West Hartlepool, South Shields, and the Ne castle-upon-Tyne Electric Supply Co., Ltd. It has been a ranged to issue renewal certificate slips to obviate the annu exchange of certificates. During the year three complain of bad workmanship were received. The Executive Co mittee decided that it could take no action in one case; in t second case the responsible contractors were struck off t register; and in the third case the firm went into liquidatio thus forestalling the cancellation of its certificate. The E.C. passed a resolution calling upon the Register to adopt a co of wiring rules, and a meeting is being arranged with t E.C.A. The retiring members of the Registration Boa were re-elected, but Mr. Barnett was elected in the place the retiring representative of the Electrical Wholesale Federation.

In replying to a criticism of the accounts, both the Chai man and Mr. W. R. Rawlings claimed that the Register w run in a very economical manner. Replying to Co Crompton, Mr. Hunter said that he had heard, unofficiall

hat the E.C.A. had decided to adopt a set of wiring rules. Ir. A. H. Dykes seconded the adoption of the report, and it vas carried.

A member asked for fuller definition of the local advisory ommittees' functions. Mr. H. J. Cash pointed out the resent need for propaganda, which should aim at showing hat registration did not increase costs. He regretted that it ad not proved possible for the Register to adopt the I.E.E. Viring Rules. No doubt their adoption would deplete the Register for a time, but those that were left could pay a arger subscription to make up for that. Mr. W. A. Shaw aid that many large firms were not yet on the Register; e was informed that there were 350 members of the E.C.A. ot yet registered. He suggested the certification of the ompetency of contractors by the municipal supply engineers, 'ho would then take a keener interest in the register. 'ol. Crompton said that the present I.E.E. Rules were ar too complicated, and they were only temporary. They eeded more easily understood rules. That was being done, nd he commended the summary produced by the E.C.A. or the use of its members. Mr. W. Cross said that there ere complaints that individuals had been put on the Register 'ho were not strictly electrical contractors. Many contractors onsidered that the business qualification requirements ould be stiffened up. He also urged the adoption of wiring ules. Mr. F. W. Purse thought that even the "small" an should be registered if he fully complied with the condi- ons; it was easy to cancel his registration if he proved ncompetent, which was all the worse for the man concerned. Ir. Hunter said that there was a member of the E.C.A. n every local advisory committee, which should prove a afeguard. The Executive Committee was more stringent in s requirements from the small man. Messrs. P. V. Hunter nd A. H. Dykes were re-elected chairman and vice-chairman spectively. The rule regarding the status of applicants was nended to enable the Executive to require candidates to sub- it particulars of past work. The members of the Executive ommittee, Messrs. Munro, Calvert and Rawlings, were re- ected. Mr. L. Gaster suggested that the Register should be a eans of enabling the placers of orders to look up the past ork of contractors. The chairman said that the Executive ould consider the matter, although he thought it was beyond ie scope of the Register. On the proposition of Mr. Purse, was resolved to subscribe five guineas to the I.E.E. enevolent Fund. Votes of thanks to Messrs. Cash and urse (the Scrutinising Committee) and the chairman con- nded the meeting.

Published Specifications.

mpiled expressly for this journal by a firm of Chartered Patent Agents. e numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

21,846. "Transmission and reproduction of views, scenes, or images by res or wirelessly." Television, Ltd., and J. L. Baird. September 1st, 5. (266,564.)

5,347. "Telephone systems." Automatic Telephone Manufacturing Co., d. (Automatic Electric Co.). October 10th, 1925. (Addition to 179,930.) 6,774.)

26,615. "Electrical condensers." Karas Electric Co. August 1st, 1925. 6,167.)

27,051. "Electric accumulators.' C. H. O. Lubeck. October 31st, 1924. 2,280.)

27,496. "Sparking plugs." E. J. Buckingham. November 2nd, 1925. 6,778.)

27,724. "Armatures for asynchronous motors." C. Shenfer and English ctric Co., Ltd. November 4th, 1925. (Addition to 234,191.) (266,780.)

27,788. "Construction and windings of armatures for electric generators motors." F. W. Lanchester and Lanchester's Laboratories, Ltd. Novem- 5th, 1925. (266,782.)

29,428. "Thermionic valve amplifiers, automatic distribution systems." D. Edmonds. November 21st, 1925. (Cognate applications 6,843/26 and 72/26.) (266,788.)

29,475. "Device for obtaining easy starting of internal-combustion engines ed with magneto ignition." E. M. Dodds. November 23rd, 1925. 6,790.)

29,724. "Telephone systems." Standard Telephones & Cables, Ltd., H. E. Baker, W. R. Moscrip, and A. J. Chanter. November 24th, 1925. 6,794.)

29,785. "Thermionic valve sockets." Hazeltine Corporation. May 21st, 5. (252,315.)

29,865 "Electric storage batteries." Foolprufe Patent Accumulator Co., l., and F. J. Brown. November 26th, 1925. (266,797.)

29,934. "Improvements in or relating to electric signalling systems." M. E. Aitken, D. A. Gordon and Metropolitan-Vickers Electrical Co., d. November 26th, 1925. (266,798.)

30,014. "Electric motors." W. M. Mordey. November 27th, 1925. 6,799.)

30,218. "Rotary switches for use with electrical apparatus for transmitting nals." M. Graham, A. Graham (legal representatives of E. A. Graham, ceased), and A. C. Brockies. November 30th, 1925. (266,802.)

30,248. "Electrolytic decomposing cells." F. Lawaczeck. November 30th, 5. (266,803.)

30,579. "Electrical contacts." British Thomson Houston Co., Ltd., and B. Tuppen. December 3rd, 1925. (266,811.)

30,666. "Electric relays." A. Reyrolle & Co., Ltd., and B. H. Leeson. cember 4th, 1925. (266,816.)

30,697. "Apparatus for signalling the extinction of electric lamps." N. Bray, Ltd., and E. N. Bray. December 4th, 1925. (266,818.)

30,782. "Supporting of electrical conductors within tubular insulators." G. Maxwell and Metropolitan-Vickers Electrical Co., Ltd. (Cognate lication 21,743/26.) (December 5th, 1925. (266,822.)

30,882. "Automatic switches for use in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd. December 9th, 1924. (244,458.)

31,763. "Electrically-driven lawn mowers." H. Watson & Sons, Ltd., and E. Watson. December 16th, 1925. (266,844.)

1926.

45. "Dry batteries." Burgess Battery Co. January 2nd, 1925. (245,464.)

107. "Synchronous dynamo-electric machines." Crompton & Co., Ltd., and R. A. Lochner. January 2nd, 1926. (266,853.)

307. "Electric cables." W. T. Henley's Telegraph Co., Ltd., and W. W. Watkins. January 5th, 1926. (266,855.)

1,193. "Electric switches." C. L. Arnold and M.K. Electric, Ltd. January 15th, 1926. (266,863.)

1,295. "Choke transformers for wireless telephony." R. Woods. January 16th, 1926. (266,865.)

2,108. "Combined arc lamp and radiator." J. R. Quain. January 25th, 1926. (266,872.)

3,399. "Tension regulating by means of asynchronous wattless current machines." Siemens-Schuckertwerke Ges. February 27th, 1925. (248,344.)

3,607. "Irradiation apparatus for treating fluids with ultra-violet rays." Quarzlampen Ges. February 9th, 1925. (247,231.)

4,072. "Switch-operating mechanism for electric transformers." Bruce Peebles & Co., Ltd., and J. W. Rodger. February 12th, 1926. (266,890.)

4,074. "Electric transformers." Bruce Peebles & Co., Ltd., and J. W. Rodger. February 12th, 1926. (266,891.)

4,436. "Electrical signalling devices." Dr. M. J. Huizinga. February 18th, 1925. (247,953.)

5,588. "Electric converting apparatus." J. E. Calverley and W. E. Highfield. February 27th, 1926. (266,962.)

13,074. "Electrostatic sound-box for talking machines." W. Groenebaum. May 21st, 1926. (266,949.)

14,176. "Braking systems." British Thomson Houston Co., Ltd. June 4th, 1925. (253,136.)

15,010. "Alternating-current vapour electrical devices." Hanovia Chemical and Manufacturing Co. February 23rd, 1926. (266,663.)

15,377. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). June 18th, 1926. (266,965.)

15,512. "Electric luminous discharge tubes." General Electric Co., Ltd. November 4th, 1925. (260,943.)

16,822. "Synchronised asynchronous electric motors." J. Rezelman. July 5th, 1926. (266,976.)

17,885. "Electric arc-welding process." W. Kassteen. July 16th, 1926. (266,981.)

18,045. "Apparatus for treating gases and vapours with silent electric discharges." W. Carpmael (I. G. Farbenindustrie Akt. Ges.). July 19th, 1926. (266,983.)

18,147. "Method of producing coloured lighting effects for signalling, advertising, and kinematographic purposes as well as for illuminating fountains or the like." B. Jirotka. August 12th, 1925. (256,938.)

20,285. "Switch-actuating mechanism for electric signs." E. S. Andrews (Elektro-Automaten, M.B.H.). August 17th, 1926. (266,994.)

21,926. "Electric incandescent lamp." Dr. G. Von Mery and R. Basch. September 6th, 1926. (267,009.)

23,831. "Electric flat irons." H. Golob. September 25th, 1925. (258,907.)

24,316. "Synchronisation of alternating-current systems." International General Electric Co., Inc. October 1st, 1925. (259,235.)

24,827. "Picture and the like telegraphy." Telefunken Ges. fur Drahtlose Telegraphie. October 7th, 1925. (259,584.)

25,965. "Electric starting machines for motor vehicles." Soc. de Paris et du Rhone. November 24th, 1925. (262,064.)

29,493. "Electric welding machines." E. G. Budd Manufacturing Co November 24th, 1925. (262,104.)

31,215. "Electric lamps." R. C. Turner. December 9th, 1926. (267,054.)

31,940. "Electric glow-discharge lamps." Television, Ltd., and J. L. Baird. September 1st, 1925. (Divided application on 266,564.) (267,056.)

32,805. "Apparatus for feeding oil to high-tension electric cables." Pirelli & Co. June 12th, 1926. (Addition to 255,034.) (Divided application on 255,034.) (267,059.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 23rd :—

Magnet (design only). No. 471,778. Class 1. No. 471,779. Class 1 (lettering only). Chemical substances used in the manufacture of goods exclusively for electrical purposes.—General Electric Co., Ltd.

Televisor. No. 464,125. Class 8. Apparatus for use in transmitting views, scenes, or images to a distance by telegraphy.—J. L. Baird, The Lodge, Argyle Street, Helensburgh, Scotland.

Mer-tone (lettering and design). No. 474,831. Class 8. Loud speakers for radio-telephonic instruments.—London Radio Manufacturing Co., Ltd., 61, Borough Road, S.E.1.

Omiceon. No. 477,713. Class 8. Apparatus for use in radio-telegraphy and telephony.—W. L. Colassi and G. Ventura trading in co-partnership, 130, Fenchurch Street E.C.3.

Accident Prevention.

The Accident Prevention Department of the National Employers' Mutual General Insurance Association, Ltd., informs us that one of its member firms has just reported a reduction of accident loss by 87.5 per cent., on a man-hours-worked basis. The Department issues posters weekly, suitable for display in factories, and has started a monthly paper styled "Industrial Safety," an interesting 8-page journal containing a variety of information calculated to reduce the frequency of accidents. A note therein recommends the painting of crane hooks white, so that they are more easily seen and fewer heads are broken—unpainted, they are difficult to see against a dark background. Methods of preventing falls from ladders, on stairs, &c., are described, and the use of flashing electric signs to attract the attention of employés to safety "slogans" is said to have proved highly effective. Too much effort cannot be devoted to the prevention of accidents, and the Department is anxious to help all employers to that end.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AUSTRALIA (Adelaide).—Bridge (£70,000); city engineer.
(Hobart, Tasmania).—Reconstruction Sandy Bay Baths; Corporation engineer.
AYRSHIRE.—Housing scheme (162), for the C.C.; the clerk, Ayr.
BARNSLEY.—Municipal wash-houses and Turkish baths; borough engineer. Casualty and out-patients' buildings, Beckett Hospital; C. F. Moxon, architect, Regent Buildings.
BARNSTAPLE.—Housing scheme (22), for the T.C.; borough surveyor.
BASINGSTOKE.—126 houses, Hackwood Road; borough engineer.
BEBINGTON (Birkenhead).—Church (£7,000), for the Wesleyan trustees; Rev. F. A. Speight.
BEESTON.—42 houses; U.D.C. surveyor.
BRADFORD.—Central improvement scheme, including six-storey block (over £200,000); W. Williamson, city architect.
BRIGHTON.—Reconstruction of station (£90,000), for the Southern Railway.
BROMLEY (Kent).—Houses (92), Bromley Park Garden Estate, for Hugh F. Thoburn. Seven blocks of flats (£13,720), for the T.C.; J. Elliman & Son, Ltd., builders.
BURSLEM.—Extensions marl works, High Lane; Mr. Wilkinson.
CHADDERTON.—Extension of works, Halliwell Street, for Ferranti, Ltd., electrical engineers.
CROYDON.—Extensions, High School; Girls' Public Day Schools Trust. Bank, Brighton Road; Midland Bank, Ltd. Kinema, High Street; R. Cromie, 73, Edgware Road, W.2. 24 shops and flats, Dovercourt Parade North; Robin & Wilsdon, 39, Maddox Street, W.1. Warehouse, 252, London Road; C. H. Ridge.
(Addiscombe).—Flats, Park Hill Road and Addiscombe Road; W. H. Merret & Sons, Carshalton Road, Sutton.
DERBY.—Church (£6,000), for Junction Street Baptist Church; J. Wills & Sons, architect.
DONCASTER.—Houses (80), Bawtry, for the R.D.C.; Ward and Sons, builders, Maltby.
EASTBOURNE.—Additions, Victoria Hotel, Latimer Road; A. Ford, architect.
EDINBURGH.—Extensions at dancing academy, 22 and 24, Albany Street; G. Dickson.
FALKIRK.—Extensions at foundry (£1,400), for Messrs. R. and A. Main, Gothic Iron Works, Camelon; the manager. Reconstruction scheme for Falkirk and Counties Savings Bank (£9,100); J. G. Callander, architect, Royal Bank Buildings.
GILDERSOME.—Rag and mungo warehouse, for W. Morris, Springfield Mills; W. Wilby, Council House.
GRANGEMOUTH.—Reconstruction of buildings for Macpherson & McLaren, timber merchants; Wilson & Tait, architects.
GREENOCK.—Super-kinema, with café and dance hall, for Greenock Picture Palace Company; the secretary.
GRINDLEFORD (Sheffield).—Public hall (£6,000); Major Ross-Innes, President, Public Hall Committee.
GLASGOW.—Clinic, Kennedy Street; medical officer of health.
HAMPTON WICK.—Parish hall (£5,073), for St. John's parish; A. J. Hardwick, architect, Eagle Chambers, Kingston-on-Thames; Bernard & Picket, builders, Wallington.
HUNSLET.—Shed, Stourton Works, for Bramley Engineering Co., Ltd.; J. A. Webster, architect, 12, Hanley View, Bramley.
IRISH FREE STATE.—(Clonakilty, Co. Cork).—Reconstruction of wing at the County Home for the W. Cork County Board of Health; J. J. Crowley, architect.
(Skibbereen, Co. Cork).—Hospital for the West Cork County Board of Health; J. J. Crowley, architect, Clonakilty.
(Cork).—Farm buildings, dairy, and dairy institute, University College; H. H. Hill, 22, George's Street, architect.
(Limerick).—Dock extension (£150,000), for the Harbour Board.
KINROSS.—Additions to Green Hotel (electric lighting and central heating); Sir Basil Montgomery, director, Green Hotel, Kinross, Co., Ltd.
LONDON (Hackney, E.).—Rehousing scheme, Wells Street; L.C.C. architect.
(Stepney, E.).—89 tenements and 10 shops, Vallance Road; borough engineer.
(Hornsey, N.).—Elementary School, Coldfall site; Education Committee.
(Stoke Newington, N.)—Workshop extensions, 166-168, High Street; Eley & Allen.
(Wood Green, N.W.).—Elementary School, Albert Road; Education Committee.
(Battersea, S.W.).—Seventh block of tenements, Plough Road; borough engineer.
(Brentford, W.).—Houses on Gunnersbury Park Estate; Douglas Smith & Barley. 10 shops, Lionel Road; E. Haydon. Sports pavilion, Metropolitan Railway Works, Acton Town; W. Downs, Ltd. Factory, Great West Road. Industrial Constructions, Ltd.
LYTHAM ST. ANNES.—80 houses on three estates; borough engineer.
MAIDSTONE.—Schools (£29,000), Loose, for the borough E.C.; T. F. Bunting, borough surveyor.
MALVERN.—Additional housing scheme (34), for the U.D.C.; W. O. Thorp, surveyor.
NEWCASTLE.—Shopping centre, Walker housing estate; city engineer.
NEWTON-IN-MAKERFIELD.—Housing scheme (154), South Mesnes; J. Elson, architect, Market Chambers, Earlestown.
NORTHOP HALL (Flintshire).—Institute, for the Miners' Welfare Committee; F. A. Roberts, architect, Earl Chambers, Mold.
OLD FLETTON (Peterborough).—Housing scheme (120), for the U.D.C.; H. W. Hawkins, architect.
PAIGNTON.—Hospital accommodation; U.D.C. surveyor.
PENKRIDGE (Staffs).—Wesleyan Church, Wolverhampton Road; F. Jones, Otherby Cottage.
PENRITH.—Improvements, Market Hall; U.D.C. surveyor.
PITSTONE (near Aylesbury).—Cement works, Associated Engineering & Finance, Ltd., London, promoters.
RISHWORTH.—Church of St. John the Divine; Walsh and Maddock, architects, Halifax.
ROCHDALE.—Offices and showrooms, Samuel Street, for Electricity Department (£20,000); borough engineer.
ROTHERHAM.—Sewage works, for R.D.C.; C. O. Rawstron, engineer and surveyor, Grove Road, Moorgate.
RYDE (I. of W.).—Pavilion, Eastern Esplanade; borough engineer.
ST. HELENS.—600 houses, various estates; borough engineer.
SHIPLEY.—Extensions, wool warehouse, Otley Road; Wicksteed & Andrea.
SHREWSBURY.—Museum alterations; Curator.
SKEGNESS.—Secondary Schools, for Lindsey E.C.; director of education, Lincoln.
SOUTH AFRICA (Cape Town).—Schemes to cost £500,000 for various improvements; city engineer.
SOUTHEND-ON-SEA.—School (800 places), for the borough E.C.; A. B. Kelly, director of education. Sanatorium extensions, for the T.C.; borough surveyor.
STIRLINGSHIRE.—Hall at Fallin for West Stirlingshire Unionist Association; the secretary, Stirling.
STOKE-ON-TRENT (Hanley).—Temporary art gallery, School of Art; city engineer. 196 houses, Stoke Lodge Estate; Sutton Trustees. Office accommodation, engineers' department; city engineer.
SWANSEA.—Shops and offices, Union Street and Orange Street; W. C. Phillips-Powell, Cardiff.
THORNTON HEATH.—179 houses, Dixon Road, and other streets; W. H. Aston, Dixon Road.
TORQUAY.—Alterations, Princess Hall, Princess Street; Trustees.
WALSALL.—Additional 536 houses, for the T.C.; borough surveyor.
WALTON-ON-THAMES.—Houses (78), for the U.D.C.; David Weston & Co., Ltd., builders, Blackfriars House, New Bridge Street, London.
WELLINGBOROUGH.—Infirmary and extensions to nurses' block, for the B.G.; Talbot, Brown & Misher, architects, Burystead Place.
WHITEFIELD.—Housing scheme (38), Nipper Lane; C. F. Porter, clerk to U.D.C.
WITTERSHAM (Kent).—Residence, for Mr. Jowett, K.C.
WOLVERHAMPTON.—Infant welfare clinic, Lea Road, for the T.C.; town clerk. Block of business premises, Victoria Street, for Horton's Estates, Ltd.
WORSBOROUGH.—Housing scheme (36), Ward Green, for the U.D.C.; T. Shield, surveyor.

The
Electrical Review

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Contents:

	PAGE
Canada and Chicago	545
Electricity in Agriculture	546
Anglo-Australian Wireless Telegraphy	546
Electrical Development at Ilford (*illus.*)	547
Electro-Farming, by R. Borlase Matthews (*illus.*)	549
Some Reminiscences	551
Bigger British Trade in Canada	552
I.—Handicaps to British Business	552
II.—The Influence of the Chicago Underwriters	553
Business and Industrial Notes	555
Lighting and Power Notes	560
Tramway and Railway Notes	562
Telegraph and Telephone Notes	562
Radio Notes	563
Contract Information	563
Forthcoming Events	564
Notes	565
Institution Notes	566
Our Personal Column	566
Financial Section—	
New Companies Registered	567
Official Returns of Electrical Companies	568
Financial Section—*continued.*	
City Notes	568
Stocks and Shares	571
Russian Electrical Notes	573
Indian Electrical Notes	573
A "Press" Radio Receiver (*illus.*)	574
Electricity in Warships, by W. McClelland (*illus.*)	575
Selected Radio-Telephone Apparatus (*illus.*)	577
Parliamentary News	578
The E.D.A.-E.L.M.A. Campaign	579
The Metro-Vick Carnival (*illus.*)	579
The National Physical Laboratory	580
A Large Electric-Sign Controller (*illus.*)	581
Legal	582
Correspondence—	
The Salaries of Engineers	582
Electrical Engineers in the Navy	582
The Irish Free State Electricity Supply Bill	582
Faults in Flexibles	583
Published Specifications	583
Trade-Mark Applications	583
New Work for Contractors	584

Canada and Chicago.

THERE are men connected with the British electrical industry who have devoted so many years' thought to the subject of our electrical export trade with Canada that it has become one of their life problems.

Interest in the situation has occurred in waves during the past twenty years and more. It is only typical of the dogged persistence and perseverance of our race that every year or two new men have come forward filled with determination to surmount the peculiar difficulties and to find ways for securing to British electrical products their due recognition and adoption. The vastness of Canada, the immensity of the scope offered to our people through the great national resources of a new world, and the ever-increasing need for population-relief for the Motherland—all these and many other considerations have surrounded the Dominion with an atmosphere of romance and that spirit has naturally had associated with it a home desire to do better business with our kith and kin there, finding increasing employment for our people.

More electrical men have visited Canada to investigate British electrical trade possibilities than have gone to any other electrical market—that is, judging by the number of them who have discussed their experiences with us—yet the actual progress made during a lengthy period has amounted to so little. Also, more electrical men from Canada have conversed with us here on the chances of securing British trade agencies there than have come from any other market, though visitors from Australia have run them pretty close. Many have been the efforts made by private individuals, by co-operating companies, and by associations, to promote new trade, but the actual advance made has been far from commensurate with the effort taken.

Only the newest entrants to the industry need to ask: "Why is it?" Sometimes it is said that our manufacturers have been lacking in enterprise—have neglected the market; this we know is not so in a number of cases. We have too close a knowledge of their endeavours to credit that statement to-day. It is true that the effort in certain instances has been

only half-hearted, but this has been due to the impression, not without justification, that there were handicaps in the Canadian market which existed in no other part of the world save the United States. Therefore, when there were many more promising fields open to them, our firms used their enterprise where it was more likely to bring a reward. Why bang your head against a stone wall in Canada when other countries give easier access? But the acceptance of that state of things as inevitable does not last long with British manufacturers, and it is gratifying to be able to congratulate those who decline to sit down despairingly and do nothing. Grievances have continued too long already, and they will only be removed by persistence and publicity. All honour to those who take the initiative in bringing about a change!

We venture the view that whatever other handicaps there may or may not have been, the one that has been directly and *indirectly* the most serious deterrent to British progress has been the influence of the Chicago Board of Underwriters through its Electrical Rules and Regulations. The attitude is not free from what looks very much like definite obstruction, for certainly from what we hear, irritating difficulties are placed in the way of those seeking approval for British manufactures which are superior to much other product that is permitted or approved. However real this Underwriters' difficulty has been in actual fact—and its seriousness has varied in degree with different products—there has always been a Chicago smoke pall over Canada which has had a restraining influence upon our trading concerns.

With the Electrical Review and its readers and contributors the whole subject is one of long standing. We have supported all efforts that have been made to bring relief to British firms. Fourteen years ago, as the result of operations in connection with which we and our representatives took no small part, we published a report by Mr. C. Hamilton Wickes, then H.M. Trade Commissioner in Canada, in which the effect of the Underwriters' Code upon British trade was dealt with in great detail. Since that date (Elec. Rev., January, 1913) many things have happened, but British traders' wrists are still shackled by Chicago. No British or Canadian trader can feel that we are being fairly dealt with until this restraint is either removed or substantially modified.

We publish two articles to-day in which this and other aspects of the Canadian situation are reviewed, and we hope that the attention that is now being given to the subject will bring about the desired result—reasonable approval of British electrical material and manufactures on the basis of quality, safety, and other merits, taking the place of rejection through prejudice or irritating objections in matters of unimportant detail.

Electricity in Agriculture.

We all know the reputation of "hope deferred," and some of our readers who have followed, perhaps with waning interest, our quarter-of-a-century's advocacy of the application of electricity to farming, may have little faith in the future of that branch of electrical activity. But the omens are favourable, and there are good reasons for believing that the subject will come into prominence in the not-distant future. That the leaders of political parties are interested in the extension of electricity supply to the rural areas is, of course, well known, but we do not attach much importance to that fact; the matter is now in the hands of the Central Electricity Board and will be dealt with as and when conditions permit of it—not much is to be expected from that quarter for some years to come.

But in other ways real progress is being made, which should make itself felt quite independently of State action. The chief obstacles to the application of electricity to farming have been the relatively high cost of the supply mains and the low value of the small and intermittent demand for electricity in farming operations, two factors which entail a high price for energy and thus restrict consumption. So long as the lighting of the farmhouse and the occasional driving of a few small motors constitute the farm load, the business cannot prosper. The remedy is to be found in the heavier applications of electric power, namely, to ploughing, harvesting, &c. Elsewhere in this issue Mr. R. Borlase Matthews gives an account of a remarkable development, on sound commercial lines, of the artificial drying of crops, with the aid of power-driven machinery, which will greatly increase the duration as well as the magnitude of the farming demand. We have reason to believe, too, that the system of electric ploughing devised by Major A. McDowall, which has been described in our columns, has aroused practical interest in influential quarters and is being closely investigated; this system permits of the electric tractor being used for harrowing and other cultural processes involving haulage on the land—an important feature, because it is of little use to replace horses for ploughing if they must still be retained for other operations. Again, the extremely interesting and instructive lectures delivered at various centres in Great Britain and Ireland last year by Dr. A. Ekström made it clear that a supply of electricity immensely facilitated agricultural operations, and that in Sweden this agency was eagerly availed of by the farmers. Another favourable indication is the strong movement towards the use of electric cooking and heating apparatus, which, stimulated by the coal shortage, and fostered by the E.D.A.-E.L.M.A. campaign, is continually gaining strength and will inevitably be felt in rural areas.

Hence the tendency is towards removing the obstacle of small and fitful demand, and obviously, amendment in this respect diminishes the importance of the cost of overhead lines—here, as elsewhere, improvement in load factor is an infallible remedy for high capital charges. If now the Electricity Commissioners would take measures to facilitate the erection of cheap overhead lines in rural areas, a further important advantage would be gained. The development of the rural load was largely relied upon by the Government advocates of the Electricity Bill as a means of improving the general load factor, and they were reminded of it in the House of Commons twice last week.

Hackneyed though the subject may be, we must insist upon its importance; every endeavour should be made to educate public opinion and to pave the way to development in this direction.

Anglo-Australian Wireless Telegraphy.

To-day, we learn, the wireless "beam" service between the Home country and Australia will be opened for public traffic. This is the first wireless channel for regular communication between the two countries on a commercial basis to be brought into existence; it is the longest direct telegraph service in the world. It has a duplex capacity of no less than 100,000,000 words per annum, and is available by day and night.

Do we fully realise the meaning of this stupendous achievement? Even five years ago the feat was utterly impossible—a mere dream of the future, if foreseen at all. We British are only too ready to find fault with ourselves, but slow to take credit for our triumphs. Let us try to view this event in its true light: it is, as we have said, a stupendous achievement, worthy to rank with any of the marvels of science with which the past half-century is adorned. It is the work of two associated concerns—Marconi's Wireless Telegraph Co., Ltd., and Amalgamated Wireless (Australasia), Ltd.—and has been developed under the personal guidance and supervision of Senatore G. Marconi, with the benevolent support of the British and Australian Governments. To all these, but especially to Mr. Marconi himself, we offer our heartiest congratulations.

Electrical Development at Ilford.

The conversion of the 1,000-kW manually-operated rotary sub-station at Goodmayes to automatic working, utilising the existing machines and introducing some new and interesting features in automatic installation work.

An official inspection of the electricity works and sub-stations of the Ilford electricity supply undertaking on Saturday last marked the completion of an interesting job at Goodmayes, and an important stage in both the development of electricity supply at Ilford and the installation of automatic sub-station equipment generally.

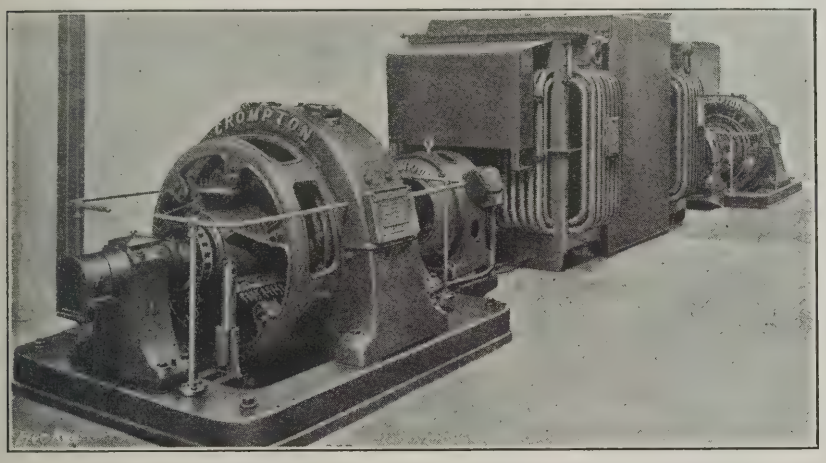


Fig. 1.—Rotaries and Transformers.

The Goodmayes rotary-convertor sub-station, which was up to a few months ago manually operated (Electrical Review, April 30th, 1926, p. 688), has now been converted for either full-automatic or remote-control working. The existing plant of the "sub" has been utilised practically in full for the new scheme, the only alterations being the provision of thermostats and other minor apparatus on the machines and transformers, to give the more complete protection necessary, the replacement of the main h.p. and l.p. circuit breakers, and, of course, the addition of the actual apparatus for automatic control.

The scheme is of increased interest in that it is believed to be the first of its kind where the machines can be guaranteed definitely to run up with the correct polarity for synchronising. Each convertor is run up to nearly full speed by a pony motor, when synchronising current is supplied by means of a special transformer. This current is within the limits necessary to avoid any reaction on the phase sequence built up in the machine itself, under the influence of the driving motor, but is sufficient to bring the machine definitely into step

The sub-station works in conjunction with two ring-main systems and is fed at 6,600 V, 3-phase, supplying at 500 V d.c. to the local networks.

Two standard 6-phase, 500-kW Crompton rotary convertors, directly coupled to pony motors for starting, are installed, and receive the incoming supply at 355 V from two 3- to 6-phase British Electric transformers. These are equipped with coil tappings for 2½ to 5 per cent., above or below, voltage regulation. Fig. 1 shows the rotaries and the transformers. The h.p. switchgear, fig. 2 left, is of the cubicle truck type, duplicate busbars with the necessary change-over switches being provided. The equipment includes two incoming, two transformer, and one p.l. panels, a.c. being used for street lighting in the district. As already indicated, the old transformer switches have been replaced by others suitable for automatic working; these are interlocked with the trucks, but the interlocking is so arranged that it is closed by the switch but can only be opened manually. The h.p. and l.p. breakers, a.c. and d.c., are so interconnected, through lock-out relays, that in the event of a fault on either the a.c. or d.c. system the breaker on the other side is thrown out. A separate flat-type switchboard, fig. 3 and fig. 2 centre, accommodates the automatic equipment.

With a definite drop of voltage across the d.c. bars, a governor relay is energised and closes an a.c. low-voltage contactor which, if the a.c. pressure is up to normal, closes a governor contactor, thereby completing the operating circuit to a timing motor. This, with the rest of the sequence control apparatus for

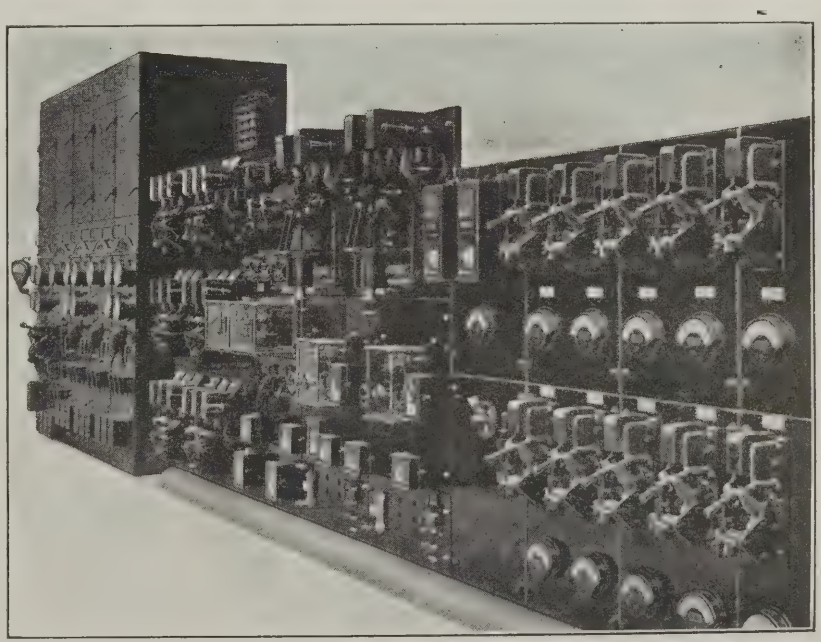


Fig. 2.—Complete Sub-station Switchgear.

each machine, is housed in a glass case, the whole being of a very substantial design. The timing motor, through a suitable train of gearing, drives a common shaft to which are fitted a number of contacts and a

system of magnetic clutches for operating, in the correct sequence, the various circuit-breaker relays. A hold-on coil is also fitted, and is closed simultaneously with the first clutch. This is energised as long as the machine is running, but as soon as the latter is stopped it is de-energised and allows the timing mechanism to return to the "off" position. After a definite time delay of 10 seconds, the first contact switch is closed, providing an alternative path for the operating current, the main governor relay remaining closed, whether the d.c. busbar voltage is normal or not. After a further delay of 5 seconds, the second timing

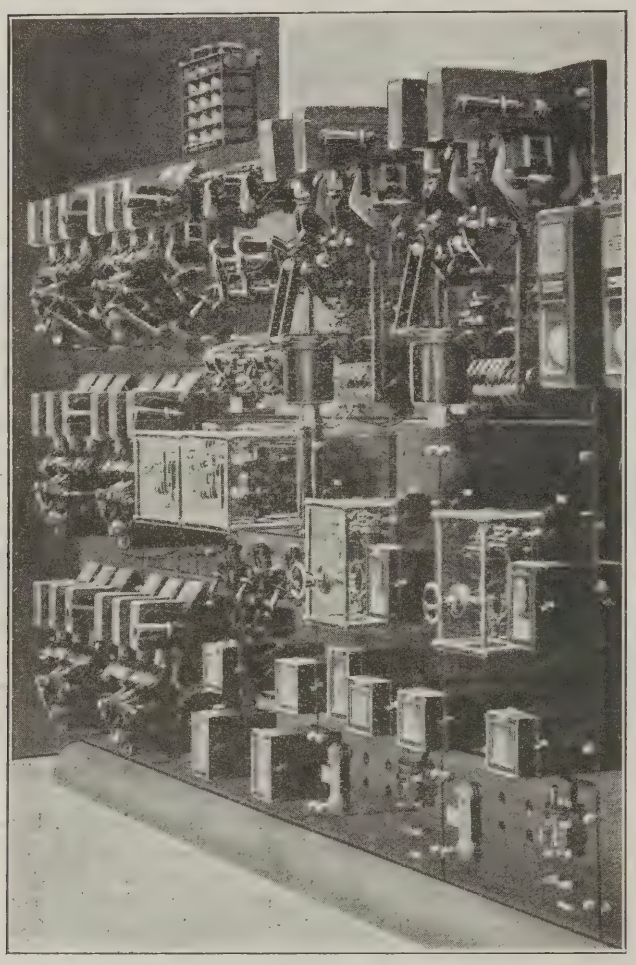


Fig. 3.—Automatic Switchgear.

switch closes and completes the supply to the main operating solenoid of the a.c. oil switch which connects the main transformer to the a.c. system.

With the oil switch closed, a contact switch completes the operating circuit for the coil of the first starting contactor: this is thrown in and the pony motor is connected to the supply, starts, and runs the rotary up to nearly synchronous speed. After a further time delay of 40 sec. another switch of the timing mechanism closes and operates the main synchronising contactor. This connects the rotary convertor to the special synchronising transformer, fig. 3 top left. Another lapse of five seconds, and the last timing switch closes the running contactor, connecting the synchronised rotary to the a.c. system, and at the same time opening the pony-motor and synchronising contactors.

The machine is now self-excited, and running at the correct speed, the supply being carried through polarised and correct-voltage relays. As the latter closes at the correct pressure, the main solenoid of the d.c. breaker is excited, connecting the convertor to the d.c. busbars. This operation connects the supply through the governor relay, which, with the increased pressure, opens and disconnects the timing motor and mechanism. Each machine is started up in a similar manner, duplicate equipment being provided for each, except that the timing mechanism of the second or any subsequent rotary is brought into operation by means of a d.c. loading relay, set, of course, at a predetermined load value. Underload relays provide for the shutting down of the machines. Each of these, on a predetermined loading, connects the timing mechanism in the reverse direction, and the machine is shut down after a time-delay of 15 minutes. To ensure against a polarity reversal on the d.c. side, a suitable relay, interconnected with the lock-out relay, is installed for each machine. Overload, reverse-current and no-volt relays are installed in addition to the other protective devices which have been mentioned. Provision is also made for the machine to shut down should the d.c. breaker fail to close within 5 min. of the completion of the previous sequence operations. A system of sequence switches enables the machines to start up automatically in any order.

For the remote control of the sub-station, a small pilot control board, fig. 4, is housed in the main generating station and enables the operator to stop or start at will either of the rotaries, and also to see at a glance which, if any, of the machines is running. The pilot board is equipped with two indicators and two two-way switches, one of each for each machine. Each indicator is connected to the d.c. bars at the generating station and by means of a pilot wire to the neutral at the sub-station end. A differential relay is employed in conjunction with the remote control apparatus, and operates the timing mechanism to start or stop the rotary according to the position of the control switch. By the insertion of additional resistance in the indicator circuit when the rotary is stopped, different scale deflections are obtained for "run" and "stop," and the scale is marked accordingly.

Arrangements are made for the hand control of the whole of the equipment in the case of emergency.

A particularly interesting feature of the equipment is the automatic voltage regulation. A shunt field regulator is provided with a pressure relay which has its main coil connected directly across the d.c. terminals of the machine. A central contact arm will, according to its position, make contact with either of two terminals of two operating coils equipped with plungers. The plungers are coupled by suitable driving mechanism to a common disk. According to the

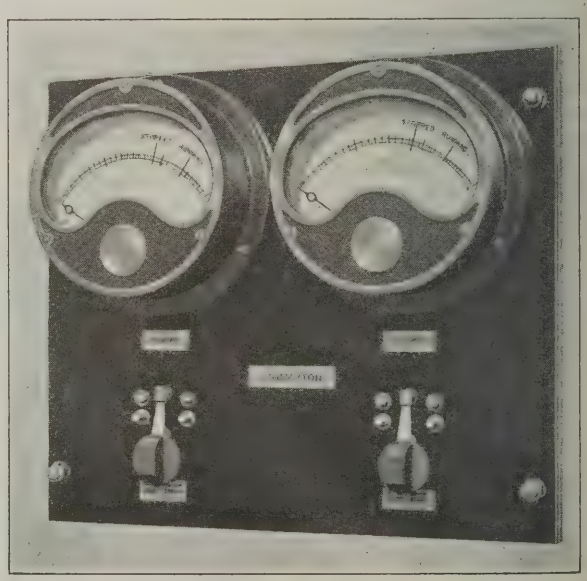


Fig. 4.—Remote Control Board.

direction of travel of the disk, the regulator will be operated to increase or decrease the pressure. It is claimed that the apparatus will result in a pressure accuracy of within 2 per cent. either way.

The load balancing is effected by means of a relay governor controlled by the busbar pressure.

The whole of the work on the change-over scheme has been carried out by Messrs. Crompton & Co., Ltd., under the direction of Mr. A. H. Shaw, M.I.E.E., borough electrical engineer, and most of the automatic equipment was supplied by Messrs. Whipp & Bourne, Ltd.

Electro Farming.

A new continuous crop-drying process, which offers the prospect of an attractive load for the central station and prosperity for the farm.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ac.S.

NOT only is the problem of haymaking by artificial methods receiving renewed attention in this country, but American engineers are also seriously studying the proposition. Mr. Arthur J. Mason, who was one of the leading American engineers in developing mechanical methods in the steel industry, has been studying and experimenting on the hay-drying problem for the past fourteen years, and has spent over £20,000 in developing a mechanical system for handling and drying crops on his own farm at Flossmor, near Chicago, Illinois. During last season, the first commercial plant was installed on the Walker-Gordon Dairy Farms at Plainsboro', New Jersey, on which there are 3,000 head of cattle, consuming a great deal of fodder.

It might be of interest to explain how Mr. Mason approached the problem. In the first place he was struck by the lack of continuity of operation in agricultural work; for instance, haymaking takes on an average only a few days a year, and all the haymaking machinery lies idle for the rest of the time; and secondly, he was impressed by the fact that artificial drying had displaced natural drying in practically every industry except agriculture. Though this may not occasion any surprise to the engineer, it is most certainly a very strange gospel to the average farmer. It was only a short time ago that the author, when delivering a lecture on his method of artificially curing hay, was taken to task by a practical farmer because the new system he advocated involved the spending of money in doing something that Nature would do for nothing. Of course this is not the view taken by all farmers, but it is general enough to make it necessary to warn engineers of the fact and so make them realise the importance of demonstrating to the farmer that what has been done for other industries can be done for agriculture. The farmer must also be taught that the secret of low costs in the making of bricks, cement, salt and similar products lies in the fact that they can be made on any day in any season and that it is not necessary to wait for the sun to appear before the moisture can be extracted. Important as this change was in these industries, it is far more important in agriculture. Under the old system, say with bricks, those that could not be made one day could always be made at a more favourable time, and every stoppage owing to weather conditions only postponed the operation (and incidentally delayed and restricted deliveries and reduced profits). In the case, however, of farming, apart from the losses cited, if the crop is not cut at the correct time, a great deal of its value is lost, and if the weather is unfavourable, the crop is often ruined.

Not only is an artificial method necessary to improve present practice, but a change of method would open up tremendous possibilities; for instance, there are crops such as lucerne, which grows in abundance in damp climates, yet the very conditions which are favourable to its growth are dead against its successful harvesting; this is, no doubt, why so little lucerne is grown in this country. It is one of the most profitable of crops; a good acre of it will support three times as many cattle as an acre of any other crop. It also binds the land together and enriches it by a process of fixing nitrogen by nodules on the roots. It is claimed by Mr. Mason that at least two, and sometimes three, crops could be grown in one season. Of course, these could not be harvested in the ordinary way, but if mechanical methods were introduced which could cut, carry off and dry the crop in a short time, this would be possible. In fact, Mr. Mason has already done it. He is now farming 600 acres in Illinois, and the crops are on their way to market within a few hours of the time they were growing in the fields.

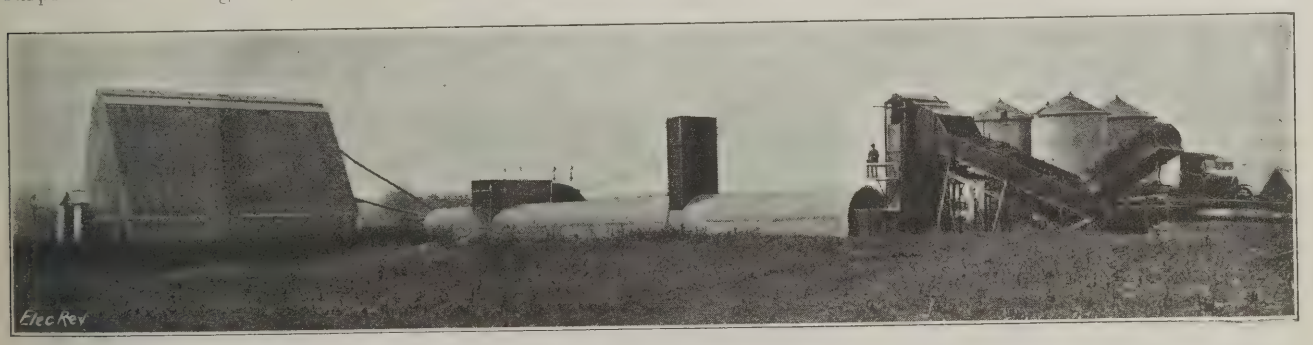


Fig. 1.—The Mason Continuous Hay-drying Plant.

A modified harvesting machine which is drawn by a tractor cuts the crop, chops it into lengths not exceeding 9 in. and delivers it automatically, by means of a special elevator which forms a part of the machine, into a lorry with a capacious steel tipping body about 8 ft. wide, which is driven alongside the harvester. When the lorry is full, another takes its place alongside the harvester, while the loaded one goes off to the drying plant. As an area of 600 acres is a large piece of land, it will mean a haul of 2 to 3 miles, on the average, hence one harvesting machine will probably keep three lorries fully occupied. The crop is tipped from each lorry on to an elevator (fig. 1, right) which is operated by a 10-h.p. electric motor; this carries the crop up to a height of about 20 feet. From here it passes through some spiked rollers or beaters, where it is combed and prepared into an endless mattress of uniform texture, 8 ft. wide and about 10 in. thick. This mattress, which fits closely to the side of the container, is then delivered by a chute on to a horizontal conveyor band, 160 feet in length, which is driven at a speed of about five ft. per min. by a 10-h.p. motor. This conveyor, with the exception of ten feet at each end, is enclosed in a drying tunnel about 8 feet high, made of corrugated, curved,

galvanised sheets (fig. 1, centre). The rectangular vertical structure in the centre is the discharge stack for the used air and gases. The hot-air fan is positioned at the far end of the tunnel (fig. 2, left centre). A floating door which rests on the crop is placed at each end of the tunnel (fig. 3), and another is placed at 60 feet from the finishing end door, so as to cut off the inlet heated air from the escape stack. Heated air at a temperature of about 250 to 275 deg. F. (or for non-leguminous crops, up to 400 deg. F.) is blown in at the finishing end, over the top of the crop. An 80,000-cu. ft. fan, driven by a 30-h.p. motor, is employed for this work. The air is heated directly by an anthracite coal fire. As this coal is free from smoke, sulphur and deleterious fumes, there is no objection to this method. With other fuels, such as ordinary coal, coke, or oil, only indirect heating can be employed, which, of course, is less efficient. About two pounds of dried crop are obtained per pound of anthracite coal consumed, or 20 tons of crop for 8½ tons of coal per day of ten hours. By the time the air gets to the inlet end of the conveyor, its temperature has fallen to about 130 deg. F.



Fig. 2.—The Mason Hay-drying plant, seen from the other side.

The air, which enters at the finishing end over the top of the crop, passes down through the latter, then along underneath it and past the central floating door; it then rises through the crop at the entering end and in a saturated state escapes through the vertical stack. On leaving the tunnel the dried crop is fed by a cross conveyor into a chaffing machine. After this it may either be bagged or baled (with a 15-h.p. motor) as it is, or alternatively, if the crop is lucerne, it can be reduced to a powder in a disintegrating machine. The latter requires a 40-h.p. motor to drive it, including the operation of a fan to blow the finished product through a delivery pipe. In the case of the Plainsboro' plant there are two such pipes; one leads to a barn, equipped with storage bins with a capacity of 200 tons, and the other to a cyclone double sack-filler. These pipes are made of light galvanised sheet-steel tubes and are ingeniously suspended on a steel rope, fig. 3. In this way, it is claimed, a crop growing in the field may be converted into hay and baled ready for transporting in forty minutes, the whole operation being carried out without handling by a single individual.



Fig. 3.—Delivery end, showing the chaffing machine on the right.

The plant will cure 20 tons of hay and bale it in 10 hours (two tons per hour), and the labour required is one man for mowing, three men and lorries for hauling, and four men at the plant. The amount of coal used in the heaters is about 8½ tons per day. By the process, seven men working on 600 acres for 165 days of the year can deal with over £12,000 worth of products.

The cost of the plant, including all machinery, tractors, electric motors and storage plant would seem very high to the ordinary farmer, as it is about £4,500. However, it must be borne in mind that it deals with the crop from 600 acres of land. The annual cost of operating is about £4,200; this includes fuel, allowance for rent of ground taken up by the plant, and the wages of each workman at £4 per week. Hence a product worth £12,000 is created by an installation costing £4,500. The possibilities of improving the farm load with such plants may be gauged by the fact that it is necessary to use 90-h.p. for ten hours per day for about six months of the year when working on lucerne alone. In the Chicago district a month's work can be found before May 15th on winter rye, and after October 15th a month's work on peas. Thus it is not difficult to visualise what such a load would mean in rural areas. No longer would central-station engineers see such difficulties in the way of providing distribution lines for the farmer. The makers are prepared to erect the plant at their own cost on the basis of a royalty on the output. They will also provide plants for groups of farmers who are prepared to contract to supply the necessary tonnage of green stuff.

The author has seen excellent samples of the product of this plant and has sampled the powdered form of lucerne which has been suggested as suitable for human consumption; when cooked it looks like spinach. Of course this material has been successfully used for a long while for chick-feeding at times of the year when it is impracticable to obtain green vegetables or other stuffs rich in vitamines. The author is also assured by Mr. Mason that the hay has passed the highest court of reference: the cattle never hesitate between the so-called natural and the artificial, and always ignore the former if the latter is available.

Mr. Mason is confident that the adoption of similar

methods in England would result in a revolution of the agricultural industry; he states that our moist climate, which is now a liability, can be turned into a great national asset; we should devote our land to forage crops, cut them at the milk stage and then artificially dry them. This would result in the grain crop yielding three times as much animal food as it does now, at least two crops per year, and the culture of lucerne becoming possible, giving 6,000 lb. per acre per year of dry material containing at least 18 to 20 per cent. of protein, as against 14 per cent. (or less if exposed to rain) of sun-made lucerne.

The arguments that are employed in favour of other methods of artificial crop drying apply also to this method. The process can, of course, be carried on during wet weather, as long as the lorries can be run on the land. If chain-track vehicles are employed, there need never be any stoppage for weather conditions.

Here, then, is a new aid to agriculture: a process that enables the farm to operate more along the lines of the factory—and that seems to be the only salvation for the agricultural industry. It is certainly a matter of very great importance to this country and can easily be worked along somewhat similar lines to those adopted for sugar-beet factories. The capital required is infinitesimal when compared with that necessary for such factories; but the farmer has to be convinced, publicity is needed, and confidence has to be instilled. However, the engineer can render considerable assistance in this direction, so let us get on with the good work.

Some Reminiscences.

By a Quondam Apprentice.

TEMPERAMENTALLY thoughtful, and inured to grappling with ever new technical problems, the electrical engineer is apt to consider life a serious business; apart from an occasional smile at the mirth-provoking troubles of the ubiquitous salesman, and his funny stories, he finds little to laugh at. Nevertheless, to most of us, a retrospective glance of memory at the days of our probation reveals a picture of the lighthearted and irresponsible game of electrical engineering as it used to be played in those days.

My own vivid impressions of experiences gained in a small manufacturing shop, manned by equal numbers of workmen and apprentices, fill me now with wonder and amazement—wonder at the tremendous change that has taken place in designs and methods since then, and amazement that with such a state of things a works could ever have been made to pay. Never, surely, was so diverse and withal so irresponsible a company of boys gathered together in one small shop. Nicknames there were for every one, and the workmen were not exempt. One, the young father of a rapidly-growing family, Arthur —— by name, became known as "Arthur-any-more?"; whilst the pattern-maker was rather unkindly given the sobriquet of "Warpy"—a sly reference to the conveniently unseasoned quality of the wood used for his patterns.

"Mack," the shop foreman (of Scottish extraction), whose real name I—and most of the others, I fancy—have forgotten, was at times not immune from the prevailing spirit of folly. Once, requiring some buckets, he sent a boy for them. The lad returned with three.

"What have ye brought them old things again for?" he demanded. "They're leaky: I told the governor I wanted new ones weeks ago."

Taking the buckets from the boy, he upturned all three. "There, now, that's one; that's two; and that's three" (driving the point of a chisel through each in turn). "The governor'll nae doot be able to see the holes the noo."

Even the classes at the technical college were by some regarded as an entertainment—as when the only note made by one of the students was to the effect that Mr. Brown, the lecturer, had "wished everyone a happy new year." The said Mr. Brown, being a practical man, delighted in reliability, and would sometimes hyperbolically describe an armature of which he approved, as one that "might be struck with a sledge hammer without injury." This so impressed our apprentices that one day "Brown's test," as it was called, was wantonly applied to a small armature at the works! The fact that it failed to pass the test was, however, not reported.

The proprietor of the works was, on the whole, an easy-going man, though equipped with an amazing vocabulary which he reserved for special occasions. When in the works he invariably wore a favourite dilapidated straw hat. Always on entering the office he would change his hat or cap for that badge of authority—the ancient straw. There was a legend current to the effect that he had started the works with the assistance of a legacy which was conditional upon his wearing his benefactor's old hat at least once daily.

It was easier then than it is now for employers to impose fines for infringement of rules. One of his rules, that outworkers should make good half the cost of any tools inadvertently lost or left behind on outside contracts, had the curious, though not altogether inexplicable, effect of actually augmenting the shop's small tool equipment.

His right-hand man, and almost constant attendant, was the draughtsman, a quiet-looking individual with tired eyes. When the firm's prosperity had begun to wane, and our employer was becoming morose and irascible, he was giving the draughtsman instructions regarding a dynamo for which he had just obtained the order; and he explained that certain old parts which were in stock were to be used. "We must make a profit on this machine," he said. "Use all the odd parts you can find—build up the machine from the scrap heap, if possible."

"I never know what you call the scrap heap," said the draughtsman, meekly.

"Why, the whole b——y shop, of course," the boss replied. (I regret the adjective, but truth compels.)

At that time it had become the custom on a winter's morning for the workmen and apprentices to gather in a group around the smithy fire in the early morning to discuss the prospects of the local football team, political questions, and that perpetual, favourite, vital subject, the mistakes and failings of the boss. These proceedings usually terminated abruptly owing to the unwelcome arrival of the subject of discussion, whose approach was heralded by his dog, which always preceded him. When the dog died, an effective warning signal was arranged by opening wide the throttle of the electric lighting engine and overrunning the lamps by several volts. This invariably induced the chief, immediately on his arrival, to go first to the engine room and lower the lights.

Through it all, though, some of us did manage to get an initiation into electrical engineering; and perhaps the close contact with practical work, and the rubbing of shoulders with workmen, had their advantages, for which the modern system of engineering training offers no exact equivalent.

That old works was closed down long ago, and ultimately demolished. The picture house since erected on its site is no doubt a more profitable venture—at any rate, for its promoters—than any merely utilitarian concern, such as an electrical engineering works, could ever be. The apprentices who served their time there are now widely dispersed, some to positions of responsibility, some into other trades, and some in no position at all. Yet to all of them the remembrance of their early training must at times bring some amusement, tempered perhaps with a feeling of regret for their follies. Those halcyon days!

Bigger British Trade in Canada.

Some reasons why we are not doing it.

COMPLAINTS are frequently made by British manufacturers that the Canadian market is unsympathetic to British-made equipment, and that American influence dominates Canadian buying. We publish below two important articles dealing with the situation and we commend the observations of our contributors to the serious attention of British manufacturers and exporters.

The writer of the first article—an English engineer who has been resident in Canada for 10 years applying British engineering equipment to Canadian conditions—holds that basic misunderstandings of the Canadian outlook and requirements exist in the minds of many British manufacturers and that these misunderstandings and not any underwriters' regulations or prejudice for American manufactures are principally responsible for more British equipment not being used.

The author of the second article is a Canadian correspondent who has had lengthy practical electrical engineering experience both in this country and in Canada. He holds that great as is the influence of the Underwriters' Laboratories in handicapping the British manufacturer, it is not responsible for the whole, or even the greater part of America's electrical success in Canada. Yet British articles of workmanship superior to American and at least as safe are not being approved, and European products are in consequence not available. He shows that Canadian electrical men object, as do British manufacturers, to electrical goods for sale in Canada having "to be approved in a foreign country," and he refers to the steps that have been taken to formulate a Canadian Electrical Code as a step towards emancipation.

I.—Handicaps to British Business.

(Communicated.)

It is a common occurrence to read and hear complaints made by members of British manufacturing companies visiting Canada, who undertake to enter the Canadian market either by establishing branch assembling or manufacturing plants in Canada or by establishing representatives to solicit business on their behalf. The nature of the complaints is almost always the same, and is to the effect that Canadian policy and practice are completely under the influence of the United States, or the American underwriters—that British equipment is not wanted and that Canadians put forward requirements which are frequently designed to exclude British companies from supplying it—that the requirements are unnecessary and unreasonable—that standard British equipment will actually meet the case, &c.

In the vast majority of cases, these complaints are not justified, and a more careful study and investigation, undertaken with the definite object of securing a real understanding of the Canadian point of view, would show that the British company is probably at fault.

The statement that American example dominates Canadian practice will first be dealt with. It is admitted that there is a great similarity between the general electrical engineering policies and conventions of the two countries, but this is to be expected on economic grounds alone on account of the exact similarity between problems to be solved in each country; British problems are totally different, and require a correspondingly different treatment.

The fundamental nature of the differences is as follows:—

(1) In Canada principally, and the U.S. largely, electrical energy is generated from water power. It is transmitted relatively great distances by overhead lines to distribution centres, which are widely separated and spread out and consequently must serve much larger areas than would be the case in England. The distribution networks are still principally overhead, and even where the larger towns have begun to put in underground cables, the load density per square mile is far less than is the case under similar locations in England, despite the larger energy usage per person in Canada. This is because the towns in Canada have their populations and industries spread over wide spaces and not concentrated into small areas as is unavoidable in the older countries.

It is at once obvious that distribution systems built as in England would involve expenditures quite out of proportion to the revenue earned. This condition has made it an economic necessity to develop distribution apparatus and equipment of the simplest and least expensive nature without undue sacrifice of reliability and efficiency. These latter factors cannot be, and are not, however, given anything approaching the same weight as in England when distribution systems are laid out. This affects sub-station layout and equipment, the pole line hardware, transformers, protective devices, wire and wire insulation, all of which, as used in Canada, would be considered far below permissible standards in Great Britain. This is not a matter of copying American practice, however; it is the spur of economic necessity, which incidentally has for the same reasons produced similar solutions to the problems arising.

(2) Industrially, the economic differences have compelled correspondingly different courses. In Canada, for instance, electrical energy forms a much smaller proportion of total manufacturing costs than in England. Labour is the big item, and rates for skilled mechanics range from 75 cents (3s. 1d.) to $1.00 (4s. 2d.) per hour. Other grades of labour cost less, but are correspondingly more highly paid than in England. With this condition is also the condition that the same grade of mechanical skill is not available—or cannot economically be availed of—in Canada as in England. This applies particularly to the labour used for manufacturing, maintaining, and repairing electrical industrial equipment—motors, transformers, switchgear, &c.

A little consideration of this will immediately show that refinements of design and manufacture for producing the highest efficiencies (and power factors) are quite unattractive to the Canadian buyer if a less rugged machine results. Ease of repair is more important than superior test characteristics, overload capacity than a lower price, reliability under severe (and what in England might be considered unfair) conditions than a merely safe mechanical design. These very definite requirements have also nothing to do with copying American methods; they are dictated by forces just as compelling as are those that have produced typical British practice to-day.

To illustrate how this has worked, a few examples will be given:—

(*a*) *Wires and Cables.*—The Canadian and American standards in quality of copper, quality of insulation

(rubber), and degree of stranding, are much inferior to British standards. They are, however, adequate for the conditions for which they are intended.

(*b*) *Distribution Transformers.*—These are practically all of the pole mounting type, and are sold at prices below English manufacturers' figures, despite the higher Canadian labour costs. The designs of all makers are almost standardised, and every trimming that can be left off has been eliminated. The sizes used are principally 5 kVA, 7½ kVA, 10 kVA, and 25 kVA. It is actually usually cheaper for an owner to sell for scrap a burnt-out transformer, certainly up to 50 kVA, and even up to 100 kVA frequently, than to endeavour to repair it himself or send it to the manufacturer for re winding. Exactly the same condition applies in the States, although, of course, practice in the very large centres like New York, Chicago, &c., is quite different, due, of course, to the entirely different needs. Such centres do not exist in Canada yet.

(*c*) *Motors.*—The industrial needs of Canada have resulted in motors being manufactured and used, which are lower in efficiency and power factor than good English practice will tolerate. Their pulley shafts are larger and longer, their starting torques are greater with consequent greater overload capacity. The air gaps are longer, the stator slots are open (except in small sizes), and squirrel cage machines are used in the ratio of probably 20 for each slip-ring machine. The resultant Canadian and American machine does stand up to the much severer conditions without trouble than do most British motors in Canada, and to-day there are many users in Canada who, after having tried English motors for three or four years, have gone back to the Canadian and American motors at higher prices with poorer technical performances on account of the lack of general ruggedness of some English machines, and because of the difficulty of repair. The only way in which the British manufacturer can compete is to produce equipment just as well able to meet Canadian conditions as the Canadian and American manufactured articles do. Conditions cannot be changed; practice will improve in time, but the process is slow and only evolutionary.

(*d*) *Switchgear and Control Apparatus.*—This class of equipment, as developed in England, is, with very few exceptions, absolutely unsuited for Canadian use, and the Americans have developed motor control apparatus that is cheaper, better and simpler for industrial use than anything produced in England. The policy of switching squirrel cage motors across the line is developing in both the U.S. and Canada. Push button contactor type switches are available, which give proper protection and complete safety at much less than the cost of English manual auto-transformer starters. Even American push button type auto-transformer starters frequently cost less than English manual starters. It is admitted that the English apparatus is generally of a very high grade, but actually the writer is quite unable to see any economic justification for the large amount of copper, iron and oil commonly found in English starters.

English manufacturers of oil circuit breakers generally speaking, over-rate the interrupting capacities and offer such equipment with stated and guaranteed ratings far in excess of what have been proved the abilities of the switchgear in service in Canada. The explanation offered for this is that English systems are far more safely installed (all underground instead of overhead), very completely protected and more carefully watched than is possible in Canada. The result is that serious faults only very occasionally occur, so that the equipment is very occasionally—if at all—called upon to render the service that it is rated at or designed for. The failures that sometimes do happen when a really bad fault comes on are then ascribed to some very unusual and exceptional condition.

In Canada, this is not the case and most circuit breakers and allied apparatus are called on fairly frequently to meet their full duty, as overhead lines frequently fall and short circuits are common on nearly all systems.

Four of the principal lines of electrical apparatus have been enumerated; they constitute some of the major types of electrical apparatus which Great Britain is able to furnish competitively in Canada, and the reason that very large incursions into the Canadian market have not been made, is the very general failure of manufacturers to ascertain what are the requirements of Canada from an economic and industrial (*not* an ideal) point of view, and properly to realise their true significance in respect to actual equipment design.

The Canadian buyer is becoming disappointed with English equipment in many cases—nevertheless, apart from some American owned industries, there has been —and still is among many buyers—a distinct policy to buy British equipment in preference to American if the former is available.

Some British manufacturers do not take proper care to test thoroughly apparatus shipped to Canada.

The Chicago Underwriters are admittedly anti-British but they no longer exercise (and have not exercised for some years) any control over apparatus used. The various provinces have established their own respective inspecting and testing bureaux, which have official status and are independent of any American control. The writer, for years, has never had the least difficulty in obtaining approval of British equipment of a very wide range and of many manufacturers.

To sum up, the Canadian market is available for, and receptive to, British manufactured electrical equipment, and whilst competition with America is much keener than probably anywhere else in the world, due to the proximity of the United States manufacturers, nevertheless British exports to Canada can be very largely increased by a more careful study and appreciation of the actual requirements, and the adaptation of British manufactures thereto.

II.—The Influence of the Chicago Underwriters.

(By a Canadian Correspondent.)

CANADA'S proximity to the United States, with a population some twelve times as great as her own, is responsible for the fact that certain difficulties confront British manufacturers wishing to trade here which are not met with in other parts of the Empire.

One of these, which affects electrical manufacturers particularly, is the domination which the Underwriters' Laboratories of Chicago hold over the Canadian market.

This situation has been discussed several times within the past few months by various technical journals both in Canada and England but some further comment on it may not be amiss.

Figures have been quoted in connection with the discussion referred to, showing the enormous preponderance of Canada's imports of electrical goods from the United States as compared with those from Great Britain. It must not be supposed, however, that, great as may be the influence of the Underwriters' Laboratories in preventing the British manufacturer from selling his products in Canada, that body is responsible for the whole or, necessarily, even the greater part, of the discrepancy between the value of the U.S. and British electrical exports to Canada.

Generally it may be stated that the Underwriters' Laboratories' approval of electrical equipment covers only such materials, apparatus and devices as are in common use in ordinary installations, *e.g.*, wire, conduit, small porcelain insulators and tubes, lamp-holders, the smaller sizes of motors, electric heaters,

domestic electrical appliances and devices, including electric cooking-ranges, &c. Large motors and generators, transformers, switchgear &c., and even incandescent lamps do not come within the purview of the Laboratories. If the value of the latter imported into Canada from the United States be subtracted from the value of the total electrical imports the value of the remaining imports from that country would be appreciably less. This does not make the comparison between Great Britain and the United States, so far as electrical materials are concerned, any less alarming, but it does indicate that the actual influence of the Underwriters' Laboratories of Chicago is not quite so great as it would otherwise appear to be. Furthermore, it is not quite fair to imagine that the Laboratories deliberately plan to keep British, and other countries', manufactures out of Canada—they arrange their rules and specifications to suit United States conditions; Canada is a neighbouring country and of much less account so far as population is concerned, with a great deal of her property insured against fire with United States' companies. Naturally enough, therefore, the Underwriters' Laboratories' standards were made to apply in Canada, and Canadians, finding a ready-made set of rules—the National Electrical Code—and ready-made specifications of the Underwriters' Laboratories, available for their use, adopted them without question, as, in the main, they suited Canadian conditions quite well; moreover, due to American aggressiveness, and perhaps to laxity on the part of British manufacturers, the electrical apparatus, fittings, materials, &c., available to the Canadian buyer were preponderatingly of United States origin.

The present situation has, apparently, arisen gradually from the causes outlined above, probably without anyone definitely foreseeing what the result would be, but the electrical interests of the United States realising, in recent years, what a trump card they hold in regard to their activities in Canada, now play it to the best advantage. British electrical manufacturers have, somewhat tardily, begun to recognise what this situation means to them. Unless they are prepared to turn out products, for the Canadian market, which conform absolutely to the Underwriters' specifications their products will not be approved in Chicago, the Canadian Fire Underwriters' Association will not accept, at standard rates, risks on buildings in which they are installed and Canadians will be loath to use them, as they will not care to run the risk of having to pay higher premiums, or of losing their insurance in case of fire should they install some unapproved materials or apparatus without the knowledge of the insurance company.

It is not only the British manufacturer who feels aggrieved at the fact that electrical goods for sale in Canada need to be approved in a foreign country, but the most important Canadian electrical manufacturers and several organisations and individuals interested in electrical matters object most strongly to the situation which exists. It is owing to this attitude here that, some three years ago, the Canadian Engineering Standards Association took definite action in the matter of formulating a "Canadian Electrical Code" or book of rules and regulations covering electrical installation work as the first step towards emancipating Canada, as far as possible, from the double yoke of the National Electrical Code (of the United States) and the approval of the Underwriters' Laboratories of Chicago.

The Canadian Engineering Standards Association created a strong, representative Committee to deal with the proposed Code and later engaged the services of two men for several months to compile the "Canadian Electrical Code," also, Sub-Committees were formed in most of the provinces, and the first draft of the Code has been under consideration by both Main and Sub-Committees for some time, although, owing to some divergence of views the matter has been delayed considerably. It is believed, however, that there is at present renewed activity and that the first draft is now under review—largely in order to bring it more into line with the National Electrical Code which has just undergone its usual biennial revision. It should be remarked here that Canada and the United States must, inevitably, always have many standards in common and for that reason it is not, in numerous instances, feasible for the latter to depart very far from the rules and regulations and standards adopted by the former.

The next step in the plans of the Canadian Engineering Standards Association is believed to be the preparation of specifications for electrical material, apparatus and devices on lines similar to those adopted by the Hydro-Electric Power Commission and the Underwriters' Laboratories, and when this work is completed there is little doubt that it will result in the establishment of a Canadian Laboratory where approval of electrical goods can be obtained.

Many readers of the Review will have learnt from its columns that Ontario already has its own rules and regulations, its own specifications, and its own electrical testing laboratories, and that approval can be obtained, for Ontario, independently of the Underwriters' Laboratories. The influence of the United States on the situation in Ontario is, however, very strong since the market provided by this one province is, relatively, so small. If the conditions in Ontario were extended to cover the whole Dominion, as the Canadian Engineering Standards Association so much desires, matters would be greatly improved, and the way of the British manufacturer would be less hard.

The "Underwriters' Laboratories of Chicago, Incorporated," an organisation created in 1901, has grown greatly during the intervening years. According to a recent article in the *Electragist* by Mr. Dana Pierce, the president, its technical work is conducted by the following departments:—Protection, Hydraulic, Electrical, Gases and Oils, Chemicals, Casualty and Burglary Protection. A list of the extremely numerous classes of materials, apparatus and equipment tested would be a very long one. Mr. Pierce states that "for the laboratories' purpose a standard is limited to items affecting safety and good practice as regards fire hazards and accident hazards." This, however, is not in all cases strictly true, as it is known that there are instances in which the specifications contain clauses which cannot strictly be held to affect either safety or good practice—this is no hardship to the American manufacturer who has already designed his product and arranged his tools, &c., so that the underwriters' specification will be complied with, but it has the effect of keeping out of the United States market and also, at present, out of the greater part of the Canadian market, perfectly good and safe electrical goods of foreign manufacture which, except for such entirely unnecessary and irksome restrictions, would undoubtedly receive the Underwriters' Laboratories' approval. As a matter of fact, the result of this situation is that many articles, of superior workmanship, at least as safe, and of much better appearance than those of American manufacture, which are readily obtainable in Europe, are not available over here.

"Underwriters' Laboratories of Canada" was formed in 1920 under a Dominion Government charter, and although no actual laboratory is in existence yet, there are rumours that it is intended to establish one before very long, and if this is done, it will make the United States influence in Canada all the stronger and still more difficult to counteract than under existing conditions.

The Underwriters' Laboratories are not the only factor at work in Canada tending to draw this country more and more closely to the United States in matters electrical. The Western Association of Electrical Inspectors has recently changed its name to "International Association of Electrical Inspectors (Western Section)," and now operates internationally in the two countries. The Association of Electragists (International) is similarly constituted. The American Institute of Electrical Engineers has branches in various

parts of Canada, some of them (*e.g.*, that in Toronto) are very active and doing useful work, while the I.E.E. still remains unknown. The *Electrical World* and other U.S.A. technical electrical journals have a great influence in keeping United States' electrical manufacturers and their products and all developments in electrical matters prominently before those interested in such matters, and even the Canadian papers must to a considerable extent follow suit on account of the great similarity between Canadian and United States practice, while British manufacturers, British products, and the British electrical Press are of relatively little importance.

With such numerous and powerful influences at work, the British manufacturer has indeed a hard task before him if he wishes to make headway, but several firms have done it through determination, hard work, and perseverance, so doubtless it can be done by others, through co-operation, especially, rather than by independent action. Last year some aggressive spade work was done in Canada by one British firm which may have far-reaching results; this, combined with the very useful and highly commendable work of the Canadian Engineering Standards Association, as outlined above, will undoubtedly tend to minimise the overwhelming domination of United States influences if properly followed up, though it would seem that this domination will be large for many years to come.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Trade Union Bill.

The text of the Government's Trade Disputes and Trade Unions Bill was published this week. The main points are as follows:—Strikes with objects outside a trade dispute or directed against the community are declared illegal and punishable. Members of unions refusing to take part in such strikes cannot be expelled. Picketing and intimidation are defined and penalties are prescribed. The political levy is subject to a member's consent and not his refusal as at present. Civil servants are prohibited from joining "outside" trade unions or becoming affiliated to "outside" associations of trade unions. Local authorities are prohibited from making membership of a trade union a condition of employment. The Attorney-General is empowered to apply for an injunction to restrain unions from using their funds in contravention of the provisions of the Bill. The Bill does not apply to Northern Ireland.

The E.D.A.-E.L.M.A. Campaign.

During the last few weeks the organisers have been overwhelmed with ballot papers. The accompanying illustration



The Ballot—A Last-minute Rush.

shows a portion only of one day's haul. On the day in question—March 31st—over 30,000 papers were received.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during February last, were valued at £31,439, as compared with £38,715 in February, 1926. The imports during the first two months of the present year are returned at £72,373, as against £91,122 in the corresponding period of last year.

Church Lighting.

The accompanying illustration is a night view of St. John's Church, Great Clacton, which has recently been equipped with electric lighting. To obtain the successful result the fittings are concealed at the bases of the windows in such a way that the light radiates from the windows, giving a daylight effect; the wiring and fittings cannot be seen. There are six win-



St. John's Church, Great Clacton.

dows and the lamps (60-W gasfilled) are installed in groups of four in silvered glass reflectors. The chancel is lighted by six silvered glass reflectors with 100-W gasfilled lamps. The Callender wiring system was employed, and the installation was designed and carried out by Mr. F. Allum (Clacton manager for Mr. Arthur Cozens).

The Free State Radio Apparatus Duty.

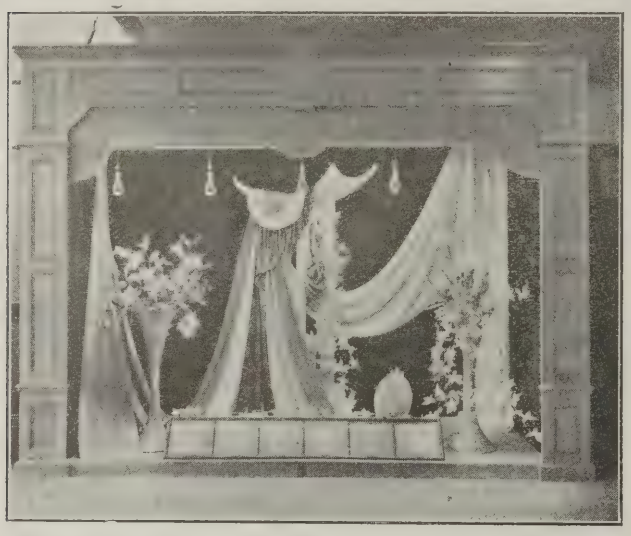
In a statement to the Minister of Finance, Mr. James Kitchen, secretary of the recently-formed Irish Free State Joint Wireless Committee, says that in January, 1926, before the imposition of the duty upon imported radio apparatus, the value of imports of such goods was £22,099; in January, 1927, the value was only £3,387. The increase in prices due to the duty is said to be restricting the growth of broadcasting. The potential market is not big enough for the establishment of a home radio manufacturing industry, and therefore a protective tax is not needed. It is considered that the increased revenue from licence fees which would follow the abolition of the duty would more than compensate the Government for loss of revenue. The duty has been the cause of the closing down of a number of wireless retailers' businesses, it is stated.

"Magnet" Industrial Cooking Equipment.

The General Electric Co., Ltd., informs us that important establishments in different parts of the country have been equipped with "Magnet" industrial cooking equipment. Among them are Messrs. Bryant & May's factory at Bow; Messrs. Gestetner's factory at Tottenham Hale; Marylebone Station (G.C.R.); Maison Lyons (Oxford Street); the Regent Street Polytechnic; the Royal Academy of Music; Unity House (National Association of Railwaymen); Bucks. County Mental Hospital, Aylesbury; the Birmingham Infirmary; Messrs. W. D. & H. O. Wills's factory, Bristol; the Belfast Municipal College; and the County Borough Municipal College, West Ham.

Model Shop-Window Lighting.

The nicely-arranged shop window seen in the accompanying illustration formed part of a display arranged by the London Lighting Service Bureau at the recent Drapers' Exhibition at the Agricultural Hall, Islington. The window was a full-sized one. At first glance there seems to be something wrong; those naked lamps are not in accordance with the best practice. This, however, was part of the scheme—the horrible example which was first demonstrated before staging the



A Shop-Window Lighting Demonstration.

correct methods. Copious lighting equipment operated by a sign-type flasher was installed, bringing into play various combinations. Apart from the use of glaring lights, the window showed the effects of complementary banks of colour, and the application of floodlighting and spotlighting. During the exhibition brief lectures were given by members of the Bureau's staff.

Social Events.

On March 11th the staff of the Wiring Supplies Department of the British Thomson-Houston Co., Ltd., held a dinner at the Union Helvetia Club, W.1, the main object of which was to welcome the manager of the department, Mr. J. N. Stephens, on his return after a long illness. The dinner was attended by a large gathering of the staff, and among those present were Mr. R. A. Lower, the assistant manager, and other leading members of the department. The chair was taken by Mr. W. Millner, B.Sc., of the lighting engineers' section, who made a brief speech of welcome. Mr. Stephens, in his reply, expressed his pleasure in being present, and hoped that, in future, a staff dinner would be arranged annually. After dinner there was a concert, contributed to by members of the staff, and a dance.

A Siemens social and dance was held at Slater's, Leadenhall Street, E.C., on April 1st. About 200 people attended, and music for the dancing and community singing was provided by the Bohemians' Dance Band. Messrs. C. Hughes and W. G. Izant acted as M.C.'s.

New Australian Company.

Airzone, Ltd., has recently been formed in Sydney, N.S.W., with a capital of £10,000 to acquire an existing business of radio, electrical and mechanical engineers.

Australian Duty on Valves Deferred.

According to the *Board of Trade Journal*, the Commonwealth Government has further postponed the date of operation of the increased import duties on valves for wireless telegraphy and telephony until July 1st.

Catalogues for Honduras.

Commerce Reports states that the Honduras Government has decided to inaugurate a general information bureau for the benefit of both merchants and agriculturalists in Honduras. It is proposed to maintain a complete file of catalogues of products from different countries, and at present catalogues of electrical products are desired. They should be forwarded to Señor Ingeniero don M. R. Moncada, Ministro de Fomento, Obras Publicas, Agricultura y Trabajo, Oficina de Informacion, Tegucigalpa, Honduras.

The Luxemburg Concession.

According to the Luxemburg correspondent of a Frankfort newspaper, as the Rhenish-Westphalian Electricity Works Company has given up its idea of competing for the concession for the electrification of Luxemburg, there only remain two offers before the country, those of the Belgian Centrales Electriques des Flandres and the Armstrong, Whitworth Co. The Council of State is said to have expressed itself against the English offer on the ground of the suggested gas concession, the gold currency tariff, the State guarantee for an annuity of over 22,000,000 fr., the lack of a coal and blast furnace basis, the use of English materials, &c. On the other hand preference is stated to be given to a scheme for co-operation between the Belgian company with the Luxemburg iron and steel industry. The project, it is added, will shortly be laid before the Legislative Chamber.

New Italian Company.

A company has lately been formed in Milan with the title La Compania Internazionale per Impianti Elettrolitica to acquire and exploit the patents of the International Electrolytic Patents Co., Ltd., in Italy, Austria, Bulgaria, Czecho-Slovakia, Greece, Jugo-Slavia, and Hungary. It is stated that contracts for a number of installations for the electrolytic production of hydrogen and oxygen have already been obtained.

A French-Belgian-Polish Undertaking.

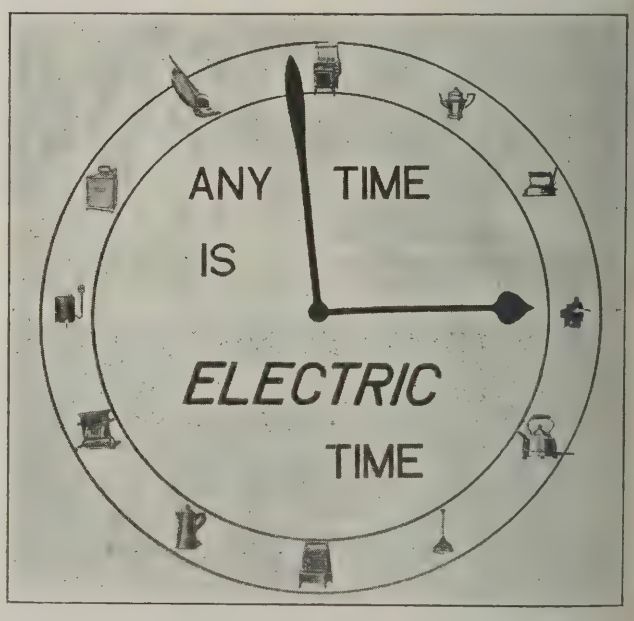
A company is being formed in Brussels with the title Le Trust Métallurgique Belge-Francais, to amalgamate the principal electric power and tramway undertakings in Poland, including the following: Le Centrale Electrique du Bassin de Dombrowa; la Centrale Electrique du Bassin de Cracovie; les Chemins de fer Electriques Suburbains; and les Chemins de fer Electriques du Bassin de Dombrowa.

The G.E.C. at a Co-operative Exhibition.

The Prince of Wales spent some time during his visit to the Co-operative Exhibition in the old Royal Dockyard at Woolwich in inquiries as to the electrical features installed in the model bungalow by the General Electric Co., Ltd. In the entrance hall a "Magnet" electric fire had been installed, but the Prince's greatest interest was in the kitchen, where he closely examined the "Electric Wizard" which was on view. The Prince plied the attendants with questions as to the details of these electrical appliances, and expressed satisfaction as to their utility.

The "All-Electric" Day.

The photograph shows one of the many arrangements adopted by the Blackburn electrical engineer (Mr. P. P. Wheel-



"Every Hour has its Electrical Appliance."

wright) for the purpose of popularising the showrooms in Darwen Street. The huge clock moves and the hours are indicated by appropriate electrical apparatus.

A French View of the South African Market.

The French Commercial Attaché in the Union of South Africa calls attention to the large consumption of all kinds of electric household appliances in South Africa. Demand, he says, is increasing daily and is at present met principally by Germany and the United States. All the big ironmongers sell these goods retail; they do not order them direct but from the import houses where ample stocks are kept. These houses are usually the exclusive agencies of a European or American factory and either work on a consignment basis or actually buy the goods. The best method of gaining a footing on the market is to have a capable and reliable agent in whose hands a small stock should be placed on consignment.

Irish Contractors and the Government Electricity Bill.

We have already made reference to the Bill which the Irish Free State Government has drawn up, giving it the control of practically the whole of the electricity supply business in the Free State. Last week the Irish Section of the Electrical Contractors' Association issued a temperately-worded manifesto urging the Dail (the equivalent of our House of Commons) to support amendments which it was proposing to Sections 47 and 48 of the Bill which empower the State or local authorities to maintain showrooms and sell installations, fittings, and apparatus. The contractors point to the valuable work which they have already done in the interests of the industry and claim that the best results will be obtained if they are allowed to proceed unhampered by State or municipal competition. They point out that in the parallel case of the British Electricity (Supply) Act a clause agreed between the various interests was inserted; their amendments aim at the same idea.

For Sale.

Ilford Corporation Electricity Department has for disposal one 1,000-kW d.c. generating set. Prestwich County Mental Asylum invites offers for one 75-h.p. motor-generator for battery charging, one 460-V balancer, one mains booster, and one 300-kW Browett-Lindley steam balancer, coupled to 260-V generator. (See our advertisement pages to-day.)

Trade Announcements.

Mr. P. Gardiner, late of Edison Accumulators, Ltd., has become sales manager to Messrs. A. F. A. Accumulators, Ltd., who have been appointed sole concessionaires in British territory of the D.E.A.C. nickel steel alkaline accumulators.

Mr. A. B. Godden, radio engineer and manufacturer, of Canterbury, has removed his business from 31, Wincheap, to 3, Oaten Hill.

Messrs. Allen, electrical engineers, of Watford, have opened showroom premises at 40, High Street, Bushey.

Mr. Lionel Robinson terminated his agreement with Messrs. Henry Wiggin & Co., Ltd., as London manager on March 31st. He is now acting as London consultant for them, and will continue his business at 3, Staple Inn, W.C., from which address he will factor all their nickel and nickel alloy products. Stocks will be carried.

Messrs. Arthur Lyon & Co., 82, Fenchurch Street, E.C.3, inform us that they have been appointed sole distributors of the synchronised electric clocks made by Messrs. Gillett and Johnston, Croydon. The department is under the supervision of Mr. A. A. Lyon, late managing director of Arthur Lyon & Wrench, Ltd.

Mr. Frank Knight, electrical engineer, 16 & 18, Rose Street, Wokingham, has opened new showroom premises.

The Normand Electrical Co., Ltd., 3, North Side, Clapham Common, S.W.4, has decided to open its Clapham works to public inspection on Wednesday afternoons.

New Catalogues and Lists.

Brookhirst Switchgear, Ltd., Northgate Works, Chester. —Folder 194, dealing with the "Brookhirst Junior" solenoid starting panel.

Messrs. Crompton & Co., Ltd., Chelmsford.—List No. 81, containing brief notes and illustrations of the various types of generating plant manufactured by the company.

Wagner Electric Supples, Ltd., 66, Victoria Street, S.W.1. —Stock List No. 22E, containing particulars and prices of fractional h.p. and other motors, starters, &c. Also a pamphlet giving notes on single-phase repulsion motors.

Pope's Electric Lamp Co., Ltd., 5, Arthur Street, New Oxford Street, W.C.2.—April calendar-blotter advertising "Elasta" lamps.

The D.P. Battery Co., Ltd., Bakewell, Derbyshire.—A coloured wall sheet advertising "D.P." wireless and portable accumulator batteries.

Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow.—April calendar-blotter advertising the company's underground conveying equipment.

Messrs. Belbin & Bowden, Ltd., 3, Finsbury Square, E.C.2.—A series of priced and illustrated pamphlets dealing with lamps, radio valves, irons, kettles, and fires.

Hopkinson Induction Motors, Willesden Lane, North Acton, W.3.—April stock list of single- and three-phase motors

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Catalogue Section H (3) containing fully-illustrated particulars of industrial and commercial electric cooking equipment for hotels, restaurants, bakeries, &c.

Messrs. Mawdsley's, Ltd., Dursley, Gloucestershire.—Two illustrated catalogues containing particulars and prices of the many types of motors and generators made by the company.

Bankruptcy Proceedings.

A. J. Garrod, Whitehorse Place, Wellingborough, manufacturer of radio sets and components.—The first meeting of creditors was held recently at the Official Receiver's offices, Northampton. The statement of affairs showed gross liabilities of £3,219, of which £2,947 was expected to rank, against assets estimated to produce £467, leaving a deficiency of £2,480. Debtor attributed his failure to the calling in of borrowed capital when his wireless experiments were in a critical stage and not quite perfect. It was decided that Mr. P. R. E. Smith should be appointed to act as trustee with a committee of inspection.

L. Wintle, electrical engineer, 27, Stafford Street, Market Drayton.—Receiving order made March 24th, on a creditor's petition. First meeting, held April 5th, at the Official Receiver's offices, 12, Lonsdale Street, Stoke-on-Trent. Public examination, April 28th, at the Court House, Crewe.

G. C. Barnes (Regent Electrical Works), electrical engineer, 3, Swift Street, Barnsley.—First and final dividend of 2s. 0½d. in the £, payable at the Official Receiver's office, 21, King Street, Wakefield.

H. A. Sanders, electrical contractor, The Black Cat Restaurant, Chawston, St. Neots.—Last day for proofs for dividend, April 28th. Trustee, Mr. H. Ball, Duke Street, Bedford.

J. R. Martin, electrical engineer, 11, Middlesbrough Road, South Bank, York.—Receiving order made March 29th, on debtor's own petition.

M. C. Jones (M. C. Jones & Co.), stockists of wireless parts and accessories, 239, Westgate Road, and 65, Thornton Street, Newcastle-on-Tyne.—Trustee, Mr. W. Brittain, Pearl Buildings, Northumberland Street, Newcastle-on-Tyne, released September 24th.

A. Stock, electrical and radio engineer, 323, Chapel Street, Salford.—First meeting, April 12th, at the Official Receiver's offices, Byrom Street, Manchester. Public examination, May 12th, at the Court House, Salford.

F. H. Armitage, electrical engineer, 9, Occupation Lane, Pudsey.—Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford, released March 25th.

Company Liquidations.

Claremont, Johnson & Co., Ltd., electrical and wireless factors, 4, Union Place, Wells Street, Oxford Street, W.1. The following are the principal creditors herein:—

	£		£
Armorduct Cable Co., Ltd.	233	Finston Mfg. Co. ...	82
Berry's Electric, Ltd. ...	61	Ludenscheider Install Werke	74
Belling & Co.	64	Midland Electric Mfg. Co., Ltd.	82
Bernard & Co.	95	Magnesia-Werke Weissence	95
Credenda Conduits Co., Ltd.	168	National Electric Supplies	81
C.A.S.E.	91	Shrimpton & Sons ...	52
General Electric Co., Ltd.	133	Stella Conduits Co., Ltd.	103
Grothe & Sohne... ...	146	Southgates, Ltd. ...	137
Gottlieb, J. L.	75	Siemens-Schuckertwerke	88
Brownie Wireless Co. ...	79	Three Star Accumulator Co.	116
Krageloh & Co.	235		
London Commercial Electric Co.	146		
Lee, A., & Co.	68		

Autochrome Signs (1926), Ltd., 12, Gerrard Street, W.—A meeting of creditors was held on March 28th, at the Society of Incorporated Accountants, E.C. The chair was occupied by Mr. C. H. Temple, 5 and 6, King Street, E.C., the liquidator in the voluntary liquidation of the company. The chairman reported that the liabilities were £670, whilst the assets were estimated to realise between £250 and £300. A gentleman who had been associated with the company, and who had found money for it, had intimated that if the voluntary liquidation was confirmed he would find sufficient to enable the whole of the liabilities to be paid in full. A resolution was passed confirming the voluntary liquidation of the company, with Mr. Temple as liquidator.

H. Clough & Co. (Bacup), Ltd., Bacup, electrical engineers, &c.—A meeting of creditors was held last week, at the offices of Messrs. F. Hunter, Gregory & Lord, Bacup. Mr. H. Pickup, the liquidator, submitted a statement of affairs which disclosed liabilities of £9,592, and net assets of £619, leaving a deficiency so far as the creditors were concerned of £8,973. As regarded the shareholders there was a deficiency of £11,973. The company was registered in 1919, with a nominal capital of £3,000, all of which had been issued, and was fully paid up. The company had made losses almost from its inception. The creditors confirmed the appointment of the present liquidator. The following are creditors:—

	£		£
Greenwood & Co. ...	237	Mitchell & Co.	22
Bailey & Co.	360	Wright, A.	10
Hunter, Gregory & Lord	34	Irvin & Sellers, Ltd. ...	46
Bacup Corporation ...	20	Keizer, L., & Co., Ltd....	23

The Foolprufe Patent Accumulator Co., Ltd., Market Harborough.—The resolution to appoint Mr. G. T. Berry as liquidator has not been proceeded with, but the shareholders have appointed Mr. J. B. Bullivant, of 6, Friar Lane, Leicester, and Mr. G. T. Berry, 32, The Square, Market Harborough, as joint liquidators. The appointment of Mr. Bullivant followed the wish of the largest creditors expressed at a meeting on March 25th. A meeting of creditors will be held on April 11th. Creditors should send particulars of debts, &c., to one of the liquidators by April 20th.

F. J. Jones & Sons, Ltd., electrical engineers, Chester.—A meeting of creditors was held last week at Chester, when Mr. J. Dodd, the liquidator of the company, submitted a state-

ment of affairs which disclosed liabilities of £5,212. The net assets were £3,945, leaving a deficiency of £1,267. The company was registered in July, 1922, with a nominal capital of £5,000. Shares to the face value of £3,940 had been allotted, of which £3,839 were issued to the Jones family. The business was for many years carried on by the father of the present directors, and after his death by the executors. The company then took over the business, but no cash consideration was paid. During 1925 the turnover was in the neighbourhood of £14,000, and there was a net loss of £239. Down to the end of October last the sales exceeded £14,000, and there was a loss of more than £1,000. Debentures were issued in July, 1925, the consideration being the guarantee of the bank overdraft. A resolution was passed confirming the voluntary liquidation of the company, subject to Mr. F. Lloyd Williams, C.A., Liverpool, being appointed to act as joint liquidator with Mr. Dodd, whilst a committee was also appointed consisting of the representatives of Electric Lamp Factors, Ltd., Callender's Cable & Construction Co., Ltd., Hollingdrake & Sons, Ltd., Crossley Bros., Ltd., and the General Electric Co., Ltd. It was stated that there was reason to hope that the business would be sold on advantageous terms as a going concern. The principal creditors are:—

	£		£
Elec. Lamp Factors, Ltd.	865	Crossley Bros., Ltd. ...	355
Callender's Cable & Construction Co., Ltd. ...	590	General Electric Co., Ltd.	271
Hollingdrake & Sons, Ltd.	469	Lister & Co.	160
		Tudor & Co.	158

Re-Echo Radio Co., Ltd., late 109, Marsham Street, Horseferry Road, S.W.1, radio manufacturers.—A further dividend of 9d. in the £ has been declared, and it is stated that there is an option for three months to purchase the registered trade mark, name, &c., of the company, and should this mature, it will be possible to pay another small dividend.

Goswell Engineering Co., Ltd.—Winding up voluntarily. Liquidator, Mr. R. G. Pye, 6, Martin Lane, E.C. A meeting of creditors was held at 95-98, White Lion Street, N., on April 6th.

Marine & Mechanical Electric Welding Co., Ltd., and Marine & Mechanical Electric Welding Co. (Cardiff), Ltd.—Meetings of members are called for May 2nd, at 146, Bishopsgate, E.C., to hear an account of the winding up from the Liquidator, Mr. L. C. F. Robson.

Electrical Stores (Nottingham), Ltd.—A meeting of members is called for April 28th at the offices of Messrs. Leman, Hill & Hilton, 1, St. Peter's Church Walk, Nottingham, to hear an account of the winding up from the Liquidator, Mr. S. H. Hill.

Kingsway Radio, Ltd.—Winding up voluntarily. Liquidator, Mr. W. C. Todd, 3, Cannon Street, E.C. Meeting of creditors, April 12th, at the Institute of Chartered Accountants, Moorgate Place, E.C. Particulars of claims to the liquidator by May 2nd.

Private Arrangements.

F. F. C. King, wireless dealer, 1, Botley Road, 87, St. Aldate's, and 32, West Street, Oxford.—A meeting of creditors was held recently, when a statement of affairs was presented which showed ranking liabilities of £1,627, of which £1,277 was due to unsecured creditors and £350 to the bank, partly secured. Net assets were £1,221, leaving a deficiency of £406. The present position was attributed to lack of capital. The creditors passed a resolution confirming the deed of assignment already executed, and the trustee was authorised to carry on the business with a view to its sale as a going concern. The following are creditors:—

	£		£
Burndept Wireless Co. ...	110	Johnson & Co., R. J. ...	24
Cleartron Radio, Ltd. ...	20	Kingerlee, T. H., & Sons	23
Cooper, G. R., Ltd. ...	21	Metro-Vick Supplies, Ltd.	40
De la Mare	55	Richardson, W. B. ...	57
General Electric Co., Ltd.	20	Wratton, J.	110
Hayward, C., & Son ...	36	Ewers, C. (Exors.) ...	127
Houghton-Butcher, Ltd.	54	Stroud, P. W.	116
Hughes, A., & Co. ...	53	Langmore, G.	20

Dissolutions of Partnership.

Partridge & Wilson, electrical and radio engineers, 217a, Loughborough Road, Leicester.—Mr. C. A. F. Partridge and Mr. H. G. A. R. Wilson have dissolved partnership. Mr. Wilson will attend to debts and continue the business under the same style.

Pearn & Carson, electrical and mechanical engineers, Sherwell Lane, and 27, Tavistock Road, Plymouth.—Messrs. J. E. Pearn and A. S. Carson have dissolved partnership. Mr. Carson will attend to debts and continue the business.

York Radio Supplies, vendors of wireless supplies, Coffee Yard, York.—Messrs. S. M. Stevens and C. Shepherd have dissolved partnership.

Stone & Nicholls, electrical and radio engineers, 7, Locket Road, Wealdstone.—Mr. G. H. Stone and Mr. C. J. Nicholls have dissolved partnership. Mr. Stone will attend to debts and continue the business.

Holt & Co., wireless engineers, &c., 7, Garden Street, St. Annes-on-the-Sea.—Mr. S. I. Holt and Mr. G. W. Hammett have dissolved partnership.

Mutch & Farquharson, motor and electrical engineers, 367, King Street, and Seaforth Road, Aberdeen.—Mr. J. G. Mutch and Mr. C. V. J. Farquharson have dissolved partnership. Mr. Mutch will attend to debts and continue the business in his own name at the old address. Mr. Farquharson will carry on business in his own name at 36, Gordon Street, Aberdeen.

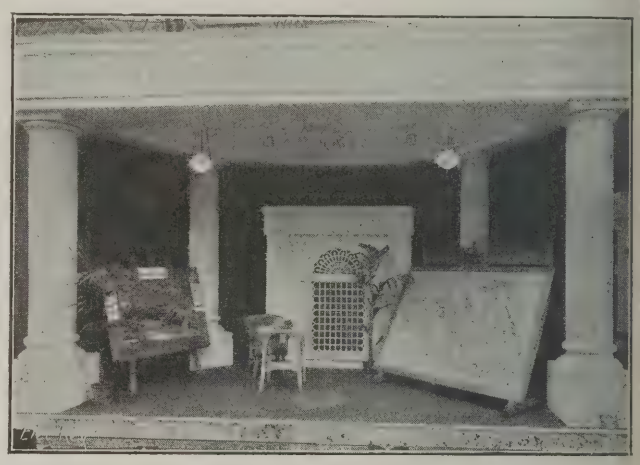
Philpot & Son, electrical engineers, 3, St. George Street, Canterbury.—Mr. D. McKellar and Mr. R. M. Pudney have dissolved partnership. Mr. D. McKellar will attend to debts and continue the business under the same style.

Frozen Time Switches Still Work.

Venner Time Switches, Ltd., has received from the cable ship *Lord Kelvin* photographs of a buoy bearing lamps controlled by "Venner" time switches. The lamps were frozen into a solid block of ice after the buoy had been at sea for five days in a heavy gale. The buoy was then brought aboard the ship after the top of the staff had been broken by the weight of ice. A letter states: "The steel sleeve which extended from above the cross trees to the top of the buoy prevented the lower part of the staff from breaking off, and thus saved the lamps intact, the clocks, &c., being in perfect condition, ticking away as usual."

The Shropshire Power Co. at the Fair.

In our notes on the British Industries Fair, Birmingham, we made mention of the very effective display arranged by the Shropshire, Worcestershire and Staffordshire Electric Power Co. The view reproduced herewith gives a better idea of the stand, which was only one phase of the company's tireless activities. With the photograph we received a little



The Shropshire Power Co.'s Stand at Birmingham.

booklet which the company is distributing. This is a consumer's *vade mecum*, telling him how to read a meter; how electricity is generated and distributed; how to obtain a supply; how to get premises wired; how to replace fuses and effect minor switch repairs; and what one unit of electricity will do. It is one of the best efforts of its kind that we have seen.

Major Segrave's Record.

Although a great deal regarding Major Segrave's speed record has appeared in the daily Press, we are compelled to refer to it, for the 1,000-h.p. "Sunbeam" in which the record was accomplished was fitted with B.T.-H. magnetos. We are also informed that the bearings of the car were made by the Ransome & Marles Bearing Co., Ltd.

Messrs. Vickers, Ltd., state that their steels were used in all the vital parts of the car.

Local Exhibitions.

Carmarthen.—A domestic electrical exhibition was held last week at St. David's Memorial Hall. The organisers were the Carmarthen Electric Supply Co., Ltd., and they secured the assistance of the staffs of local electrical contractors—Messrs. Chapman & Sons, A. H. Stoodley, and I. Davies. The opening ceremony was performed by the Mayor (Ald. W. Spurrell) and he was supported by the chairman (Mr. J. B. Arthur) and other officials of the Supply Co. Mr. Arthur, on behalf of the company, presented an ultra-violet ray apparatus to the County Infirmary, and was thanked by the Mayor. The exhibition was arranged in the form of rooms, each section being equipped in a thorough manner with the appropriate appliances. Cooking demonstrations were given in an adjoining hall. No fewer than 40 firms sent goods for exhibition. The company has an attractive tariff for domestic supply, namely, 1½d. per kWh all the year round.

Battersea.—Under the auspices of the Borough Electricity Department (engineer: Mr. F. A. Bond) an exhibition of electrical appliances was held recently at the Latchmere Baths. A comprehensive range of appliances was shown and demonstrations were given. As the department has a domestic flate rate of 1d. per kWh, as well as wiring and hiring schemes, electricity should be within the reach of everybody in the borough.

Calendars.

Just when we were waiting for it, the new wall calendar of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., came to hand from Trafford Park. The "Girl" series is continued, but there is a change in the type, and Miss Mona Maris, who acts for the British films, will inspire us and soften some of life's asperities until the end of March, 1928.

BROOKHIRST SWITCHGEAR, LTD., has sent us the April, May, and June cards for its 1927 calendar. These, similarly to their predecessors, bear excellent drawings of architectural features of ancient buildings.

Nottingham Contractors' Dinner.

Mr. H. J. Miles, president of the Electrical Contractors' Association, was the principal guest at a dinner of the Nottingham branch, at which Mr. Sidney Farr presided, on April 1st, and, responding to a toast proposed by Mr. H. Talbot, engineer of the Nottingham Corporation Electricity Department, to which Mr. A. D. Phillips, the manager of the Derbyshire and Notts. Electric Power Co., also spoke, he said their endeavour was to get a square deal not only for members of the organisation, but for everybody connected with the industry. He was sometimes asked why, as there were five or six thousand electrical contractors in the country, the Association had only 1,120 members. There were some electrical contractors whom the Association did not want; they claimed that their members were men who understood their work. Mr. Miles said that if all sections worked together harmoniously the Electricity (Supply) Act would lead to the advancement of the electrical industry. Mr. A. D. Phillips said that the success of the industry was dependent upon the capacity of the consumer. The consumer wanted his wiring done cheaply, but he should pay a fair price for what he got. The Association had gone a long way towards establishing principles of fair dealing. Ald. E. Huntsman, chairman of the Nottingham Electricity Committee and of the East Midlands Board, observed that his committee had determined that Nottingham should be supplied with electricity on the most advantageous terms that forethought, wise expenditure, and good management could secure. The committee aimed at getting electricity in all types of houses for all purposes, and desired very close co-operation with the contractors. A conference would have to be arranged to enable them to get together.

Electrical Imports of British Malaya.

The *Board of Trade Journal* reports that the imports of electrical goods and apparatus into British Malaya during 1926 were valued at £493,289, as against £386,492 in 1925—an increase of 27 per cent.

Book Notices.

A feature of the spring number of the M. & C. Apprentices' Magazine is a portrait and sketch of the career of Sir Duncan Watson, who is proudly claimed as an old M. & C. apprentice. An interesting section is that describing, and in many cases illustrating, suggestions for improvements in processes or equipment for which awards have been granted; in this issue some 50 awards are recorded, ranging from 5s. to three guineas, and nearly 150 suggestions are printed, whether adopted or not, the reasons for their rejection in many cases being given.

The first number of the *Kipling Journal* has been received from the hon. secretary of the Kipling Society, Mr. J. H. C. Brooking, The Milestone, Slough. It contains particulars of the origin and formation of the Society, many interesting reminiscences of Kipling's schooldays by his contemporaries, and a list of members.

"Business Simplified; the W.R.C.H. Plan Explained," by Barry W. Bruce. (18 pp.) Manchester: John Heywood, Ltd. Price, 1s. net.—The initials in the title of this pamphlet stand for "Wholesalers' and Retailers' Clearing House." This suggested organisation would deal with the accounts of businesses of all kinds. A retailer would only need to send a cheque covering the whole of his purchases, with a list of suppliers, and the clearing house would do the rest, saving the retailer money in the direction of cheques, postage, &c. The clearing house would also act as a comprehensive trade protection association, &c.

"Applied Magnetism," by T. F. Wall. Pp. 262; 146 figs. London: Ernest Benn, Ltd. Price, 28s. net.

Messrs. Petters, Ltd., have sent us a copy of an official guide to Yeovil (1s.), which has been written and illustrated by their publicity manager (Mr. A. T. Warbis). It is a production of great merit; the sketches of the features of Yeovil and district are particularly good.

German Turbine Syndicate.

A transaction which has just taken place in Germany has disclosed the fact that a syndicate exists for steam turbines in that country. The matter concerns the transfer to the Siemens-Schuckertwerke of the electrical and turbine branches of the Thyssen machinery works of Mulheim. As a result of the latter being in possession of raw material supplies it had been possible, it is said, for the concern to underbid the electrical firms in the prices of turbines by up to 20 per cent. The transfer of these branches to the Berlin firm will thus dispose of a competitor of the turbine syndicate and at the same time strengthen the position of the latter.

The Brush Co-partnership Scheme.

In connection with the co-partnership scheme which was established twelve months ago by the Brush Electrical Engineering Co., Ltd., shares to the value of £8,000 have been distributed among the employés. The average of allotment represents nine shares per employé. Each of the men engaged on weekly terms have received four £1 shares, which at present stand at 26s. 9d., the weekly staff six shares each, and the monthly staff 16 shares each.

The F.B.I. President's Address.

The annual general meeting of the Federation of British Industries was held on March 30th. In his address the retiring president, Sir Max Muspratt, Bt., said that the general strike from being a great catastrophe was converted into a great advertisement of British common sense and patriotism. During that strike and the coal dispute the F.B.I. gave invaluable assistance to its members to enable them to obtain coal from home stocks and overseas. The industry of this country showed unexpected vitality by the way in which it carried on; that could only be explained by the expansion of the home market in various directions. With regard to the future, there was room for optimism, for if so much of our industry could be maintained under last year's serious conditions, it was not unreasonable to expect that portion to continue and to expand. In addition, there was every sign that our export trade would reach a new normal not appreciably worse than our pre-war condition. Sir Max then dealt with the subject of international industrial conferences. The position had been summarised in the statement that the war had impoverished the Old World and enriched the New World, while it had reduced the purchasing power of the Old World and increased its productive power. It was necessary to make an effort to reorganise, to reduce costs, and to avoid excessive competition. By reason of its frequent meetings the Grand Council of the Federation had become a real clearing house of modern industrial thought. The industrialist must now not only understand his own industry, but must understand its relation to other industries, and be acquainted with all social and economic problems.

Recent Contracts.

The MIRRLEES-WATSON CO., LTD., Glasgow, has just received an important order for pumping machinery from the Indian State Railways for the Kalyan electric power station (consulting engineers: Messrs. Merz & McLellan). The contract includes three 27-in. and two 18-in. vertical-spindle type motor-driven centrifugal pumps, these supplying the condensing water required for the generating units; and nine pumps of smaller size for general service purposes. It also includes the water-screening plant of bracket type, the 42-in. circulating mains, and all pipework from the screens to the condenser and back to the river.

Marlborough House, St. James' Park, S.W., is at present being prepared for the occupation of the Prince of Wales. The extensive alterations include the complete re-wiring of the building, for which a contract has been placed by the Office of Works with MESSRS. H. J. CASH & CO., LTD., of Westminster. The steel conduits used throughout are being supplied by the "Perfecta" Seamless Steel Tube and Conduit Co. (1923), Ltd.

The HORSTMANN GEAR CO., LTD., Bath, has secured an order from the Engineering Department of the G.P.O. for 750 service boxes with time switches, and 250 service boxes without time switches, all for use in telephone kiosks. This is an interesting illustration of the growing adoption of automatic clock control for all types of public lighting.

American Radio Apparatus Licences.

The *Telegraph and Telephone Age* states that the Radio Corporation of America has entered into an agreement with the Zenith Radio Corporation, Chicago, one of the largest independent radio manufacturers, under which the Chicago concern is licensed to use the patents held by the Radio Corporation and also by the Westinghouse Electric and Manufacturing Company and the General Electric Company. The Zenith Corporation, the first of the independents to be so licensed, admitted, in the agreement, that the patents were basic and paid a large lump sum covering their use in the past. It is stated that negotiations are under way with several other independent concerns and that in all probability licences will be issued to those concerns. This movement is generally accepted as indicating that the Radio Corporation is soon to become the controlling factor in the radio industry in the United States. The agreement with the Zenith ends negotiations which have been under way since 1922, and also means the dropping of two civil actions against that concern. Numerous infringement suits brought by the Radio Corporation are pending, and if other independents are to be let in it probably will mean an early end of a great deal of litigation.

Price Reduction.

The MULLARD WIRELESS SERVICE CO., LTD., has reduced the price of its "D.U. 10" rectifying valve, which is used in connection with the "Drake" receiver described in No. 2 of "Radio for the Million."

Improved Tube Production.

At last week's meeting of Stewarts & Lloyds, Ltd., the chairman, Mr. A. C. Macdiarmid, said that the company's tube plants were being continuously improved and speeded up; the new mills were in operation and with full work they would be able to meet fair competition from any source. Special efforts were being made, with success, to open up new markets and develop existing ones. Mr. Macdiarmid also refered to the tube works which was being erected in South Africa by the company in co-operation with the United Steel Corporation (of South Africa), Ltd.

A Large Canadian Project.

M. Taschereau, the Premier of the Province of Quebec, has received a cable from the Agent-General for Quebec in London, Dr. Lemieux, stating that four members of a British syndicate, which has schemes in view for the industrial development of the Lake St. John region, involving ultimately a total capital expenditure of £100,000,000, are sailing shortly for Canada. Dr. Lemieux said that the members of the syndicate represent banking, railway, iron and steel, shipping and electrical supply companies.—*Reuter* (Quebec).

A Birthday Souvenir.

We have received from Venner Time Switches, Ltd., a handy blotter as a souvenir of the company's approaching 21st birthday. Its customers are eligible for similar souvenirs.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.		Price April 5th.	Fortnight's inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£13 10s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3½d to 3¾d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ...	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots...	per ton.	£107 to £112	...
b ,, Wire	per lb.	1/6 to 2/-	...
b ,, Sheet	,,	1/8 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£272	£2 dec.
Grade II	,, ,,	£189	£1 dec.
Grade III...	,, ,,	£97	£1 dec.
Brass (rolled metal 2" to 12" basis)	per lb.	9⅜ 1.	¼d. dec.
c ,, Tubes (solid drawn) ...	,,	11¼d. to 11⅜d.	...
c ,, Wire, basis	,,	9⅜ 1.	...
c Copper Tubes (solid drawn) ...	,,	1/0½	...
c ,, Bars (best selected) ...	per ton.	£86	...
c ,, Sheet	,,	£86	...
c ,, Rod	,,	£86	...
d ,, (Electrolytic) Bars ...	,,	£63	2/6 dec.
d ,, ,, Sheets ...	,,	£143 10s.	...
d ,, ,, Wire Rods ...	,,	£73	2/6 dec.
d ,, ,, H.C. Wire	per lb.	9⅜d.	¼d. dec.
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
n German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	8/-	...
h India-rubber, Para fine	,,	1/5½	¾d. dec.
l Iron Pig (Cleveland No. 3.) ...	per ton.	122/6	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£28 5s.	30/- dec.
g Mercury	per bot.	£21 to £22	nom.
e Mica (in original cases) small ...	per lb.	3d. to 4/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large ...	,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2½	...
p ,, ,, wire...	,,	1/3½	...
o Platinum	per oz.	£23	...
d Silicium Bronze Wire	per lb.	10¾d.	...
r Steel, Magnet, in bars	,,	7¾d.	...
n Tin, Block (English)	per ton.	£308 to £309	£4 10s. dec.
n ,, Wire, Nos. 1 to 16	per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Reporting on the lead position on April 2nd, Messrs. James Forster & Co. stated that a distinctly steadier tone had been in evidence. More activity had been shown by the Continent, Germany being reported as buyers. In this country a better demand was experienced, cable makers were buying fair quantities, while the home trade was fully occupied. Arrivals, on the other hand, in March were not excessive, totalling about 20,000 tons. "The stabilisation of the franc, which cannot now be long delayed, would at once stimulate French consumption, and at the same time relieve this market of its surplus lead."

The London Chamber of Commerce.

We have received from this organisation a copy of its report for 1926. The section devoted to the electrical and allied trades records the resignation of its chairman, Mr. S. A. Russell, through ill-health, and the appointment of Mr. P. M. Rossdale as his successor. Mr. A. M. Sillar continues to act as deputy-chairman. A committee appointed to consider the Electricity (Supply) Bill made a number of recommendations in support of amendments which, however, were not carried. The criticisms were that the Central Board was not under any effective control; that the developed areas would have to contribute to the cost of supplying undeveloped areas; and that the interconnection of stations and the construction of an efficient network could be secured by means which were less objectionable than those proposed in the Bill. The section welcomed the steps which had been taken by municipal supply authorities to reach an agreement with contractors upon the subject of municipal trading. The Merchandise Marks Bill also received the general approval of the section.

An Anglo-Italian Conference.

A conference was to take place yesterday and to-day between representatives of the Federation of British Industries and of the General Fascist Confederation of Italian Industries. The list of Italian delegates included On. Antonio Benni, president of the Confederation and of the S.A. Ercole Marelli and the S.A. Magneti Marelli; Gr. Uff. Avv. Rinaldo Panzarasa, president of the Società Idroelettrica Piemonte and the Società Telefoni Interprovinciali Piemonte e Lombardia; and Comm. Dott. Giorgio Pirelli, president of the Italian Chamber of Commerce in London and managing director of the Pirelli-General Cable Works, Ltd. The British representatives included Sir Max Muspratt, Bt.; Col. O. C. Armstrong, D.S.O. (Greenwood & Batley, Ltd.), Mr. D. A. Bremner (British Engineers' Association), and Mr. D. N. Dunlop and Col. R. K. Morcom (British Electrical and Allied Manufacturers' Association).

Lighting and Power Notes.

Birkenhead.—Supply to Wirral.—General contracts for overhead mains, transformers, sub-stations, kiosks, &c., in connection with the Corporation's electricity scheme to the Wirral Peninsula have been let. In about two months' time six or eight sub-stations will probably be erected in different parts of the area.

Brighton.—New Feeder.—At a recent meeting of the Lighting Committee the engineer reported that to deal with the increasing demand for supply in the south-west area of the borough, it would be necessary to lay a new 460-V feeder and make some slight modification to the existing feeder at present supplying that section of the area. The Committee authorised the work to be undertaken at a cost of £5,000.

Canada.—Electrical Development.—The Gatineau Power Company, subsidiary of the Canadian International Paper Company, has acquired two additional hydro-electric power installations in the Ottawa Valley. The first, near East Templeton, Que., is the Bonhomme electrical plant developing 600 h.p. The other is the plant at Papineauville, Que., of the Papineauville Electric Company, with a capacity of about 1,000 h.p. The purchase of these two power plants includes important water rights on the Blanche, Ottawa and Nation Rivers, and the Gatineau Power Company, which already controls the Chelsea, Farmers Rapids and Paugan Falls developments, on the Gatineau River, intends to carry out extensive works for the augmentation of the supply of electrical energy in the districts which may be served by the company.

Cannock.—Termination of Agreement.—The Urban District Council is to give Wolverhampton Corporation twelve months' notice to terminate the agreement under which the Corporation has had control of the commercial and distributing side of the Cannock electricity undertaking during its initial years. The Council's agreement with Wolverhampton for bulk supplies will continue.

Cardiff.—Loan Sanctioned.—The Corporation has received sanction to the borrowing of £110,000 for mains.

Chelmsford.—Supply to Marconi Station.—The Electric Supply Corporation, Ltd., is to give a supply of electricity to the Marconi experimental station, Broomfield Road.

Continental.—Spain.—The Spanish Consul in Gothenburg states that the utilisation of the waterfalls in Spain is one of the general reforms which are proceeding in that country. It is intended to harness about 1,500,000 h.p., and he states that Swedish firms will presumably be allowed to make proposals for the establishment of the works.

Sweden.—The Korsnaes Saagverksaktiebolag has bought from the Avesta ironworks its share in the Kraangedsforsen waterfalls on the Indal River in Lower Norrland, which will be able to develop about 200,000 h.p. when fully exploited.—*Reuter's Trade Service* (Stockholm).

Italy.—The Società Idroelettrica de l'Alto Timavo is engaged on the construction of an installation for the supply of electricity to the town of Trieste to the extent of 180 million kWh per year. Two hydro-electric stations are being established, one on the River Recca, which will comprise five 15,000-h.p. Pelton-type turbo-generators, and a smaller one one the River Padez, which will have three 1,000-h.p. sets.

Crookhill.—Institution Supply.—The West Riding County Council has arranged with the Doncaster Collieries Association, Ltd., for the supply of electricity to the Crookhill Hall receiving home on the following terms :—The Association to supply, erect and maintain the necessary line from the Association's Edlington Village sub-station to Crookhill Hall; also supply the necessary transformer for stepping down the pressure from 3,300 V to 110 V for lighting and power; the County Council to make a minimum annual payment of £80 for an annual consumption up to 9,600 kWh, but if the consumption exceeds this amount the payment to be at the rate of 2d. per kWh.

Darlington.—Electricity Supply.—The Rural District Council has consented to the application of the Town Council for a Special Order to supply electricity to houses in the garden suburb, outside the borough, but has reserved power for the Cleveland & Durham Co. to take over the supply if found convenient. Consent has also been given to the company for the erection of an overhead cable to supply electricity to Middleton St. George.

Eastbourne.—Opposition to Order.—The Corporation has lodged formal objection to the application of the Electric Supply Corporation, Ltd., for a Special Order authorising it to supply electricity in the parish of Hailsham, which is proposed to be included in the Eastbourne area.

Harwich.—Loan.—The Electricity Committee is to apply for sanction to the borrowing of £5,000 for the following purposes :—Services, £2,000; meters, £1,000; assisted wiring installations, £1,500; domestic apparatus, £500.

Lytham-St. Annes.—Loan.—Application is being made by the Town Council for sanction to a loan of £31,813 for electricity purposes.

Prestatyn.—Electricity Supply.—According to the *Manchester Guardian*, at a recent meeting of the Urban District Council it was reported that good progress was being made with the laying of the underground cables and the construction of the sub-station, and that the supply to the district would be available shortly after Easter.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts :—

Preston.—Lighting :—In the borough : From 8d. per kWh, less 10 per cent. discount, to 6½d. per kWh, less 5 per cent. discount. In the urban district of Fulwood : From 8d. per kWh, less 10 per cent., to 7d., less 5 per cent. Other districts : From 8d. with no discount, to 7d., less 5 per cent.

Southampton.—The increase of 20 per cent., made owing to the coal dispute, has been removed.

Bedford.—Lighting : Flat rate reduced to 6d. per kWh. The temporary increase of 10 per cent. withdrawn.

Winchester.—The temporary increase of 7½ per cent. has been removed.

Reigate.—Lighting : From 6½d. to 6d. per kWh. Power for commercial purposes : From 2d. to 1½d. per kWh.

Erith.—Domestic purposes other than lighting or power : From 2d. to 1d. per kWh. Power (except supplies given under power agreements) : From 3d. to 2d. per kWh.

Reigate.—Loan.—The Town Council is applying for sanction to a loan of £24,000 for the installation of new plant at the electricity works.

Rochdale.—Supply for Institution.—The Board of Guardians has decided to expend a sum of £3,500 on removing existing plant, and installing new plant to enable electricity from the Corporation's mains to be used at Birch Hill Institution.

Seaham Harbour.—Electricity Scheme.—The Urban District Council has accepted a revised tender of Messrs. Gray Bros. (Newcastle), Ltd., amounting to £15,468, in connection with the electricity scheme for the district, being an increase of £259, and application is to be made for the proposed loan to be revised accordingly.

Scarborough.—Revised Electricity Charges.—The Electricity Committee has recommended to the Town Council the adoption of a flat rate of 6½d. per kWh for electricity for lighting, with a discount of 5 per cent. for prompt payment of accounts. Flat rates of 1½d. per kWh for heating and cooking and 2½d. per kWh, less 5 per cent., for power are also proposed. There is a graded scale of special contract rates for power consumers who take between 10,000 and 100,000 kWh per annum.

Shrewsbury.—Inauguration of New Plant.—A new 600-h.p. Diesel engine, coupled to a 400-kW generator, was formally set in motion by the chairman of the Electricity Committee on March 28th. The cost of the extension was £15,000.

Taf Fechan.—Railway Station Supply.—At a recent meeting of the Water Board the Great Western Railway Co. inquired whether the Board would be in a position to give an electricity supply from its generating station for lighting Pontsticill station, the stationmaster's house and sidings at either end of the platform. The question as to whether a supply might be afforded to the village of Pontsticill was also raised. Consideration of the matter was deferred.

Uckfield.—Rescission of Order.—The Rural District has decided to request the Electricity Commissioners to rescind the powers granted to the Crowborough District Gas & Electricity Co. for the supply of electricity in Rotherfield and Mayfield, on the grounds that the company has taken no steps up to the present to give a supply, and in view of the company's supplying gas, the Council is of opinion that it has less inducement to supply electricity than the Weald Electricity Supply Co., Ltd. If the Commissioners are not prepared to rescind the powers at present, the Council proposes that if the company fails to give a supply in these areas within the next two years, the Commissioners should transfer the powers to the Weald Company.

Acquisition of Gas Stock.—The *Sussex Daily News* reports that the Electric Supply Corporation, Ltd., has acquired practically the whole gas stock of the Uckfield Gas & Electricity Co.

United States.—Electrical Development.—Work will be commenced shortly on a sub-station which the Public Service Electric & Gas Company has planned for the Marion generating station at Jersey City, N.J. According to the *Electrical World* it will cost approximately $3,000,000 and will be called the Hudson switching station. It will be the third of a new type of station to be built by the company, the others being at Trenton and Athenia, near Passaic. The Hudson station will distribute electricity generated at the Essex, Kearny and Marion stations so as to take care of the growing demands of Jersey City, Union City, Hoboken, Hackensack, Bayonne, Rutherford, Englewood, Edgewater, Leonia and other municipalities in Hudson and Bergen Counties. The portion of the station to be completed this year will represent a capacity of 126,000 kW. The ultimate capacity is designed to be 216,000 kW. The station will contain six 85-ton transformers furnished by the General Electric Company. The first part of the station is scheduled to go into operation by October 1st.

Work has commenced on the foundations of Debray No. 3 power station of the Detroit Edison Co., the initial installation of which will include two 50,000-kW turbo-generators. The plant will be put into commission in 1928, and the cost is estimated at $9,500,000. A sixth unit is also to be installed at the company's Trenton Channel station, which will raise the plant capacity to 300,000 kW. At the Marysville station a 30,000-kW set is to be installed which will increase the rating of the station to 110,000 kW. It is anticipated that the company will spend $32,000,000 on construction work during the current year.

Walsall.—Supply to Housing Estate.—Plans for mains to supply 666 houses to be erected by the Corporation on the Ide Road and Four Crosses housing sites have been approved, the estimated cost being £8,000.

Walton-on-Naze.—Electricity in Bulk.—The Electricity Committee has submitted a report to the Urban District Council regarding the conference with Clacton Town Council in connection with the proposed bulk supply of electricity to Walton. The Clacton borough electrical engineer proposes the erection of a sub-station near Frinton railway gates, the cost of laying the cable from the sub-station to Walton to be borne by the Urban Council, and the cost of the cable from Clacton to the sub-station to be borne by the Clacton Council, which has already applied for the necessary Order. It is anticipated that a bulk supply will be available within one year from the granting of the Order.

West Ham.—Loan.—The Town Council has applied for sanction to a loan of £83,280 for mains, services, transformers, feeders, sub-stations, and wiring installations.

Wirral. — Institution Supply. — Whether it would be cheaper for the Board of Guardians to generate its own electricity for the Clatterbridge Institution or to obtain a supply from the Birkenhead Corporation was considered at a recent meeting. Mr. Lloyd Barnes, consulting engineer, advised that it would not be a wise policy to take a supply from the Birkenhead Corporation at the present rates. If the Corporation offered electricity at 1.2d. per kWh the Guardians should accept. A Committee was appointed to meet the Birkenhead Corporation.

West-Midland Electricity District.—Inquiry.—A public inquiry was to be opened at Iron Bridge Police Station on Wednesday last relating to the proposed erection of a super-power station at Buildwas.

Wrexham.—Loan.—The Town Council has applied for sanction to a loan of £1,550 for a rotary-convertor, switchgear, &c., for the Grosvenor Road sub-station.

Wiring of Small Houses.—The electrical engineer is to submit proposals for the installation of electricity in small houses under an assisted wiring scheme.

Showrooms, &c.—A public exhibition of electrical appliances is to be held in September, and it is proposed to open a permanent showroom for the undertaking.

York.—New Boiler Plant.—The City Council has received sanction to the installation of two new boilers in place of certain existing boilers at Foss Islands generating station.

Tramway and Railway Notes.

Bradford.—Tramway Accounts.—A loss of about £10,000 on the year's working of the city tramway is attributed to the general strike. The loss on the tramway during the year has been largely compensated for by increased receipts on the railless-car services and the department's motor-'buses. The revised fares, outlined in our issue of March 25th, came into operation on April 4th.

Continental.—Poland.—Construction work on the first long-distance tramway, between Warsaw and Zyrardow, a distance of 30 miles, which was entrusted to the Power and Traction Finance Co., of London, has been completed. Services will begin when the rolling stock arrives from Great Britain.—*Reuter* (Warsaw).

Belgium.—The Compagnie Générale des Tramways d'Anvers has recently replaced the old rotary convertors at its transformer stations at Merxem and Hoboken by mercury rectifiers. A new transformer station is to be constructed in Antwerp.

Croydon.—Route Abandoned.—The Addiscombe route of the Corporation tramway was closed down on March 31st, and a motor-omnibus service introduced by the London General Omnibus Co. The company has agreed to employ a large number of the men affected by the change, and work is to be found for the remainder.

Dearne Valley.—Fares.—The Dearne Valley Light Railway Committee met recently to receive the report of a deputation which had interviewed Sir Henry Maybury, Director-General of the Roads Department, Ministry of Transport, on the question of protective fares for the Light Railway, over the route from Thurnscoe to Barnsley. According to the *Electric Railway and Tramway Journal*, this matter had been previously discussed with the Minister, but some doubt still remained whether the arrangement applied to the whole route or only that part of it in the areas of the four Councils who form the Light Railway authority. The Committee contended that the protective fares applied to the whole route, and emphasised this in its representations to the Minister. The Minister's ruling on the point is not yet known. It is understood that he is arranging a meeting with the other interested party, the Barnsley Traction Co.

Glasgow.—Tramway Improvements.—A scheme for the reorganisation and reconstruction of the rolling stock of the Corporation tramways has been approved by the Tramways Committee. It is proposed that tenders be invited for 50 new double-deck cars, and for the reconditioning of 150 of the present cars, the work to be carried out at the Department's workshops at Coplawhill. The estimated cost is £345,000. The proposals have been submitted to the Corporation for approval.

Heywood and Middleton.—Light Railways.—The Minister of Transport has recently made the Heywood and Middleton Light Railways Order, 1927, authorising the construction of light railways in the boroughs of Heywood and Middleton.

London.—"Tube" Telephones.—According to *The Times*, further safety devices are being installed on the Underground Railways in the form of telephonic means of communication between driver and guard, and experiments are now being made to ascertain whether the arrangement could be effectively employed to allow of the use of instruments in the carriages, so that announcements as to routes, non-stopping, &c., might be made by the guards to passengers throughout the train. The policy of the company is to reduce to a minimum all automatic or routine manual work, as such work is monotonous and often wasteful. The aim must be to supply the most efficient and fully-developed instrument to be handled by a limited but skilled staff. The change of system will occupy at least two or three years to carry out.

Tramway Station.—The Metropolitan Electric Tramways Co., Ltd., is to construct a tramway station in the forecourt of the Golder's Green Tube station on property belonging to the railway company, and a connection from the existing tramway in Regent's Park Road to connect up with the station at a cost of £1,870.

Tramway Reconstruction.—The Highways Committee of the L.C.C. has recommended the doubling of the tramway track in Old Street and Kingsland Road, at an estimated cost of £12,000.

Perth.—Proposed Abolition of Tramcars.—A Special Committee of the Town Council recently considered a report submitted by Mr. Pilcher recommending the substitution of motor-omnibuses for the present tramway system, and it was decided to meet Mr. Pilcher to discuss his report.

West Hartlepool.—Railless Cars.—Mr. J. H. Parker, Corporation electrical engineer and transport manager, in the course of a recent address to local Rotarians, stated that the town had the largest fleet of pneumatic-tired railless cars of any transport authority in the country. Tramcars had their merits as large-capacity moving platforms in densely-populated areas, but were doomed for passenger traffic outside those conditions. In answer to the criticisms as to the cost of the new service, he stated that the total cost of the new vehicles, the overhead equipment, taking up the tramway track, and the restoration of the roadway, would amount to less than half what it would have cost to relay the tramway track.

The new railless-car service between West Hartlepool and Seaton Carew was formally inaugurated on March 28th. With the conversion of this route, the Corporation's transport service has been completely changed over to railless cars.

Telegraph and Telephone Notes.

Aircraft Navigation.—New Wireless Station.—Among the developments now in hand for the reorganisation of the London air port at Croydon is the provision of a new wireless station, which is to be erected for the Air Ministry by Marconi's Wireless Telegraph Co., Ltd., to replace the one that has done duty there for the last seven years. The new station will consist of a group of four 3-kW transmitters operated in conjunction with a direction-finding receiver. The transmitters will be capable of telephony and continuous-wave and interrupted continuous-wave telegraphy transmission, the wave range being from 800 to 2,000 metres; independent drive circuits will be incorporated to maintain constancy of frequency and wave-length, and energy is to be supplied by a common motor-alternator group, the power from which may be switched on to any of the transmitters. The new direction-finding receiver has been specially designed to have selective characteristics and incorporates filtering and amplifying devices; it is arranged so that, if required, two or more circuits can be operated on different wave-lengths for the reception of telephony and telegraphy on the same aerials. In order to keep the neighbourhood of the aerodrome as free as possible from obstruction, the wireless masts and transmitters will be erected two or three miles from the air port and operated by the "remote-control" system.

"Beam" Radio-Telegraphy.—Australian Service Opened.—Amalgamated Wireless (Australasia), Ltd., announces that the radio-telegraph "beam" service between Australia and England will be opened to-day, April 8th. Messages will be accepted throughout Australia to all parts of Great Britain, Ireland, and the Continent of Europe, and messages from Great Britain, Ireland, and the Continent of Europe will be received for delivery to any address in Australia. Although cable rates between England and Australia have been reduced twice during the past twelve months, the rates of the "beam" wireless service will be lower than the existing cable rates and one-third less than the cable rates existing on January 1st, 1927. A second "beam" station is now being completed for the Amalgamated Wireless Company to give a direct service to and from Montreal. Over this route messages to and from all parts of Canada and the United States and South America will be sent and received, and it will also be available if required as an additional channel of communication with London.

Ecuador.—Telephone Reconstruction.—The Allmaenna Telefonaktiebolaget L. M. Ericsson has received an order from the Government of Ecuador for the complete reconstruction of the telephone system in Quito, the capital. The new system will be equipped to serve 2,000 subscribers to begin with.—*Reuter's Trade Service* (Stockholm).

The Telephone Service.—"Absent Subscribers'" Service.—What is known as the "absent subscribers' telephone service" was initiated, as an experiment, on April 1st by the Post Office. The City exchange was selected for testing the service, under which a subscriber, before going out and leaving his telephone unattended, may inform the exchange how long he will be out and where he may be found, for the benefit of persons ringing him. The fee is: For any period of interception not exceeding four hours, sixpence; exceeding four hours, one shilling. For every call intercepted a charge of a penny will be made. The minimum period for interception is half-an-hour, and the operator continues to intercept calls until the subscriber returns and notifies the switchboard.

Transatlantic Telephony.—London-Mexico Service.—The long-distance telephone line between Mexico City and San Luis Potosi, covering half the distance between the capital and the American border, is now open, and it is expected that the remaining half will be completed in September. By an agreement between the Telephone and Telegraph Companies of Mexico and America, the privileges of the transatlantic service to England will then be extended to Mexico.

Radio Notes.

France.—School Aerials.—On the ground that aerials might during a sudden storm fall to the ground and injure passers-by, the directors of Paris public schools have been requested to take down the aerials erected over their buildings, says the *Daily Mail*. The Paris municipal authorities justify their decision by arguing that the wireless sets installed in buildings used as public schools are not used by the directors for the purpose of teaching their pupils, but solely for their own personal amusement.

Japan. — New Stations.—A considerable extension of Japanese broadcasting is indicated by an order which has been placed with Marconi's Wireless Telegraph Co., Ltd., by the Japanese Broadcasting Association for three broadcasting transmitters. They are to be designed to deliver 10 kilowatts of aerial energy, and it is understood that one is to be located in the Japanese capital (Tokio), and another in Osaka, the largest city in Japan; the situation of the third station has not yet been indicated. Tokio will be the twelfth capital city of the world in which a Marconi broadcasting station has been installed.

It is reported that an order has also been placed with Standard Telephones and Cables, Limited, for the complete equipment of three broadcasting stations, their associated studios and the necessary machinery, for the Japanese Broadcasting Association. The stations will have three times the power of 2LO, which is of 3-kW capacity.

Licences.—Substantial Increase.—On the last day of February, 1927, the number of receiving licences issued by the Post Office had reached 2,234,988, an increase of 329,000 in a year; the total is exclusive of the 4,403 licences which have been granted free of charge to blind persons.

Loud-Speakers.—Sheffield By-Law.—The Watch Committee of the Sheffield City Council has recommended the making of a by-law to control the use of wireless loud-speakers which cause a nuisance by their "noise." A fine not exceeding £5 is the proposed penalty.

New High-Power Station.—Plant Installed.—Complete new transmitting apparatus has been instaled at the Daventry broadcasting station; it will have a power of 20 kW and operate on a wave-length between 300 and 400 metres. It will be the first true source of alternative programmes in this country, which, however, are not likely to become available until the autumn, for the test period will be a lengthy one. When the Postmaster-General formally sanctions the establishment of the first h.p. regional station, the new plant will be removed from Daventry to the location chosen for that purpose.

South Africa.—New Company.—As has already been briefly stated, an agreement has been signed between the Minister of Posts and Telegraphs and Mr. I. W. Schlesinger, of the African Theatres, Ltd., and African Films, Ltd., for the grant of the licence of the J B station to the African Broadcasting Co., which was formed by, and its capital underwritten by, Messrs. I. W. Schlesinger & Co., and listeners will be given preference in the allotment of shares. The Government has two directors and the Transvaal Radio League one. The company will control broadcasting in the Transvaal and Orange Free State. If the licences at Cape Town and Durban are at any time surrendered voluntarily they will be transferred upon application to the A. B. Co. Meanwhile the relaying of A. B. Co.'s programmes will be prohibited unless duly authorised. Within nine months the existing station will be transferred to Bloemfontein, and a licence will then be granted for transmission in the Free State, says *World Radio*, and a more powerful station will be erected in Johannesburg. The Transvaal and Orange Free State licences are to be granted for five years with the option of renewal for another five, the Government retaining the right to take the licence during the latter period. Out of the first profits shareholders will first receive a non-cumulative dividend of not more than 10 per cent. per annum; thereafter further profits will be distributed equally between shareholders and the Government, the latter using its share to reduce fees. To check piracy, the Minister has promised to ask Parliament to pass an Act compelling traders to examine their clients' licences before the latter can purchase wireless sets or parts.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—May 10th. Postmaster-General's Department. Telephone relays. (B.X. 3333.)*
May 17th. Resistances and reactances. (B.X. 3307.)*
May 23rd. State Electricity Commission. Switchgear and accessories. (B.X. 3285.)*
May 9th. 6,600-V transformers and spares. (B.X. 3331.)*
July 5th. One 15,000-kW steam turbo-generator and accessories. (B.X. 3369.)*
Sydney. — May 9th. Electricity Department. Station auxiliary switchgear. (B.X. 3338.)*
April 26th. A.c. electricity meters. (B.X. 3407.)*

Barnes.—Electricity Department. 1,200 yd. l.p. armoured multiple cable. (April 1st.)

Barking.—May 9th. County of London Electric Supply Co., Ltd. Cables and accessories for the Barking power station. (April 1st.)

Belgium.—Brussels.—May 13th. Municipal Council. Two 6,000-kW steam turbo-generator sets and one 1,500-kW set, for the municipal power station. Particulars (Cahier des Charges), for 125 francs, from Hotel de Ville, Brussels.

Bolsover.—April 19th. Urban District Council. Cables, boxes, pillars, &c. (April 1st.)

Bristol.—April 11th. Electricity Department. 39 miles (approx.) 3-core, paper-insulated cable. (March 18th.)

Clayton.—April 18th. Urban District Council. E.h.p. feeder cables, l.p. distributing mains, fuse pillars and transformer kiosk. (April 1st.)

Colombia. — Bogota.—April 30th. Ministry of Public Works. Two electric lifts. (A.X. 4433.)*

Edinburgh.—April 9th. Education Authority. Electric installation at St. Anthony's R.C. School, Leith. Schedules from office of the Authority.
April 18th. Electricity Supply Department. De-aerating plant and boiler feed pumps. (March 25th.)

Glasgow.—April 23rd. Parish Council and District Board of Control. Stores, including electrical fittings and lamps, for six months. Forms, &c., from Mr. A. Reynard, inspector and clerk, 266, George Street, Glasgow.

Ilford.—April 26th. Electricity Department. One 1,500-kW motor-convertor or rotary-convertor and transformer, 6,600-V switchgear cubicles and alterations to existing switchgear. (See this issue.)

India.—India Store Department. April 26th. 66-kVA motor-driven alternator sets, transformers, switchgear, &c. (April 1st.)
Telephone cable. (See this issue.)

London.—Holborn.—April 13th. Board of Guardians. Electric lighting installation at the London Road, Mitcham, schools. (March 18th.)
London County Council. April 12th. Wiring and fittings for electric lighting for Everington Street School, Fulham (approx. 196 points). (April 1st.)
April 22nd. Electrical installation at the Stonhouse Street elementary school, Clapham (approx. 167 points). (See this issue.)
April 26th. Wiring and fitting for electric lighting in two blocks of tenements at the Ring Cross housing estate, Islington (approx. 274 wiring points).
G.W.R. April 21st. Stores, including electrical wires and cables and telegraph ironwork. (April 1st.)

New Zealand.—Wellington.—May 31st. Public Works Department. 50-kVA transformers for the Waikaremoana electric power scheme. (B.X. 3294.)* 50-kVA transformer for Arapuni scheme. (B.X. 3293.)*
June 21st. Sub-station switchgear and metering equipment for Arapuni. (B.X. 3398.)*
June 7th. Railway sub-station equipment, Lake Coleridge electric power scheme. (B.X. 3295.)*
May 4th. General Post Office, Stores Division. Sub-station protectors. (B.X. 3286.)*

June 13th. New Zealand Railways. Machine tools, workshop equipment and overhead electric travelling cranes. (A.X. 4344.)*

June 6th. Six electric locomotives. (A.X. 4355.)* Overhead equipment for the Christchurch-Lyttelton electrification scheme. (B.X. 3301.)*

Invercargill.—May 31st. Southland Electric Power Board. Transformers. (B.X. 3379.)*

June 15th. 66,000-V, oil circuit-breakers. (B.X. 3378.)*

Plymouth.—April 25th. Electricity Department. Electricity meters, cables, and transformers. (April 1st.)

South Africa. — Johannesburg. — May 7th. Municipal Council. Electric street lamp fittings and globes. (B.X. 3395.)* Cables. (B.X. 3406.)*

Cape Town.—June 1st. The University. Electric cooking utensils for the new residences at Groote Schuur. (B.X. 3393.)*

Southend-on-Sea.—April 9th. Light Railways and Electricity Department. Remote-controlled rotary convertors. (March 11th.)

April 19th. 4,000 joint boxes. (March 25th.) 1,400 current limiters. (April 1st.)

Spain.—Madrid.—Ministerio de Fomento. Six electric cranes for the port of Alicante.—*Reuter's Trade Service* (Madrid).

Stafford.—April 30th. Staffordshire Education Committee. Electric wiring and fittings for the new infants' department of the Slater Street Council school and in the additional class rooms, laboratory, &c., in the Salisbury Street central school. (See this issue.)

Uruguay.—Montevideo.—June 15th. State Electricity Supply Works. 15 transformer sub-station equipments (6,600/220 V, 50 cycles). (B.X. 3371.)*

Wrexham.—April 19th. Electricity Department. One 250-kW rotary-convertor equipment and d.c. switchgear. (April 1st.)

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*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—Melbourne.—Commonwealth P.M.G.'s Department. Accepted :—

Underground and aerial cable.—(£123,303), British Insulated Cables, Ltd.; (£59,832), Connollys (Blackley), Ltd.

Insulated wire (£1,723).—W. T. Henley's Telegraph Works Co., Ltd.

—*Tenders.*

Birkenhead.—Elecricity Committee. Recommended:—

11,000-V overhead and underground transmission lines (£26,308), l.p. distributing mains for Heswall and Gayton (£15,288).—W. T. Henley's Telegraph Works Co., Ltd.

Brighton.—Tramways Committee. Accepted:—

Brake blocks (£144).—Dover Engineering Works, Ltd.
Trolley wire (£84).—Elliotts Metal Co., Ltd.
Steel tires (£222 15s.)—A. Brown & Co.
Tungsten filament lamps (£100).—Kye, Ltd.

Dundee.—The Electricity Committee has decided to accept tenders for cables from three foreign firms in preference to British offers. The foreign quotations (Dutch, Danish, and German) were £648 lower than the British offers.

Eastbourne.—Electricity Committee. Accepted:—

Cable, transformers and switchgear in connection with the ring main (£10,192).—Standard Telephones and Cables, Ltd.

Glasgow.—Tramway Committee. Recommended:—

Welding of rail joints.—Thermit, Ltd.
Special track work.—Hadfields, Ltd.

Corporation. Recommended :—

Additional electrical work at Kelvin Hall (£119).—Edmiston, Brown & Co.

Hull.—Telephones Committee. Recommended:—

3 tons bronze wire (£276).—F. Smith & Co.

Japan.—

Complete radio equipments for three 10-kW broadcasting stations for the Japanese Broadcasting Association.—Standard Telephones & Cables, Ltd.

London.—London County Council Education Committee. —Wiring and fittings for electric lighting, power telephones, electric clocks and bells at Trade School for Girls, Barrett Street, Marylebone :—

E. Wender	£947
Alpha Manufacturing and Electrical Co., Ltd. (accepted)	**995**
Anderson, Angell & Co.	1,062
J. F. Prendergast	1,095
L. G. Tate & Co., Ltd.	1,098
Alex. Hawkins & Sons	1,157
Richard Hunt & Co., Ltd.	1,167
J. Briggs & Co.	1,241
Pinching & Walton	1,365

Post Office.

Telephone switchboard lamps.—Edison Swan Electric Co.,

London, Midland & Scottish Railway Co.

Part contract for the supply of electric lamps.—British Thomson-Houston Co., Ltd.; Metro-Vick Supplies, Ltd.

London & North-Eastern Railway Co.

Electric lamps.—Edison Swan Electric Co., Ltd.

Southwark.—Electricity Committee. Accepted :—

Battery plates (£189).—Alton Battery Co.

Plymouth.—Tramways Committee. Accepted:—

25 tramway standards (£240).—Equipment & Engineering Co., Ltd.

Reigate.—Rural Council. Accepted:—

Wiring and fitting houses at Chipstead for electric light at £4 16s. and £5 12s. each.—County of London Electric Supply Co., Ltd.

Salford.—Baths Committee. Accepted:—

Electric lighting installation at the Hodge Lane baths and washhouse (£268).—R. H. Clampett & Co.

Electricity Committee. Accepted :—

Extras on the contract price on account of delay and additional testing expenses in connection with the supply of turbo-alternators at the Agecroft power station (£3,950). — Metropolitan-Vickers Electrical Co., Ltd.

Dismantling and supplying new pressure part for No. 19 boiler economiser (£1,100 approx.).—Babcock and Wilcox, Ltd.

Tramways Committee. Accepted :—

25 fully-enclosed top covers for tramcars (£15,300).—Massey Bros.

Sheffield.—Electricity Supply Committee. Accepted:—

12,000-V switchgear for Blackburn Meadows generating station.—A. Reyrolle & Co., Ltd.

South Africa.—*The South African Engineer* states that the Electricity Committee of the Durban Town Council is of opinion that a preference of not more than 10 per cent. should be given to goods of British manufacture over those of foreign origin, and has accordingly recommended the acceptance of auto-transformers from Holland, where the saving was 14 per cent., and lamps from Austria, where the saving varied from 14 per cent. to 19 per cent., but in the case of cables for interconnection between Alice Street and Congella power stations, it preferred the lowest British offer, the gross difference in price, compared with cable from Holland, being 9.8 per cent., which would have been appreciably reduced by the consulting engineers' charges for inspection and testing.

Forthcoming Events.

Physical Society.—Friday, April 8th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Junior Institution of Engineers.—Friday, April 8th. 39, Victoria Street, S.W. 7.30 p.m. "Electrical Osmosis." Mr. E. Ambrose.

Women's Engineering Society.—Friday, April 8th. 26, George Street, W. 6.30 p.m. "A Business Woman's Trip to America." Miss E. M. Kennedy.

Royal Institution.—Friday, April 8th. 9 p.m. "Early Days in Radio-Activity." Sir Ernest Rutherford, F.R.S. Saturday, April 9th. 3 p.m. "The Alpha Rays and Atomic Structure." Sir Ernest Rutherford, F.R.S.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, April 9th. School of Mines, Treforest. 6 p.m. "Aerial Wire Ropeways." Mr. J. W. White.

(London Branch).—Tuesday, April 12th. Junior Institution of Engineers. 6.30 p.m. "Mixed Pressure Turbines for Colliery Use." Mr. C. H. Naylor.

Chief Technical Assistants' Association.—Saturday, April 9th. Holborn Restaurant. 7.45 p.m. Annual dinner.

Institution of Electrical Engineers.—Informal Meeting.—Monday, April 11th. London. 7 p.m. "Maintenance of Small Electric Power Plant." Mr. T. Hodge.

(North-Eastern Centre). — Monday, April 11th. Literary and Philosophical Society, Newcastle-on-Tyne. 7 p.m. "The Applications of Electricity to Agriculture." Dr. A. Ekström.

(Scottish Centre).—Tuesday, April 12th. Royal Technical College, Glasgow. 7.30 p.m. "The Applications of Machinery at the Coal Face." Mr. S. Mavor.

(Western Centre).—Monday, April 11th. South Wales Institute of Engineers, Cardiff. 7 p.m. "The Design of City Distribution Systems." Messrs. J. R. Beard and T. G. N. Haldane.

(South Midland Centre).—Wednesday, April 13th. University, Birmingham. 7 p.m. "The Applications of Electricity in Warships." Mr. W. McClelland.

Edinburgh Electrical Society.—Thursday, April 14th. 117, George Street. 8 p.m. Business meeting.

Electrical Power Engineers' Association (Manchester Section).—Thursday, April 14th. Geographical Hall, Manchester. 7.30 p.m. "Rotary Convertors." Mr. E. P. Hill.

(Glasgow Section).—Friday, April 15th. Reid's Restaurant, Glasgow. 7.30 p.m. "Modern X-Ray Plant and Practice." Mr. W. S. Weir.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

A hand lamp with magnet in base so that the lamp will attach itself to ironwork. Must operate on usual supply voltages.

An electrical band saw brazing machine.

Notes.

Summer Time.

Readers are reminded that "summer time" comes into operation this week-end. All timepieces should accordingly be advanced one hour during the night of Saturday-Sunday, April 9th-10th.

The British Science Guild.

The British Science Guild dinner will be held at the Criterion Restaurant, London, on Thursday, May 13th, when the Rt. Hon. Lord Askwith, K.C.B., K.C., will preside. Amongst the speakers and other guests will be Sir Alfred Mond, Bart., P.C., M.P., Sir Herbert Samuel, P.C., G.B.E., General Sir George Milne, G.B.E., G.C.M.G., K.C.B., D.S.O., and Sir William Pope, K.B.E., F.R.S. Particulars may be obtained from the Secretary, 6, John Street, Adelphi, W.C.2.

Electricity in Mines.

The 1926 edition of the annual volume of "Regulations and Orders under the Coal Mines Act, 1911," has now been published (H.M. Stationery Office, price 1s. net, by post, 1s. 3½d.). In this edition, which contains the Statutory Rules and Orders relating to mines in force on January 31st, 1927, the amending orders have been consolidated with the relative principal orders, and a general subject index has been added.

Public Lighting Conference.

The annual conference of the Institution of Public Lighting Engineers is to be held this year at Brighton on September 12th to 15th. Among the important papers which will be read are one on the "Public Lighting Scheme of the Borough of Brighton," by Mr. John Christie, M.I.E.E., engineer and manager, Brighton electricity undertaking; and a joint paper, "Descriptive of the British Engineering Standards Association's Standard Specification for Street Lighting," by Capt. L. B. W. Jolley, M.A., M.I.E.E., research engineer, General Electric Co., Ltd., and Mr. Robert Watson, engineer and manager, Doncaster gas undertaking. The proceedings will also include the address of the incoming president, Mr. A. C. Cramb, M.I.E.E., engineer and manager, Croydon Electricity Department. During the conference there will be an exhibition of some of the most modern street-lighting appliances.

Electrical Precipitation of Gold.

An electrical device for reclaiming the particles of gold which formerly escaped up the flue of the smelting furnaces has just been installed in the Government Assay Office at New York. In tests, as much as 600 oz. of gold has been reclaimed from 5,000 lb. of dust extracted from the fumes. Electrical action drives the dust particles from the heavy gases; the dust is collected, and the gold recovered by smelting again. Silver and platinum atoms are also arrested by the device.—*Reuter's Trade Service* (New York).

The Engineers' Club (London).

During this month eleven meetings of societies are being held at the Engineers' Club, of which three are electrical.

Appointments Vacant.

Showroom manager for the Westminster Electric Supply Corporation, Ltd. Meter assistant for the Fulham Borough Council, Electricity Department. (See our advertisement pages to-day.)

Service Notes.

From 15 to 20 vacancies for permanent commissions in the Stores Branch of the Royal Air Force will be offered for competition among young men between 23 and 25 years of age who have not less than five years' business experience in a firm of standing. Accepted candidates will be gazetted to commissions as pilot officers on probation, and will be eligible for promotion to the rank of flying officer. Particulars can be obtained from the Secretary, Air Ministry, London, W.C.2.

Electrical Association for Women.

On March 30th, a party of members of the above Association visited the Poplar power station and were shown the new pulverised-fuel plant. During tea at the staff canteen Mr. J. H. Bowden, borough electrical engineer, and Councillor Keys, chairman of the Electricity Committee, outlined the work which is being carried out by the electricity undertaking.

Conference on Extra-High-Pressure Systems.

As announced in our issue of January 7th, the Fourth International High Pressure Transmission Conference is to be held in Paris from June 23rd to July 2nd next. The work of the Conference will be divided into three main divisions, to each of which a couple of days will be allotted, *viz.*, The Production of Power; The Construction of Transmission Lines; and The Operation of Transmission Systems. Two days will also be devoted to excursions and visits to electrical installations in the Paris district.

The Institution of Engineers-in-Charge.

Annual Dinner.—On Saturday last the annual dinner of this Institution was held at the Holborn Restaurant, London. The president, Mr. L. St. L. Pendred, M.I.Mech.E., was in the chair, and amongst the many guests were Mr. W. H. Patchell and Mr. T. Cooper, past-presidents, Eng. Vice-Admiral Sir R. B. Dixon, Sir Henry Fowler (Pres. I.Mech.E.), Eng.-Capt. W. Onyon (Pres. I. Marine Engineers), Dr. W. H. Eccles (Pres. I.E.E.), Sir Philip Dawson, Sir W. J. Berry, Mr. J. L. Musgrave (Pres. I.H. & V.E.), Mr. D. A. Bremner, and Mr. R. H. Hutchinson (Pres. I. Prod. Engineers).

After the loyal toasts, Sir Philip Dawson proposed "The Institution," commenting on the opportunities it afforded the members to interchange information and thus increase the efficiency of their installations, to visit works, and to engage in social intercourse. He urged them to promote that goodwill and co-operation between employers and employed which was indispensable to industrial success, and prophesied that the closing of small generating stations by the Central Electricity Board would not result in loss of employment to their staffs. The president responded, expressing admiration at the efficiency with which the work of the Institution was carried on, and commending the ability and enthusiasm of Messrs. G. A. Hughes and J. E. Watkins, and Capt. A. E. Penn, the hon. secretary. The meetings, he said, were thoroughly practical; the members spoke of what they really knew.

Mr. H. King, vice-chairman, proposed "Our Guests and Friends," expressing gratitude for the support of the leaders of the great Institutions; Sir Henry Fowler, responding, emphasised the importance of the men who used the machines, and Dr. W. R. Ormandy, also responding, referred to the value of meeting men who controlled men. Mr. W. Edwards, chairman, proposed the health of "Our President," quoting a horoscope cast by Capt. Penn; Mr. Pendred, in response, said he was impressed with the active social side of the Institution, and urged that it was essential for all classes to "get together." All the great engineering inventions were British, and if they held together and used all their resources they would come out on top, in spite of the burden of taxation that weighed upon industry.

Mr. W. H. Patchell proposed the health of the hon. secretary, paying a tribute to his industry and efficiency; and Capt. Penn briefly acknowledged the compliment. A programme of music, interspersed with the speeches, contributed to the success of an enjoyable evening.

Gear-Tooth Grinding.

We have received a copy of a pamphlet, "Notes on straight spur gears with special reference to gear-tooth grinding," by A. H. Orcutt. The author advocates the gear-grinding machine as the only solution to the difficulty of keeping the tooth design within the necessary limits of accuracy. With heavily loaded gearing running at high speeds it is necessary for the error of each tooth to be under .0003 in. Advantage can also be gained by using ground gears for light loads and slow speeds. The truing device on the "Orcutt" machine is briefly described, and the process of setting up and inspection by the Gear Grinding Co., Ltd., is given.

Institution Notes.

Institution of Electrical Engineers.

Summer Meeting.—The summer meeting is to be held this year from June 14th to 17th, at the North-Eastern Centre, Newcastle-upon-Tyne. Visitors will assemble at the Central Station Hotel on the Monday evening to meet the Committees of the Centre (Mr. J. Rosen, chairman) and of the Tees-side Sub-Centre.

On the Tuesday morning and afternoon visits will be paid to the Heaton works of C. A. Parsons & Co., Ltd., and the Hebburn works of A. Reyrolle & Co., Ltd., and there will be a civic reception in the evening at Newcastle.

On the Wednesday morning the North Tees power station of the Newcastle-upon-Tyne Electric Supply Co., Ltd., will be inspected, whilst in the afternoon the main party will proceed on an excursion to Durham, and a subsidiary party (limited to 100) will visit the Blackhall pit of Horden Collieries, Ltd. The evening will be free for members to do as they choose.

On the Thursday there will be alternative visits to the Elswick works of W. G. Armstrong, Whitworth & Co., Ltd., or to the Ford Potteries of C. T. Maling & Co., Ltd. (party limited to 60). During the afternoon alternative visits will be paid to the Wallsend shipyard of Swan, Hunter & Wigham, Richardson, Ltd. (party of 150), the Ford Potteries (party of 60), or the new library at Armstrong College, Newcastle, the Council of which will hold a reception and dance in the evening.

On the Friday morning the new steel works and rolling mills of the Consett Iron Co., Ltd., will be inspected; ladies are advised to avail themselves of the alternative excursion to Hexham and the Abbey. In the afternoon both parties will visit the Roman wall and camp at Borcovicus, returning to Newcastle, where an evening reception and dance will terminate the proceedings.

Mersey and North Wales (Liverpool) Centre.—The annual meeting of the Centre will be held at Liverpool on April 25th. The Committee has nominated the following officers for the 1927-28 session:—*Chairman*—Prof. F. J. Teago, D.Sc.; *vice-chairmen*—Mr. S. E. Britton and Prof. E. W. Marchant, D.Sc.; *ordinary members of committee* (four vacancies)—Mr. G. D. Coe, Mr. H. C. Hazel, Mr. W. M. Horsfall, Mr. E. V. L. Mathias, and Mr. J. L. F. Vogel; *hon. secretary and treasurer*—Mr. Oscar C. Waygood.

Western Centre Summer Meeting.—The week-end summer meeting of the Centre this year is to take the form of a visit to Plymouth, where the chairman, Mr. W. G. Heath, resides, from Friday, May 20th, to Monday, May 23rd. It is proposed to make the journey by charabanc, starting from Weston-super-Mare if the steamers are running, or from Bristol; ladies are specially invited.

The Faraday Society.

Change of Address.—It is announced that the Society has changed its address to 13, South Square, Gray's Inn, London, W.C.1; its telephone number is Chancery 7230.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The appointment of Mr. Archibald Page, M.I.E.E., to be chief engineer and manager to the Central Electricity Board, which was briefly mentioned in our last issue, marks an important step towards the organisation of the staff of that body. Mr. Page, whose portrait is here reproduced, is a native of Alloa, N.B., and was educated at Dollar Academy; he received his technical training at the Heriot-Watt College, Edinburgh, and the Royal Technical College, Glasgow. After practical service at the Broad Street Engine Works, Alloa, and Messrs. Mavor & Coulson's, at Glasgow, he joined the staff of the Glasgow Corporation Electricity Department in 1899, and quickly rose to the position of chief assistant engineer under Mr. W. W. Lackie, and deputy chief engineer, positions which he occupied from 1905 to 1917. He then became assistant general manager to the Clyde Valley Electrical Power Co., and two years later general manager. In 1920 he was appointed one of the first Electricity Commissioners. At the end of June, 1925, Mr. Page returned to active participation in the electricity supply industry, becoming a director and general manager of the County of London Electric Supply Co.

His new post is perhaps the most important, and certainly the most onerous, that is open to the ambition of electrical engineers in this country. As engineer to the Board, Mr. Page will be charged with the duty of carrying out the schemes of interconnection and transmission on a colossal scale which are being prepared by the Electricity Commission for submission to the Central Electricity Board; as manager he will conduct an enormous commercial enterprise—the purchase and resale of more than half the total output of the statutory undertakings of the country. But as nothing has been done yet, and it will take time to build up the huge machine and get it into motion, his work for the present will be mainly constructive, laying the foundations well and truly for the structure that will be erected during the next ten or twenty years—the most important commercial undertaking in the Empire. He will take up his new duties on May 1st.

Mr. Page, who has been a vice-chairman of the Scottish Centre, is a vice-president of the Institution of Electrical



Lajayette] *[Glasgow*

Mr. Archibald Page,
Chief Engineer and Manager to the Central Electricity Board.

Engineers; he is held in the highest esteem by his electrical *confrères*, on account of his professional ability as well as his personal qualities, and his appointment will restore the confidence of many whose anticipations of the working of the Act were far from optimistic.

Mr. A. S. Blackman, general manager and engineer of the Sunderland Corporation Electricity Department, has returned from the three months' leave of absence which the Corporation granted him upon his completion of 20 years' service.

Mr. George Offor had many callers and a host of congratulatory letters and telegrams from his friends on March 30th, when he attained his hundredth birthday. The King and Queen sent a telegram wishing him peace and happiness for the remainder of his days, and among the day's callers at Peak Hill Villa, Sydenham, were Sir Philip Dawson, member for the Division, and Lady Dawson, and a delegation from the British Electrical Federation, Kingsway. A brief thanksgiving service, conducted by local ministers, was held at the house, which was decorated with many floral gifts.

At Colne, on March 31st, Mr. Edgar Duckworth, of the London and Provincial Radio Co., was married to Miss Emily Stansfield, of Foulridge.

Accrington Council is recommended to confirm an increase in the salary of Mr. A. W. Clegg, the electrical engineer, from £866 to £913, with a further addition of £50, with bonus at the full rate then prevailing, from April 1st, 1928.

Mr. John Macleod, secretary of the Oriental and China and Japan Telephone Companies, retired on the 31st ult., after 45 years' service.

About 100 members of Blackpool Athenæum Club assembled on March 31st, when a dinner and dance were held in honour of the chairman, Mr. Charles Furness, borough electrical engineer.

The salary of the Perth Corporation electrical engineer has been increased by £25.

The *Financial News* reported last week that Lord Ampthill and Major O. Sumner, O.B.E., accompanied by their principal contracting and electrical experts, had left Southampton by the R.M.S.P. *Andes* in connection with important public works developments in the Argentine Republic.

The *Daily Telegraph* states that Sir James Parr, the High Commissioner for New Zealand, has been nominated by the New Zealand Government as its representative on the reconstituted Pacific Cable Board.

Mr. Robert Allan, of Messrs. Allan & Mayes, electrical engineers, Falkirk, was presented with a clock by staff and friends on the occasion of his marriage.

As we briefly reported last week, Mr. S. J. Watson, borough electrical engineer of Salford, has been appointed chief engineer to the London and Home Counties Joint Electricity Authority. Mr. Watson went to Salford over four years ago, relinquishing a similar post at Bury, which he had held since 1896. Prior to that he was station superintendent to the National Electric Supply Co., Preston. In 1917-18 he was president of the Incorporated Municipal Electrical Association, and he has been chairman of the Manchester local section of the Institution of Electrical Engineers.



Mr. S. J. Watson, M.Inst.C.E., M.I.E.E.,
Chief Engineer to the London Joint Electricity Authority.

Mr. Watson's resignation came before the Salford Electricity Committee on March 30th. In accepting it the Committee expressed its regret at losing Mr. Watson, and placed on record its high appreciation of his services and abilities. Congratulations on his new appointment were also extended to him. The Committee decided to invite applications for the position of city electrical engineer at a salary of £1,500 inclusive, rising by annual increments of £100 to £2,000.

Obituary.—Mr. W. R. Mickelwright.—The death of Mr. W. R. Mickelwright, to which we briefly referred last week, occurred on March 23rd. He was managing director of Mickelwrights, Ltd., electrical engineers, of Alperton, Wembley. He received his early training at Finsbury Technical College, leaving there to take up a post with the Central London Railway. He founded the firm of Mickelwrights, Ltd., in 1912, and served during the war in the Royal Naval Air Service. He had a large circle of business friends, and the Wembley Radio Society had in him a popular secretary.

Eng.-Com. W. Dobson.—We regret to record the death, which occurred on March 29th, at Wembley, after a few hours' illness, of Engr.-Commander William Dobson, R.N.R., M.I.E.E., superintendent electrical engineer at Stonebridge Park power station of the L.M.S. Railway. After serving an apprenticeship with Vickers-Maxim's at Barrow-in-Furness from 1889-1892, he became engineer-in-charge of various liners of the P. & O. S.N. Co., and was granted a commission in the Royal Naval Reserve in 1896. From 1898-1904 he was assistant engineer in the Whitehall Court, Rathbone Place and Amberly Road stations of the Metropolitan Electric Supply Co., Ltd. In 1904-1905 he was operation and guarantee engineer for the Neasden power house contract (Metropolitan Railway) on behalf of the British Westinghouse Co. Then followed seven years (1905-1912) as assistant electrical engineer with the Metropolitan Railway in charge of the electrical operation of the power house and sub-stations, also the train equipments; and, finally, service from 1912 to 1927 as superintendent electrical engineer at Stonebridge Park power station, as stated above. He was 58 years of age.

Mr. G. A. Schanschieff.—We regret to record the death, at the early age of 49 years, of Mr. George A. Schanschieff, for 25 years managing director of the Premier Accumulator Co., Ltd., of Northampton. Mr. Schanschieff passed away on Saturday last after a short illness, at his residence, North View, Marriott Street, Northampton. The works of the company were closed on Tuesday, the day of the funeral. The deceased gentleman was a son of the late Mr. A. Schanschieff, so well known in London many years ago as a battery inventor and expert.

Mr. S. Aspen.—The death is announced of Mr. S. Aspen, who was for many years connected with the Scarborough Tramway Co., of which he was a director. He was 72 years of age.

Mr. W. Chadburn.—*The Times* records the death, on April 3rd, of Mr. William Chadburn, chairman of Chadburn's (Ship) Telegraph Co., Ltd., in his 84th year.

Mr. R. Crush.—The death has occurred, at the age of 68 years, of Mr. Robert Crush, who was for a number of years on the staff of the Electric Supply Corporation at Chelmsford.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Frigidaire, Ltd.—Incorporated outside the United Kingdom. Particulars filed on March 24th. Capital is $25,000 (United States) in 250 shares of $100 each. The company was incorporated in Canada on September 1st, 1926, to manufacture and deal in mechanical and electrical devices, machines, engines, refrigerators, appliances and apparatus of all kinds, especially pumps, washing machines, and other household devices, &c. The chief place of business is at Toronto. British address: Imperial House, 19, Kingsway, W.C.2. H. L. McGurk is authorised to accept service of process and notices on behalf of the company.

W. Hammerl & Co., Ltd.—Private company. Registered March 28th. Capital, £600 in £1 shares. Objects: To carry on the business of manufacturers, importers, exporters, and repairers of and wholesale and retail dealers in all kinds of electric and other lamps, and apparatus for wireless telegraphy and telephony and television, &c. The first directors are:—W. Hammerl, 56, Minster Road, West Hampstead, N.W.2; H. J. McCarthy (permanent), 23, Staverton Road, Brondesbury Park, N.W.2. Secretary: M. J. McCarthy. Solicitors: Romain & Romain, 132, Seymour Place, Bryanston Square, W. Registered office: 4, Norfolk Mews East, Paddington, W.1.

Radio Investigations, Ltd.—Private company. Registered March 29th. Capital, £90 in £1 shares. Objects: To assist in and finance, research, investigation, inquiry into and experimenting upon, developing and perfecting all matters connected with electrical and photographic knowledge and apparatus in connection with such matters, including wireless transmitting and receiving apparatus, kinematograph films, &c. The subscribers (each with one share) are:—L. A. Levy, D.Sc., 31, Shoot-up-Hill, Cricklewood, N.W.2; D. W. West, 5, Shalimar Gardens, Acton, W.3, research chemist. Solicitors: Oliver Richards & Park, 1c, King Street, St. James, S.W.

Partridge & Mee, Ltd.—Private company. Registered March 31st. Capital, £4,000 in £1 shares. Objects: To carry on the business of manufacturers and importers of and wholesale and retail dealers in all kinds of electric telephones and telegraphs and all apparatus used for and connected with the transmission and reception of telephonic, telegraphic and radio telephonic and telegraphic communications, &c. The first directors are:—C. A. F. Partridge (chairman), 6, Clarendon Park Road, Leicester; S. N. S. Mee, 48, Queen's Road, Leicester; V. F. Hewitt, Budden Lane, Quorn, Leics. The first two named are permanent. Solicitors: Stone, Davis, Savage & Partridge, 4, Welford Place, Leicester.

C. P. Ribton, Ltd.—Private company. Registered April 1st. Capital, £500 in £1 shares. Objects: To carry on the business of electrical, mechanical, and general engineers, manufacturers of and dealers in engineering plant and accessories, dealers in motor vehicles, machinery, &c. The subscribers (each with one share) are:—P. A. C. Ribton, 34, Allington Street, Liverpool, electrical engineer; Mrs. A. Ribton, 34, Allington Street, Liverpool. P. A. C. Ribton is the first director. Registered office: 44, South Castle Street, Liverpool.

Jays & Co. (Engineers), Ltd.—Private company. Registered April 1st. Capital, £700 in £1 shares. Objects: To carry on the business of general and electrical engineers, lubricating ring and general manufacturers, &c. The first directors are:—W. Hinson, 25, Irving Street, Edgbaston, Birmingham, engineer; H. Hinson (same address), engineer. Qualification: Two shares. Registered office: 188a, Bromsgrove Street, Birmingham.

Baird Television Development Co., Ltd.—Public company. Registered April 1st. Capital, £125,000 in 100,000 10 per cent. preferred participating ordinary shares of £1 each and 500,000 deferred ordinary shares of 1s. each. The objects of the company are to test, exploit, exercise, develop, manufacture, exhibit, use, let out on hire, grant licences in respect of, sell, and generally turn to account and trade with inventions relating to a system of transmitting views, portraits and scenes by telegraphy or wireless telegraphy, &c., and to enter into certain agreements, the parties to which are not named. The minimum cash subscription is 7 shares. The first directors (to number not fewer than 3 or more than 8) are:—Sir Edward Manville, Kt., 3, Whitehall Court, S.W. (chairman of Daimler Co., Ltd.); Sir James C. Percy, Kt., "Ardenvohr," Cowper Road, Dublin (chairman, Sackville Press); F. R. A. Shortis, Firfield, Weybridge, banker; J. L. Baird, 975, Finchley Road, N.W., inventor (director of Television, Ltd.); O. G. Hutchinson, 87, St. George's Road, S.W. (director Television, Ltd.). Subject to any contract or appointment made, and to the maximum number of directors fixed as above, Television, Ltd., shall, being by itself or its nominees the holder of 300,000 deferred ordinary shares, have the right at all times to nominate and appoint half the directors. One of the directors so nominated and appointed shall, if required by that company, be chairman. Qualification (other than O. G. Hutchinson and J. L. Baird, whose qualification shall be £100): £500 shares. Remuneration: £300 each per annum (chairman £100), free of income tax. Solicitors: Kenneth Brown, Baker, Baker, Lennox House, Norfolk Street, W.C.

Official Returns of Electrical Companies.

Radions, Ltd. — Mortgage debenture dated March 8th, 1927, to secure £800, charged on the company's undertaking and property, present and future, including uncalled capital (ranking *pari passu* with debenture for £1,200 issued October 26th, 1926). Holders: R. Dobson and R. T. Hindley, Mosley Street, Manchester.

Windsor Electrical Installation Co., Ltd.—Satisfaction in full on March 9th, 1927, of mortgage dated March 11th, 1902, securing £20,000.

A. E. Tribe & Co., Ltd.—A. E. Tribe, of 18, London Street, Basingstoke, ceased to act as receiver on March 24th, 1927.

Allen, West & Co., Ltd.—Capital, £150,000 in £1 shares. Return dated February 22nd, 1927. 141,724 shares taken up. £141,724 paid. Mortgages and charges, £60,000.

Electric Advertising Clocks, Ltd. — Capital, £36,000 in 30,000 ordinary shares of £1 each and 120,000 deferred shares of 1s. each. Return dated January 6th, 1927. 27,492 ordinary and 120,000 deferred shares taken up. £8,600 paid (being 10s. per share on 17,200 ordinary shares). £16,292 considered as paid (being £1 per share on 10,292 ordinary and 1s. per share on 120,000 deferred). Mortgages and charges, nil.

General Cable Manufacturing Co., Ltd.—Particulars filed of £60,000 debentures authorised March 18th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued. Also registered, a debenture of same date to secure £10,000 with a bonus of £1,000, charged on the company's property, including uncalled capital, subject to above debentures. Holder: H. Bisseker, c/o E. G. Bisseker, 1, Balderton Street, Satisfaction in full on March 18th, 1927, of debentures dated October 26th, 1923, and January 2nd, 1924, securing £20,000 and £5,000 respectively.

B. A. Manufacturing Co., Ltd.—Issue on March 23rd, 1927, of £500 debentures, part of a series already registered.

City Notes.

English Electric Co., Ltd.

The annual meeting was held on March 30th, Mr. P. J. Pybus presiding. In moving the adoption of the report, the chairman said that while the industrial disputes were not the sole cause of their troubles, no group such as theirs could operate profitably under the labour conditions which dislocated their shops for the major portion of last year. Having referred to some of the principal items in the balance sheet, he said that the continued existence of unbridled competition for export work had also been a disquieting feature of the year. Not only their company, but other British companies engaged in the manufacture of heavy electrical plant, starting with the laudable object of defeating the foreigner, had too often found themselves defeating one another in a race for extra output as a corrective for too low prices. Competition in the heavy electrical industry had been carried to a point of wastefulness, and was, from the national point of view, a costly rivalry. That was now generally recognised, and it was to be hoped that some arrangement would be made by which the destructive internecine competition between all the principal companies engaged in the heavy trade for foreign work could be reduced. It needed but a small increase of the selling prices of their invoices for export—certainly not more than three per cent.—to change entirely the result of a year's trading, and to put the heavy business on to a reasonably sound footing. That fierceness of competition was partly a legacy of the war, and the optimism which followed its conclusion. By the amalgamation of 1918 they secured six businesses with works at Preston, Coventry, Stafford, Rugby and Bradford. At two of those works considerable extensions were already in hand at the time of the amalgamation. The optimism of 1918 affected almost every type of business, and they, in common with many other concerns, set out to re-equip their shops for what had so far proved to be an output which they could not secure. Lack of purchasing power abroad, combined with the surplus of producing capacity at home, had brought down prices from two-and-a-half times above pre-war to a point at which, in certain cases, they were little more than 25 per cent. above pre-war. By the end of 1921 it became obvious that not only was the producing capacity greater than the orders necessary to fill it, but that the selling price and consequent gross margin of profit were falling with unexpected rapidity. In February, 1922, a drastic scheme of re-organisation of the works was put in hand and rigid economies were enforced. One great works was closed down, the manufactures of the others were grouped according to type and size, and each works undertook the manufacture of one class of goods, in order to secure for each plant as much repetition work as possible. Then, to effect another economy, the de-centralisation of the London technical organisation to each works was undertaken as far as possible. That was fully completed last November, and the major activities of each works were now concentrated at that centre. The last phase of reconstruction and economy, most of which would have effect during the current year, would bring down expenses to an absolute minimum, and would give them a reasonable expectation of orders at a profit. While they hoped to increase their home business, they were obtaining a fair share of it, but the necessity of filling their works and covering their overhead charges made it essential for them to secure a large amount of export trade. The company depended almost exclusively on orders for heavy electrical and mechanical plant. It did not manufacture cables, lamps or wireless equipment. The prosperity which those light and ancillary products were at the moment enjoying in this country and in America, thanks to a strong patent position or some other cause, had probably tended to reduce price levels in the heavy engineering side, particularly in the export trade. That was, in his opinion, the only explanation of the absurd prices quoted for railway electrification and similar installations in foreign countries and our own Colonies. They had examined each of those ancillary businesses on which, for the moment, the margin of profit was considerable, and were still looking into many more developments; but in general principle they had felt that their only sound course was to concentrate their energies and resources towards a perfecting and extending of the business which they inherited, which they thoroughly understood, and for which their works were specially designed and laid out. Notwithstanding this policy they were constantly seeking for new outlets, directly or indirectly, ancillary to their main operations, and several lines had been developed and were now at the stage of financial success. For instance, the ordinary Diesel and semi-Diesel engine had been established for many years, and was the object of fierce competition. They felt that, if they could develop a new type of oil engine which could safely be carried into sizes larger than was possible with the ordinary Diesel engine, they could secure a market in which there were fewer competitors. That was actually what had happened with their Fullagar engine, and to-day they stood in an unrivalled position in that particular class of work.

That engine was operating with great success in waterless oil fields, in the Sudan, in the Colonies and at home. Thirty-five per cent. of the business consisted of repeat orders. Again, the company had entered the water-wheel business, partly for itself and partly for the orders for electrical plant which it carried with it. In 1922, American competition practically destroyed other British competition, and to-day they stood in the position of being the only British manufacturers capable of producing large water-power units complete with their electrical adjuncts. In conclusion, Mr. Pybus expressed his confidence for the future. A large increase in the electrical business, which had been too long delayed, could not be indefinitely postponed. Delayed legislation in this country and lack of purchasing power abroad had reduced demand and increased competition. That condition could not be permanent, and with a revival in trade should come a fair world selling price. Their works were never in better shape nor their products so good. Their expenses had been reduced enormously, and were still coming down. New types of manufacture had been perfected, new markets had been opened up and were rapidly being consolidated. Their products were well known and favourably regarded all over the world. Further, if to their present large order book they added a very conservative amount for the normal everyday business on which they might rely, that would suffice to keep four out of their five works employed for the remainder of the year. The report and accounts were adopted.

County of London Electric Supply Co., Ltd.

This company's report for 1926 was reviewed in our issue of March 18th (p. 443). The annual meeting was held on March 29th, when Sir Harry Renwick (chairman), in the course of his speech, referred to the capitalisation of £1,773,334 of the reserves and its distribution as ordinary shares. The company's revenue had been adversely affected by the industrial troubles of the past year. Preparations had been made for the supply of electricity to large power consumers who had been unable to take the supply until a much later date than had been anticipated. In addition to that the company had had to pay exorbitant prices for coal, some of which was of very inferior quality. Dealing with the question of the allocation of capital and assets as between the inside and the outside areas, the chairman said that the provisions of the London Electricity (No. 1) Act, 1925, as to sinking funds, standard price and dividends, did not apply to the outside areas, and profits received from those areas would go to swell the profits of the company, and should be available to increase, if desirable, the dividends over and above the standard fixed by the Act. The dividend for the past year was equivalent to 16⅔ per cent. on the old capital, as compared with 15 per cent. for 1925. The authorities had had to agree to the company's schedule of values of assets and they had practically accepted the value shown in the company's books, which meant that the plant was modern and up-to-date. During the year the company's holdings in the South Metropolitan and South London Companies were increased by those companies' bonus issues; further advances towards extensions were made to a subsidiary company. The balance of the reserves remaining was £130,649; that belonged to the shareholders as part of the undistributed reserves. At the beginning of the year the company had reduced its rates for supply by 10 per cent., but that decrease had to be rescinded. After reviewing the accounts, the chairman pointed out that it would not be necessary in future to make provision for depreciation on the same lines as previously, as the matter was dealt with by the sinking funds established by the Act. He pointed out that, in spite of the troubles of last year, progress had been made, and said that an additional area of 33,000 acres with a population of 75,000, had been opened up by the company's distributing mains. It was hoped to have the new Barking extensions ready for service this year, but their calculations had been upset. Referring to the Electricity (Supply) Act, 1926, Sir Harry said that it undoubtedly had great possibilities for good; the Act as passed was a great improvement upon the original Bill. It behoved all who had the interests of the supply industry at heart to co-operate with the Central Board to make the Act a success. By a "sentimental side issue" the Bill for the extension of the company's powers in Essex was defeated in the House of Commons; a less controversial Bill was being promoted. To show that the companies were working in accordance with the spirit of the London Electricity (No. 1) Act, 1925, Sir Harry mentioned that the generating stations of the group had been interconnected and also that the Barking station had been linked up with the North Metropolitan Company's Brimsdown station and the Kent Power Co.'s station at Rochester. After mentioning the social activities of the staff and the acquisition of new premises, the chairman said that the prospects were never brighter and they looked for largely increased output and revenue. The report and accounts were adopted.

British Electric Transformer Co., Ltd.

The annual meeting was held on March 29th, Mr. A. F. Berry presiding. In moving the adoption of the report (Electrical Review, March 25th, p. 488), the chairman, after referring to the loss which the company had sustained during the year by the deaths of his brother, Mr. George Berry, who had been a member of the board and manager since 1907, and Mr. Roothaan, one of the oldest engineers in the company's service, said that the net profit had increased by 12 per cent. It was proposed to pay 12 months' dividend on the cumulative preference shares, bringing the dividend up to date, and 5 per cent. on the ordinary shares. Mr. Berry said that 1926 had been the most difficult year of a bad series. Referring to the general strike, he said he need hardly say that practically the whole of those employed by the company did their utmost to help the community. The long drawn out coal strike caused them the gravest anxiety with regard to supplies of raw materials, and the consequences of the bitter fight would be felt for a long time by many industries, including their own. There were, however, some hopeful signs and illuminating rays among those dark clouds. Having at last seen their error, millions in this country had tightened their belts and now endeavoured to do their day's work more cheerfully. The question before them always at their works was how to get orders and execute them so quickly and well as to ensure future business. The competition in the engineering world was both national and international. There was an effect of the coal strike upon the junior branch of their business to which reference should be made. For many years the company had led a campaign in favour of electric heating and cooking. They knew that the more they could stimulate the orders for electric heating and cooking apparatus the larger would the need for transformers become. Their electric cookers, fires, radiators, kettles, toasters, &c., had steadily been improved, and as a result of much demonstration work and publicity, the public turned to them when coal was almost unobtainable. Their entire output was taken through municipal and other supply authorities and greatly appreciated by thousands of householders. The effect of the extended use of electricity for domestic and kindred purposes consequent upon the coal strike would undoubtedly be very marked in the near future. They were taking steps to care for both the publicity and output sides of that business during this year. It was hoped that early next year, if not before, they might reap substantial benefit as the result of their efforts. The "Tricity" Restaurant, which did excellent service as purveyor and propagandist at Oxford Street, succeeded in making the premises which it occupied too valuable for retention as a restaurant. A new "Tricity" Restaurant in the Strand had been opened. They intended to open showrooms in the same building block, and he had no doubt of the ultimate success of this branch of their sales business.—The report was adopted.

London Electric Supply Corporation, Ltd.

The annual meeting was held on March 31st. Mr. R. H. Benson (chairman), in moving the adoption of the report (*vide* our last issue, p. 528), said that notwithstanding the adverse conditions of the past year, the company's profit had only declined slightly. After referring to the issue of £199,800 of the reserves as bonus shares, Mr. Benson said that the demand for energy continued to increase, and the year's output was over 45 per cent. above that of 1925. The average revenue per kWh had decreased by 9 per cent. The high cost of fuel and rates had had a marked effect upon production costs. The amount of rates paid had increased from £39,783 in 1925 to £76,586 last year—an increase of over 90 per cent.; that figure would be still further increased in the current year. The amount paid represented over 10 per cent. on the whole of the ordinary share capital, and with coal at normal prices was over 30 per cent. of the works costs. The supply to the Southern Railway had materially increased during the last few months. In future, the London Power Co., of which the company was a constituent, would supply the whole of the company's requirements and those of nine other constituent companies. During the general strike 85 per cent. of their men left work, but with the assistance of the remainder of the staff and volunteers the company was able to maintain a full supply. Mr. Benson referred to the Electricity (Supply) Act, and said he hoped that the London companies would be allowed to carry out the obligations under their own Acts without hindrance. If they were, he felt confident that they would combine to assist the Central Board in its task of unifying and consolidating electricity supply. During the past year the company had concentrated to a greater extent upon the development of its residential area, and considerable extensions of mains were made. The public was beginning to realise that the adoption of electricity had many advantages of which it was previously unaware, and the company hoped to obtain increased revenue from domestic consumers within the next few years. With regard to the current year, he thought that, given industrial peace, output and revenue should greatly increase.

Clyde Valley Electrical Power Co.

Among the matters referred to by Sir Frederick Gardiner, K.B.E., at the annual meeting on March 30th, were the passing of the Electricity (Supply) Act and the constitution of the Central Electricity Board. With regard to the Bill he confined himself to expressing the hope that the Central Board would examine and weigh each proposal with great care in order to ensure that the results likely to be attained were commensurate with the expenditure involved. There was reason to believe that a scheme for Scotland would be published without delay, shortly after Easter. The directors would receive it with sympathy, but it would be their duty to subject it to thorough examination. They sincerely trusted that it might be found to further public interests, and that it would deal equitably with the shareholders and consumers of that

company. Should they be disappointed in that regard, the directors would naturally feel bound to take all steps open to them to protect the interests confided to their care. That was the policy they had always pursued, and the company would not fail to discharge its obligations to the area it served. After dealing with the difficult conditions caused by the coal stoppage, Sir Frederick said the company had not lost its vitality. Large sums still fell to be spent under the head of "mains," so that in the area entrusted to their care the demand for electricity might be fully met. As the demand grew additional generating plant would be required, but when and where the plant was to be installed was a matter which would largely be decided by the Central Electricity Board. Work on the hydro-electric scheme at the Falls of Clyde had been delayed. It was expected, however, that the plant would be completed in time for next winter's load. In conclusion, the chairman said that if the energy which was at present devoted to domestic conflict were spent in a united endeavour to recover our trade, he did not doubt that they would find ample reward. He had too much faith in the inbred sagacity and commonsense of all classes of the people to believe that they would continue to be led astray from their plain duty and obvious interest.

Charing Cross Electricity Supply Co., Ltd.

Mr. W. F. Fladgate (chairman) presided at the annual meeting on March 30th, and prefaced his speech with congratulations to Mr. J. M. Gatti upon his appointment as chairman of the London County Council. Dealing with the report (Elec. Rev., March 25th, p. 485), Mr. Fladgate said that although there had been an increase in the sales of energy of 9¾ million kWh, most of the increase was attributable to two large bulk supply consumers—the Metropolitan Electric Supply Co. and the Post Office. The receipts were about the same as in 1925, but it should be borne in mind that substantial reductions had been made in the charges. The chairman then dealt in some detail with the capitalisation of the reserves, &c., and pointed out that the company had only earned about sufficient last year to pay the standard dividend, but the conditions in 1926 were not normal. Efforts were being made to improve the distribution system. A new 1,500-kW automatic sub-station was started up in October last to supply the electricity required in the Soho Square area; that was the first station of its kind in London, and the first anywhere which was entirely underground. A saving of 8 per cent. in the distribution losses had thus been made. In conclusion, the chairman thanked those of the staff who loyally remained with the company during the general strike. The report and accounts were adopted.

Ericsson Telephones, Ltd.

The annual meeting was held on March 30th under the chairmanship of Mr. W. M. Crowe, who, in presenting the report and accounts (Elec. Rev., March 25th, p. 486) expressed the directors' regret at the recent death of Mr. L. M. Ericsson. He said that the issue of about £100,000 seven per cent. cumulative preference shares had met with success; and he also referred to the issue of £200,000 of ordinary shares as a bonus. Their associated company would soon be placing some surplus ordinary shares on the market and permission to deal in those shares had been granted on the Stock Exchange. The results of the past year were highly satisfactory in view of the extremely difficult nature of the period. The future was not altogether free from clouds; the air had to be cleared of the mistrust and suspicion which marred the past year, and it had to be realised that capital and labour were interdependent and not antagonistic. Telephone expansion in this country reached a record level last year, but there was tremendous scope for still greater progress. Orders received during the current year were encouraging, although prices were lower. One important development was the changing over to the automatic system. The company had made a study of this branch and had recently received a number of contracts for automatic exchanges, and further orders were hoped for. The report and accounts were adopted.

Anglo-Portuguese Telephone Co., Ltd.

Viscount St. Davids (chairman) presided at the annual meeting last week, and in presenting the report and accounts (*vide* our last issue, p. 528) said that the company had a bad record as a payer of dividends. Since an interim dividend in 1920, nothing had been paid until last year, when they were able to distribute 7 per cent. In 1924 and 1925 the profits made were used for capital expenditure. Last year, however, they raised their capital and freed themselves from that position. Little damage was done to the company's property during the Portuguese disturbances in February, and the company had done useful work in maintaining communications. They had been in negotiation with the Portuguese Government for a new or extended concession. After about 12 or 18 months, further capital would be required, and the raising of the necessary amount depended upon an extension of the concession. At the present time the company had issued £300,000 on debentures, while £100,000 remained unissued. All the loans had been paid off, and the old 5 per cent. first debentures and extension debentures would be cleared off by May next. The standard rate of dividend for telephone companies was considered to be 8 per cent., and they hoped to reach that rate next year. The report and accounts were adopted.

Lancashire Dynamo and Motor Co., Ltd.

The report for 1926 states that the company's sales were greatly curtailed by the coal dispute; the profit was reduced from £20,201 to £6,801. As the provision for taxation has proved greater than necessary, a part of it (£15,000) is put to the credit of the profit and loss account. Including this and the balance of £2,147 brought forward, the amount available is £23,948. From this the preference dividend and directors' fees are paid, £10,000 is transferred to reserve (making £75,000), an ordinary dividend of 5 per cent. is to be paid (as compared with 7½ per cent.), and £4,128 is carried forward. During the year an agreement for taking over the Crypto Company by an exchange of shares was concluded and powers have been taken to create the additional shares required. The two companies have worked amicably together for seven years and the complete fusion is expected to be still more advantageous. Mr. F. J. West has been compelled by pressure of other business to resign from the board. Mr. S. G. Shaw, the representative on the board of the Crypto Company, vacates his position owing to the amalgamation, but he and his brother (Mr. C. R. Shaw) have been elected directors.

Waste Heat and Gas Electrical Generating Stations, Ltd.

The annual meeting was held on March 25th, Mr. E. Lloyd Pease presiding. The chairman said that no new development had been undertaken during the year. The instalments received during the year in respect of the purchase of the stations under the agreement which was entered into in 1922 amounted to £21,478; the total unredeemed capital expenditure was £219,193. Their investments had been increased by £18,360 and this had been invested in 3½ per cent. Conversion Loan. The total investments were £142,862 and the income therefrom for the year was £7,313, or £1,000 more than last year. The decrease in revenue, due to the reduction in the output from the power stations, was £4,700. All their stations were shut down completely immediately after the commencement of the strike in May and continued so until the end of November or the middle of December. One station, at Weardale, using surplus gas and waste heat from coke ovens, had not yet been commercially started up. The present outputs of the stations were good and the indications were that they would continue to be so during the year.

British Aluminium Co., Ltd.

Speaking at the annual meeting, on March 31st, Major R. W. Cooper, O.B.E., M.C., said that the general strike and coal stoppage had affected every branch of the business, causing a fall of over £100,000 in the net profit. In certain directions the demand for aluminium had developed, particularly in the electrical industry, whose demand last year was double that in 1925. That was the result of the continued good service of aluminium in practice. It was anticipated that the Electricity (Supply) Act would stimulate the use of aluminium for electrical purposes. Other favourable developments occurred in the use of the metal for engine work and domestic utensils. The civil engineering work on the Lochaber hydro-electric scheme was progressing, and during the past year actual tunnelling operations were commenced. The pier to serve the aluminium factory had been completed and the factory and power house foundations had been commenced.

A. Reyrolle & Co., Ltd.

The report for the past year shows a profit of £83,351 (against £70,621 in 1925), to which is added a net amount of £29,123 brought forward, making £112,474. After transferring £15,000 to the reserve account and meeting the preference dividend, it is proposed to pay a dividend of 12½ per cent. on the ordinary shares, as in 1925, leaving £49,674 to be carried forward. The capital expenditure during the year was £19,098, mainly upon machine tools. The report records the death of Mr. W. Negus, who had been a director since the formation of the company, and the appointment to the board of Messrs. F. Coates and H. W. Miller, who have held responsible positions with the company for a number of years. The meeting was to be held yesterday (Thursday).

Gateshead and District Tramways Co.

The total revenue for the past year was £125,611 (as compared with £138,448 in 1925), and the balance on the year's working was £18,235 to which is added £31,410 brought forward, making £49,645. After providing for mortgage redemption and preference dividends, it is proposed to pay a dividend of 10 per cent. on the ordinary shares and to carry forward £23,342. The report says that the traffic receipts fell by 9 per cent., while the local rates payable by the company increased by 49 per cent.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

Col. R. E. Crompton, C.B., presided at the annual meeting on March 31st, and in presenting the report, which was reviewed in our last issue (p. 528), said that during the past year it was hoped to devote a great deal of effort to the further development of the company's domestic business, as distinct from lighting, but the financial rearrangements had absorbed the attention of the staff and the board. In the company's case that matter was complicated by the fact that it was not sole owner of the Wood Lane works. Even now the standard price had not been fixed, and while the company was paying the standard dividend for 1926, he could not say what would be paid for the current year. The indications of increasing

demand were very encouraging. The effects of the coal dispute had been to increase the cost of coal, and the restrictions imposed almost nullified the increase in output which was anticipated when the charges were reduced at the beginning of the year. The output had risen by only 3.15 per cent., and the average revenue per kWh had fallen from 3.21d. to 3.03d. Col. Crompton thought that the industrial outlook was favourable and referred to the establishment of a pension fund for the company's employés.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

Folkestone Electricity Supply Co., Ltd.—40,000 new ordinary shares of £1 each 4s. paid, Nos. 100,001 to 140,000.

North Wales Power Co., Ltd.—59,918 ordinary shares of £1 each fully paid, Nos. 323,966 to 383,883.

Application has been made to the Committee to allow the following to be officially quoted :—

Atlas Light and Power Co., Ltd.—£889,757 5 per cent. debenture stock.

Ericsson Telephones, Ltd.—99,980 (cumulative 7 per cent.) preference shares of £1 each fully paid, Nos. 200,001 to 299,980.

River Plate Electricity Co., Ltd.

To a net revenue of £49,249 for 1926 is added £7,318 brought forward, making £56,567. It is proposed to pay a final dividend of 8½ per cent. on the ordinary stock, making 11½ per cent. for the year, to transfer £6,555 to general reserve, and to carry forward £7,576. During the year 34,669 £1 ordinary shares were issued to shareholders as a bonus, and 1,318 shares were sold at a premium of £1,412, which has been transferred to reserve, making the latter £353,000.

Peterborough Electric Traction Co., Ltd.

The revenue during the past year increased by £7,299 to £40,536. The net profit rose from £3,508 to £5,618, and the addition of £2,203 brought forward makes £7,821 available. From this £251 is paid in staff bonuses and a dividend of 10 per cent. is paid on the ordinary shares, leaving £3,825 to be carried forward.

Midland Electric Manufacturing Co., Ltd.

The net profit for 1926 amounts to £20,010. The preference dividend is paid, £3,585 is written off preliminary expenses, £10,000 is transferred to reserve, and after paying an ordinary dividend at the rate of 7½ per cent. per annum, £4,454 is to be carried forward.

Tynemouth and District Electric Traction Co., Ltd.

The revenue for the past year was £46,563, and after meeting expenses, including £5,000 for renewals, there remains £2,840 to which is added £2,369 brought forward, making £5,209. It is proposed to pay an ordinary dividend of 5 per cent., and to carry forward £1,364.

London Electric Wire Co. & Smiths, Ltd.

Out of the profits of the past year the directors have placed £25,000 to contingency reserve, and after paying the preference dividend propose a final distribution of 6¼ per cent. on the ordinary shares, making 7½ per cent. for the year. A balance of £23,480 is carried forward.

Reduction of Capital.

C. A. Vandervell & Co., Ltd., & Reduced.—A petition for the confirmation of the special resolutions reducing the capital of this company from £350,000 to £175,000 has been presented to the High Court, and will be heard in London on April 26th.

Babcock & Wilcox, Ltd.

A final dividend of 8 per cent., free of tax, has been declared on the ordinary shares, making 13 per cent., free of tax, for the year. A similar payment was made for 1925, but 3 per cent. was included as a bonus.

Jarrow and District Electric Traction Co., Ltd.

The revenue for 1926 was £9,879, and after meeting expenses and adding £1,596 brought forward, the balance available is £1,724, which is to be carried forward.

Metropolitan-Vickers Electrical Co., Ltd.

The annual meeting was held on Tuesday last; a report of the proceedings will appear in our next issue.

German Companies.

The *Electricity Supply Co.*, Berlin, reports a successful year. Special efforts were made to extend the use of electricity in agricultural operations and for domestic use. The dividend is increased from 9 per cent. to 10 per cent.

The *Saxony Works, Light and Power Company*, reports that the degree of activity in the electrical industry was less than in 1925, and competition increased. Considerable economies were realised through the "rationalisation" of working. The dividend is 6 per cent., as in 1925.

The *Berlin Elevated and Underground Railway Company*, which increased its share capital by 62,000,000 marks to 75,240,000 marks last year for the purpose of taking over the North-South railway and the Schoneberg line, reports net profits amounting to 8,010,000 marks for 1926, as compared with 8,810,000 marks in the previous year, and the dividend is reduced from 7 per cent. to 5 per cent. The number of passengers carried increased from 163.18 millions in 1925 to 172.53 millions last year.

Correction.—The domicile of Brown, Boveri & Co., mentioned in our last issue, is Mannheim, not Baden, as stated.

Belgian Companies.

The *Société Belge pour la Fabrication des Câbles et Fils Electriques* reports that all the fixed property has been written off. The gross profits amount to 2,774,000 fr. The dividends are at the rate of 34.41 fr. per ordinary share (against 25.45 fr.), and 47.14 fr. per tenth founder's share (compared with 25.35 fr.).

The *Société de Constructions Electriques de Belgique* reports a net profit of 1,671,000 fr. for 1926, which has been carried forward. With a view to opening up markets, the report states that a considerable stock of motors was formed and many depôts were established to permit immediate delivery. The sales progressed despite keen competition. A special department has been established for export trade.

Stocks and Shares.

Monday Evening.

There is not a great deal in the present financial outlook to cause any animation in Stock Exchange markets. The continued easiness of money is an encouraging factor, and it is taken for granted in the City that the 5 per cent. Bank rate, which has been in force since December, 1925, would have been reduced, before this, to 4 per cent., had it not been for the trouble that has arisen in China. Were the Far-Eastern cloud to become dissipated, the outlook for cheaper money would be immediately brightened, and, with this in prospect, investment securities maintain a tolerably firm front notwithstanding the expectation that the Chancellor may have something unpleasant to announce in regard to Budget legislation. Any sort of tax upon income, estates, or legacies is a bear point for gilt-edged securities. Curiosity is agog to hear how the Chancellor will deal with the deficit of 36½ millions for 1926-27, and how he will provide for the nation's needs in the current year.

Electricity supply shares show a good deal of firmness, but rises in prices are mainly confined to the shares of the provincial power companies to which attention has been recently drawn here as likely to prove profitable investments from the point of view of the future. Metropolitans gained 1s. for reasons discussed a fortnight ago. Clyde Valleys are 1s. better, so are Lancashire Light & Power and Newcastle-on-Tyne ordinary. The Newcastle company reduced its dividend by 2 per cent. to 5 per cent. for 1926 as compared with 1925, but the decline was due, as the report showed, entirely to the labour conditions that ruled during last year, which can scarcely be expected to recur. The profit for 1926 of £371,700 went against £507,500 in the previous twelve months, which latter is a fairer criterion of the earning capacity of the company than is the former, and, with profits of half-a-million a year, the company can pay 7 per cent. with ease on its ordinary shares. The current price of 22s. 6d. implies that the 7 per cent. dividend is regarded as a better standard of expectation than 5 per cent., for the yield on the present basis of dividend is under 4½ per cent. on the money, whereas Lancashire Light and Power yield 5¾ per cent.

Midland Counties ordinary are in favour, the return in their case being £5 6s. 8d. per cent. on the money. The company is considered to be very well situated for the obtaining of fresh business on a large scale. Its profits last year showed an increase of £16,000 in spite of the industrial state that prevailed, and 6 per cent. was paid on the ordinary shares for the third year in succession. A new issue was made last year, the expenses in connection with which were written off in last year's accounts. The yield is sufficiently modest to imply anticipation of an increased dividend in the comparatively near future.

The strength recently shown by Underground Electric Railways of London £1 shares, and which has raised the price to 16s., has had the effect of directing somewhat specialised attention to the shares of the London tramways companies. We say specialised attention, because many people decline point blank to see any future at all for tramways, except that of the scrap heap. They maintain that investment of money in tramways shares is simply a loss to hospitals or other institutions where the money would prove of some service. On the other hand, the people who adopt the opposite viewpoint to the substantial stake that the L.C.C., to take one authority alone, has in the tramways, contending that it is impossible to imagine the L.C.C. consenting to cut such a loss as would be involved by giving up trams altogether. If the L.C.C. continues with its tramways, then the private companies may be assumed to have a sporting chance of success.

The recent endeavours, evidently quite sincere, that have been made to deal with the London transport systems and to restrict extravagant competition, are held to point to what may be expected in the future. A less haphazard method of traffic direction already prevails, and it is claimed that a purchase of ordinary shares in the London United Tramways, London & Suburban Traction, and one or two others of similar nature, will result in the speculator

doubling or trebling his money within the course of the next few years. The theory has something to recommend it, though not to the man who will only put money into a speculation on the idea that his purchase of this morning must show him a profit in the afternoon of the same day.

The Metropolitan-Vickers net profit for last year came to £179,675, a figure curiously close to the net profit in each of the two preceding years, £178,167 for 1925, and £178,808 in 1924. The price of the shares remains at 28s. 9d., at which the return on the money, on the 8 per cent. dividend, works out to £5 11s. 4d. Johnson & Phillips have weakened to 2 7/16, showing a drop of 3s. 9d. on account of pessimistic dividend forecasts. The rest of the list of manufacturing shares is steady. British Insulated have recovered to 3½. Babcock & Wilcox are unchanged, in the engineering group, at 52s. 6d. The previous dividend of 13 per cent. free of tax is repeated.

The London Electric Wire Company and Smiths made a profit of £90,900 for last year, from which the directors have taken £25,000 to place to special reserve for contingencies. The profit is about £6,600 less than that of the previous twelve months, but the dividend on the ordinary shares is maintained at 7½ per cent. The price of the 7½ per cent. cumulative preference shares is 23s. 9d., and the ordinary, which rarely change hands, stand at 26s. 9d.

In the foreign traction group, Anglo-Argentine Tramways are again better, the first preference improving to 3⅜, while the second preference retain their last week's advance at 3 5/16ths. A good many holders must now be able to secure good profits by selling at to-day's level, and, in spite of the high return which the shares offer, it might be worth the proprietor's while to sell his shares and to take advantage of the improvement that has lately occurred. Possibly the outlook is as bright as optimism declares it to be, but, in the continued state of uncertainty which surrounds the company's affairs, the acceptance of a handsome profit may be discreet.

The Montevideo Telephone Company announces to its shareholders that an offer of £2 per share has been made, by a purchaser whose name the Board does not disclose. The directors advise acceptance of what they consider to be a good price, but the uninformed proprietor naturally asks why he is not given more information. The supposition is that an American, or an American group, inspires the offer, and, if this is correct, the natural question again is: Why? As the shares were quoted not long ago in the neighbourhood of 30s., the bid of £2 looks handsome, and it piques curiosity as to the reason for this offer from someone whose identity is not disclosed. Oriental Telephones are rather easier at 52s. Chili Telephones have gone back to 6½. In the cable list the changes are of no particular consequence.

A well-known firm of Stock Exchange dealers has issued a brochure entitled "Submarine Cables and Wireless Developments, 1927," giving extracts from the report of the Mackay Companies. The intention is not to belittle the achievements or value of radio, but to allay apprehension on the part of shareholders in the cable undertakings. "Had wireless been discovered first," say the authors, "cables would have been welcomed as an improvement." The remarkable financial strength of the Eastern cable companies is set out as follows:—

Company.	Years.	*Net Profit.	To Reserve.	Ordinary Dividend 10 per cent. Free of Tax.
		£	£	£
Eastern	1922	847,248	400,000	500,000
	1925	1,044,399	500,000	
Eastern Extension	1922	724,802	250,000	400,000
	1925	851,294	450,000	
Western	1922	547,518	250,000	311,895
	1926	590,626	250,000	

*Net Profit is calculated after allowing for Income Tax, Debenture and Preference Interest.

The statement made six weeks ago by the President of the Mackay Companies is then quoted. The argument is that neither the "Beam" system nor the transatlantic telephone service is likely to have any real effect upon cable business, and this is the view consistently taken for the past twenty years by those of us who consider that there is ample room for all the various systems. The cable companies have gone steadily ahead. Marconi shareholders have suffered continual disappointments of late years, but the result of the meeting on the Tuesday in this week should prove the foundation of future prosperity. The price of Marconis remains at 17s. 6d. middle.

Brazilian Tractions are 5½ up at 137; the preferred, after touching 122, have reacted to 120½. Dollar stocks are somewhat irregular. Pennsylvania Water and Power capital stock at 188 is 4 up; Canadian General preferred is easier at 59½.

British Columbia Electric Railway stocks have given way, and, in the Home issues, British Electric Traction ordinary is 2 points down. These declines are due to the general condition of markets as a whole, and have little to do with the intrinsic values. The rubber share market is similarly affected. It is now a practical certainty that the exportable allowance of rubber allowed to companies that conform to the Stevenson Restriction scheme will be reduced to 60 per cent. on May 1st. Rubber shares remain in an uninteresting and somewhat neglected condition, the public taking no active interest at present.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Apr. 4 1927.	Rise or fall.	Yield p.c.
Home Electricity Companies.	£					
Bournemouth and Poole	1	14	14	60/9	—	4 12 0
Brompton Ordinary	1	10	8⅝	25/-	—	5 12 0
Charing Cross Ordinary	1	15	8½	25/6	—	5 9 10
do. do. ½ Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	12	8⅞	25/-	—	5 12 0
City of London	1	15	10	2 1/16	—	... ...
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	31/-	+1/-	5 3 3
County of London	1	15	7⅞	28/-	—	5 0 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	26/3	—	6 2 0
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	30/6	—	6 11 2
Kensington Ordinary	1	15	8	25/6	—	5 9 10
Lancs. Light and Power	1	7½	7½	26/-	+6d	5 15 5
London Electric	1	10	8½	24/6	—	5 14 8
do. do. 6% Pref.	5	6	6	5½	—	5 9 1
Metropolitan	1	11	8	28/6	+1/-	4 19 0
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary ...	1	7	5	22/6	+6d	4 9 0
do. 5% Pref. ...	1	5	5	17/6	—	5 14 8
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	—	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	25/6	—	5 9 10
South London	1	15	8½	25/6	-	5 9 10
South Metropolitan Pref.	1	7	7	1¼	—	6 3 0
Urban Ordinary	1	4	7	25/6	—	5 9 10
do. 6% Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20 3	—	7 8 2
Yorkshire Elec.	1	8	8	29/6	—	5 8 4
Home Rails.						
Central London Ord. Assented ...	Stock	4	4	70	—	5 14 4
Metropolitan	,,	5	3	62½	—½	4 16 0
do. District	,,	3½	3½	59	—	5 18 8
Underground Electric	£1	Nil	1½	16/6	—	1 16 4
do. do. Income ...	Bonds	6	6	102	+1	*5 17 8
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	100	—	6 0 0
do. Def.	,,	1½	1½	23⅜	—	6 6 0
Automatic Telephone	1	8	10	50/-	—	4 0 0
Chili Telephone	5	5	6	6½	—⅛	4 12 4
Cuba Sub. Ord.	10	5	5	7	—	7 2 10
Eastern Extension	10	10	10	17½	—	*5 14 3
Eastern Tel. Ord.	Stock	10	10	173½	—	*5 15 3
Globe Tel. and T. Ord.	10	10	10	18¼xd	—	*5 9 7
do. do. Pref.	10	6	6	10⅜	—⅛	5 11 7
Great Northern Tel.	10	22	20	27	—	7 8 2
Indo-European	25	8½	10	46½	—	*5 7 6
Marconi	1	Nil	Nil	17 6	—	... ...
Marconi-Marine	1	10	7½	23/9	—	6 6 4
Oriental Telephone Ord.	1	12	12	52/-	—1/16	*4 12 4
United R. Plate Tel.	5	8	8	8 1/16	—	*4 12 1
Western Telegraph	10	10	10	16⅝	+⅛	*5 18 8
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅜	+1/16	8 2 6
do. do. 2nd Pref. ...	5	6	6	3 5/16	—	9 1 2
do. do. 5% Deb. ...	Stock	5	5	71½	—	7 0 0
British Electric Traction Ord. ...	,,	8	—	141½	—2	5 13 1
do. do. 6% Pref. ...	,,	6	6	109	—	5 10 1
Brazil Traction	100	5	6	137	+5½	4 7 3
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	89½	—	5 11 9
do. do. Preferred ...	,,	6¾	6¾	116½	—1	*5 7 6
do. do. Deferred ...	,,	8	—	156	—2	*5 2 9
do. do. Deb. ...	,,	4¼	4¼	79½	—	5 7 0
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	7/3	—	Nil
London United Tram. Deb. ...	Stock	4	4	51	—	7 16 10
Mexico Trams, 5% Bonds	—	5	5	21½	—	6 18 0
Mexican Light Common	100	Nil	Nil	46	—	Nil
do. Pref.	100	Nil	Nil	99½	+2	Nil
do. 1st Bonds	—	5	5	71½	—	6 19 10
Yorkshire (West Riding)	1	5	—	8/9	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	1	13	13	52/6	—	*4 19 1
British Aluminium Ord.	1	12½	10	45/-	—	4 9 5
British Elec. Transformer Pref. ...	1	Nil	7	18/9	—	7 9 0
British Insulated Ord.	1	15	—	70/-	+1/16	4 5 9
Brush Ord.	1	10	—	28/3	—	7 1 7
Callenders	1	15	—	3½	—	4 5 9
do. 6½% Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	—	30/-	—	6 13 4
Enfield Cable Pref.	1	7½	7½	1¼	—	6 6 4
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	3	—	12/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	1	20	—	90/-	—	4 8 11
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	18/9	—	*5 6 8
Johnson & Phillips	1	17½	—	2 7/16	—1/16	7 2 9
Met.-Vickers Ord.	1	8	8	28/9	—	5 11 4
do. Pref.	2	8	8	2 7	—	6 11 5
Siemens Ord.	1	7½	—	26/9	—	5 12 2
Telegraph Construction	12	10	10	29xd	—	*4 2 9

* Dividends paid free of Income Tax.



Russian Electrical Notes.

(By Our Special Correspondent.)

Electrical Production.—At a recent conference of the representatives of the Leningrad works of the State Electrical Trust, it was stated that the production of all the works embodied in the Trust in 1925-26 amounted to a value of 78,548,000 roubles, an increase of 46 per cent. over the previous year. The share of the Leningrad works in the total was 45 per cent. Reductions in the cost of production were made last year to the extent of 40 per cent. in the case of lamps, 25 per cent. on apparatus, and 10 per cent. on machines.

According to the decision of the Industrial Planning Commission, the total value of production of electrical manufactures in the current year (1926-27) is estimated at 119,700,000 pre-war roubles. The output of the Heavy Electrical Engineering Trust will show an increase of 23 per cent. over the previous year, the Low-pressure Trust an advance of 55 per cent., the Accumulator Trust 20 per cent., and the Karbolite Trust 40 per cent. The demands of the market will be covered by home production to the extent of 80 per cent. The number of workmen employed in the industry will this year be increased by 9 per cent., and that of the staff by 38 per cent., while the efficiency of labour is expected to advance by 16 per cent. and the wages by 8.5 per cent. As to the capital expenditure on extensions this year, it is calculated that a total of 16,500,000 roubles will be required, of which about 44.5 per cent. will apply to the development of the construction of machines; some 51 per cent. of the total capital expenditure will be devoted to new construction and equipment. The scheme provides for the establishment of new transformer works, and works for the production of measuring apparatus and dry batteries. The Planning Commission considers it necessary for the sale prices of heavy products to be reduced by 12 per cent., those of the Low-pressure Trust by 10 per cent., and those of the Accumulator Trust by 12 per cent. It is calculated that the industry as a whole will yield a profit of 16,800,000 roubles this year, or over 11 per cent. on the turnover.

The "Elektrosil" Works.—At the end of 1923, when the question arose of allocating orders for the equipment of the hydro-electric works on the Volkhoff, which was recently brought into operation, the General Electrical Commission decided to place part of the contracts abroad and part with the Soviet works known as the Elektrosil. With great difficulty the latter succeeded in executing its allotted task in the form of two large generators, eight motor generators, and a number of transformers. Now that the contracts have been fulfilled the plant at the works is lying idle owing to the lack of further orders, the staff is being dismissed, and the experience gained is being lost. Under the circumstances it is suggested that fresh orders should be placed with the Elektrosil in connection with the projected construction in the near future of the Svir hydro-electric works, which is to afford a supply to the north-western industrial region.

The first turbo-generator (5,000 kW) has recently been completed at the works of the Elektrosil for the Ural platinum undertaking, the speed being 3,000 r.p.m. A 10,000-kW set is in progress for the Novorossisk works, and designs are being prepared for the construction of a 20,000-kW set.

The First Goods Locomotive.—The first electric locomotive built at Soviet works, constructed according to the system devised by Prof. Obraznova, has been placed in service between the Cherkizovo Okrujnoi station and the works of the former Provodnik, where the production of the State Electrical Trust is concentrated. The line passes a number of works and serves twelve undertakings.

Foreign Engineering Assistance.—In connection with the scheme for the utilisation of the falls of the Dnieper, and the proposed erection of a works of an ultimate capacity of 650,000 h.p., it is stated that the Russian Government has decided to secure the co-operation of foreign engineering firms. Besides the American firm of Cooper, with whom negotiations have already been conducted, it is said that the assistance of German works is to be obtained, as, for instance, the Siemens Bau-Union, which is to submit plans, descriptions, and offers concerning the method of construction and equipment.

The Electrical Bank.—The report for 1925-26 of the Electrical Bank states that the basis capital was increased by 71 per cent. and the turnover by 150 per cent. It is now proposed to raise the share capital by 20,000,000 roubles to 35,000,000 roubles, and to offer the new shares to all interested in electrification.

Hydro-Electric Development.—A representative of the Electric Planning Commission, referring to the projected large hydro-electric works on the Dnieper, is reported to have stated that in all probability it would be possible partly to utilise for this station the technical personnel employed on the Volkhoff constructional works. The Leningrad engineering works would also no doubt participate in the delivery of equipment for the Dnieper works as the former play a prominent part in the construction of hydraulic turbines, cables, &c.

Investigations have been concluded in connection with the construction of a hydro-electric works on the Volga, about two miles to the south of Ulyanovsk, with a capacity of 10,000 kW.

Preparations are now being made with a view to the construction of a hydro-electric works on the Svir, to have an ultimate capacity of 110,000 kW. The subject has attracted interest abroad, a Swedish turbine firm having sent in two schemes, one for three turbines of from 37,000 to 50,000 h.p. each, and one for four turbines. German firms have also asked for particulars of the contemplated works, while the British Vickers interests are said to be occupied in the preparation of estimates for high- and low-pressure equipment. Moreover, the Leningrad Metallurgical Works has presented a project for four turbines of 27,000 h.p.

The four Swedish turbo-generators are now at work at the Volkhoff hydro-electric works, which is largely assisting in affording a supply to Leningrad. The first Russian generator was started in February, and the three others will be put into operation shortly.

The Electric Planning Commission has decided that it is necessary to begin this year the construction of a hydro-electric works in Northern Georgia on the River Rione, near Kutaisa. The initial capacity is stated to be 21,000 kW in three units. The expenditure is estimated at 13,000,000 to 14,000,000 roubles. Hydro-electric works are also proposed in Carelia, Armenia, and on the Neva.

The Shteroff Station.—The first instalment of the Shteroff station, in the coal basin of the Donetz, has been completed, together with five sub-stations. One of the two 20,000-kW turbo-generators is now supplying energy to the neighbouring mines, while the other has been ordered in Germany for delivery this year. Three special furnaces have arrived from France for the consumption of pulverised coal.

A New Regional Station.—It is reported from Kharkoff that the Donetz Coal Trust and the General Electrical Commission have decided that it is necessary to construct a new regional station in the district of Stalin. Even if the extension works in connection with the existing station are fully completed the Stalin-Makevsk district, which is one of the largest in the coal basin of the Donetz, will experience a shortage of supply in 1929. The General Electrical Commission is now in search for a suitable site for the proposed new station. A second message from Kharkoff announces that the necessity has arisen for beginning this year the construction of a new station in the town of Zaporoje for the supply of the local industries and for assisting in connection with the construction of the projected Dnieper hydro-electric works.

Indian Electrical Notes.

(From Our Indian Correspondent.)

THE total provision made in the Indian Railway Budget for the year 1927-28 for the electrification of railways, is about 3¼ crores. The G.I.P. Railway alone accounts for nearly 2 crores of this amount. The projects include the electrification of the main line from Bombay to Igatpuri and Poona (costing altogether 5½ crores), for which 1 crore is provided in the Budget, and the construction of a power house at Kalyan, near Bombay, costing altogether 97½ lakhs.

The rapid success of electrification is quite evident from statistics recently published. The section between Victoria Terminus and Kurla, a distance of 9½ miles, was electrified with effect from February 5th, 1925. By January, 1927, the train mileage of the section had increased sevenfold, and passenger traffic and earnings were twenty times as great as in the period prior to February, 1925. Similarly on the Mahim Chord of the Harbour Branch Railway, which was completed on February 3rd, 1926, a comparison between the statistics of January, 1926, and those of October, 1926, shows that the train mileage increased four times, that passenger traffic was doubled, and that earnings were trebled.

Mysore Electrical Extensions.

His Highness the Yuvaraj of Mysore recently opened the newly-constructed transformer and switching station at Kankanhally, which is meant to receive and transform not merely the power now transmitted from Sivasamudram but also that which may be developed later at Krishnarajasagar and Mekadatu. The present station is well equipped and designed with special care. The essential purpose for which it has been erected is to meet the increasing demands for power from the Kolar gold mining companies and for the lighting and running of industrial concerns in Bangalore and Channapatna.

New Undertaking in Jaipur State.

The Jaipur State in Rajputana in Central India has now been equipped with a modern electric generating plant. The capacity of the power station is at present 650 kW, made up of two sets of 250 kW each and one set of 150 kW, the engines being of Messrs. Vickers-Petters' latest design, direct coupled to alternators by the Metropolitan-Vickers Electric Co., Ltd.; the generating pressure is 3,300 V. The power house building is designed not only to house the present power plant but to provide for ample extensions. It is estimated that the cost of the public supply part of this scheme is over 11 lakhs of rupees, and, in addition to this, there is likely to be an expenditure of five lakhs in the substitution of electricity for gas street lighting, &c.

A "Press" Radio Receiver.

Marconi apparatus guaranteed for aural reception of news bulletins from any long-wave continuous-wave radio-telegraph station at the extreme limit of its range.

A RADIO-TELEGRAPH receiving outfit has been designed by Marconi's Wireless Telegraph Co., Ltd., to meet the growing demand for a dependable instrument wherewith to receive the official news bulletins which are transmitted daily by the Governments concerned from numerous high-power stations all over the world.

This "Press" type Rg.12 receiver is intended to operate over a wave range of from 10,000 to 25,000 metres, and is guaranteed to intercept messages from any long-wave c.w. station at the extreme limit of its range. A feature is that it is readily tunable to any particular station with the aid of the calibration chart and instructions supplied with each instrument; the calibrated handle of each tuning circuit



A, high-frequency filters.
B, rectifier.
C, local oscillator.
D, low-frequency filters.
E, note magnifier.
F, filament resistance, fuses and switches.

Fig. 1.—The Marconi "Press" Receiver.

enables the receiver to be instantly set at the required wave-length, so that the outfit can be used by any telegraph operator, although he may be quite unskilled in wireless reception. It is not a toy, but a high-grade commercial article made for the purpose of regular long-distance reception at predetermined times each and every day with reliability.

The criterion of good apparatus is not so much its ability to receive signals, as its ability to eliminate unwanted signals from other stations which may be operating simultaneously, and disturbance caused by atmospherics and local sources of electric radiation, which interference may be many hundreds of times stronger than the wanted signals. The selectivity of the new receiver is such that two transmitting stations of equal strength, lying in the same direction, can be separated if their frequencies differ by 120 cycles per second, which means that at 10,000 metres the receiver will select between two stations only 40 m. apart, whilst at 20,000 m. it will select between two stations only 160 m. apart.

The Rg.12 outfit (fig. 1), the dimensions of which are 3 ft. 3 in. by 1 ft. $10\frac{5}{8}$ in. by 13 in. deep, incorporates five DE.5 and two DE.5B valves, and selects directively by means of a 6-ft. rectangular wooden frame aerial, on the outside of which two multi-turn coils of insulated wire are wound: three fixed condensers and a variable one are mounted on the frame for aerial-tuning purposes, and each or all of the fixed condensers can be connected across the variable one by plugs and sockets. The vertical components of the frame, which tend to partially destroy its directional properties, are balanced to enable a pure figure-of-eight polar diagram to be obtained. If on the latter the circular polar diagram (obtainable with an ordinary open aerial, which receives with uniform sensitivity from all directions) is superimposed in correct phase (with the aid of the device shown in fig. 2) a "cardioid" diagram will be obtained (fig. 3): O is the centre of reception and X X the direction in which the frame lies; the lengths of the lines O E, O F, O G from O to the periphery of the heat-shaped figure indicate the relative sensitivity of the receiver in those particular directions when the figure-of-eight diagram is superimposed on the circle diagram. It will be noticed that in the direction O F the sensitivity is increased twofold and that the angle θ of approximate zero sensitivity is represented by A O B.

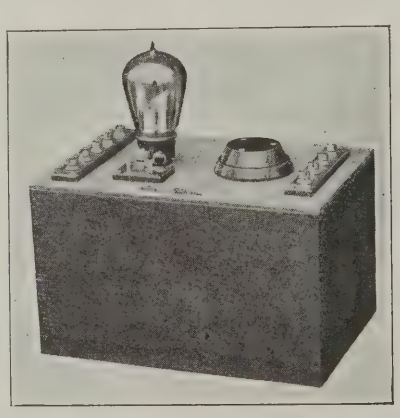


Fig. 2.—The Phasing Device.

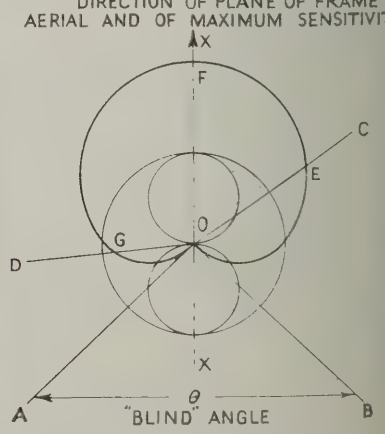


Fig. 3.—Heart-shaped Polar Diagram.

Which particular diagram is the most suitable depends upon the particular conditions prevailing at the moment of reception and can be chosen accordingly. The phasing device (fig. 2), which measures 10 in. by $6\frac{3}{4}$ in. by $7\frac{1}{8}$ in. high, consists of a single DE.5B valve, the grid of which is connected to a 35-ft. single-wire open aerial, whilst the anode circuit contains a rotatable coil inductively coupled to two fixed coils, which are connected to the frame aerial and to the receiver; a simple switch enables the valve to be switched on and off, thereby providing for heart-shaped or figure-of-eight reception respectively.

In addition, high-frequency selection is obtained by a system of three valve-coupled balanced tuning circuits of low damping; each contains a fixed inductance, three fixed condensers (any one of which can be included in the circuit by plug connectors), and a variable condenser. The first valve is coupled to the frame aerial by means of an adjustable coil; the third valve has a separate grid negative connection to enable it to be set at the rectifying point; and each circuit is enclosed in a separate screening box, the series collectively forming an efficient filter.

"Bottom bend" rectification is employed; it has an advantage over the "leaky grid" method inasmuch as it prevents strong atmospheric "paralysis" by enabling the circuits to return instantly to their normal condition. A local oscillator is embodied, consisting of a single valve with a tuning circuit comprising a fixed inductance, a fixed coupling coil, three fixed condensers with plug connectors, and a variable condenser; the circuit is enclosed in a screening box and works in conjunction with the rectifier, reducing the incoming signal to audio frequency before it is passed through two note filters designed for 1,200 cycles, which figure depends upon the difference between the frequency of the incoming signal and that generated by the local oscillator. Since a small change in the former produces a large percentage change in the latter, any incoming signal that differs slightly in wave-length from that to which the receiver is tuned will be eliminated by the note-frequency filters; the latter comprise two valve-coupled tuning circuits in separate screening boxes, one or both of which can be plugged into circuit. The single-stage note magnifier has transformer inter-valve coupling, its input being derived either from the rectifier or note filters, and it feeds low-resistance telephones through a step-down transformer.

The new receiver, other models of which are made for wave-ranges of from 4,000 to 10,000 metres and from 1,600 to 4,000 metres, is normally arranged for the aural reception of telegraphy, but can be adapted for operating a drum recorder by the addition of a Morse rectifier.

The receiver's total filament current is 1.75 A and that of the phasing device 0.25 A at 6 volts, the anodes being maintained at 120 volts with suitable grid bias. The component parts of the outfit are mounted on a vertical aluminium panel fixed to rigid framework which slides into a teak case, so that the whole can me withdrawn for inspection.

Electricity in Warships.

A survey of the applications of electricity on board British naval vessels.

By W. McCLELLAND, C.B., O.B.E., M.I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers.)

PROBABLY the years 1904-6, with the adoption of 220 volts, the ring-main system, and parallel running of dynamos was the beginning of modern electrical development in the British Navy. Since then the applications of electricity have advanced in variety concurrently with those on shore, and the electrical installation of a warship to-day embraces most of the modern uses of electricity. Fig. 1 shows the growth of electrical developments in warships of the British Navy from 1887 to 1920.

The conditions obtaining in warships are so severe that special specifications are necessary, not only for completed apparatus, but for materials also. This does not mean that the Admiralty cuts itself adrift from the movement towards standardisation of specifications; in fact, the opposite is the case. The Admiralty is represented on many of the electrical committees entrusted with the preparation of the specifications of the British Engineering Standards Association, as well as on similar bodies, and British standard specifications generally are applied to the utmost limit possible.

Type of System.—When the whole installation is considered, there is little to choose between the a.c. and d.c. systems on the score of weight; bad commutation is now comparatively rare, and the use of direct current for ship work is supported, therefore, not merely by argument, but also by the consensus of naval opinion of the chief powers. The system of distribution must have its highest efficiency under action conditions. The ideal arrangement of a generator of appropriate size for each watertight compartment with suitable stand-by, so as to make each compartment self-contained, would be impracticable, on account of the number of generators required; the method adopted, however, should approximate to that condition. The d.c. two-wire system is adopted by nearly all navies, except the United States Navy, which uses a three-wire d.c. system at 120/240 volts, probably adopted when difficulties were experienced in manufacturing metal-filament incandescent lamps suitable for 230/240 volts and strong enough to withstand shock and vibration. A full consideration points to the superiority of the two-wire single-pressure d.c. system with both poles insulated; a great attraction of this system is its simplicity and reliability and the comparative ease with which defects can be made good in action.

Reliability, from the naval standpoint, means usually some method of interconnection of dynamos. In certain foreign navies, what might be termed a "multiple switchboard system" is used, each dynamo having its own switchboard from which the various supplies radiate. Separate busbars on each switchboard are arranged to be connected in series, so that by means of change-over switches each board may be fed either from its own dynamo or from the other dynamos in the ship. The chief argument against this system is that the average length of cable run per point must be greater than in the ring-main system; the total weight of cable used must be greater, and the additional amount of drilling of watertight bulkheads which such a system entails is a serious drawback.

The ring-main system was first introduced into the British Navy in 1904 by the late Mr. C. H. Wordingham, C.B.E., the author's predecessor at the Admiralty. It was a bold and progressive step and, although since that date many modifications and developments of the original system have been devised, in principle the system remains the same. Main switchboards are abolished as distributing centres, every supply being taken from the ring main by a path (mostly vertical) which avoids as much drilling of bulkheads as possible. Each dynamo is connected through a supply breaker and change-over switch directly to the ring main, and the whole supply system is controlled by electrically-operated apparatus from one central control room, although local control, as an alternative, is provided. With arrangements for isolating dynamos and sections of the ring main which may become damaged in action, the system offers maximum reliability.

Machinery.—Many diverse types of electrical machinery are used in modern warships. Generating units fitted in a modern capital ship may be taken to be as follows: from 4 to 6 steam-driven dynamos of from 200 to 300 kW each, and 1 or 2 Diesel-driven dynamos of about 200 kW each. About 400 electric motors are fitted, totalling approximately 2,300 b.h.p.; individually, the powers vary from 195 b.h.p., developed by some boat-hoist motors, to 0.3 b.h.p., the output of a small ventilating fan motor.

With so many motors to be maintained, the carrying of spares becomes an important consideration, and it was partly

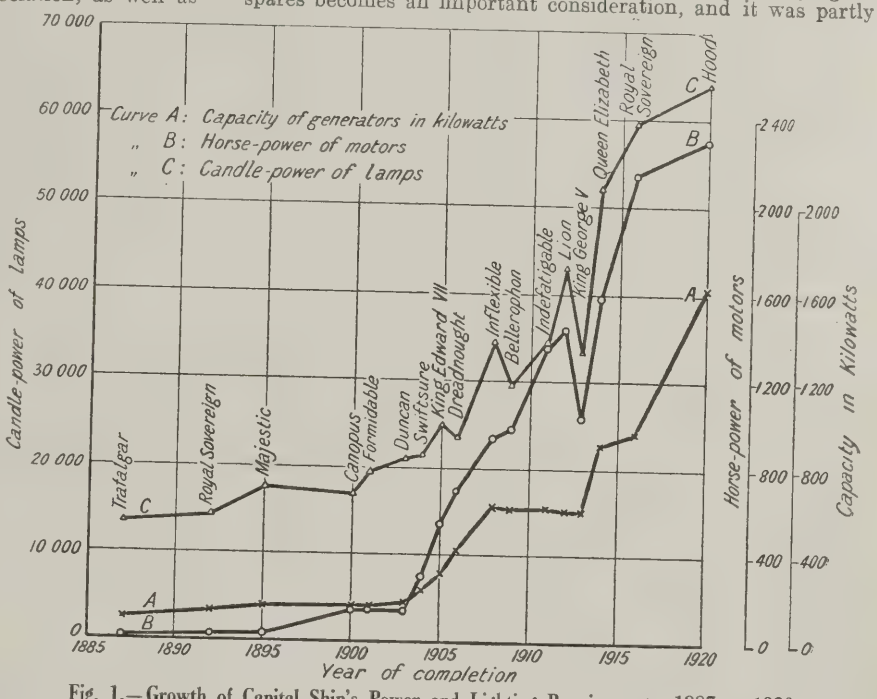


Fig. 1.—Growth of Capital Ship's Power and Lighting Requirements, 1887 to 1920.

for this reason that the British Admiralty designed ten sizes, the range of outputs being from 0.7 to 20 b.h.p. Aluminium alloys are used wherever they can be suitably employed, and special requirements are necessarily specified: bearings must permit the machine, when running, to be tilted from the horizontal through a specified angle which may be 15 deg. or 22½ deg.; special provision must be made for taking any thrust which might occur, and the larger motors are split horizontally, including the bearings when ring-lubricated. Nine standard sizes of brushes are specified, eight of which are the same as B.E.S.A. standards. The differences in the environment temperatures at various positions in the ship are considerable, and, for this reason, motors are divided into three classes, the object being to ensure that the maximum temperature of any particular motor shall not exceed an agreed figure. Totally-enclosed machines possess distinct advantages for warship purposes; various types of machines incorporating special cooling devices have been installed, and in some machines total enclosure may be used not as an end, but as a means, the transference of heat from the machine outboard being the primary consideration.

The methods adopted for motor control are similar to those in shore practice, but designs have usually to be modified very considerably for warship conditions. Electromagnetic devices are designed to hold on under shock and vibration even if the voltage is reduced by 20 per cent. Control gear must not contain inflammable material, and is arranged to break circuit on both poles. The majority of the motors are controlled by

startors, with or without shunt regulating resistances, or by controllers using series resistances or field grouping. A few automatic startors are used. For the larger motors, contactors operated by master controllers are employed. Many variable-speed motors are used in warships: the degree of control obtained with the electro-hydraulic system is very good, and an important application of this system is its use for the working of heavy gun turrets. Many of the lighter turrets have, however, been electrically operated, various methods of speed control having been used, some purely electrical and some electro-hydraulic. The latter is usually preferred by gunnery officers because of the precise control obtainable of the actual gun mechanism. In foreign navies, however, direct electric control for turret working is often employed. The Ward-Leonard system of control is applied to certain of the larger motors.

Lighting.—The head-room between decks is usually very restricted; machinery is mounted in all manner of positions, and structural obstructions are numerous. Consequently, except in a few spaces, it becomes necessary to employ a number of small and compact units, and often the positions available for the fittings do not coincide with the most desirable positions from the point of view of illumination alone. Resistance to shock is a very important problem where lamps and fittings are concerned, and manufacturers are required to supply a lamp of somewhat lower efficiency than is normal for shore use. The British Admiralty specification for lamps includes a shock test under which selected lamps, after being burnt for 50 hours, must withstand a certain number of blows. It is probable that the test will be increased in severity in view of the results of experimental work which has been proceeding, and, also, the lamps may be tested with the filaments burning, instead of cold as at present.

During the late war, a British h.c.d. (high current density) lamp was developed at one of the Royal Dockyards. The luminous power of this lamp was 6 to 10 times that of previous lamps using the same current. The carbons were bathed in methylated spirit, as in the Beck lamp, the object being to prevent oxidation of the electrodes near the tips; a pump and vaporiser had therefore to be incorporated. At the present time, both l.c.d. (low current density) and h.c.d. lamps are in use in the British Navy; the latter differ in several particulars, such as:—(1) Forced cooling and ventilation are essential, owing to the intense heat generated, and the necessity for removing from the projector the products of combustion at the arc; (2) excessive oxidation of the electrode tips is prevented by various methods, such as the methylated spirit flame, or forced-air cooling of the electrode holder; (3) special arc-striking mechanisms are used; (4) the position of the negative electrode is automatically controlled to maintain constant arc length; (5) the positive electrode is rotated to maintain the symmetrical crater formation necessary for the maximum intrinsic brilliancy; (6) automatic focal control of the positive crater is provided by various means, such as thermostatic control, or a "third electrode."

The silvered glass parabolic reflector is almost universally employed for projectors, mounted on springs in order to withstand the effects of gun shock and to cope with the temperature differences obtaining over the surface of the glass, especially with the h.c.d. lamp. When a beam of high penetrating capacity is required, it is necessary to use carbons of small diameter working at high current densities; both carbons are cored, and certain metallic salts are embodied in the positive cores. Formerly, adjustable shutters, somewhat similar to venetian blinds, were fitted outside the front glass of the projector for purposes of signalling. In modern

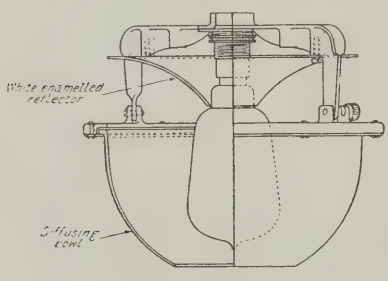


Fig. 2.—Semi-indirect Fitting for Officers' Cabins and Living Spaces.

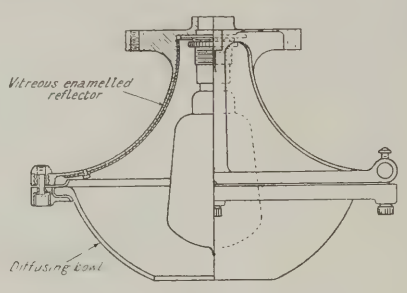


Fig. 3.—Mess Deck Pendant.

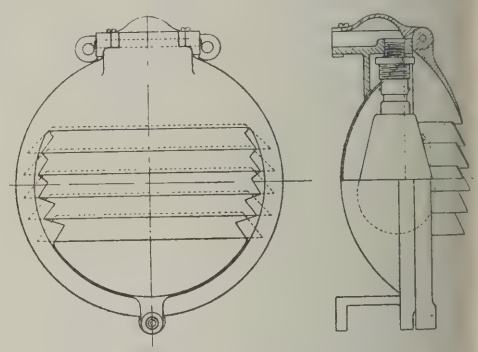


Fig. 4.—Police Light Bulkhead Fitting.

There is also the problem of screening the light source: so far as possible, fittings are designed to prevent the filament being visible at an elevation of less than 40 deg. to the horizontal, and the brightness of the luminous surfaces of the fittings within the range of vision is limited to 2.5 candles per square inch.

In order that there may be sufficient light to enable persons to move about the ship after "lights out," selected lights are fed from the "police light circuit," which is independent of the main switches in the distribution boxes. Screening may be accomplished by a suitable shade or diffusing glassware. A suitable non-brittle diffusing material of high transmission ratio which could replace glass would be of great utility for warship lighting fittings. Several typical fittings are shown in figs. 2, 3 and 4.

Magazine lighting fittings are designed to be watertight and very robust. The circuit of the lamp is automatically broken if the glass cover is accidentally smashed, or immediately the fitting is dismantled for the renewal of a lamp. A locking device makes it difficult for any unauthorised person to dismantle the fitting. The illumination of the hangars of aircraft carriers also requires special consideration, owing to the possible presence of heavy petrol vapour. For general lighting, high-candle-power gasfilled lamps are fixed overhead; there is, however, a considerable use of portable hand-lamps in these compartments, and in order to provide safety against possible explosion hand-lamps are supplied from a special 12-volt a.c. system at a frequency of 50 cycles per second. Petrol compartments and pump rooms themselves are lighted by means of external light boxes, gastight glass windows being fitted to the sides of the compartments.

In the design of fittings standardisation of parts is carried as far as the special conditions permit, so that the large variety of complete fittings may be made up from the minimum number of component parts.

Searchlights.—Such lamps are used extensively; in 1914, both automatic inclined and automatic horizontal lamps were in use, some of the projectors being arranged with electric motor-operated elevating and training gear. A short arc ($\frac{5}{8}$ in.) was used in all 80-volt ships, while in 100-volt ships the resistances were adjusted to burn the light with a longer arc (1 in. to $1\frac{1}{8}$ in.) in order to reduce the screening effect of the negative carbon. In larger warships having a 220-volt supply system, a motor-generator was fitted with each searchlight, the set being designed to give a constant current of 110 amperes over a pressure range of 58 to 62 volts; the motor-generators had automatic starters, and the arrangements permitted an arc to be started within 5 seconds from the moment of switching on.

searchlights, shutters are necessary also for completely obscuring the light for indefinite periods. Shutters of the "Iris" type (as used in cameras) have now been adopted for normal use, the former type being retained for signalling purposes only. Ventilators are fitted in all projectors, but with the h.c.d. lamp a motor-driven exhaust fan is essential to free the barrel of fumes and to equalise the temperature over the mirror. In 220-volt ships a motor-generator has hitherto been used for reducing the voltage because of its economy in comparison with a series resistance, but experience indicates that the latter may probably give better all-round service. The methods of training and elevating the projector in action introduce many intricate and confidential electrical devices and circuits. *(To be concluded.)*

Discussion in London.

Dr. C. C. Garrard, who opened the discussion by expressing his appreciation of the author's sympathetic references to the work of the late Mr. C. H. Wordingham and of the B.E.S.A., wanted to know whether the metal-mica type of switchgear insulation had really justified itself; it might show mechanical weakness when subjected to vibration. With regard to the constant-current method of supplying winches, &c., when the motor was stalled the full current continued to pass through the commutator; would that not involve a risk of burning the commutator? He hoped that experience with *H.M.S. Adventure* would change the Admiralty's opinion of electric propulsion. He understood that at the end of each trip certain transatlantic liners' mechanical gearing was subjected to examination under a magnifying glass, a significant procedure which was indicative of the reliability that might be expected of such gear in war service. Electric ship propulsion might be considered in relation to railway electrification, which was undertaken for secondary reasons and not necessarily because it was more economical than steam traction. In the case of a merchant vessel, the increased cargo space made available thereby would be a governing factor, but in the case of a warship the greatest advantage was improved flexibility and quicker manœuvring ability; he believed that on the *Adventure* operations could be carried out more quickly than had been anticipated. Because the Admiralty staff had become accustomed to operating steam valves was not a reason why electrical controllers should be made to resemble steam valves. He urged the Admiralty to make the fullest possible use of automatic control from one position, which should not be the engine room. The weakest link in the chain was the human operator.

Mr. E. C. McKinnon was of the opinion that the problem of manufacturing a reliable submarine battery had been solved, if the conditions specified in the paper were taken as the criterion. The pasted-plate type had a life of at least four years, though operating conditions were very variable: some batteries might remain idle for long periods, while others might be required to undergo a large number of charge-discharge cycles. In the American Navy submarine batteries which had been installed in 1917 and 1918 were still in service, which was a reasonable life.

Mr. W. H. Scott pointed out that the British Navy had always been in the forefront, and had set a high standard of engineering practice, which had been of much benefit to land and marine practice in general. Methods introduced to the Navy by the late Mr. C. H. Wordingham had been adopted on land and in the merchant service.

Dr. P. J. G. Jakeman thought the paper would be of value to all manufacturers, for all could do their work better when they knew what was wanted. With electric propulsion it was possible to reverse the ship's propeller (not the ship) in from 15 to 20 seconds. He supported the plea for the adoption of more automatic control, for the man in charge should not have to depend on others who might not carry out orders properly, or quick enough. In the case of the a.c. system it was the stability of the whole (*i.e.*, generators plus motors) which must be considered, not that of individual parts; when Ward-Leonard control was employed provision must be made for the absorption of surplus energy at certain times, either by means of auxiliary plant or resistances: d.c. control was simpler, and the so-called difficulties introduced by the use of a large number of brushes no longer obtained.

Mr. Rickets drew attention to the need for collaboration in research and experiment with large-scale tests, in order to avoid time-lag between theory and practical application; a few months' delay in application might have serious consequences.

Mr. A. Regnauld thought the Admiralty was right in not worrying too much about the respective merits of the geared-turbine and turbo-electric drives, because they differed little in respect of efficiency, especially as the Navy had confined itself to the use of single-reduction gearing, and had not made the mistake of trying the double-reduction type. Now that the Admiralty was employing Diesel-electric propulsion it was on surer ground; the cruising range could thereby be increased at once by 100 per cent., or, alternatively, a corresponding reduction of fuel-carrying capacity could be made. He had recently been in New York, where Lloyd's chief surveyor had told him that such trouble as had been experienced had not been due to the electrical machinery, but to the Diesel engines; their speed was a little too high for their size and operating conditions. The difficulty had apparently been overcome, for the United Fruit Co. had placed a further order in this country for another ship, a fact upon which they could congratulate themselves; her electrical gear was to be made by the B.T.-H. Co., but the engines would differ from those installed in the company's earlier vessels. The late Lord Fisher, who introduced oil fuel to the Navy, probably visualised the ultimate introduction of the internal-combustion engine for propulsion. When the torque on the shaft of a Diesel engine was considered, it became evident that mechanical gearing would have to be ruled out, and the electrical transmission system became the only reasonable one.

Mr. C. E. Vines referred historically to the introduction of the electrical helm indicator.

Mr. H. Allcock pointed out that the "bleeding" of cables in warm situations had also occurred in South African gold mines, but it could be overcome by impregnating the insulating paper before it was applied to the conductor. The author's twin flexible cable sheathed with tough rubber and reinforced with canvas might be improved by applying the canvas spirally, which would impart more flexibility to the cable. Resistance to crushing could also possibly be increased by placing a shaped cradle between the cores of the cable.

Mr. A. D. Constable explained that Navy specifications had been considered faddy and not commercial, but manufacturers were now beginning to appreciate the Admiralty's point of view. Since the late war most of its specifications had been revised. It was not realised outside the service what sort of conditions ships and their gear had to stand up to, and if Dr. Garrard interviewed the naval staff his enthusiasm for automatic control would wither; they preferred simple gear and relied on human operation.

Mr. E. T. Williams drew attention to the author's courage in breaking away from traditions of secrecy, and his attempt to present a perspective view of some of the problems encountered by the naval engineer. The author tried to co-operate with all concerned in order to obtain the best results; he had broad views about scientific advancement, but dared not make a mistake.

Mr. W. McClelland, in reply, said, with regard to insulation, that, while makers would guarantee anything, the Admiralty was unable to get consistency from them. He would like to find a substitute for mica, and the American General Electric Co. and the British Thomson-Houston Co., Ltd., were developing a synthetic resin product with very promising results. Concerning the electric propulsion of ships, he thought it was a question of high policy whether the best cruising or maximum speed should be aimed at; personally, he was of the opinion that maximum speed was the desirable thing to achieve.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

The "Mandem" Dial.

A new condenser dial, of the 4-in. diameter size, has been laced on the market by Messrs. McLeod & McLeod. The 1.55 knobbed pattern is illustrated in fig. 1; it is a high-grade

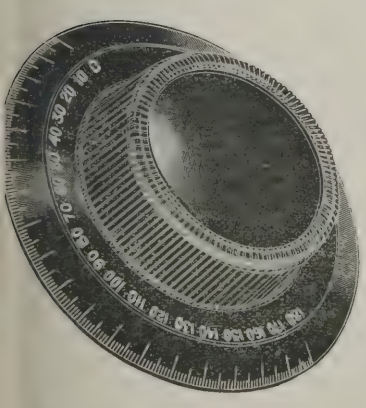


Fig. 1.—The "Mandem" Dial.

mponent of good finish, made of moulded ebonite, engraved om 0 to 180 degrees, and provided with a grub screw for tachment to a ¼-in. spindle.

Hospital Equipment.

The equipment of hospitals with wireless receivers has brought into the sick wards a much appreciated means of entertainment and recreation. The General Electric Co.,

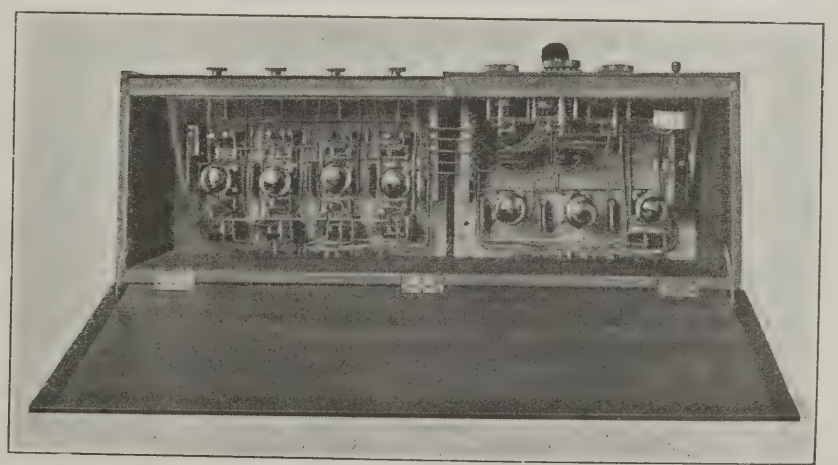


Fig. 2.—A G.E.C. Hospital Receiving Set.

Ltd., has supplied many hospitals and other institutions with wireless equipment, and the accompanying fig. 2 illustrates a set built for the Cambridge Hospital at Aldershot, to operate

approximately 400 headphones. The photograph shows clearly the neat design and compact lay-out of the receiver; in this particular case three tuned circuits were incorporated in order to cut out interference from a nearby telegraph station, which would not normally be necessary. The low-frequency amplifying portion consists of transformer-coupled stages, followed by a number of resistance-coupled single stages in parallel.

Filament Transformers for "K" Valves.

The General Electric Co., Ltd., is shortly putting on the market a transformer specially designed for use in connection with the "Osram" KL.1 valve, which has an indirectly-heated cathode. We understand that the transformer will be suitable for mains supply voltages of 200/250 at 50/100 cycles; the secondary winding will have a number of tappings by a combination of which the secondary voltage, for any number of valves up to four, will fall within such limits as will ensure that the valve is neither over-run nor under-run; this arrangement dispenses with the use of regulating resistances. The transformer will be enclosed in an iron case, the connections to the high- and low-voltage terminals being taken to terminals inside the casing.

The "R. C. Twosome" Amplifier.

It is refreshing to be reminded that crystal reception is undoubtedly advantageous in several respects. The reminder came in the form of a sample 2-valve amplifier designed by the Edison Swan Electric Co., Ltd., not to increase the range of the crystal receiving set with which it is incorporated, but to amplify the output sufficiently to enable a loud-speaker to be used. The circuit is exceedingly simple,

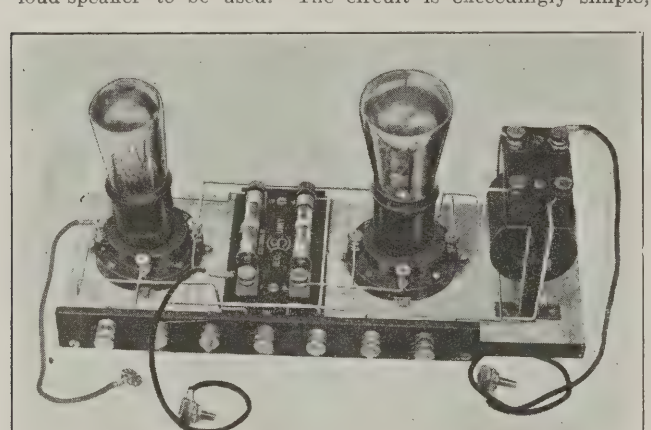


Fig. 3.—Ediswan Crystal Set Amplifier.

allowing of the set being home assembled at low cost. The crystal output is fed through a transformer, as indicated in fig. 3, to the grid and filament of an RC.2 valve, which is resistance-capacity coupled to a PV.2 power valve, both being of the 2-volt filament, 120-volt anode type, requiring 3 and 9 volts negative grid bias. The outfit is neat in appearance and workmanship, and occupies little space; the sample sent us was tried in conjunction with an "Ediswan" crystal set, and functioned quite satisfactorily.

A New B.T.-H. Valve.

The latest addition to the range of thermionic valves made by the British Thomson-Houston Co., Ltd., of which we have received samples is the B.8 type designed for resistance-capacity coupling. Its filament takes 0.12-amp. at 2.8 volts maximum, and marked diminution of results is not noticeable until the pressure is reduced below 1.8 volts. The amplification factor is 50, which large figure prompts the makers to claim that the amplification per stage can be made actually greater than that obtainable with transformer coupling. The valve is unsuitable for coupling direct to a loud-speaker: in order to utilise its great amplification factor fully, it is desirable to apply 120 volts to the anode circuit and to insert a resistance of from 2 to 5 megohms in series with the valve plate. Another feature is that if an ordinary transformer-coupled stage be replaced with a B.8 r.c. stage, the high-voltage anode consumption will be reduced to something like one-sixtieth. This valve is intended to function primarily as a l.f. amplifier or detector, but it can be used in the h.f. stage providing the set is adequately stabilised, preferably by a neutralising condenser.

New Mullard Valves.

The development of resistance-capacity coupled amplifiers having anode circuit resistances of several megohms in value has led to the design of valves specially suited to these new conditions. The impedance of the coupling being so high, the valve amplification factor can be made very high, the attendant increased valve impedance being of no consequence. The Mullard PM.1A and PM.3A valves have amplification factors of nearly 40; in consequence, if the anode circuit resistance be, say, 2 or 3 megohms, the amplification per stage should be equal to that obtained from a transformer-coupled amplifier. For reception of the local station, two PM.1A o two PM.3A valves may be followed by a 2-volt PM.2 or 4-vol PM.4. For stronger signals, the super-power PM.254 valv should be used in the last stage when using a 4-volt accumu lator. Grid leaks should be fairly high, and sufficient negativ grid bias should be used on the power amplifier.

The characteristics of the valves are as follows:—

	PM.1A.	PM.3A.
Max. filament voltage	2.0	4.0
Filament current (amp.)	0.1	0.1
Max. anode voltage	125	150
*Anode impedance (ohms)	72,000	63,000
*Amplification factor	36	35
*Mutual conductance (m/A per V)	0.5	0.55

*At anode volts=100; grid volts=zero.

It should be noted that the DP.425 and DP.625 power valve have been redesignated PM.254 and PM.256, respectively.

"Layerbilt" Batteries.

A new type of dry battery of American manufacture is now available for the heavy duty demanded by the anode circuit of neutrodyne and multi-valve radio receiving sets. Known as the "Columbia Layerbilt" No. 4486 pattern, its elements are made in the form of flat layers compressed against each other in order to actively employ all the cubic space and so reduce size. The 45-volt battery weighs 15 lb. 1 oz., and its dimensions are 8 3/16 in. in length, 7 7/16 in. in width, and 7 3/16 in in height. It is a product of the National Carbon Co. (Inc.) U.S.A.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Easter Recess.

Replying to a recent question, the Prime Minister said tha it was hoped that the House would adjourn for the Easte Recess on April 14th until April 26th.

Private Bill.

The Farnham Gas and Electricity Bill has been read a secon time in the House of Lords.

Electricity and Agriculture.

On March 28th, during a debate on agriculture in the Hous of Commons, Sir Douglas Newton referred to the applica tion of electricity to agriculture. He said that during th passage of the Electricity Bill through the House they were told that they would be able to get a cheap and plentiful sup ply of electricity, but a situation had arisen which was not very helpful and not very hopeful as far as a cheap and plentifu supply of electricity to agricultural areas was concerned The fact that a large volume of electrical power was available on the farms enabled farmers in Germany and othe countries to use larger and more efficient machines. It was a matter of some consequence to farmers and agriculturists tha electricity should be made available to them, and steps must be taken to provide greater facilities for the erection of over head lines. Arrangements should be made for the official recog nition of standard rates of payment in connection with the pro vision of wayleaves for overhead lines and similar arrange ments for obtaining consents in a simplified and cheaper way At present the cost of an overhead line was increased by £100 or even £200, for the expense of obtaining consents and way leaves. Those difficulties were not in all cases due to land owners; the Postmaster-General himself was an offender Even when the Postmaster-General was not a first comer, he sometimes subsequently called on the undertaker who brought the current to provide protection for the Post Office wires Electrical development would continue to be retarded unti general power was given to undertakers to use overhead lines provided that they erected them in compliance with a certain standard basic specification.

On March 30th, during a debate on the need for a revival of rural industries, Mr. Fenly urged the Minister of Agricul ture to press for the application of the Electricity Act to rura areas. The Government stood self-condemned because it had not appointed one single person specifically interested in agriculture to the Electricity Board.

Broadcasting.

On March 29th, Sir W. Mitchell-Thomson informed Mr Everard that no application had been received from the British Broadcasting Corporation for permission to make any further alterations in the wave-lengths employed by its stations.

Mr. Day inquired when the regional scheme for broadcast ing on higher wave-lengths would be completed, so that lis teners would be able to obtain alternative programmes from the Daventry broadcasting station.

Sir W. Mitchell-Thomson said that the British Broadcast ing Corporation proposed to carry out experiments at Daventry at an early date, and when those had been completed they

might be in a position to submit proposals for the establishment of regional high-power stations.

Lieutenant-Commander Kenworthy asked why it was that the British Broadcasting Corporation was to receive £50,000 in revenue less this year than last year; and how many licences were in force this year as compared with last year.

Sir W. Mitchell-Thomson said that the amount paid to the British Broadcasting Company last year covered not only the revenue for the service, but also the sum required for the repayment of the company's share capital and the expense of winding up the company. The revenue of the British Broadcasting Corporation during the financial year 1927-28 would be substantially greater than the revenue of the company for the conduct of the service during the year 1926. The number of licences in force on February 28th, 1926, was about 1,906,000 and the number in force on February 28th, 1927, was about 2,235,000, in addition to about 4,400 free licences for blind persons.

Special Orders.

Special Orders have been approved in respect of the urban district of Rothbury and parts of the rural districts of Alnwick and Rothbury, Northumberland; the urban district of East Dereham, Norfolk; the urban district of Seaham Harbour and the parish of Seaham, Durham; the borough of Rye, the urban district of Battle, the rural districts of Hastings, Rye, and Battle, and the parish of Ninfield, in the rural district of Hailsham, East Sussex.

Rural Telephone Developments.

On March 31st Sir W. Mitchell-Thomson, replying to criticisms of the telephone service, said that in 1913 the rural telephone exchanges numbered 1,254. They were now nearly 2,700, and of those 1,000 had been provided at unremunerative rates. The number of those exchanges was growing at the rate of from 13 to 14 a month, and each started with an average of 12 subscribers. The number of subscribers tended to grow, and in 1925 the average number per exchange opened rose from 14.8 to 16, and in 1926 it rose to 17.3. The average initial loss on each of those exchanges was about £50 per annum. He agreed that the Post Office ought to carry an unremunerative fringe in order to provide for the expansion of the telephone service, but if the interests of the majority of telephone users were not to be prejudiced by having their rates kept at an unnecessarily high level the expenditure on the unremunerative fringe must be kept under some sort of control. Out of about 950,000 subscribers throughout the country, 88,000 were connected with rural exchanges, a proportion of 9.3 per cent. The population outside the urban districts was, however, only 20 per cent. of the whole. The Post Office was doing its best to meet the desire of farmers to have means of communication with railway stations. Nearly 100 railway stations were now provided with telephones, and about 40 more were under consideration. If the telephone service were conducted by private enterprise there would have to be either a close working agreement providing for the closest possible intercommunication between two competing systems, and a standardisation of plant and general working conditions, in which case competition would be eliminated altogether; or else a consistent and vigorous competition between the two systems, refusing all intercommunication, resulting in a restricted service, and sooner or later the disappearance of one of the systems, leaving behind a wasted or wasteful plant.

The E.D.A.-E.L.M.A. Campaign.

Discussion at Newcastle.

THE last E.D.A. Conference at Newcastle, on March 9th, discussed the E.D.A.-E.L.M.A. campaign. Mr. A. Albrecht, who presided, said that much good had been done and nuclei now existed all over the country for the furtherance of the work. Mr. Wilson (Johnson & Phillips) said that the demand had been increased by the campaign, supported by the assisted wiring schemes of the municipal authorities. There was a need for a standardised wiring system. He also thought that there was a need for "tighter" registration to secure good workmanship. Mr. Edgar (South Shields), while admitting that the campaign had done enormous educational work, considered that it had lasted too long; a shorter, more intensive, campaign would have been better. Moreover, the districts should have been consulted before the campaign was launched. He looked forward to further, improved, campaigns in the future. Mr. S. G. Pike (Newcastle Electric Supply Co.) agreed with Mr. Edgar that the Press publicity could have been improved upon if local people had been consulted first. He produced a communication which a gas company had issued to its employés asking them to do their utmost to counter the effects of the campaign. Mr. Pike suggested that the company should be asked for its views on the success of the campaign. Mr. E. L. Beck said that great courage had been shown in running a scheme of American origin in this country, and it had been done successfully. Mr. R. Kirkland thought that the campaign to a certain extent overlapped the good work which was already being done by the Newcastle Supply Co. He also agreed that the period was too long to sustain public interest. Mr. G. W. Umpleby (Newcastle Co.) gave his unqualified approval to the campaign and thought that it could be extended with advantage; he hoped that another one would be held soon. Mr. J. Coney (Siemens & English Electric Lamp Co., Ltd.) said that the campaign had undoubtedly sent up the sales of lamps and appliances. Mr. W. Horsfall (General Electric Co., Ltd.) considered that the campaign had helped the industry to withstand the strain of the past year. Mr. Adam also gave his approval to the scheme. Mr. J. H. Parker (West Hartlepool) said that valuable work had been done in getting the contractors together, and the exhibition houses had proved remarkably successful. Mr. McKenzie thought that greater success would be achieved if assisted wiring schemes were extended beyond lighting and if appliances were standardised. Mr. Evans stated that he thought the discussion was premature, for the results of the campaign were not yet known. While perhaps the period was too long for the North-East Coast, that was not true with regard to many other areas which were not so advanced. While Mr. Alderson was grateful for what had been done, he, too, thought that the campaign had lasted too long. Mr. Hibbert Smith said that the period was too long from the public point of view only; such a campaign should last six months, but the first half or more should be devoted to organising the circles, &c. Mr. Pinkney said that consideration was being given to a campaign next season, and he thought that next time the local centres would be consulted first. Mr. Heslop did not doubt that good would come from the campaign. The chairman, in concluding the discussion, said that the points mentioned would be brought to Mr. Beauchamp's attention.

The Metro-Vick Carnival.

THE annual Metro-Vick carnival was held in Manchester on April 1st. A large number of people in a brilliant variety of costumes spent a happy evening. Our illustration shows an 18th-century group who gracefully danced a minuet.

Over a thousand took part in the grand parade, and the task of the judges was a difficult one. After a careful process of elimination, prizes, distributed by Mrs. Hilton, wife of the vice-chairman, were awarded as follows:—Ladies: Prettiest costume, 1st, Miss Darwin (maintenance department), "Russian Dancer"; 2nd, Mrs. Crawford (Glasgow office), a "Fan"; 3rd, Miss Dora Bentley (M.V. Supplies, Manchester), "Dolly Sisters"; visitors' prize, Miss Hamp, "Bouquet of Roses"; most original costume, 1st, Miss Cooniham (G. Coil winding), "Sarah Gamp"; 2nd, Miss M. Brierley, "Squibs." Gentlemen: Most effective costume, 1st, G. Burness (switchgear drawing office), "Fortune Teller"; 2nd, J. Lyst (K. switchboard), "Mark of Efficiency"; 3rd, J. Brierley (K. machine), "Phantom of Opera"; visitors' prize, G. Bircumshaw, 1st, "Persian Market"; 2nd, C. Sanders, Tom Webster's "George"; most original costume, 1st, C. Booth (instrument department), "Clown"; 2nd, C. Glover (D. machine), "Buffalo Bill." The scheme of decoration was a great triumph for the Metrovick engineers. Festoons of coloured lamps arranged along the balustrade of the gallery, practically encircled the hall, and were interspersed with a dozen powerful "spot" lights of various shades, giving a charming effect. In addition, no fewer than 3,000 balloons were used and by an ingenious contrivance they were released simultaneously while the dancing was in progress. Another novel feature was an arrangement in the shape of a silver coloured champagne glass hanging from the centre of the dome. At a given signal this slowly overturned and discharged close on 2,000 inflated balloons. There were also a number of other "stunts."



18th Century Costumes at the Metro-Vick Carnival.

The National Physical Laboratory.

A Review of the Annual Report for 1926.

THE annual report of the Executive Committee of the N.P.L. on the work in hand and that accomplished during 1926 indicates that the steady progress which has marked the work of the Laboratory during the past few years was well maintained during the year under review. Notwithstanding the adverse industrial conditions which prevailed there was no material diminution in the amount of work the Laboratory was called upon to perform for firms and outside bodies; the demands made on it by the Research Boards and Committees of the Department of Scientific and Industrial Research increased, while the additional provision recently made for the more fundamental work of the Laboratory enabled satisfactory advance to be made with many problems requiring investigation. In general, the advance in the application of science to industry has created a demand for accurate measurement in a multiplicity of directions, and at the present time the resources available are barely adequate to enable the Laboratory to maintain the required lead.

A recent example of development is furnished by the application of X-rays in industry: an institute for the examination of materials by means of X-rays has been established in Berlin, and on the recommendation of the Laboratory Research Committee, approval has been given by the D.S.I.R. to the formation of a section at the Laboratory for this purpose. The work will be under the general supervision of a Committee of the D.S.I.R., with Sir William Bragg as chairman. The measurement of ultra-violet light has recently become of great importance for medical and other purposes, and experiments are in progress with a view to establishing standard methods of measuring the intensity of ultra-violet radiation.

The employment of very high voltages in the distribution of power has introduced a number of new problems in the measurement of electrical quantities, and of new requirements in respect of the knowledge and use of insulating materials. The extension of the Laboratory's activities in this direction was approved, with the support of the Electricity Commissioners, in 1923; the building for the work is complete and the equipment, to give one million volts, with an available supply of 500 h.p., will shortly be installed. The Executive Committee has appointed a special Committee to advise as to the programme of work to be undertaken in this new high-voltage laboratory. The work of the Physics Department has been greatly hampered by the inadequate accommodation, and the urgent need of a new building has been pressed repeatedly by the Committee during the past seven or eight years; it is hoped that the erection of the central block of this building will not be long delayed.

The Laboratory has important duties to perform in connection with international standardisation generally. The Commission Internationale des Poids et Mesures will hold its next meeting in Paris in September, 1927, and discussions will take place on the establishment of a suitable international thermometric scale extending to temperatures of 2,000 deg. C. and upwards. The International Illumination Commission is to hold its next meeting in America in 1928, when the difficult questions of heterochromatic photometry and the establishment of suitable standards of candle power for measurements of modern high-efficiency electric lamps will be further considered. It is proposed that meetings of the Executive Committee should be held in Italy in September, 1927, when a full meeting of the International Electrotechnical Commission is to take place. The Union Radio Scientifique Internationale will meet at Washington in 1927. A considerable programme of work is in progress at the Laboratory in connection with these international conferences; intercomparisons of the standards of resistance, voltage, candle power, and radio-frequency with those of other national laboratories are also proceeding.

Comparison shows that the total number of tests undertaken in all departments during 1926 was 609,323, being a decrease of 44,989 on the 1925 figures; in the Radiology Division the number of tests declined by 167 to a total of 134, while in the Electricity Department the number decreased by 1,175 to 2,499.

General Research.

In the Physics Department research into the heats of combustion of gases has been added to the programme during the current year, and further work has been done in the designing of simplified forms of steel mercury-vapour pumps for medium and high backing pressures. Notable progress has been made with "sound" research; the main questions dealt with have been the provision of suitable sources for the production of sounds for experimental work; methods of measuring intensity; measurement of the reflecting, absorbing and transmitting properties of materials; and examination into the acoustics of buildings is now amongst the test-work undertaken in the Sound Division.

In the Radiology Division a new form of Shearer tube has been designed and work has been continued on the determination of the optical axes of single crystals. Study of the X-ray spectral lines in copper in different chemical combinations has been commenced, and research is in progress into the variation with wave-length of the absorption coefficient of homogeneous rays, more particularly on either side of the K discontinuity of the elements of low atomic number.

Good progress has been made in the Optics Division with the development of photo-electric methods of spectrophotometry, which it is proposed to employ for the measurement of ultra-violet light; difficulty has been found in obtaining a steady source of ultra-violet radiation for experimental work, and special methods of photometry adapted for use with fluctuating sources have had to be devised.

In the Electrical Standards Division of the Electricity Department, a modified form of Kelvin double bridge for alternating-current measurements has been devised, and measurements of the impedance of thermionic valves have been made, in connection with the research into methods of measurement of amplification. An investigation is in progress into methods of precision measurement of the properties of liquid dielectrics. The horizontal force magnetometer for Abinger, Surrey, completed last year, has been erected there, and comparison with the Laboratory instrument showed very close agreement. Good progress has been made with the construction of the vertical force magnetometer; a null method is used, and a novel and ingenious device is employed for the detection of any residual magnetic field, which enables an accuracy within about 2γ to be obtained in the measurements. The investigation into the magnetic properties of alloys is being continued, in collaboration with the Metallurgy Department.

The Electrotechnics Division has been largely occupied with the study of suitable methods of measurement for use at very high voltages. The results of tests on resistance materials, extending over a considerable period, have been collected for publication, as have also those on methods of earthing electrical circuits. The study of photo-electric methods of photometry in the Photometry Division has yielded important results.

Special Investigations.

This heading comprises the work of various kinds, other than that for Government Departments, for which payment is received. It includes tests in the Radiology Division on materials of low radioactivity, such as waters and pastilles used in emanators. The work of the Standards Division of the Electricity Department has, as usual, included tests of standard coils and cells, condensers and inductances, wavemeters, &c., and magnetic tests of various materials. Assistance has been given to firms in the construction of apparatus for the total loss testing of magnetic material, and for other purposes. In the Electrotechnics Division some important researches have been undertaken for the British Electrical and Allied Industries Research Association. An investigation is being made into the different methods of measuring the power lost in the insulating material of cables for the transmission of electricity. A beginning has also been made with an investigation into the physical properties of high-voltage power transmission cables, as affected by the conditions of loading and laying. A report on the resistivity of porcelain is being revised for publication. There has been a steady flow of alternating-current test work, and a number of approval tests of meters for the Electricity Commissioners are in hand. At the request of the Commissioners the Laboratory is considering the verification of watt-hour meters designed to record a standing charge in addition to the power consumed. Standard resistances have been designed and constructed for the testing of heavy current meters as employed in connection with electrochemical processes. Test-work in the Photometry Division has included the calibration of portable photometers, measurements of the light distribution of various lighting units and tests of thermionic valves.

Sir J. E. Petavel, director, records that a number of changes in the senior staff took place during the year. Mr. Murdock retired in May, on reaching the age limit. Dr. Owen, who was in charge, under Dr. Kaye, of the Radiology Division of the Physics Department, was appointed Professor of Physics in University College, Bangor; Dr. Hanson was appointed to the Feeney Professorship of Metallurgy at Birmingham University, and a number of promotions and new appointments have been made.

A Large Electric-Sign Controller.

A machine for operating an "electric-newspaper" sign in Siam, which is believed to embody the fastest "make-and-break" contact apparatus ever devised.

A LARGE electric-sign controller which has recently been made in this country and is about to be shipped to Siam is of unusual interest in that it is claimed to embody the fastest "make and break" ever devised. It is to operate a sign of the "electric-newspaper" type consisting of a rectangular bank of lamps upon which is produced the effect of a constant stream of travelling words, and which will be used for giving news and for advertising purposes, in both English and Siamese.

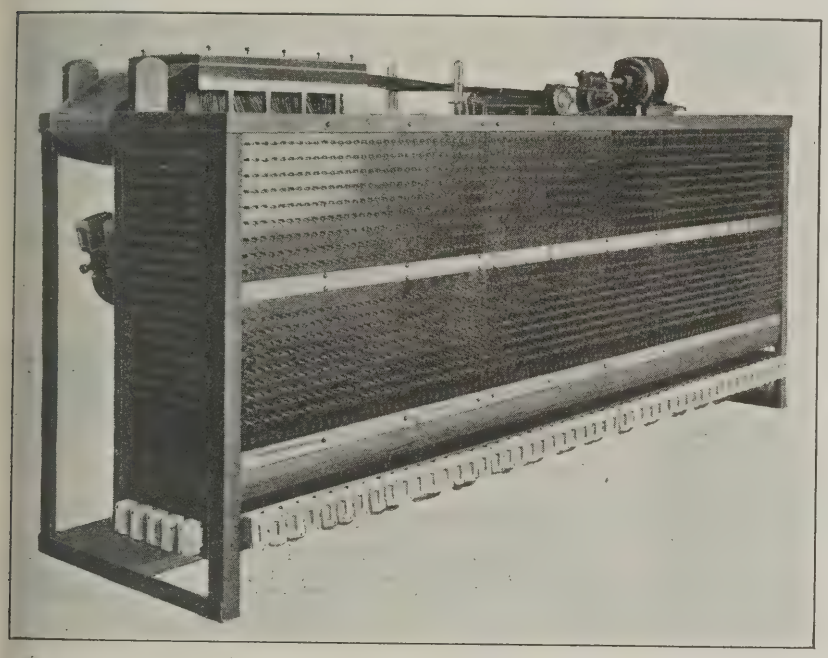


Fig. 1.—Electric-Sign Controller (Exterior).

The operating principle employed is that in which a perforated paper is passed between two identical sections of spring-operated contacts, actual connection being made at the points of, and hence in the same formation as, the perforation.

The apparatus is built up in a framework of angle-iron measuring 7 ft. 9 in. long by 2 ft. wide and 3 ft. 6 in. deep. Fig. 1 shows an external view of the controller. The panelled sides are of bakelite, and accommodate 2,340 bolt-and-nut contacts, each acting as the return or control connection for one lamp in the actual sign. The contacts are arranged in the same formation as the lamps in the sign, *i.e.*, in a rectangular block with 130 vertical and 18 horizontal rows, any one contact being connected to the corresponding lamp in the sign. Each pair of vertical rows is protected by one of the s.p. fuses shown at the base of the equipment. Leads from the contacts on the internal side of the panels, fig. 2, are taken to the lower portion of a master contactor unit mounted horizontally on the top of the controller, fig. 2 right, fixed contacts being employed for the actual connections. In conjunction with these fixed contacts there are spring-controlled ones which, with similar and corresponding devices in the top part of the unit, act as the master control of the apparatus. The contacts in the lower section of the unit are separately insulated, being built up in an ebonite slab, while those in the top portion are housed in a brass block which itself forms a common return to the whole circuit.

The perforated paper is drawn between the two sections of the control unit by means of a small rolling machine constructed on the lines of an ordinary domestic wringer. This is chain driven through a worm gearing by a small electric motor. Between the roller and the control unit the travelling paper is taut and lifts a metal rod, the ends of which run in slots in two vertical guides. In the event of the paper breaking, the rod drops and lifts a small mercury cut-out, which in turn opens a relay governing the main contactor switch. This switch, with a pair of main fuses, controls the whole apparatus and is installed at one end of the framework. Two local circuits serve the paper-driving motor and the release cut-out and relay. The equipment is designed for a maximum loading of 200 A, and will operate on 120 V, a.c., 50 cycles.

It is estimated that in normal working the contactor unit performs some two million make-and-break operations per minute, while it is claimed that the apparatus is capable of a sustained operation of ten million contacts in a similar period. Each contact point on the master unit occupies a space of about 1/50 sq. in., and the corresponding area in the sign is about 36 sq. in.

The controller is wired, internally, with single 22 C.G.S. wire threaded in sleeve insulating tubing, about 5,000 yd. of each material being used.

It is, of course, necessary, where a continual change of wording on the sign is required, to have a ready means of perforating the paper, and a suitable machine for this purpose is being dispatched with the controller. Ordinary good-quality brown paper is used. The sign will be equipped with 20-W m.f. lamps, and 350 English letters per minute will traverse it in normal operation.

The complete controller has been manufactured by the Sign Construction Co., Ltd.

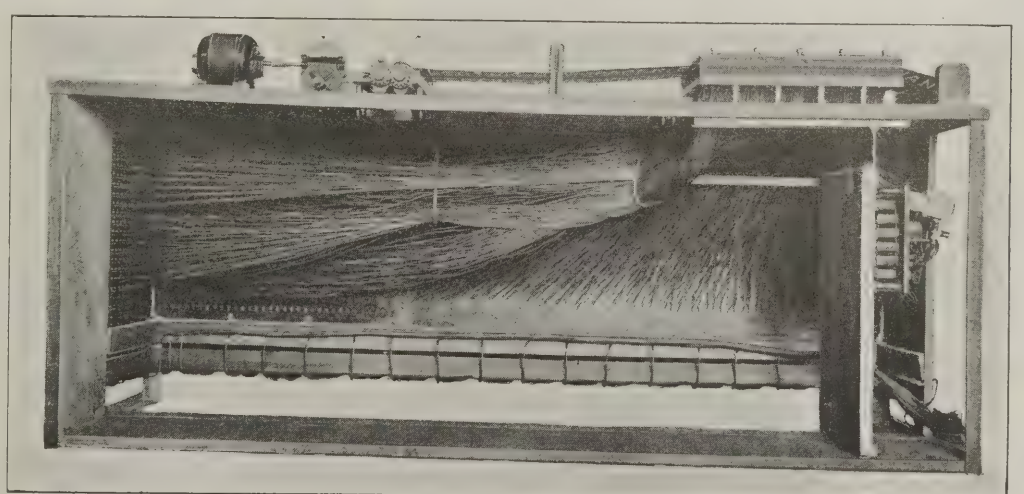


Fig. 2.—Back of Controller, showing Internal Wiring.

The Batti-Wallahs' Society.

At the annual general meeting of this Society on Tuesday, March 29th, the following officers for 1927 were elected:—President, Mr. G. W. Partridge, M.Inst.C.E.; vice-president, Mr. Walter Riggs; hon. secretary, Mr. M. Whitgift; committee: Messrs. A. E. Apps, H. Howard, H. S. Jacob, H. Tomlinson Lee, H. S. May, and G. S. Peckham.

Legal.

Imprisonment for Faraday House Secretary.

The Times reports that on March 30th, Henry William Fairman, 47, of Dulwich, was charged, on remand, at Bow Street Police Court, before Mr. Fry, with stealing £52 10s. belonging to his employers, the Electrical Standardising, Testing, and Training Institution, Ltd. (Faraday House), Southampton Row, W.C. Mr. E. B. Knight, prosecuting, said that the defendant had been in the employment of the company for 27 years, and had latterly held the position of secretary at a salary of from £550 to £600 a year. For three or four years past he had made a practice of misappropriating fees paid by students, the total sum involved being £4,500. After discovery had been made Fairman offered to make full restitution, and had already placed £4,500 in the hands of his solicitors for this purpose. He attributed his trouble to living on a higher plane than his salary warranted. Mr. Walter Frampton, for the defence, said that the whole of the money had not been accumulated, but full restitution was possible by means of wise investments. The magistrate passed a sentence of three months' imprisonment in the second division.

False Pretences Charge.

At Bolton, on April 1st, Duncan McQueen, traveller, pleaded guilty to obtaining various sums of money by false pretences. Norman Richardson, radio engineer, Burns Street, said that he advertised for a traveller, and prisoner responded. He was engaged, and he was to receive one-third of the value of the orders he obtained. Mr. Richardson found that all his orders were false, none of the persons named having given prisoner any order. The Bench imposed a fine of £10 and accepted prisoner's offer to pay at 10s. per week.

General Engineering Development Trust, Ltd.

The petition of Walter Hill & Co., Ltd., judgment creditors for an order for the compulsory liquidation of the General Engineering Development Trust, Ltd., was before Mr. Justice Romer in the Companies' Winding-up Court on March 29th, the petition having been presented in January. It was then stated that the respondent company was exploiting an electric route indicator which was applicable to tramways and 'bus services. The petition was adjourned to facilitate negotiations for raising new capital and settling the petitioners' debt. Mr. Wallington informed his Lordship that terms had been signed, and it had been agreed that the petition should be dismissed without costs. His Lordship made an order accordingly.

Electric Light Plant Dispute.

In the Chancery Division on March 31st, Mr. Justice Tomlin heard a motion by Mr. R. W. Pudsey-Dawson, of the Barn Engineering Works, Effingham, Surrey, asking for an injunction against the Effingham Estates, Ltd.

Mr. Grant, K.C., for the plaintiff, said he desired an injunction to prevent the defendants from entering certain premises which, the plaintiff said, the defendants had demised to him, and making use of the electric light plant that was there. The plaintiff negotiated for the purchase of the plant from the defendants, but nothing came of it. When the plaintiff refused them access to the plant the defendants, he alleged, made a hole in the wall and had regularly gone on to his premises and used the plant. He wanted them to take it away.

Mr. Preston, K.C., for the defendants, said there was a definite agreement to buy the plant, which, he said, the plaintiff had wrongfully repudiated. The defendants were entitled to have access to the plant and to work it.

His Lordship said that if the parties would agree to some form of undertaking in the meantime he would fix the trial of the action for the first day next sittings.

Mr. Grant, after consulting Mr. Preston, said they had agreed on an undertaking. His Lordship thereupon fixed the hearing of the action on the day stated.

The Truth About Electric Ovens.

Since the publication of our "leaderette" upon the subject of the alleged generation of ozone in electric baking ovens (March 11th), the Metropolitan-Vickers Electrical Co., Ltd., has sent us copies of two letters which it has received bearing on the matter. The first is from the chief electrical engineer of Zurich, who says that any disagreeable smell which may arise in an electric oven is due to failure to clean the appliance. The other, from M. F. Graf, consulting engineer, Baden, says that the production of ozone in electric ovens is impossible. In some of the early types the disintegration of the material in which the elements were embedded caused pastry to acquire a disagreeable taste, but this defect cannot occur in the modern types of oven.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

The Salaries of Engineers.

Whilst agreeing with your correspondent "P.W." that the placing of electrical undertakings in the control of gas managers is not to the complete benefit of the electrical industry it is no doubt a course dictated by the desire for so-called economy. The question, however, is whether this so-called economy in management costs is not of the most expensive kind, not only to the undertaking itself, but to the electrical industry generally.

I heard some time ago of a case where a bulk supply undertaking of not the smallest dimensions was handed over to the care of the local sanitary inspector and surveyor. Not long ago I heard of a town of over 4,000 population, about to take bulk supply, where, on completion of the scheme, it is to be handed over to the supreme care of a local tradesman as part-time job, as if the undertaking were a kind of voluntary fire brigade.

This is the kind of thing for which some public bodies want severely trouncing, and then guiding in the way they should go.

But for this kind of thing (not forgetting, of course, the general overcrowding at present so evident), perhaps there would be less of a scramble for the £2-a-week jobs to which your correspondent referred—with a consequent improvement in the salaries of those engineers whose qualifications entitle them to a reasonable protection from the labour profiteer.

Hopeful.

March 26th, 1927.

Electrical Engineers in the Navy.

Perhaps you or some of the numerous readers of the Review could advise me as to the conditions obtaining in H.M. Navy for electrical engineers, *i.e.*, general conditions, terms of service, &c., and if it is really worth trying for experience; and also where to send application for joining.

Anxious.

March 28th, 1927.

The Irish Free State Electricity Supply Bill.

The Government Bill is meeting with determined opposition from two powerful interests. On the one hand there are the local authorities, companies and individuals, statutory or otherwise, who have carried out schemes, and on the other the electrical contractors acting through their Association.

The management and organisation of the Shannon work follow naturally on the Act of 1925, but as the present Bill now stands the Government claims arbitrary powers over all existing undertakings, even to the point of confiscation.

At the inception of the scheme it was understood that electricity was to be supplied in bulk to all existing undertakers at a cheaper rate than they could produce it by themselves, and that the body to be put in control was not to engage in distribution except in such areas as had not already made provision for supply. With reference to the existing undertakings it was clearly stated by the Government's experts in their report: "It should be remarked that the State supply and the development of the Shannon scheme will by no means involve the dismantling of the organisation existing in these towns (the larger and medium-sized towns) with the exception, perhaps, of a small portion of the operating staff." It is now sought to obtain powers enabling the Electricity Board to offer an authorised or statutory undertaker a bulk supply at a rate equal to, or less than, the cost of generation by the undertaker, and if he does not want to take it he can be made to do so. The whole thing is cleverly shaped under Clause 20, which provides that up to 1932 the Board may charge an uneconomic or nominal price for bulk supply. This means the end of all existing undertakings, private or municipal. When they are wiped out the Government comes into its own, for after 1932 the Shannon scheme must be firmly established as a paying concern, and such prices or rates as have hitherto been made for bulk supply must be increased to make it so. It is all very simple.

The Irish Section of the Electrical Contractors' Association may be depended upon to put up a good fight against Clauses 47 and 48. These clauses give the Electricity Board powers separately or in conjunction with authorised undertakers, to open shops and showrooms, and to sell fittings, apparatus, and appliances for heating, lighting, power, and all other purposes for which electricity could, or might, be used, and also to undertake the wiring of private houses. This may, or may not, mollify to some extent the confiscated undertakers at the expense of the contractors, but it can scarcely be expected that the contractors are prepared to go out of existence in order to make things easy for the Government. They do, however, appreciate the joke as quite racy of the soil, but unlike the consulting engineers who have had no practice for the last three years, they want something more to keep them alive and hearty. As one of the unemployed consultants said to the writer the other day: "This is the Government

which, like Moses, was going to lead us by the hand into he Promised l and, or at least those fortunate ones who were live at all when they gave us leave to suck our sustenance rom the Shannon after they had done with it themselves."

P. T. White.

Rostrevor, *April 1st*, 1927.

Faults in Flexibles.

Mr. J. W. Meares's letter in your issue of to-day calls for a eply.

We recommend "Feraflex" flexible cord with steel auxiary conductors and asbestos separator as a general-purpose exible cord, particularly for electrical heating appliances.

For vacuum cleaners, however, the "Anti Shock" flexible specially recommended, as it is important for a flexible cord r such purposes as vacuum cleaners that the insulation rotecting the conductors should be mechanically and electrilly sound. Hence our recommendation of "Anti Shock" exible cord for vacuum cleaners.

The "Anti Shock" flexible cord is made up with the insuted conductors embedded in a jacketing of flexible rubber, id over the rubber jacketing there is a stout polished yarn raiding.

We would like to take this opportunity of thanking Mr. W. Meares for his appreciation of our "Anti Shock" exible.

Ward & Goldstone, Ltd.
(M. H. Goldstone.)

Manchester, *April 1st*, 1927.

Published Specifications.

mpiled expressly for this journal by a firm of Chartered Patent Agents. e numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

2,560. "Metallic mirrors within electroionic discharge tubes." Edison an Electric Co., Ltd. September 9th, 1924. (239,861.)

2,744. "Wireless and other electrical apparatus." Paragon Rubber Manufturing Co., Ltd., and G. W. Croot. September 11th, 1925. (267,172.)

4,914. "Electric accumulators for hand lamps." C. R. Fowler and M. Roberts. October 6th, 1925. (267,175.)

5,699. "Electric telegraphic systems." H. V. Higgitt and Eastern Teleph Co., Ltd. October 14th, 1925. (267,180.)

7,664. "Telephone systems." Standard Telephones & Cables, Ltd. (B. A. rkhud and F. de Fremery). November 3rd, 1925. (267,181.)

0,172. "Electrical oscillatory circuits such as those employed in wireless egraphy." K. E. Edgeworth. November 30th, 1925. (267,196.)

0,581. "Wireless receiving apparatus." A. H. Midgley. December 3rd, 5. (Cognate application 211/26.) (267,198.)

0,583. "Electric contact springs and the operation thereof." Siemens os. & Co., Ltd., and W. E. Goodwin. December 3rd, 1925. (267,199.)

0,845. "Electric accumulators." H. Leitner. December 7th, 1925. 7,205.)

0,997. "Method of and apparatus for the production or generation of nds or tones." M. J. Goldberg & Sohne Ges. December 8th, 1924. 4,133.)

1,165. "Control of rotary convertors." A. Reyrolle & Co., Ltd., Mather Platt, Ltd., R. E. Grime and B. H. Leeson. December 10th, 1925. 7,217.)

1,195. "Automatic and semi-automatic telephone systems." Standard lephones & Cables, Ltd., and G. C. Hartley. December 10th, 1925. 7,220.)

1,363. "Wireless receivers of the superheterodyne type." L. Levy. ember 12th, 1924. (244,484.)

1,572. "Method of treating, and an electric furnace for the treatment of, onaceous material." J. J. Naugle. December 14th, 1925. (267,240.)

1,579. "Magnetic vibratory devices." Standard Telephones & Cables, , and H. J. Gowring. December 15th, 1925. (267,243.)

1,386. "Control of electrically-operated railway points." P. E. Carter R. Connell. December 22nd, 1925. (267,249.)

1,898. "Brush-holders for dynamo-electric machines." Bruce Peebles and Ltd., and F. G. Brookhouse. December 30th, 1925. (267,252.)

1926.

6. "Containers for electrical apparatus." Metropolitan-Vickers Elecl Co., Ltd. January 16th, 1925. (246,131.)

4. "Automatic control devices for electric arc-welding apparatus and r purposes." W. R. Hume. January 11th, 1926. (267,256.)

5. "Horns for wireless receiving sets, gramophones, and other musical ruments." S. F. McCord. June 18th, 1926. (267,258.)

442. "Electric signalling devices." H. Karabetz. January 19th, 1925. 179.)

752. "Wireless electric signalling systems." H. Wade (Naamlooze nootschap Philips' Gloeilampenfabrieken). February 9th, 1926. (267,279.)

356. "Brakes of tramcars and like vehicles." A. W. Maley. February 1926. (267,280.)

473. "Oil-immersed electric transformers." Bruce Peebles & Co., Ltd., J. W. Rodger. February 12th, 1926. (267,284.)

775. "High-frequency power supply for electric induction furnaces." C. nz Akt. Ges. February 18th, 1926. (247,949.)

781. "Electric motor control systems." Express Lift Co., Ltd., and . Meacock. February 15th, 1926. (267,289.)

1,881. "Circuits of train-lighting and similar installations and switches for controlling the said circuits." J. Stone & Co., Ltd., and A. H. er. February 19th, 1926. (267,294.)

904. "Magneto electric machines." J. Lucas, Ltd., and E. O. Turner. h 9th, 1926. (267,304.)

92. "Electromotors." Aircraft Patents, Ltd., and G. H. Cooke. March 1926. (267,310.)

7,045. "Manufacture of substantially non-sagging coiled filaments from highly refractory metal." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). March 13th, 1926. (267,312.)

8,615. "Variable electric condensers and the like." R. Atkins and Ormond Engineering Co., Ltd. March 30th, 1926. (267,334.)

9,540. "Foundation for "A" and "H" poles supporting telegraph, telephone, and electric power wires." J. E. Rutter. April 12th, 1926. (267,340.)

10,226. "Sound-receiving devices for submarine signalling." Walker Signal and Equipment Corporation. April 25th, 1925. (251,269.)

11,108. "Driving arrangements for electrically-driven vehicles." J. Buchli. February 12th, 1926. (265,911.)

11,322. "Electrically heated lighters for smokers." E. W. Puckert. April 20th, 1926. (267,349.)

11,669. "Electro-magnetic clocks." M. P. Favre-Bulle. May 3rd, 1926. (267,351.)

14,143. "Artificial line for use in cross-talk calibration in telephony." Felten & Guilleaume-Carlswerk Akt. Ges. November 12th, 1925. (261,338.)

16,158. "Variable self-inductances." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. June 29th, 1925. (254,338.)

16,376. "Electrically-driven rail vehicles." J. Buchli. June 29th, 1926. (Addition to 265,911.) (267,376.)

16,595. "Transmission and reproduction of views, scenes, or images by wires or wirelessly." J. L. Baird. September 1st, 1925. (Divided application on 266,564.) (267,378.)

18,735. "Apparatus for the treatment of organisms with electrical current." W. T. Arnberg. July 29th, 1925. (256,236.)

18,847. "Train-control systems." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. December 9th, 1925. (Divided application on 266,485.) (267,388.)

19,507. "Separate drive for the axles of electric motor vehicles." Maschinenfabrik Oerlikon. July 9th, 1926. (267,393.)

19,746. "Voltage or current regulators." International General Electric Co., Inc. August 10th, 1925. (256,652.)

20,171. "Electromagnetic circuit interrupters or switches." Metropolitan-Vickers Electrical Co., Ltd. August 5th, 1925. (257,594.)

20,320. "Impedance measuring bridges." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). August 17th, 1926. (267,397.)

20,605. "Electric cells." G. Weissmann. November 30th, 1925. (262,049.)

21,794. "Vapour-discharge valves, mercury-vapour rectifiers, and the like discharge devices." Siemens & Halske Akt. Ges. September 3rd, 1925. (257,951.)

22,621. "Coil sockets for electric cables." Siemens-Schuckertwerke Ges. September 15th, 1925. (258,583.)

23,941. "Hollow cables for electric overhead lines." Siemens Schuckertwerke Ges. February 4th, 1926. (265,544.)

24,370. "Electric switching arrangements for use with the lighting systems of motor-cars." K. M. Chapman and G. E. Chapman. October 3rd, 1925. (259,239.)

24,450. "Alternating-current rectifiers." C. Lorenz Akt. Ges. October 2nd, 1925. (259,243.)

24,723. "Lighting fixtures." Korrectolite Co., Inc. July 15th, 1925. (Divided application on 252,353.) (259,256.)

24,724. "Lighting fixtures." Korrectolite Co., Inc. July 15th, 1925. (Divided application on 252,353.) (259,257.)

25,282. "Cooling apparatus for electric transformers." O. Happel. October 11th, 1926. (267,418.)

26,672. "Projecting lamps." G. H. Cushing. November 5th, 1925. (260,976.)

26,870. "Controllers for electric motors." International General Electric Co., Inc. October 27th, 1925. (260,598.)

27,017. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. October 29th, 1925. (260,607.)

29,500. "Manufacture of electric incandescent lamps." General Electric Co., Ltd. May 1st, 1926. (267,438.)

30,291. "Holders for tubular electric lamps." H. Friedeberg. November 30th, 1926. (Addition to 262,424.) (267,442.)

30,434. "Pinion gear, especially for electrical vehicles with separate axle drive." Maschinenfabrik Oerlikon. December 4th, 1925. (262,434.)

31,148. "Methods of manufacture of magnetic bodies from powdered material." International General Electric Co., Inc. December 8th, 1925. (262,789.)

31,818. "Automatic machines for manufacturing electric incandescent lamps and similar articles." British Thomson-Houston Co., Ltd. January 19th, 1926. (264,805.)

31,923. "Incandescent electric lamps and like sealed envelopes." A. J. Stephens (Naamlooze Vennootschap Gloeilampenfabriek Nymegen). December 16th, 1926. (267,448.)

32,432. "Lead cable presses." F. Krupp Grusonwerk Akt. Ges. February 6th, 1926. (265,556.)

1927.

1,415. "Lead cable presses." Krupp Grusonwerk Akt. Ges. January 28th, 1926. (Addition to 259,934.) (265,180.)

5,728. "Variable electric condensers." M. J. Goldberg & Sohne Ges. December 11th, 1924. (Divided application on 244,486.) (266,760.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 30th :—

Snake Head (design only). No. 472,068. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Hydrawerk Elektricitats Gesellschaft, Charlottenburg, Berlin, Germany. (British representatives: Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Carlton Battery (lettering and design). No. 473,039. Class 8. Electric pocket, hand lamp and torch batteries, batteries for radio-telegraphy, and dry cells.—E. Fischbach, trading as A. Finnie & Co., 13, Carlton Place, Glasgow.

T.S.F. (lettering and design). No. 477,762. Class 8. Instruments and apparatus and parts thereof for use in radio-telephony and telegraphy.—T.S.F., Ltd., 10, Duke Street, Adelphi, W.C.2.

Saco. No. 476,049. Class 13. Electric fuses.—Sykes & Dyson, Ltd., Queen's Mill Road, Huddersfield.

3 Spires (lettering and design). No. 476,183. Class 13. Transmission chains of ordinary metal.—Coventry Chain Co., Ltd.

Bird (design only). No. 473,988. Class 14. Platinum-pointed screws for magnetos.—R. J. Dingley, trading as W. H. Reynolds & Co., 11, Key Hill Drive, Birmingham.

Sotonite. No. 473,203. Class 40. Copper wire covered with india-rubber or gutta-percha or with compounds of these.—Pirelli General Cable Works, Ltd.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERGELE.—Children's Sanatorium for Manchester Corporation Public Health Committee; City Architect, Town Hall, Manchester.

ARDEER.—School extensions, with electrical work, for Ayrshire E.C.; William Reid, master of works, Education Offices, Ayr.

ASHFORD (Kent).—Additional 60 houses, Beaver, for the U.D.C.; W. Terrill, surveyor, 5, North Street.

AYR.—Extension to bakery (£1,800), for W. C. Galbraith and Sons, 80, High Street; the manager.

BACUP.—Roman Catholic Church, Stacksteads; Mullen and Durkin, builders, Burnley.

BARNSTAPLE.—Extensions, High Street, for the *North Devon Journal*; Friend & Kelly, architects, Boutport Street.

BEXHILL.—Houses, Collington Lane, Little Common Lane, and Sutherland Avenue; J. E. Maynard, Collington Avenue. 36 houses, Burnt House Farm; borough engineer.

BEXLEY (Kent).—Additional 64 houses, for the U.D.C.; surveyor.

BLACKPOOL.—Hydro, Harrowside, for Town Council; borough surveyor.

BOURNEMOUTH.—Wesleyan Church, Alma Road (£5,000); Jones & Seward, builders.

BRADFORD.—Extensions to St. James' public abattoirs (£50,000); city architect, Town Hall.

BRAMPTON (Cumberland).—Housing scheme (33), for the Brampton Public Utility Society, Ltd.; secretary.

BURSLEM.—Electric heating, St. Joseph's Catholic Church; trustees.

CANADA (Ottawa).—Extensions to the Chateau Laurier Hotel ($2,000,000), Canadian National Railway; Government Offices, Wellington Street (first section, $500,000).

CHELMSFORD.—Reservoirs and waterworks (£60,000); borough engineer and W. & C. French.

COLWYN BAY.—Science block class and social rooms, Penrhos College; J. M. Porter & Co., architects, the estate office.

COULSDON AND PURLEY.—Fire station, &c., for the U.D.C.; Nicholls & Hughes, architects, 4, Raymond Buildings, London, W.C.

DONCASTER.—Warehouse, for the Co-operative Society; T. H. Johnson, architect, 20, Priory Place.

DUNSTABLE.—Church, Luton Road, for the Wesleyan trustees.

EDINBURGH.—New Home for the Blind (£10,000); Managers, Royal Blind Asylum and School.

ENFIELD.—Railway sidings, L.N.E.R.

FLEET (Hants.).—Telephone exchange; office of works.

GUILDFORD.—School, Stoke Hill (£14,200), for the borough E.C.; the clerk.

GUISELEY.—Housing scheme (75), Hawkshead Estate; M. Rennard, clerk to U.D.C.

HEMSWORTH (Yorks.).—Palais de danse, for Fred Partridge; Reginald Goodworth, architect, 5, Market Hill, Barnsley.

IRISH FREE STATE (Bray, Co. Wicklow).—81 houses for the U.D.C.; E. M. Murphy, surveyor to Council, 27, Molesworth Street, Dublin.

(Dublin).—Reconstruction of Butt Bridge, and a further new bridge (£300,000); Port and Docks Board.

(Fethard, Co. Tipperary).—Rebuilding Tullemaine Castle (electric lighting), for Major Morel; J. Hearne & Son, builders, Waterford.

KINGSTON-ON-THAMES.—Additional 58 houses, for the T.C.; borough surveyor. Extensions, Tiffin Boys' School (£42,000); Governors.

KINGSWOOD (Bristol).—Re-erection of portion of motor-cycle works, for Douglas Bros., Ltd. (£100,000); W. H. E. Millman, managing director.

LANARK.—Garage, showrooms, shops and arcade, Bannatyne Street; proprietor of the Caledonian Garage.

LONDON (Barking, E.).—Additional housing schemes (337), Upney Estate, for the U.D.C.; housing architect. Workshop and garages, Ripple Road; H. & J. Alleston. 28 houses, Buller Road; E. Glenny & Son.

(Becontree, E.)—Church, Becontree Avenue; Essex Baptist Association. 30 shops and houses, Becontree Avenue; W. White.

(Bethnal Green, E.).—44 tenements, Brady Street; Rowley Bros., Ltd., Tottenham, for L.C.C.

(Ilford, E.).—26 houses, Albemarle Gardens, and 9 shops, Victoria Parade; Suburban Developments, Ltd. Congregational Church, Broomhill Lane; G. Baines & Son. Elementary School, Redbridge; Education Committee.

(Stepney, E.).—154 flats, New Gravel Lane; borough engineer.

(Finsbury, N.).—Extensions, Technical College; Central Foundation Managers.

(Greenwich, S.E.).—Additional 80 houses, Charlton Park, for the T.C.; borough surveyor.

(Lewisham, S.E.).—1,266 houses, Downham Estate; Holland, Hannen & Cubitts, for L.C.C.

(Southwark, S.E.).—Reconstruction premises in Stamford Street.—Messrs. J. Sainsbury, Ltd.

(Hammersmith, S.W.).—Reconstruction, St. Hubert's School, for L.C.C.; Triggs & Co.

LONG SUTTON (Lincs.).—Secondary School, for Holland E.C.; director of education, Spalding.

MALDEN.—Conversion of workhouse into mental hospital: Harbrow, Ltd., for Middlesex C.C.

MERSHAM.—Development, Mersham Manor Estate, R. H. and R. W. Clutton.

MERTON.—Elementary School, Merton Abbey; Burges and Son, for Surrey Education Committee.

MILNROW.—Housing scheme (30), Bridges Road, Newhey; A. Travis, architect, Union Bank Chambers, Rochdale.

MITCHAM.—Secondary School for Girls; Surrey Education Committee.

MORECAMBE.—Church, West End Road; Secretary, Christian Scientist Society.

NEWCASTLE-ON-TYNE.—School of Mines, Armstrong College, for the governors.

NEW MALDEN.—Factory near Burlington Road; Modern Homes & Estates, Ltd., of Motspur Park.

NEWPORT (Isle of Wight).—Club premises, High Street, for the Conservative Club; A. E. Marvin, Carisbrooke.

NEWPORT (Mon.).—Gwent Cathedral (£500,000), for Monmouth Diocesan Conference; Dr. Howell Green, Bishop.

NORTON.—Elementary School, West Riding Education Committee.

PEWSEY (Wilts.).—Housing scheme (40), for the R.D.C.; Walter F. Bickford, architect.

RICHMOND-ON-TEES.—Garage (£8,000), Catterick Camp, for the Motor Delivery Co., Grange Road, Darlington; G. Dougill & Sons, builders, Darlington.

RUGELEY (Staffs.).—Works extensions, Keystone Road, for J. Key & Sons.

SELSDON (Surrey).—50 houses, Garden Village; Richard Costain & Sons.

SOUTHEND-ON-SEA.—St. Margaret's Church, Leigh; Graham Lloyd, architect.

STACKSTEADS (Lancs.).—Roman Catholic Presbytery; Mullin & Durkin, builders, Burnley.

SWADLINCOTE.—Garage for 50 'buses, for the Midland Red Motor Services; traffic manager, Bearwood, Birmingham.

SWILLINGTON (Yorks.).—School, for West Riding E.C.; director of education, County Hall, Wakefield.

TADCASTER.—Nurses' Home, Board of Guardians.

THETFORD (Suffolk).—Hospital (£6,500), for the hospital committee; Mr. Boardman, architect.

THORNE.—New buildings for Grammar School; West Riding Education Committee.

TYNEMOUTH.—New pavilions, isolation hospital, Balkwell; borough engineer.

UPPER WARLINGHAM (Surrey).—Nurses' Home (56 beds), Mental Hospital, for Croydon T.C.; H. Carter Pegg, architect, 35, Parliament Street, London, S.W.

UXBRIDGE.—Garage and petrol store, Cowley Road; Anglo-American Oil Co., Ltd.

WINCHESTER.—Additional 40 houses, Stanmore, for the T.C.; borough surveyor.

The

Electrical Review

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For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

Contents:

	PAGE
Points from Two Speeches	585
Industrial France	586
Fostering Overseas Trade	586
Oil-Driven Generating Stations	586
Electricity Supply at Ashford (*illus.*)	587
Power Transformer Operation, by D. W. McJannet (*illus.*)	589
Wireless Telegraph Communication, by Lieut.-Col. Chetwode Crawley	592
Arbitration Law Reform	595
Business and Industrial Notes	596
Lighting and Power Notes	600
Tramway and Railway Notes	602
Telegraph and Telephone Notes	602
Radio Notes	603
Contract Information	603
Forthcoming Events	605
Notes	605
Institution Notes	606
Our Personal Column	607
Financial Section—	
New Companies Registered	607
Financial Section—*continued.*	
Official Returns of Electrical Companies	608
City Notes	608
Stocks and Shares	611
French Industrial Progress	613
A Railway Signalling School (*illus.*)	614
New Electrical Devices, Fittings and Plant (*illus.*)	615
Electricity in Warships, by W. McClelland (*illus.*) (*concluded*)	616
Electrical Development in Spain	618
Indian Electrical Notes	619
Parliamentary News	619
Correspondence—	
Testing Three-wire A.C. Networks	621
Municipalities and Foreign Tenders	621
River Water—or Cooling Towers?	621
The Salaries of Engineers	621
Legal	621
Reviews	622
Published Specifications	623
Trade-Mark Applications	623
New Work for Contractors	624

Points from two Speeches.

A FEW weeks ago we were enabled to publish the collective and official view of the B.E.A.M.A. regarding the position of the electrical and allied industries. We need not now recount the various factors which influenced the course of manufacturing and trading operations during a most exceptional year. In the main the influences played havoc with all departments of industry, while some, including certain domestic sections of the electrical trade, derived a measure of advantage. On the whole, everybody felt that the electrical industry had come out of a disastrous period in a gratifying and creditable manner, but most people also felt that, though a bad year had passed away, its consequences would show themselves painfully in the first half year of 1927 as industrial and other concerns issued their reports and profit and loss accounts.

During the past fortnight or so several large electrical manufacturing companies have announced their results, and chairmen have made their explanatory statements, expressed their views on remedies that would bring relief where trouble presses, and ventured forecasts of the future course of trade.

We do not know that the individual statements differ materially from those of the collective organisation where they relate to the situation as a whole, but while an associated report reflects, we suppose, an averaged opinion, discounting extreme views of individual concerns, the separate reports of different companies have a particular interest of their own. In the privacy of the board room as well as in the publicity of an annual meeting with one's shareholders, the experiences of a single business afford the text, and deductions and forecasts are made, and optimism or the reverse is indulged in, according to what has been happening or is expected to happen to that particular undertaking.

The statement made by Mr. P. J. Pybus, as chairman of the English Electric Company, Limited, appeared in our last issue, and it is followed this week by our report of Sir Philip Nash's speech at the annual

meeting of the Metropolitan-Vickers Electrical Co. Both speakers referred to the dislocation of industry due to the year's upheaval, and both had something to say on the subject of competition. Mr. Pybus remarked that manufacturers of heavy electrical plant in their laudable efforts to defeat the foreigner, too often found themselves defeating each other in the race for extra output as a corrective for too low prices. "Competition in the heavy electrical industry had been carried to a point of wastefulness, and it was from the national point of view a costly rivalry." He expressed the hope that the general recognition of that fact would lead to some arrangement being made "by which the destructive internecine competition between all the principal companies engaged in the heavy trade for foreign work could be reduced." An increase of 3 per cent. in selling prices for export would change entirely the result of a year's trading and put the heavy business on to a reasonably sound footing. A large export trade was essential in order that they might fill their works and cover their overhead charges.

Perhaps in due course information may emerge regarding the kind of arrangement that can be made to reduce the internal competition for foreign heavy contracts without playing into the hands of foreign competitors at a time when, as Col. Morcom remarked in his B.E.A.M.A. speech, the electrical export industry is on the eve of an intense struggle with these rival producers who are designing to dominate the world markets.

Mr. Pybus, notwithstanding all the difficulties referred to in his speech, expressed confidence with regard to the future. The world's productive capacity is still largely in excess of demand. As purchasing power improves the overdue increase in demand will, in his opinion, bring a fair world selling price. The company's works, it was stated, were never in better shape. We hope that the long-awaited revival of big plant and equipment orders will bring such advantage to the various English Electric works that the chairman will have a more congenial duty to perform next year.

The speech of Sir Philip Nash was of a more optimistic order. His company is not limited to heavy plant production—it covers a very much wider field offering larger scope. The gratifying profit result which enables a good dividend to be paid and an only slightly reduced output reported for a year like 1926, could hardly justify a mood of depression. The company obtained nearly as much business (value) in the home market in 1926 as in 1925, and it considerably increased its business (in terms of tonnage) obtained in the overseas markets. Export orders received were far in excess of any previous year, but Sir Philip again had to admit that the prices obtained for export work had been barely remunerative. He mentioned with pride, however, that their export successes in such a year as 1926 were an indication of ability to compete with the other great electrical plant manufacturers of the world in overseas markets. With regard to the outlook, the speaker was not enthusiastic in his reference to the home market, because it does not seem likely, in the near future, to provide as much business as he had hoped it would do. Industry generally is not recovering from the effects of the coal strike as quickly as had been anticipated, but conditions may be expected gradually to improve "so that later in the year this market may regain its former activity." We may hope that as the Central Electricity Board is making headway with its work, schemes will speedily be proceeded with which will give the needed stimulus to the heavier section of the industry. Sir Philip Nash finds that the export market offers promise, but competition in the home market is severe.

A point which is troubling all concerns engaged in competitive production is the ever-increasing burden of rates and taxes, and here the foreigner is, of course, at an unfair advantage. This serious matter has been emphasised in Government quarters, and it needs to be driven home more and more among municipalities which are tempted to place plant and other contracts abroad.

Industrial France.

Although her population remains far more agricultural than industrial, France is an outstanding example of the change brought about in Europe by the war. The forced speeding-up of mechanical industry, and the acquisition of further important sources of raw materials, have combined to place France in the front rank of industrial nations.

As a consequence, she is now able to meet her home requirements fully in many directions and still have a surplus for export. In other directions the expansion of exports has been rapid, and a substantial share of the world trade has been obtained. For example, in the electrical material branch, while imports remained practically stationary between 1913 and 1925, the exports rose from 10,200 to 20,200 tons (in 1924 they were 23,600 tons). The balance in France's favour thus rose from 2,600 tons in 1913 to 12,400 tons in 1925.

The home demand has been stimulated by generous State aid, both in the electrification of rural districts and in water-power and other development. The report by Mr. J. R. Cahill, reviewed in this issue, attributes partly to this strong home demand the fall in exports from 23,600 tons in 1924 to 20,200 tons in 1925.

It would appear that while their home market makes French manufacturers to a great extent independent of the export trade, it also enables them to compete on better terms in foreign markets. It is to be hoped that our own home demand will so grow in the near future as to put our firms in the same enviable position.

Fostering Overseas Trade.

While it may be admitted that the present State organisation could profitably be cut down, some discrimination must be exercised in the application of the axe. The mere saving of expenditure does not always mean a gain to the country, and one of the last departments which should be attacked at the present time is that charged with the care of Overseas Trade. It was, therefore, a rather thoughtless suggestion which was made in the House of Lords recently, that the D.O.T. should be abolished as a measure of economy, and Mr. Dunwoody, secretary of the Association of British Chambers of Commerce, has our support in his condemnation of the proposal. If any alteration is desirable it is in the direction of improving and strengthening the department—not getting rid of it. We should be glad to see it occupying as important a position here as the United States Department of Commerce does in relation to that country's foreign trade. A recent statement averred that this organisation was responsible for increasing America's overseas trade in 1925, by £110,000,000; the annual cost of the organisation is £600,000. A department which gives such results is worth keeping, but it must be given sufficient scope, and not just tolerated.

Oil-driven Generating Stations.

The question whether very large power stations at a distance from their load can compete on an economic basis with power stations of small or moderate size, situated close to the consumers' premises, is one which cannot be answered offhand—the Weir Report notwithstanding.

On the following pages we give a description of the 1,200-kW, oil-driven plant at Ashford, the adoption of which was sanctioned by the Electricity Commissioners in view of the fact that the cost of energy in bulk from an economical generating station less than 20 miles away would have been far more than that of the locally generated supply, owing, we believe, to the capital charges on the transmission line.

We do not suggest that this particular instance affords a solution to the general problem, but it certainly indicates that the day of the small power station is not over; and if, as is probable, cheap British oil becomes available from the low-temperature distillation of coal, its position will be greatly strengthened.

Electricity Supply at Ashford.

A recently inaugurated municipal electricity supply undertaking, with an alternating-current 1,200-kW oil-driven generating station, to which 500 consumers were connected in four months, resulting in a maximum load of 250 kW.

ASHFORD, an important market town situated in the Weald of Kent, is the centre of an agricultural district with a population of 15,000.

Many years ago the Urban District Council obtained a Provisional Order to supply electricity, but nothing was done, and the Order, after being transferred to a company, lapsed without any scheme being put in hand. In 1923, public demand induced the Council to take up the matter again, and a firm of consulting engineers was engaged to submit a report. At this stage the question of obtaining a bulk supply from a neighbouring town was considered, but, after negotiations, the Electricity Commission notified the Ashford Council that it would be advisable for it to install its own plant. As a result, a small direct-current scheme was put forward, principally for lighting. The Council, however, decided that the scheme was of insufficient capacity to supply electricity for industrial purposes, and the matter again lapsed until early in 1924, when the Council advertised for an engineer to prepare a scheme and, subject to its approval, to become the Council's electrical engineer. As a result, Mr. H. Wilson (distribution engineer at Paisley, and previously of Croydon and Maidstone) was appointed, and from July, 1924, the town's electricity scheme has been controlled by a small committee of the Council, in conjunction with its engineer. The Special Order, as finally sanctioned by Parliament in December, 1925, included the urban and West Ashford rural districts, and, the bolder policy of catering for the future rather than the present having prevailed, it was decided to generate 3-phase alternating current at 6,600 volts, 50 periods, and to distribute from transformers at 400 and 230 volts on a 3-phase, 4-wire system.

The choice of a prime mover being in favour of crude-oil solid-injection engines of the Diesel type, three 400-kW sets were finally decided on, and armoured cables were laid direct in the ground and fed from transformer kiosks having a comparatively small radius of approximately 500 yd., *i.e.*, 1,000 yd. between kiosks; as a result, no cable of more than 0.1 sq. in. conductor section has been installed.

The site of the generating station consists of 2½ acres between the main Southern Railway line and the River Stour, on which work was commenced in February, 1926. A 4-in. pipe line 130 yd. in length conveys fuel oil from a previously existing siding to a motor-driven pump in the engine room, delivering at the rate of 600 g.p.h. through an oil meter into either of two storage tanks of a combined capacity of 200 tons; the steel-plate tanks, supplied by Messrs. Braithwaite, Ltd., are enclosed by a brick wall 4 ft. 6 in. high, and the same pump can be used to convey oil from them to an 800-gallon tank situated in the engine room, from which the oil passes, either direct or through a De Laval purifier, into a second 800-gallon tank, and thence to the engine service tanks. In any case, a centrifugal purifier was required to deal with the lubricating oil, and a 250-g.p.h. set was installed; all the fuel oil used is also passed through it.

From the engine service tanks of 100-gallon capacity, fitted with water-heated coils, the oil passes to three

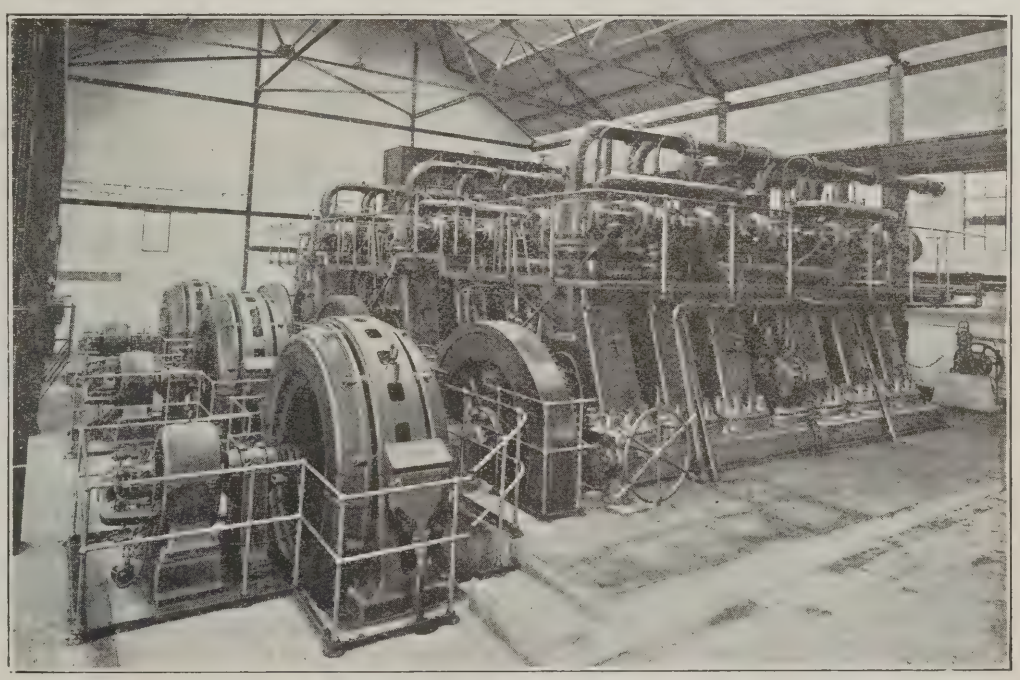


Fig. 1.—Diesel-electric Generating Plant.

Ruston & Hornsby 600-b.h.p. solid-injection oil engines (fig. 1) of the six-cylinder open type, each developing 600 b.h.p. at 250 r.p.m.; it is injected on the Ruston mechanical system, and a distributor is used in conjunction with two pumps so connected that they are controlled by one governor.

Directly coupled with the engines are three 400-kW alternators, supplied by the English Electric Co., each having its own exciter on a shaft extension. The "English Electric" e.h.p. truck-type switchboard (fig. 2) has eight panels: three for the alternators; three for outgoing feeders; one for a station transformer, which also supplies the low-voltage network; and one for splitting the busbars so that access may be obtained to any part without depriving the town of its supply.

The cooling-water system consists of a concrete pond

(fig. 3) of an area of 900 sq. yd. and a depth of 2 ft.; two motor-driven Gwynne centrifugal pumps deliver water to an overhead tank, and thence by means of a 4-in. ring main to the three engines; each of the pumps is capable of delivering 18,000 g.p.h. to the tank, which figure corresponds to 10 gallons per b.h.p.-hour with the three engines on full load. Arrangements have been made for pumping water direct into the ring main if it should be necessary to empty the overhead tank, and a 3-in. town main runs to a float valve in the overhead tank to form an automatic

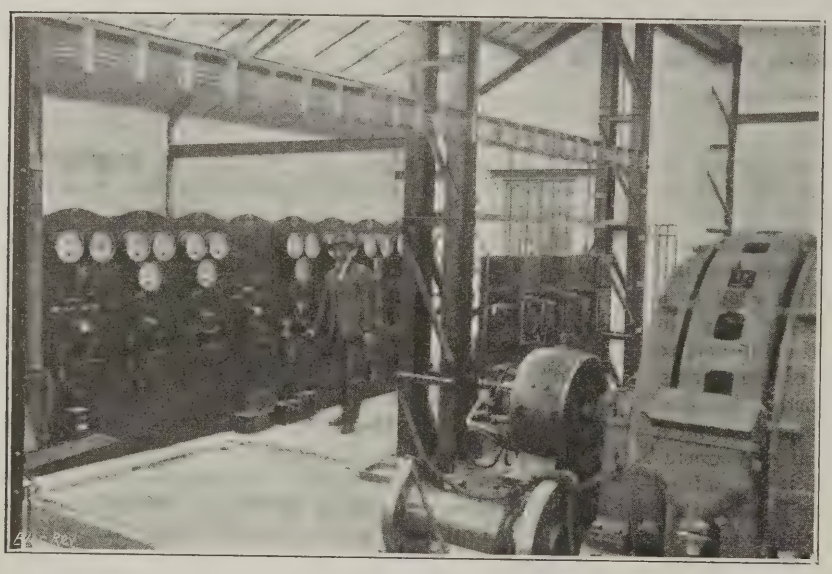


Fig. 2.—Truck-type 6,600-V Switchboard.

stand-by supply and for use when it is necessary to empty the pond for cleaning purposes.

A hand-operated 10-ton Morris travelling crane spans the engine room, which is a steel structure with brick filling and a glass and asbestos slate roof, in which no combustible material has been used.

Two six-roomed houses have been provided for the occupation of the engine-room and mains foremen, and are, of course, "all-electric," except the hot-water supply, which is provided by a boiler through which the exhaust from any, or all, of the three engines may be passed, or by-passed, by means of dampers. The boiler also supplies hot water for heating the fuel and lubricating oil before centrifuging, and gives an ample supply for all purposes. Compressed air is only required for starting the engines, and four bottles are charged either by a motor-driven compressor or by a paraffin engine-driven compressor.

Offices and stores are situated on a corner of the site, and telephone communication has been provided.

The distribution system consists of a 6,600-V ring main near the outer circumference of the town, approximately 7,000 yards in length, on which are situated six transforming points, consisting of sheet-steel cubicles supplied by the New Switchgear Construction Co., Ltd., each having an ultimate capacity of 250 kW and a spare e.h.p. way for future extension. The e.h.p. ring main is of 0.1 sq. in. conductor section, and a branch cable of the same size is taken into the Southern Railway Co.'s carriage works to feed a 500-kW Hewittic mercury rectifier which the Company has installed to operate in conjunction with its own direct-current plant.

The transformer kiosks have been placed in close proximity to possible power users in the town, so that such customers can be supplied by independent cables direct from the kiosks, the transformers at the same time feeding into the low-voltage network, which is made up of 4-core, 0.1-sq. in. paper-insulated, lead-sheathed, steel-tape-armoured cable laid direct in the ground under the footpaths. All high-voltage cables are wire armoured, so that they are readily distinguishable with a view to preventing accident. The neutral conductor of all the l.p. cables is of a cross section equal to that of the phase conductors, as it is anticipated that considerable out-of-balance currents may have to be dealt with in connection with probable domestic loads. No underground disconnecting boxes have been used, but distribution pillars (supplied by Messrs. Lucy & Co., of Oxford) have been installed at convenient points between the kiosks.

Provision for half-night street lighting has been made throughout the whole system, and a separate conductor has been provided for this purpose. All-night lighting in the main thoroughfares has been provided for by a second conductor, and all street lighting will be controlled from the works through a relay system where necessary. The half-night lighting conductor has been carried into such premises as may require a supply for sign illumination, and a special rate of £1 per 30-watt lamp per annum is quoted for this purpose.

Cast-lead service boxes with wiped joints have been used throughout the whole system, and careful attention has been given to armour bonding. The whole of the cable has been supplied by Callender's Cable and Construction Co., Ltd., and was laid by direct labour under the supervision of the Council's engineer.

The supply became available on November 1st, 1926, and by the end of February, 1927, approximately 500 customers had been connected, resulting in a maximum load of 250 kW. At an early date a supply is to be given to two flour mills and to the Southern Railway Co.'s carriage works, so that quite a good day load is anticipated. The Council is quoting very low rates to large consumers and, as there is a good deal of vacant land with

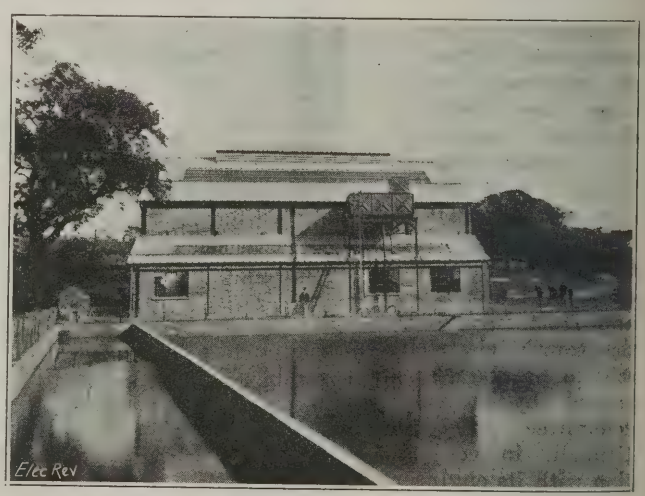


Fig. 3.—Power Station and Cooling Pond.

excellent transport facilities, it is hoped that cheap electricity will attract new industries to the district.

The annual capital charges per kW of peak load which the station can deal with, including stand-by plant, and including land and building, but excluding distribution, amount to £4. Fuel oil consumption per kWh generated will probably come out at 0.8 lb., costing 0.36d., and lubricating oil at 0.025d.; wages at 0.12d., repairs and maintenance at 0.06d., making a total running cost of 0.565d.

It is estimated that in the summer of 1929 an extension will be required to meet the autumn load of that year, and an interesting problem will then arise as to the form which the extension should take, and the alternative question of bulk supply. The figures to make bulk supply an economical proposition will probably be in the neighbourhood of £3 10s. per kW and 0.4d. per kWh.

Power Transformer Operation.

The author describes and compares the various systems at present in use, or available for use, for the protection of electrical apparatus in their application specifically to power transformers, including two recent introductions by the British Thomson-Houston Co., Ltd., and Messrs. Johnson & Phillips, Ltd.

By D. W. McJANNET.

IT is intended in this article to summarise the various forms of protection as applied to static power transformers. Many excellent papers have been presented on the general subject of protection, but very few have dealt with the subject as applied specifically to this important apparatus.

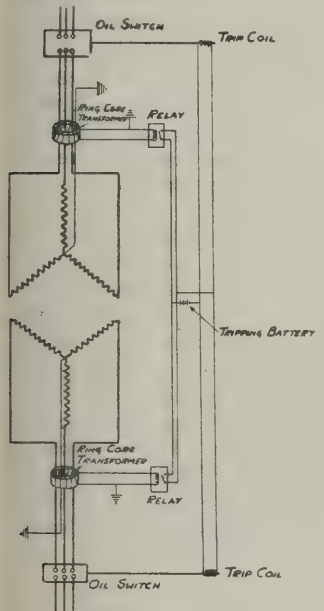


Fig. 1.—Core-Balancing Protection.

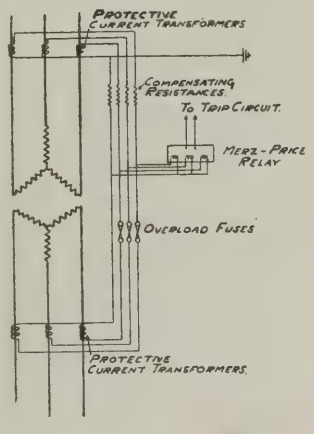


Fig. 2.—M.P. System, Star-Star Transformer.

The subject of protection from mechanical damage due to short-circuiting is one that demands attention in the design of the transformer. This usually takes the form of special bracing of the winding in a radial direction, and automatic or hand-operated axial coil supports are provided to take up any shrinkage which may occur in an axial direction. Radial coil supports are not necessary, and are generally regarded as being a source of danger rather than safety. As a further precaution, the reactance should be kept as high as possible, in order to keep down the value of the short-circuit current, the actual value depending on the output of the transformer, its position on the system, and the reactance of the rest of the circuit. The following table shows the average values of reactance usually put forward for standard designs of apparatus, but these can be increased or decreased slightly without materially varying the other values of the transformer.

For small transformers on overhead lines overload protection is usually carried out by means of fuses, either of the expulsion type or the more simple form consisting of fuse wire connected across horn breaks. For protection against high-frequency impulses it is usual to insert an air-core choke coil. The type of choke coil usually supplied often fails to smooth out the front of the wave before it reaches the transformer winding, and in this connection it is usual to reinforce the insulation between the turns for about 5 per cent. of the winding; but where the transformer is to be installed in a climate where atmospheric disturbances are frequent and severe, it is then sometimes necessary to insulate all the turns on the primary side for full-line pressure between the turns. In connection with the protection of transformers connected to overhead lines, a good deal of work has been carried out in Germany and America on choke coils and condensers used in conjunction with resistances. A particularly interesting paper on this subject by Mr. S. A. Stigant will be found in the J.I.E. *Journal* for June, 1922. This deals very fully with wave shape and the protection of transformer windings against the effect of high-frequency disturbances.

Transformer kVA.		Percentage Reactance. 50 cycles.	40 cycles.	25 cycles.
500	...	4.0	4.5	5.0
1,000	...	5.0	5.5	6.0
1,500	...	5.5	6.0	6.75
2,000	...	6.0	6.5	7.5
3,000	...	6.75	7.0	8.5
4,000	...	7.5	8.0	9.5
6,000	...	8.5	9.0	10.5
10,000	...	10.0	10.5	12.0

It is very desirable that there should be no possibility of the l.p. side of a transformer becoming charged at a higher pressure than normal, due to the breakdown of the insulation between the h.p. and l.p. windings.

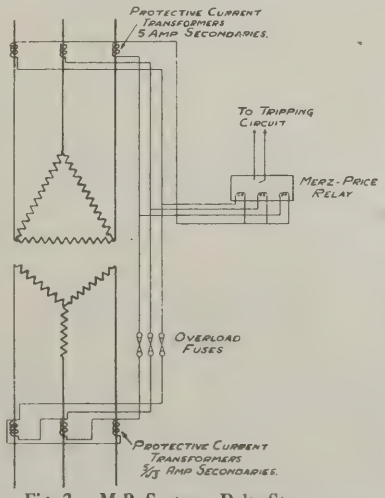


Fig. 3.—M.P. System, Delta-Star Transformer.

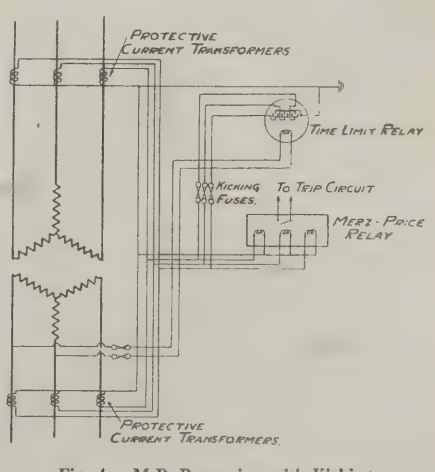


Fig. 4.—M.P. Protection with Kicking Fuses and Relay.

An early form of protection against this type of fault was the introduction of a split copper-sheath between the two windings, but insulated from them, the ends of the sheath being earthed. It was found, however, that this earth shield was in the nature of an added danger rather than a protection, as the inclusion of such a

shield tended to weaken the insulation between the windings, and unless special care was taken, the two ends of the shield came into contact and formed a short-circuited turn. Another disadvantage, which is probably not so well known, is the blanketing effect which this shield has on the inside winding. An earthing device is now more commonly employed connected to the l.p. neutral point, so that should the pressure rise in the secondary winding, a paper or other insulating disk

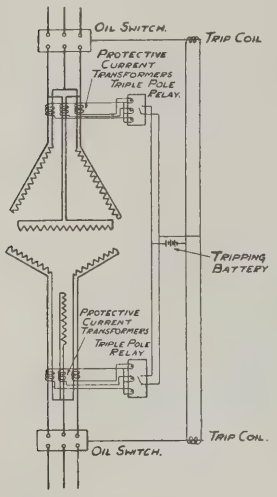


Fig. 5.—Self-Balancing Protection.

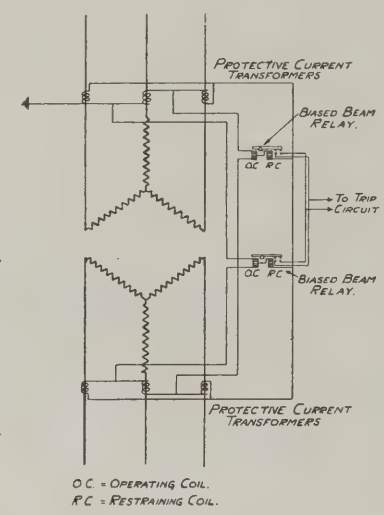


Fig. 6.—McColl System.

is punctured, thus connecting the l.p. neutral to earth. In the case of single-phase transformers, the mid-point of the secondary can be brought out and earthed through the device. Possibly the best protection from this type of fault is the earthing of the neutral direct, especially in the case of isolated units. Where transformers situated at some distance from one another are operating in parallel on both the h.p. and l.p. sides, it would only be permissible to earth one neutral positively on account of the possible circulation of third-harmonic currents. The other neutral point could conveniently be earthed through a suitable device.

For small transformer units in isolated positions, plain overload protection only is usually employed. This can be improved upon by the inclusion of leakage protection and time-limit fuses on the overload trips. A.c. tripping is usually employed, the trip coils being connected direct to the secondaries of the current transformers. Where two or more transformers are operating in parallel, plain overload protection should never be employed. If all the transformers are operating at full-load and one develops a fault which trips it out of commission, the remaining transformers will then be sharing the load of the faulty transformer, which may be sufficient to operate their trip coils, thus shutting down the whole bank of transformers.

Another simple form of protection is that provided by the core-balancing system, although this method is limited in its application and gives protection against earth faults only. The diagram in fig. 1 shows a three-phase star/star transformer protected by this method. The main leads on each side are taken through the opening of a ring transformer, the secondary of which is connected to a relay operating the tripping circuit. In order that the transformer shall not be switched out by a distributor fault, the earth connection from the neutral point should also be taken through the core of the protective current transformer. When this is done, current will flow in one direction only, in the event of an earth fault on the transformer, thus disturbing the balance and thereby operating the relay. The relays will operate with a fault on either the h.p. or l.p. windings. It is not, however, always permissible to earth the h.p. neutral, or that may not be available, but where circumstances permit, this system can very easily be installed on existing plant without any alteration to the transformer connections.

The Merz-Price circulating-current system is probably the most popular of all the protective systems at present in use. It gives protection against faults to earth and between phases, and is entirely discriminating. The principle of the system depends on the equality of currents flowing in and out of a sound circuit. Where a transformer is introduced, the currents in the primary and secondary are equal in a mathematical sense, but they can be directly compared by suitably arranging the ratio of the primary and secondary protective current transformers. The connections for the application to a star/star connected transformer are shown in fig. 2 and for a delta/star transformer in fig. 3. It will be noticed that in the case of the delta/star-connected transformer the current transformer secondaries are connected in delta on the star side and star on the delta side. This is necessary to compensate for the phase displacements between the line currents on the primary and secondary sides, and, in addition, it is necessary to make the ratio of the current transformers on the delta side X to $5\sqrt{3}$, so as to obtain 5 A in the secondary leads at full load. It is often impossible to take tappings off the secondary leads at points of equal potential, and in such cases compensating resistances can be inserted, enabling the tappings to the relay to be made at convenient points. By the insertion of suitable fuses in the secondary leads, overload protection can also be obtained with this system. In the case of a heavy overload these fuses will blow, causing the relay to operate. Where adjusting tappings are fitted on the main transformer, it is necessary to make provision for keeping the current-transformer secondaries balanced under normal conditions, whatever tappings may be used on the main transformer. This could be done by means of compensating resistances, or suitable tappings could be provided on the current-transformer secondaries, so that, should the h.p. current increase, due to working on a lower-voltage tapping, the current-transformer secondary currents would still be 5 A at full load under working conditions.

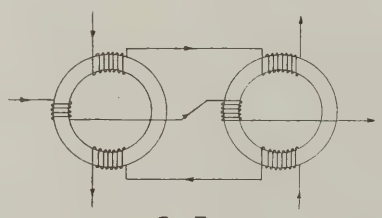
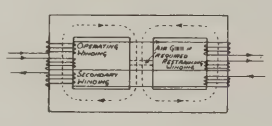


Fig. 7.



Figs. 7 and 8.—B.T.-H. Biasing Transformers.

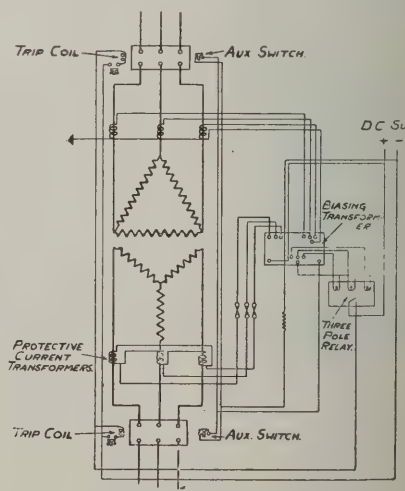


Fig. 9.—Circulating-Current Protection.

When switching in transformers there is often a heavy rush of current in the primary which does not appear in the secondary, and there is therefore a danger of this gear operating when switching on, with no fault existing. To prevent this happening, the relays are shunted by so-called "kicking fuses," usually set to "blow" at 75 per cent. overload. These cause the relay settings to be coarse, and it is advisable to provide some arrangement whereby the fuses are only in circuit during the switching-in period, and are automatically

removed when the circuit breaker has been closed for a predetermined time. This can be carried out by means of an additional relay, as shown in fig. 4. When the oil switch is closed, this device comes into operation, and the plunger commences to rise against an air dash-pot. At the end of a fixed time-setting the plunger reaches the point at which the contacts, dipping in mercury cups, are raised, thus cutting out the fuses. When the switch is tripped, the relay resets itself and the fuses are again in circuit. The only disadvantage of the switching-on protection is that the coil is always on load, and should it burn out the fuses would still be in circuit without the switch tripping. The Merz-Price system can be easily installed on existing transformer plant without making any alterations to the transformers.

Many of the disadvantages of the Merz-Price system are overcome in the self-balancing system, which provides against short-circuits between phases or earth faults, but not against short-circuits between the turns. The system is based on the comparison of currents entering and leaving the windings, separate protection being provided for both h.p. and l.p. sides. Current transformers are required for each winding to be protected, and these each have two primary windings in series with the incoming and outgoing leads to the transformer windings. The secondaries of the current transformers are connected to relay elements operating the tripping circuits, the connections for a delta/star transformer being as shown in fig. 5. Under normal conditions the currents in the two

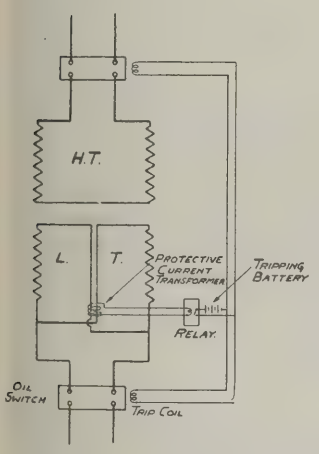


Fig. 10.—J. & P. System for Between-turn Faults.

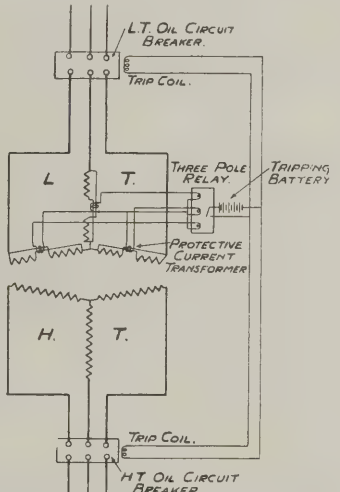


Fig. 11.—J. & P. System, Three-phase.

primaries are equal and opposite, so that no flux is produced in the core of the current transformers. When a fault occurs, current will enter through one primary winding and pass to earth, or another phase, without returning through the other primary winding, thus producing a flux in the current-transformer core, and causing operation of the relay and oil switch. The system is very sensitive, and under normal conditions no p.d. exists between the different parts of the secondary winding, thus minimising the risk of accidental operation. This risk is further reduced by the absence of pilot wires between the current transformer secondaries. As the h.p. and l.p. sides are treated independently, the system is proof against switching-on current rushes, and the presence of tappings on the main transformer does not introduce complications. It is a very simple system for all cases involving phase relationships or voltage variations. As the current transformers are inherently self-balanced, there is no danger of operation on heavy overloads due to unbalancing in the current transformers. It is difficult to install this gear on existing plants, as both ends of each phase of the power transformer must be available, but for new transformers it presents no difficulties. If the protective gear is ordered with the plant, the current transformers can be accommodated in the tank and the connections suitably arranged.

The McColl circulating-current method of protection is really an improvement on the Merz-Price system. The relays used are of the biased-beam type, one coil having a restraining effect. There are two main reasons for the instability of the Merz-Price system, namely, the faulty choice of equipotential points and the possibility of the current transformers developing different characteristics when the induction density reaches a high value; and as the unbalancing effect cannot be accurately calculated, it is necessary to make the relay-setting high to ensure stability. The McColl system, by the use of the biased relays, overcomes this objection. The restraining coil carries the main current of the system, the other coil being connected to equipotential points. If a 10 per cent. bias is required, it is necessary to wind the restraining coil with approximately 10 per cent. of the turns used for the operating coil. The relay will then be held in the off position until the unbalanced current flowing through the operating coil has a value equal to 10 per cent. of the current traversing the restraining coil. At this value the ampere turns of the two coils will balance one another. With such an arrangement it is possible to give a definite guarantee of stability, as ample latitude for unbalancing may be allowed. Fig. 6 shows the arrangement applied to a star/star transformer, two relays only being necessary. With delta/star connection the protective current transformers have to be connected in delta on the star side, the secondaries being arranged for $5/\sqrt{3}$ A as in the Merz-Price protection. The system has much to recommend it, as it is quite sensitive without the relays being in any way delicate. They will therefore stand up to any rough handling which they are likely to receive. As regards its installation, the system offers no difficulties beyond those of the ordinary Merz-Price equipment.

A further means of providing bias has been developed by the British Thomson-Houston Co., Ltd. This does not involve the use of special relays, but depends for its action on a special biasing transformer. A simple method of restraining the relay from operation is provided if, instead of introducing additional forces in opposition to the operating effect, a reduction in the magnitude of the latter be brought about. What is required is some intermediate device connecting the operating apparatus and the relay, capable of transmitting to the latter such an amount of the available energy as may be appropriate to the circumstances under which the apparatus is functioning. To meet these conditions a specially designed transformer has been produced. It is provided with a primary or operating winding, a secondary winding, and a further winding known as a restraining winding. This is not inductively related to the operating and secondary windings, but it excites a magnetic circuit, a portion of which is common to that with which the other windings are linked. Such an arrangement may consist of two ring cores, each provided with similar operating and secondary windings connected in series as in fig. 7. A third coil present on each core, but in one case reversed, will, if excited, have the following effect. Such e.m.f.'s as may be induced in each secondary by this third coil will not appear in the complete secondary circuit, as they will be in opposition; nevertheless, the magnetic circuits of each transformer will be excited. If such proportions be chosen that currents flowing in the restraining winding give rise to saturation of the iron, this will effect the secondary current corresponding to any given operating current. Excitation of the restraining winding is capable of increasing the reluctance of the magnetic circuit to such an extent as will necessitate a much greater operating current in order to deliver the required secondary energy. If, therefore, the operating winding be connected in place of the relay, this being connected to the secondary winding, the desired effect is obtained. A better type of construction is shown in fig. 8. Divided restraining windings are used which give a more efficient restraint, and

these windings will give rise to a saturating flux passing through the centre, as shown by the dotted lines. Former-wound coils may be used in this apparatus, and a further advantage is that an air gap may be used in the restraining magnetic circuit without reducing the unrestrained permeability of that associated with the other windings. A d.c. restraint can be incorporated which can be applied, when switching on a transformer, to prevent the operation of the relays due to switching-on current rushes. Fig. 9 shows a three-phase, delta/star transformer protected by the circulating-current system embodying biasing transformers. In this case a ratio-correcting element is included so that transformers with standard 5-A secondaries may be used for both sides of the transformer. Furt d.c. restraint is provided to prevent operation of the relays during switching-on periods.

A protective system for faults between turns has been patented, and, as its title denotes, has for its object the switching-out of a transformer in the initial stage of the development of a short-circuit between the turns on either the h.p. or l.p. winding. This apparatus, which is being manufactured by Messrs. Johnson & Phillips, Ltd., under licence, consists of one or more ring-type current transformers and a single- or three-pole relay, depending on whether a single- or three-phase transformer has to be protected. One winding of the power transformer, either h.p. or l.p., is split into two halves, which are connected in parallel, the parallel connections being taken in through the centre of a ring core upon which the secondary winding is arranged, the latter being connected to a sensitive relay. The two halves of the winding are arranged so that under normal conditions the impedance of each half is the same, hence the currents flowing in opposite directions through the ring-type transformer will be equal and will not give rise to any flux in the core of the current transformer. A short circuit between the turns of either the h.p. or l.p. winding will have the effect of altering the impedance of the two halves so that the currents flowing through the ring-core transformer will no longer be the same, hence a flux will be produced in the current transformer core causing operation of the relay. This method cannot be applied to existing plant without rewinding either the h.p. or l.p. winding, but it can easily be applied to new transformers without involving extra cost in manufacture. Especially is this the case with transformers wherein the l.p. current is fairly high, as the winding would, in any case, be split into two coils connected in parallel. On single-phase transformers the application is even more simple as the two limbs can be connected in parallel and only one current transformer is needed. The current transformers consist of ring cores with single bar conductors passing through the cores in a similar manner to the arrangement adopted for self-balancing protection. It will be realised that this system will only confine the damage due to a short circuit between the turns to the faulty turns. With other systems of protection the destructive effect due to a short circuit between the turns usually goes on until it develops into an earth fault, before the relays operate. This often involves the complete destruction of the winding and its repair is a fairly lengthy and costly business. With the system under consideration the transformer would be tripped out in the initial stages of the fault, and would considerably reduce both the cost and time required for repairs. The connections for a three-phase star-star transformer are shown in fig. 11, and for a single-phase transformer in fig. 10.

For further information on this subject the following works can be consulted with advantage:—

"A.C. Circuit Protection," by R. Bannister and G. E. Gittins; *Mining Electrical Engineer*; Vol. III, 1922.

"Automatic Protective Devices for A.C. Systems," by A. E. McColl; I.E.E. *Journal*; Vol. 58, July, 1920.

"Design of Apparatus for the Protection of A.C. Systems," by A. S. Fitzgerald; I.E.E. *Journal*; Vol. 62, July, 1924.

"Automatic Protective Switchgear for A.C. Systems," by E. B. Wedmore; I.E.E. *Journal*; Vol. 53, 1915.

"Design of Electrical Plant, Control Gear and Connections for Protection against Shock, Fire, and Fault," by H. W. Clothier; I.E.E. *Journal*; Vol. 63, 1925.

"The Influence of Condenser and Choke Coil Protective Devices on Travelling Electric Waves," by S. A. Stigant; I.E.E. *Journal*; Vol. 32, June, 1922.

"J. & P. Transformer Book," by S. A. Stigant and H. M. Lacey; 1924.

Wireless Telegraph Communication.

A review of the present position of maritime safety services, commercial communication, and point-to-point telegraphy in view of the proposed modified requirements and regulations to be discussed at the forthcoming International Conference in the United States next Autumn.

By Lieut.-Col. CHETWODE CRAWLEY, M.I.E.E.

THE International Conference of 1912 laid down regulations governing the installation and operation of wireless telegraph apparatus in ships, and it has been announced that the next International Conference will be held in October next at Washington, U.S.A., for the purpose of framing a new Convention.

The 1912 Convention dealt only with ships' communications, as there were then practically no wireless services between fixed stations, but the coming Conference will deal with all aspects of the problem, *viz.*, the communications of mobile stations, fixed stations, amateur experimental stations, and broadcasting. It may be of interest therefore, to take stock now of the present position of our commercial wireless communications, and briefly to indicate the main points which will come up for consideration at the International Conference.

(1) Ships' Safety Services.

The primary use of wireless telegraphy for shipping purposes is to lessen the chances of disaster at sea, and it is this aspect alone which we shall consider in this article.

Ships' Sets.—In this country it was laid down by an Act of Parliament in 1919, that every sea-going British ship registered in the United Kingdom, being a passenger steamer or a ship of 1,600 tons gross tonnage or upwards, must be provided with a wireless telegraph installation, and must maintain specified watches on the 600-metre wave, on a spark or interrupted-continuous-wave type of installation. The installation must be capable of transmitting clearly perceptible signals from ship to ship over a range of at least 100 nautical miles by day, and, in addition, emergency arrangements must be made for signalling

for six hours continuously, over a range of at least 80 miles for large ships and 50 miles for small ships, using a source of energy that is independent of the main power of the ship.

In addition to the ships' sets, it was laid down by the Board of Trade in 1925 that all our foreign-going passenger steamers which carry more than 10 lifeboats must have at least one of them fitted with wireless telegraphy, and if there are more than 15, or more than 20 lifeboats, at least one or two, respectively, must be motor boats fitted with wireless. Transmission must be on the 600-metre spark wave, giving a minimum metre-ampere figure of 15, and the normal receiver must be a valve type, with a crystal set as an alternative.

It is obvious that a method of rating stations by taking the product of maximum aerial current and the maximum height of the aerial, is more practical than rating them by range of working, which depends on so many circumstances. This is a matter which will be considered at the International Conference.

Operators.—The number of operators to be carried and their periods of watch, were laid down for different classes of ships. In ships which carry 200 persons or more, a qualified operator must always be on watch at sea. In ships which carry between 50 and 200 persons, a qualified operator must be on watch at scheduled times amounting to eight hours a day, and watchers who need only be able to recognise the distress (S.O.S.) and safety (T.T.T.) signals, must be on watch at all other times. In ships which carry less than 50 persons, a qualified operator must be on watch at scheduled times amounting to eight hours a day, and no watch need be kept outside these periods. Operators, who must be British-born of British parents, must be in possession of the Postmaster-General's certificate of proficiency.

Candidates for the examination for this certificate are trained at some two dozen privately owned schools. A watcher has also to pass a Post Office examination, but in his case the only qualification required is ability to recognise the distress and safety signals.

At present there are about 4,000 operators and 1,000 watchers serving in 3,150 British ships which are compulsorily fitted with wireless telegraphy.

The qualifications required for the various classes of operators' certificates and the regulations for having internationally scheduled times of watch, will come up for revision at the International Conference.

Inspection depôts are established by the Post Office at the principal ports for the inspection of ships' installations, to ensure that they conform with the regulations and are being properly maintained by the operators. About 3,500 inspections are carried out annually.

The Alarm Signal.—Automatic receiving apparatus has recently been designed by the Marconi Company and the Radio Communication Company to register the reception of an alarm signal by ringing a bell to call the operator to the instruments. Such apparatus, if found up to the standard required by the Government, will allow of all ships which are fitted with this apparatus being on constant watch for distress signals, without the necessity of employing watchers. The signal which has been selected in this country as an alarm signal for the purpose of working the automatic apparatus consists of a series of 12 dashes sent in one minute, the duration of each dash being 4 seconds, and the duration of each space one second. It is intended that this signal should be sent before the usual S.O.S. distress signal. There are no international regulations governing an alarm signal of this nature, and the matter is one which will come up for discussion at the International Conference.

All large passenger ships are now fitted with continuous-wave installations for long-range traffic, in addition to the spark sets which are compulsorily fitted for safety purposes, but it is laid down that all British ships, no matter how fitted, must stand by during their hours of watch to receive distress signals on the 600-metre wave on their spark receivers, whenever their continuous-wave sets are not in use, and in any case must do so for three minutes every half hour, at a quarter past and a quarter to each hour, G.M.T. This arrangement will be considered at the International Conference.

A great deal of ordinary traffic, in fact over 70 per cent., is still conducted on the 600-metre wave with the spark installations, as the great majority of ships are not fitted with continuous-wave installations, and as most of the coast stations throughout the world stand by on the 600-metre wave so as to be ready for distress calls. In order to reduce the present interference on the 600-metre wave, it is expected that regulations will be included in the International Convention by which much of this spark traffic will be transferred to other waves.

Directional Receivers in Ships.—Directional receiving apparatus, by which a bearing of a wireless transmitting station or ship can be taken, is now installed in about 9 per cent. of the British ships compulsorily fitted with wireless, including practically all our large passenger steamers, and as its great utility becomes more generally recognised, the number of ships fitted will no doubt increase rapidly. The sets used are fitted by the Marconi Company, the Radio Communication Company, and Siemens Brothers.

In the Marconi Company's sets, the aerial consists of two vertical loops in planes at right angles to one another, and in the receiving apparatus a coil is rotated, by which the strength of the received signals is varied. The direction from which the signals come is determined by the position of the coil when the signals are heard weakest. In the Radio Communication Company's set, the aerial is similar, and the direction from which the signals come is determined by rotating the loops until the strength of the signals is unaffected by reversing, with a switch, the mutual connections of the loops. In the Siemens Brothers' set, a single loop aerial is rotated, and the direction from which the signals come is determined by the position of the loop when the signals are heard weakest.

Recently, Mr. Watson Watt and Mr. Herd, working for the Radio Research Board, designed a form of directional receiver, which, when further developed, may prove of great value to ships. It is the nearest approach to a wireless compass yet produced, as it is a direct-reading instrument which can be used by the navigator on the bridge. This apparatus is still, however, in the experimental stage, and it is generally agreed that the directional instruments now on the market are best operated by a skilled wireless telegraphist.

The difficulties that ships labour under, compared with coast stations, are that errors may be introduced by changing the positions of guys, derricks, &c., that there are fewer opportunities of taking check bearings on known fixed wireless stations, and that errors may arise due to the necessity of having to refer the observations taken to the position of the ship's head as shown by the compass at the moment when the observation was taken.

Distress Messages.—In this country, including Ireland, the coast stations are worked by the British Post Office, and "look out" continuously on the 600-metre wave, with the exception of that on the Humber which is closed from 11 p.m. to 8 a.m. These stations are situated at Wick, Cullercoats, The Humber, North Foreland, Niton, Lands End, Fishguard, Seaforth, Port Patrick, Malin Head, and Valentia, so that a ship in distress anywhere near our coasts is in touch with at least one station. The average day range of the coast stations is about 250 miles, though of course much greater ranges are frequently obtained.

When a distress signal is made, all stations and ships which receive it, with the exception of those dealing with it, remain silent until the coast station which is handling the case, signifies that general communications may be resumed. This distress work often entails a complete cessation of commercial signalling

round our coasts for several hours. Nearly 100 distress cases are dealt with annually by our coast stations. The station which deals with a distress call takes all necessary steps to obtain assistance by wireless, telephone and telegraph, informing the Coast Guard, Naval Authorities, Lloyds, and others in special cases. No charge is made for any wireless messages in connection with distress work.

Weather Messages.—Other safety messages for which no charge is made are weather bulletins and gale warnings supplied by the Air Ministry, and navigational warnings supplied by the Admiralty. These are broadcast on the 600-metre wave at scheduled times by our coast stations. Weather reports are also broadcast on a 4,100-metre continuous-wave at scheduled times by the Air Ministry's station in London, and by wireless telephony at scheduled times on a 1,600-metre wave by the B.B.C. station at Daventry. In addition to the broadcast weather services, ships can obtain from any of our coast stations, for a fee of 7s. 6d., weather forecasts from the local meteorological station, or the Meteorological Office. To assist the meteorological authorities in preparing weather forecasts, arrangements are made by which certain ships, when crossing the Atlantic, send reports by wireless.

In the United States and Germany, experiments are now being carried out to apply the principles of telephotography to the broadcasting of weather reports, special receiving apparatus being fitted in the ship. By this means, the navigating officer, instead of drawing his own synoptic charts from the data received by wireless, will have the charts drawn for him by the receiving apparatus.

Directional Receivers on Shore.—Directional receiving apparatus of the fixed double-loop type is fitted at the stations at Cullercoats, Niton, and Wick, and bearings are given on the 600-metre wave to any ship on demand at a charge of 5s. per bearing; for the same fee, any coast stations will send signals to enable a ship fitted with directional receiving apparatus to obtain a bearing on the station. There is also a Post Office directional station on the 600-metre wave for ships at Flamborough, and a Naval station at The Lizard which gives bearings to merchant ships on the 800-metre wave for the usual 5s. fee. A new coast station which will be used for ordinary work and direction-giving purposes on the 600-metre wave, is being erected by the Post Office at Mablethorpe. This will replace the present Humber station and the direction-giving station at Flamborough. Directional receiving apparatus will shortly be added to the stations at Fishguard, Seaforth, and Port Patrick, and if found suitable will be available for giving bearings to ships on the 600-metre wave. Nearly 7,000 bearings were given to ships by the coast stations last year. All these directional stations are calibrated periodically, and can be relied upon to give bearings which are sufficiently accurate for navigational purposes up to distances of 100 miles by day and 50 miles by night.

Wireless Beacons.—Wireless beacons, *i.e.*, stations which transmit signals at regular intervals, in order that ships with directional receivers may be able to obtain bearings, have only recently begun to be established in this country, although a fair number has been established for some time in other countries, notably in the United States, where about 20 are now in operation. It is expected, however, that a number of these wireless beacons will be erected before long at suitable places round our coasts. Trinity House has already two in operation, one on Round Island in the Scilly Islands, and the other at the Casquets in the Channel Islands, working on a 1,000-metre interrupted-continuous-wave, and the Mersey Docks and Harbour Board is installing one in the Mersey. The Humber Conservancy Board is also about to open a wireless beacon at the Spurn Lighthouse in the Humber which, working in conjunction with submarine sound signalling apparatus, will enable a ship to obtain its distance as well as its bearing from the lighthouse, and the Commissioners of Irish Lights are installing a similar beacon in Dublin Bay. The wave lengths used and signals to be transmitted by beacons are to be considered at the International Conference. There are also forms of beacon stations which emit revolving beams of waves which can be made use of by ships fitted with ordinary receivers or with special simple receiving apparatus. These revolving beacons will no doubt be used commercially before long, but at present are in the experimental stage.

An interesting use of wireless for navigational purposes is the firing of fog guns by distant control. An installation of this kind is used at Gourock to fire fog signals at Rosneath Beacon. In case of fog, the transmitting apparatus on the mainland is put in operation and the signals when received at the beacon, over a mile distant, set in operation an apparatus which explodes a mixture of air and acetylene gas. Once started, the explosions continue so long as wireless impulses are received from the transmitting station.

The Trinity House authorities use wireless telephony to link up their light vessels off Ramsgate, Walton-on-Naze, and Cromer to each other and to the shore, and the Mersey Docks and Harbour Board has made similar arrangements in the Mersey. These stations, which work on a 250-metre wave, use a call-bell arrangement to obviate constant watch. With the exception of these services and of the weather reports sent from Daventry, wireless telephony is not used for ships' safety services, or, indeed, for any other ships' services, with the exception of a few fishing vessels. This is largely due to the fact that for equal range, telephony is more costly than telegraphy and, being less selective, is not so suitable for conducting a number of different services in the same area.

Spark Working.—Spark telegraph sets are undoubtedly the most suitable for distress work as the tuning is broad, which is a distinct advantage when dealing with many ships of many nationalities and accurate tuning cannot always be expected. In this respect interrupted-continuous-wave sets are not so good as spark sets for distress work, but are permitted for that purpose as they can be so readily modified for traffic purposes to continuous-wave working which will not interfere with any distress signalling that may be proceeding at the time. The tendency, undoubtedly, is to abolish spark working altogether, even for distress purposes, but due to the expense involved, it will take a considerable time before this is accomplished. The whole question is one which will be fully considered at the International Conference.

In this country the Post Office has decided to install an interrupted-continuous-wave set in place of a spark set at the new station at Mablethorpe, and to make a beginning with the conversion of the old stations from spark sets to interrupted-continuous-wave sets.

Time signals are broadcast principally for the use of shipping from many stations throughout the world, but at present the only time signals sent from this country are those transmitted from the British Broadcasting Corporation's stations.

(To be continued.)

Television.

A television installation between New York and Washington was demonstrated in the presence of spectators recently over a distance of 250 miles. New Yorkers in the laboratories of the Bell Telephone Company heard and saw Mr. Herbert Hoover in Washington deliver a brief address. According to the daily Press, his head and shoulders were seen in a dancing shadow composed of myriad small spots flickering upon a screen less distinct than an ordinary kinema picture. Mr. Hoover's facial expressions and movements were, however, quite visible. The installation was placed in an ordinary telephone booth, consisting of a small metal box, in which the telephone user was able to see the person with whom he was conversing. The first messages were sent by wire from Washington, and later a similar demonstration was given, utilising radio from Whippany, New Jersey.

Arbitration Law Reform.

The Lord Chancellor's Committee's Recommendations: Appeals from Arbitrators' Decisions; Umpires as Sole Arbitrators; Arbitrators' Fees; Arbitration Clauses in Contracts; Speeding-up Procedure; Codification.

[From a Legal Contributor.]

In March of last year the Lord Chancellor appointed a committee to consider the existing law relating to arbitration, and to make such suggestions for its reform as they should consider desirable. Seeing that the committee were presided over by a distinguished commercial judge and that Sir Thomas Willes Chitty was amongst the members, it is not surprising that a most valuable report has been the result.

From the point of view of the electrical engineer, arbitration is a much more important form of legal proceeding than an ordinary action at law. In the first place he is often appointed to act as arbitrator; secondly, disputes in relation to the class of contract which concern him are nearly always settled in this way. It is sometimes said that lawyers object to arbitration; but so far from objecting to this kind of litigation, they recognise that it is indispensable, for it would be impossible for the Courts to get on without the assistance of arbitration. Many an action which commences in the High Court is referred to an arbitrator, either by the order of the Court or by consent of the parties, and the lawyers find that arbitration is a very profitable source of income.

The committee have indicated in their report that there are certain defects in the present law which ought to be amended. They point out that, while the Courts do possess a certain appellate jurisdiction in relation to proceedings before an arbitrator, the right to appeal is not sufficiently clear in some cases. There is, of course, no appeal from an award as such. The only way in which the decision of an arbitrator can be reviewed in a Court of law is by having an award made in the form of a special case. Special cases are of two kinds. In one form the arbitrator merely invites the opinion of the Court as to a particular point of law. The Court having given its opinion, "the case" goes back to the arbitrator to be decided on the merits. There is at present no right to appeal to the Court of Appeal from this, which is called "the consultative" decision of the Court. The committee recommend that there shall be an appeal in such a case, by leave of the Court. Again, there is no power in the Court to order an arbitrator to state a case for the opinion of the Court.

The other kind of special case is one in which the arbitrator makes his award in that form. He can be ordered to so make his award, and when it comes before the Court judgment may be entered in accordance with the findings of the arbitrator, and there is an appeal to the Court of Appeal. The committee recommend that the practice relating to the two forms of special cases shall be brought into line, with this exception that there is only to be an appeal to the Court of Appeal from a consultative case by leave of the Court.

Perhaps the most important recommendation made by the committee is that which relates to a Court which consists of two arbitrators and an umpire. It has long been recognised that this form of tribunal is cumbersome and expensive, and that where there is an agreement to refer a dispute to two arbitrators and an umpire, the umpire only to act in case of difference between the arbitrators, it nearly always happens that the arbitrators disagree, with the result that the parties have to pay for a Court consisting of three persons where one would have been enough. The committee make the very sensible suggestion that where two arbitrators are to appoint an umpire, they must do so immediately, otherwise either party may apply to the Court, or a judge, for the purpose. They further recommend that at any time after an umpire has been appointed, either party may apply for an order that the arbitrators shall be discharged and that the case shall be conducted before the umpire as sole arbitrator without prejudice to the right of the arbitrators to act as witnesses.

It is also suggested, with regard to the fees of arbitrators, that where a dispute arises in relation to fees, as where, for example, an arbitrator keeps back his award until his fees are paid, an order may be made by the Court for the payment of the fees into Court to await taxation, it being competent for the arbitrator to be heard on the matter. This will get over a difficulty which has often arisen where an arbitrator has sought to exact what is considered to be an exorbitant fee for his services.

In certain minor particulars the committee suggests one or two important amendments of the law. Thus it often happens that a big corporation such as an insurance company is able to put forward a contract containing an arbitration clause which may press hardly upon the other party. For example, the contract may provide that an application for arbitration in the case of a dispute shall be made within a very short space of time. With a view to remedying this state of affairs, the committee would like to give the Court power to extend the time for applying for arbitration. They would also have the Court enabled to remove an arbitrator who is likely to be biased. They further recommend that where one party to a dispute is charged with fraud, that might be sufficient ground for refusing to compel him to proceed to arbitration.

A good deal has been said and written about the law's delays. We do not hear so much about delay in arbitration proceedings. This may be due to the fact that they take place in private, but that there is delay and consequent injustice is quite clear from the report of the committee. It is also apparent that under the existing law one party to a dispute has power to delay the proceedings almost indefinitely. Thus an arbitrator can prolong the time for making his award to any extent, and one party to a reference who desires to delay matters as much as possible can get his arbitrator to help him in this respect. The committee propose that unless an arbitrator makes his award with dispatch, then either party to the submission may apply to the Court or a judge for leave to revoke the submission, or for an order appointing an arbitrator or an umpire in the place of the one so in default.

There are a good many minor recommendations which are of more interest to the legal than to the engineering profession: of these, one should be mentioned. It is that, instead of amending the existing arbitration Act, a new Act should be passed codifying the law on the subject, and that this Act should contain in an appendix suitable forms of award. These should be of great assistance to lay arbitrators.

We earnestly hope that the Legislature may be able to find time to pass the necessary Act embodying these reforms in the near future.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

One of the last demonstration houses to be run in connection with the campaign was that at Paisley, which is illustrated herewith. It closed on March 26th after being open to public inspection for a fortnight. In the illustration the floodlighting arrangement adopted can be seen clearly.



Demonstration House at Paisley.

Every room was equipped with thoroughly up-to-date apparatus and evoked the interest of a large number of visitors. The Paisley Circle had one of the first demonstration houses of the campaign; this was open for a fortnight in October last.

One of the houses built by the Pudsey (Yorkshire) Town Council on the Carlisle Road estate has been equipped as an all-electric house and was opened to public inspection on April 6th, by the Mayor (Councillor S. Myers).

Foreign Trade Development.

In reply to a suggestion put forward in the House of Lords that the Department of Overseas Trade should be abolished, Mr. R. B. Dunwoody, secretary of the Association of British Chambers of Commerce, recently testified to the value of the work accomplished by the Department. The Department's duties, he said, differed from those of the other departments of the State in that it helped to get orders for this country which might go elsewhere. The British Government was bound to do all in its power to further our overseas trade, and so far from abolishing the D.O.T., still more vigorous methods should be employed. Mr. Dunwoody considered that the abolition of the Department was a certain way of increasing the income tax. In a recent issue, the *Industrial Australian and Mining Standard* reported that a movement was on foot among German business men to bring pressure to bear upon the German Government to reorganise the Consular service on the lines adopted by the American Department of Commerce. The efficacy and efficiency of that department are extolled: it is said that United States foreign trade was increased by the Department by £100,000,000 during 1925, while the cost of the whole organisation is less than £600,000 per annum. Over two million inquiries were dealt with in 1925, and 50 per cent. of the inquiries are answered within 24 hours.

Foreign Competition.

The Dewsbury Town Council, on April 7th, recommended the Electricity and Tramways Committee to purchase foreign electric cable, when advisable, in view of the lowest tenders from British firms in the Cable Makers' Association having been from 25 to 34 per cent. higher than the lowest foreign tenders. The Town Council also decided to draw the attention of the Incorporated Municipal Electrical Association to this matter.

Badminton.

The badminton team of the St. Helens Cable and Rubber Co., Ltd., met the team of Callender's Cable and Construction Co., Ltd., on April 4th and beat them by eight events to one. The successful team comprised Mr. J. H. Brooking and Miss P. Baines; Mr. H. Evans and Mrs. Carey; and Mr. R. Wetton and Miss E. Bridge.

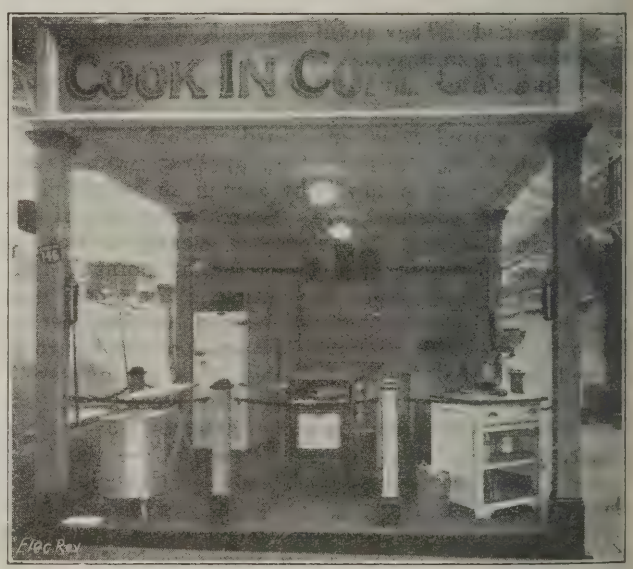
The Metropolitan-Vickers Electrical Co., Ltd., has a badminton expert in the person of Mr. T. P. Dick, who reached the semi-finals in the 1927 open singles all-England championship, and has won many events.

German Exports to New South Wales.

During December last electrical appliances valued at £1,652 were supplied by Germany to New South Wales, states the *Board of Trade Journal*.

Local Exhibitions.

Among the exhibits at the National Trades and Industrial Exhibition which is being held at Bingley Hall, Birmingham, from March 21st to May 14th, is that of the City of Birmingham Electric Supply Department, which comprises two model rooms of an "all-electric" house. Here are shown electric lighting fittings and electric fires, cooker and wash-boiler, a "Frigidaire" cabinet for domestic use, irons, kettles, a vacuum cleaner, a food mixer, and other electric labour-saving devices. One section of the Corporation's display—the kitchen—is depicted in the accompanying illustration.



An Electric "Kitchen" at Birmingham.

Another electrical exhibit is that of Tellus Super Vacuum Cleaner, Ltd., 394, Oxford Street, London, W.1, which is showing a new type of electric cleaner which can be converted into a fan, hair dryer, and bellows. Electrolux, Ltd., is showing its vacuum cleaners and refrigerators.

Erith.—An exhibition of various manufactures and commodities was held at the Erith Technical College on April 11th, 12th, and 13th. The arrangement of the electrical section was undertaken by Messrs. Dickenson & Co., Bexley Heath, and it comprised a complete range of "Magnet" household electrical appliances and a variety of "G.E.C." fittings. It is interesting to learn in connection with this exhibition that the district power rate was reduced from 2d. to 1d. per kWh as from April 1st.

East Kilbride.—The Clyde Valley Electrical Power Co. held a successful exhibition at East Kilbride, Renfrewshire, from April 7th to 9th. The company's engineers were in attendance and answered inquiries regarding supply, and electrical appliances of all descriptions were on view.

Radio Exhibition Poster Competition.

The Radio Manufacturers' Association is organising a competition to obtain a suitable poster to advertise this year's National Radio Exhibition. A leaflet setting forth the conditions of the competition has been printed and can be obtained from the secretary of the Association, Astor House, Aldwych, W.C.2.

Trade with Argentina.

A further address upon this subject was given by Sir A. Malcolm Robertson at a recent dinner of the Incorporated Sales Managers' Association. He said that, although British capital had provided public utilities all over Argentina and had developed many of the country's resources, Great Britain was losing ground in the Argentine market. Incessant strikes in this country had led to a lack of confidence on the part of foreign buyers, our prices in many cases were too high, and another handicap was high freights. Prices might be lowered and quality maintained by standardisation and mass production where these were possible. A carefully-thought-out propaganda campaign was necessary. It was useless repeating "Buy British goods"; the foreign buyer wanted to know *why* he should do so. Salesmanship was weak. The market could only be studied on the spot and not from a London office. Last, the 2 per cent. tax on foreign loans rendered it impossible for us to compete. If, however, an effort was made by British traders to co-operate, advertise, and work, we still had a great future in South America.

New French Company.

A new company has been formed at Boulogne-sur-Seine, with a capital of 535,000 fr. and the title La Société Le Fil Magneto, to manufacture electrical apparatus.

German Industrial Revival.

Herr F. von Mendelssohn, president of the German National Committee of the International Chamber of Commerce, was the guest of the British National Committee at a luncheon last week. *The Times* report of his speech states that Herr Mendelssohn said that Germany had seen the worst of economic stagnation and that conditions had begun to improve. In the second half of 1926 production and consumption experienced a steady augmentation which could not be explained merely by such adventitious events as the labour difficulties in British mining. It was due to the maintenance of regular prices, to industrial investments for the improvement of production, to increased savings, and to the increased purchasing power of the nation. A tendency towards amalgamation in industry formed the special feature of German economic organisation at the present time. Amalgamation within the Reich had bridged the way to an understanding with the industries of other countries; and this, in its future evolutions, might well lead to agreements which would do more than any customs tariffs or import prohibitions to preclude market anarchy and wild competition between one country and another.

Belgian Telephone Works Extension.

In order to meet the increasing demand for telephone material in Belgium, the works of the New Antwerp Telephone and Electrical Works Co. are about to be considerably enlarged.

Swiss Electrical Industry.

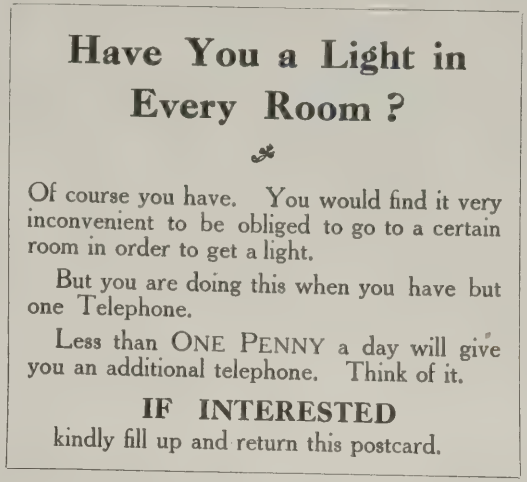
In a review of the progress of Swiss industries during 1926 issued by the Swiss Bank Corporation, it is stated that the important machine manufacturing industry of the country, after having suffered considerably during the general economic crisis commenced last year to recover, at any rate in several of its branches. As in previous years, an outlet for the greater part of the products of this industry had to be sought abroad, and it is remarked that in the second half of 1926 a severe form of protection was applied in certain countries. The review also remarks on the various resolutions passed at the recent Empire Conference in London in favour of the growing industry of the Dominions and that of the United Kingdom. It adds that the absence of the Russian market was particularly felt in Switzerland. Yet the level of employment generally in the electrical manufacturing industry was satisfactory, owing, partly, to the orders placed by the Federal Railways for the purpose of accelerating their electrification programme. As, however, the completion of all this work is approaching rapidly, the hope is expressed that orders from foreign countries, where Swiss finance is extending its influence in electricity supply companies, will gradually lead to contracts to follow those which are now nearing completion.

An X-Ray Warning Notice.

We have received a sample of the notices which Messrs. Watson & Sons (Electro-Medical), Ltd., are issuing with every X-ray equipment they supply, warning all users as to the precautions which should be conscientiously observed when operating the equipment. Clearly printed and permanently covered with celluloid, one copy is fixed inside the transformer cabinet, another is supplied loose for hanging on the wall of the X-ray room, whilst a third copy is attached to the instructions issued for handling the plant. Messrs. Watson are thus doing their best to ensure the safety of those who operate X-ray apparatus.

Telephone Development.

It is generally believed that the Telephone Service hides its light under a bushel and that it waits for people to approach it if they want telephones. This is not altogether true, as the accompanying illustration proves. This card, sent out by the Controller of the London Telephone Service,



A Card Issued by the London Telephone Service.

shows that not only is new business being sought, but an endeavour to extend existing services is being made. We may yet see a figure of two telephones per head of population!

The Telephone Development Association reports that during the run of the Ideal Home Exhibition no fewer than 115 agreements for telephone service—an average of five every day of the exhibition—were signed at the Association's stand. In addition, 239 names and addresses—172 in London and 67 in other parts of the country—were left by visitors who desired a visit from a Post Office representative in order to discuss the installation of service. These are being followed up by the Post Office, and in some cases agreements have already been secured. In the daily competition for a telephone free of rent for a year there were altogether 22,613 entries. Ten of these telephones fell to the London area, and the remainder to districts as widely separated as Aberdeen and Southampton. It is the intention of the Association to repeat the experiment at Manchester at a "Brighter Homes" Exhibition to be held from April 22nd to May 21st.

Unemployment.

After a long series of reductions, the number of unemployed rose by 3,170 during the week ended March 28th. The number at that date was 1,081,700, as compared with 1,078,530 on March 21st and 1,013,610 on March 29th, 1926.

Electric Power in Industry.

Further industries are dealt with in Preliminary Report No. 6 upon the Census of Production, published with the *Board of Trade Journal* for March 31st. The shipbuilding trades are first treated and it is shown that in 1907 these trades (in the United Kingdom) possessed 35,191 kW of generating plant, while in 1924 (in Great Britain) the aggregate capacity was 47,343 kW. Of the latter, marine engine works accounted for 35,756 kW, and shipbuilding yards for 11,587 kW. The aggregate capacity of electric motors installed was 498,415 h.p. in 1924; energy for 422,130 h.p. of these was purchased.

The generating plant installed in connection with the cement trade rose from 6,685 kW in 1907 to 43,700 kW in 1924. Motors aggregating 69,759 h.p. were installed, energy for 21,884 h.p. of which was purchased.

In 1907, 386 kW of generating plant was in use in the brush-making trade; in 1924 the figure was 1,478 kW, and the total h.p. of motors installed was 3,848 (2,138 h.p. purchased). The statistics for the coconut fibre, horsehair, and feather trades were as follows:—Generating plant, 1907, 27 kW; 1924, 645 kW; motor power installed 2,221 h.p. (1,548 h.p. purchased).

The supplement for April 7th deals first with the wire trades, and shows that the amount of installed generating plant rose from 2,336 kW in 1907 to 9,991 kW in 1924. In the latter year the capacity of installed motors was 71,612 h.p., power for 55,103 h.p. of which was purchased. The match trade power plant rose from 116 kW in 1907 to 2,348 kW in 1924. At the same time there was 3,152 h.p. of electric motors installed, power for 615 h.p. of which was purchased. The figures for the cardboard box trade were:—Generating plant: 1907, 478 kW; 1924, 903 kW. Motors installed, 5,710 h.p.; energy purchased for 4,737 h.p.

Syrian Tariff Modification.

It is reported that the duties upon electric pocket lamp batteries imported into Syria have been altered from 40 piastres per 100 to 25 per cent. *ad valorem* in the case of batteries from the United States or member countries of the League of Nations, and 50 per cent. *ad valorem* in the case of goods from other countries.

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The Brazilian Market for Radio Apparatus.

Radio communication is fairly well extended in Brazil, and there are a large number of amateurs. The number of persons who have received authority from the Brazilian Telegraph Department is about 32,000, but the number of those in possession of receiving apparatus without such authority is much above those with licences. Of the apparatus imported, 5 per cent. comes from France, 6 per cent. from Germany, 20 per cent. from Great Britain, and nearly 70 per cent. from the United States. There is preference for valve sets, and those mainly in use have from three to five valves. About as many complete sets are sold as there are sets assembled from separate parts. For the former high prices are realised. The Americans have an advantage inasmuch as the different makes are standardised to some extent, and consequently spare parts can be obtained easily and cheaply. The Telegraph Department owns six stations of the Telefunken type on the coast, the power varying from 2 to 5 kW, transmitting at 300, 600, and 900 metres. There are also two continuous wave stations. Recently the Government established an extra high power station for international communication, the transmitting section of which is situated at Sepetiba and the receiving station at Jacarépagua. The installation is partly of French and partly of German manufacture, with a few pieces of apparatus supplied by British or American firms. There are a number of journals issued dealing with wireless matters.

New Catalogues and Lists.

Marconiphone Co., Ltd., 210, Tottenham Court Road, London, W.1.—Fully illustrated and priced 72-page catalogue of broadcast radio receiving sets and component parts. The V.2 receiver has been omitted, as very few remain in stock; gramophone amplifier equipment with electrical "pick-up" has been included, whilst amongst new components are the KL.1 transformer and power choke, a potential divider for use with anode-battery eliminators, a novel valve switch, and a new rubber valve holder.

Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.—An illustrated pamphlet (No. 158), describing a new pattern "Memlock" change-over switch.

The Cork Manufacturing Co., Ltd., South Chingford, E.4.—A brochure advertising "Langite" jointing material for packing purposes, &c.

Empson Emulsifiers, 26, Bridge Road, Taylor's Lane, Willesden, N.W.10.—An illustrated pamphlet describing the making of cream by means of the Empson emulsifier.

The Relay Automatic Telephone Co., Ltd., Marconi House, Strand, W.C.2.—A booklet dealing in an interesting manner with the company's intercommunication system, and a pamphlet upon the same subject.

Messrs. C. W. Outram & Co., Woodville, near Burton-on-Trent.—An illustrated catalogue of porcelain insulators for electric lighting, heating, and power purposes.

Siemens & English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, E.C.4.—April price sheet, containing illustrated particulars of all kinds of electrical apparatus and appliances.

The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., U.S.A.—A series of illustrated pamphlets describing the company's static condensers, current transformers, electric furnaces, loom motors, and paper-mill drives.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—April calendar-blotter advertising "Jackson" wash boilers with a special spraying device.

The Drayton Regulator & Instrument Co., Ltd., West Drayton, Middlesex.—An illustrated publication dealing with the "Drayton" automatic de-superheater or attemperator.

The Wholesale Electric Lamp Co., Ltd., 150, Vauxhall Bridge Road, S.W.1.—A net trade price list of electrical materials, accessories, and appliances, including lighting fittings. Also an illustrated and priced leaflet advertising "Royalstone" dustproof lighting fittings.

The Dundee Electrical Repairs Co., Ltd., Erskine Street, Dundee.—A leaflet illustrating and describing an "indestructible" d.c. motor starting and control pillar.

The Brush Electrical Engineering Co., Ltd., Loughborough.—Publication No. 100/0-6a, an illustrated description of Brush-Ljungström turbo-generators of outputs from 5,000 kW normal to 7,000 kW continuous maximum rating.

Messrs. Wm. Geipel & Co., Vulcan Works, St. Thomas Street, S.E.1.—A pamphlet advertising "Ward-Leonard" dimmers for theatre lighting, as fitted in the Roxy Theatre, New York, which seats 6,200 people.

The L.P.S. Electrical Co., Ltd., Avenue Road, Acton, W.3.—A pamphlet advertising the company's test and battery clips, &c. Priced and illustrated.

The Tungstone Accumulator Co., Ltd., 3, St. Bride's House, Salisbury Square, E.C.4.—A folder advertising "Tungstone" accumulators, which are claimed to be free from permanent over-sulphation.

The Premier Electric Welding Co., Ltd., Abbey Wood, S.E.2.—An illustrated list dealing with the company's a.c. arc-welding plant. Also two booklets—one containing a reprint of a paper on "Thermal Disturbance in Iron and Steel during Welding," the other being a handbook for electric welders.

Messrs. Sydney Jones & Co. (London), Ltd., 28, Endell Street, W.C.2.—A price list of screws, nuts and washers of all kinds.

The Iron & Nickel Battery Co., Ltd., 17-19, Cockspur Street, Pall Mall, S.W.1.—An illustrated and priced pamphlet describing the "Ionic" electric hand lamp.

Trade Announcements.

Messrs. Philpot & Son, electrical engineers, of Canterbury, have removed from 3, St. George's Street, to 1, Iron Bar Lane, where the business will still be conducted by Mr. D. McKellar.

Messrs. Rossleigh, Ltd., of 31, Dumbarton Road, Stirling, announce that they are giving up the wireless branch of their business.

The new telephone numbers of Messrs. Mylan & Smith (Engineers), Ltd., of Sheffield, are 21371 and 21372. Sheffield changed over to the automatic telephone system on March 5th.

The Imperial Motor Works (Lyndhurst), Ltd., has changed its name to New Forest Services (Lyndhurst), Ltd.

The Kartret Switchgear Co., Ltd., is moving its sales organisation to its works at Wellesley Road, Sutton. After Easter all communications should be directed to that address.

W. R. Bottomley Private Telephone Co. has removed to Providence Electrical Works, Luck Lane, Marsh, Huddersfield. Telephone No. 3072.

Bankruptcy Proceedings.

A. J. Garrod, Whitehorse Place, Wellingborough, radio apparatus manufacturer.—The public examination of this debtor was held recently at the County Hall, Northampton. According to the statement of affairs there was a deficiency of £2,486. Debtor stated that in 1924 he commenced business as a valve repairer as the Unitron Valve Company, with £600. His business was fairly successful, and he experimented with a new valve. He required further capital, and a certain gentleman subscribed £250. An agreement was proposed under which he was to pay one-fourth of the profit. Later debtor received further sums amounting to £750 altogether, while two people each gave a £250 guarantee to the bank. Debtor said that another firm had come in with assistance in perfecting certain improvements which promised success, and it claimed as a debt the money which it had already lost, but debtor held that it was money spent on work from which they mutually hoped to benefit. The examination was adjourned.

A. H. Richardson, Wellingborough Road, Finedon, Northants, trading as "Radio Supplies," wireless manufacturer.—The public examination of this debtor was held recently at the County Hall, Northampton. The statement of affairs showed liabilities of £966, against assets of £98, leaving a deficiency of £868. Debtor stated that for some time he travelled for a radio firm at Leeds, and in February, 1925, opened a branch for the concern at Finedon, but later the firm went into liquidation. He then advertised at Kettering for capital, and was approached by another, who agreed to put £350 into the Finedon business, on condition of an equal division of profits with the debtor. A partnership was formed in May, 1925, and existed until April, 1926, when the partner, who had put further sums in, left, being paid £1,480. Debtor admitted that he had never done sufficient business to pay his way properly. The examination was adjourned.

T. F. Collier, 64, Union Street West, Oldham, electrician.—The first meeting of creditors was held recently at the Official Receiver's Offices, Manchester. The statement of affairs showed liabilities of £77, and there were no assets. Debtor attributed his failure to lack of capital. In 1919 he commenced business as an electrical engineer at Werneth, with £500 left by his father. The business declined, and in August, 1922, he sold it to a limited company for £430, in 430 £1 shares. In July, 1926, he recommenced as an electrical engineer, but owing to lack of capital was not successful, and in January last his trade effects were realised under an execution. The matter was left with the Official Receiver as trustee of the estate.

D. T. Donovan and H. A. Langlois, trading in co-partnership as the London Electrical Company, 119, St. Mary Street, Cardiff.—The adjourned public examination of these debtors was held recently at the Law Courts, Cardiff. Debtors agreed that they sustained a loss of £600 from May last year to December 13th, but did not admit that selling goods under cost contributed to their present position. Donovan agreed that £190 had been received in respect of apprentices, £170 of which was still owing, but they promised to try to repay this amount. The examination was closed.

E. Temple and Mrs. J. E. Burkett (Westoe Electrical Co.), wireless dealers and electrical contractors, 105, Canterbury Street, South Shields.—First meeting held April 12th at the Official Receiver's office, Government Buildings, 81, St. Mary's Place, Newcastle-on-Tyne. Public examination, May 5th at the Court House, Newcastle-on-Tyne.

F. J. Tizzard and N. Tizzard (Tizzard Bros.), electrical engineers and contractors, 27, Dalkeith Street, Barrow-in-Furness, and 121, Market Street, Dalton-in-Furness.—Trustee, Mr. W. G. Pearson, Official Receiver, 16, Cornwallis Street, Barrow-in-Furness, released March 30th.

J. R. Martin, electrical engineer, 11, Middlesbrough Road, South Bank, York.—First meeting, April 14th at the Official Receiver's offices, 80, High Street, Stockton-on-Tees. Public examination, April 29th at the Court House, Middlesbrough.

F. F. Gregory, electrical engineer, 2a, Westbourne Road, Luton.—Trustee, Mr. D. Helliar, Official Receiver, The Parade, Northampton, released March 30th.

Mrs. H. Spencer (Spencer & Son), wireless and cycle dealer, 30, Watergate, Grantham.—Receiving order made April 6th on debtor's own petition.

P. Cheshire (P. Cheshire & Co.), electrical engineer and contractor, Water Street Works, Middleton, Lancaster.—Receiving order made April 5th, on debtor's own petition.

W. J. Broome (Stockport Electrical Co.), electrical engineer, Garrick Place, Daw Bank, Stockport.—Receiving order made April 5th, on debtor's own petition.

Company Liquidations.

Carpax Co., Ltd., shippers of electrical and wireless goods, 312, Deansgate, Manchester.—A meeting of creditors was held last week, at Manchester, when Mr. J. Wilson, the liquidator in the voluntary liquidation of the company, reported that the liabilities were £727, all due to unsecured creditors. The assets were estimated to realise £473 net, leaving a deficiency of £254, so far as the creditors were concerned. It was stated that in addition to the liabilities mentioned there was a contingent liability in respect of an agency agreement, under which certain goods held by the company might have to be re-shipped. The company held a conference of its principal creditors on November 1st last, when figures were presented showing the position on the basis of a going concern, and they disclosed a surplus of about £280, the stock being valued at cost prices. That conference was called owing to the fact that the company was short of liquid capital, due to a slump in the wireless trade. Creditors for more than £10 each then decided to postpone payment of their accounts until March 31st this year in order that the company might have a chance to retrieve its position. A resolution was passed confirming the voluntary liquidation of the company with the present liquidator.

Service Radio, Ltd.—Winding up voluntarily. Liquidator, Mr. I. Levy, 27, Chancery Lane, W.C.2. Meeting of creditors, April 19th at the Institute of Chartered Accountants, Moorgate Place, E.C.

City Fuseboard Co., Ltd.—A meeting of members is called for May 9th at 147, Corporation Street, Birmingham, to hear an account of the winding up from the liquidator, Mr. J. W. Blackham.

Cleveland Electrical Engineering Co., Ltd.—A meeting of members is called for May 6th at 43, Albert Road, Middlesbrough, to hear an account of the winding up from the liquidator, Mr. M. McGilligan.

Radio Productions (Leeds), Ltd.—A meeting of members is called for May 5th at Standard Buildings, City Square, Leeds, to hear an account of the winding up from the liquidator, Mr. C. H. Baker.

Montreal Tramways & Power Co., Ltd.—A meeting of creditors will be held on April 25th, at Room 611, Power Building, Craig Street West, Montreal. Liquidator, Mr. F. H. Strouvelle, 24-28, Lombard Street, E.C.

Llandrindod Wells Electric Light & Power Co., Ltd.—A meeting of members is called for May 16th, at the Offices, Llandinam, Montgomery, to hear an account of the winding up from the liquidator, Mr. G. Edwards.

Automobile Electrical Repairers, Ltd.—A meeting of members is called for May 9th, at Sardinia House, Sardinia Street, W.C., to hear an account of the winding up from the liquidator, Mr. N. J. Dodd.

Private Arrangements.

F. J. Charlton, trading as the Essex Wholesale Electrical Co., 709, Romford Road, Manor Park, E.12.—A meeting of creditors was held on April 4th, at the offices of Mr. F. Sharles, 52, Queen Victoria Street, E.C., when a statement of affairs was presented which disclosed liabilities of £440 and net assets of £312, leaving a deficiency of £126. The debtor commenced business in March, 1925, with a capital of £518. The balance sheet for the year to December 31st, 1926, showed purchases of £1,804 and sales of £2,293. There was a net profit of £131 for the year. From January 1st to March 31st last the purchases were £246 and the sales £326, whilst the debtor's drawings were £88. No offer was made, and it was decided to confirm the deed of assignment already executed to Mr. Sharles as trustee, whilst a committee of inspection was also nominated. The following are creditors :—

	£		£
Electric Cables, Ltd. ...	21	Hackbridge Cable Co.,	58
London Conduit Fittings Co.	29	Stella Conduit Co., Ltd.	46
Scupham & Wood, Ltd.	44	Sandford & Co.	22
		De Maid, Ltd.	22

G. W. Cove, electrical engineer, 19, Bristol Road, Brighton.—A meeting of creditors was held recently, when a statement of affairs was presented by Mr. A. E. Orbell, 151-152, North Street, Brighton, which disclosed liabilities of £485, of which £385 was due to the trade and £100 to a cash creditor. The assets were estimated at £114, leaving a deficiency of £371. The cash creditor was the debtor's sister, in respect of money lent. The debtor had been in the employ of a well-known company, receiving a retaining fee and being paid for all jobs which he did. He was also allowed to carry on business on his own account. The arrangement did not prove successful so far as the debtor's own contracts were concerned. There was one contract for £170, which cost £300 in time and material to complete. Last October the debtor was taken ill, and was away for some months. In February a fresh arrangement was entered into with his employers, his retaining fee being increased, whilst he was also to continue to trade on his own account. The drawings had been at the rate of £6 a week. Lately creditors had been pressing, and a deed of assignment was executed to Mr. Orbell on March 30th. A resolution was passed confirming the deed already executed, and it was stated that the cash creditor would withdraw her claim. The following are creditors :—

	£		£
D'Accord	23	Siemens & English Elec-	
General Electric Co., Ltd.	55	tric Lamp Co., Ltd. ...	132

C. J. P. Davies, 9, Cheapside, Liverpool, electrical engineer.—A meeting of creditors was held on April 5th, at the offices of Messrs. R. Duncan French & Co., accountants, Liverpool, when a statement of affairs was presented which disclosed liabilities of £1,732; £1,248 of that was due to the trade and there was a loan creditor for £484. The net assets totalled £500, leaving a deficiency of £1,231. The debtor commenced business in November, 1923, with a capital of £150. Accounts prepared showed that for the period to the end of September, 1925, the sales were £3,700, and there was a loss of £15. In the following six months a loss of £275 was sustained. The accounts at that time showed a deficiency of £165. Since then the debtor's father had advanced certain sums of money. The present position was attributed to losses sustained on contracts, absence from the business through illness, and bad trade. An offer was made of 12s. 6d. in the £, which was subsequently increased to 15s. in the £, and was accepted, payable as to 10s. in three months and 5s. in six months. The following are creditors :—

	£		£
Dodd & Oulton	119	Downes & Davies ...	374
Hart, Collins & Co. ...	155	Lowe & Sons, G.	37
Wallin & Co.	48	General Electric Co., Ltd.	66
Liverpool Electric Cable Co.	20	Bankers	261
Stearn Electric Co., Ltd.	20	Davies, H. E.	483
Daniels & Son, T. ...	40		

A. J. Kirkby, Whitchurch, Ross-on-Wye, electrical engineer and radio factor.—Mr. P. S. Booth, 14-17, Holborn Viaduct, E.C., states that an investigation shows liabilities of £929 and assets of £228. The debtor commenced in the radio business 15 months ago with no capital of his own. His turnover for the first 12 months was about £1,000. A relative advanced sums from time to time, and her total claim amounts to £400. She has been asked to withdraw her claim, and in the meantime Mr. Booth is taking steps to realise the assets to the best advantage.

Welco Patents, Ltd.—Following informal meetings of the larger creditors, a scheme is proposed whereby creditors will be allotted 6 per cent. debentures in respect of the sums owing to them. In the meantime the receiver for the present debenture holders is carrying on the business with a view to the liquidation of those debentures.

Deed of Arrangement.

J. H. Gath, trading as the Gath Electrical Engineering Co., Halifax.—The trustees have issued a statement as at March 22nd. They say that a number of the assets remain unrealised; the delay in winding up the estate is due to the carrying on of the business as decided at a creditors' meeting in September last. It is hoped to complete the winding up within six months of ceasing to trade.

Anglo-Italian Conference.

The conference between representatives of the Federation of British Industries and of the Fascist Confederation of Italian Industries, held last week, discussed a number of questions of mutual interest and reached a certain measure of agreement. Among the matters dealt with were :—Uniformity of Customs practice; the adoption of specific standards for the valuation of imports and exports; the exchange of production statistics and information; international industrial agreements; fairs and exhibitions; the double taxation of the two countries' nationals; and international conferences.

The Luxemburg Concession.

The Council of State of Luxemburg has decided to give its approval to the project for the electrification of the province submitted by the Société des Centrales Electriques des Flandres. Two schemes are under consideration, the main one comprising the establishment of a distribution system, estimated to cost about £550,000, 25 per cent. of which would be borne by the Government.

Social Events.

The Amateur Dramatic Society of the Automatic Telephone Manufacturing Co., Ltd., assisted by the A.T.M. Orchestral Society, gave a successful joint performance at Liverpool on April 5th. Three short plays, comprising a comedy—"The Amateur Palmist"; a drama—"The Touch of the Child"; and a farce—"Uncle Sam," were presented by the Dramatic Society under the direction of Mr. J. Ready. During the intervals the Orchestral Society, under Mr. C. Brandreth, rendered selections.

On April 1st, the Victor Works of the Automatic Telephone Manufacturing Co., Ltd., held its final Social Club ball of the season at Colomba Hall, Liverpool. The function was well attended and resulted in a highly enjoyable evening. Messrs. Whitby and Anderson acted as M.C.'s.

Copper, Lead and Rubber Prices.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report April 12th:—No change in copper prices. English pig lead, £28, 5s. decrease.

Messrs. Edward Till & Co. report April 12th:—No change in the price of india-rubber, Para fine.

For Sale.

Ashford Urban District Council Electricity Department has a Lister electric lighting plant for disposal. Warrington Corporation Electricity Department has for disposal a number of second-hand d.c. motors. (See our advertisement pages to-day.)

Book Notices.

"Deafness Explained" is the title of a small book by Mr. C. M. R. Balbi, A.C.G.I., A.M.I.E.E. (John Bale, Son and Danielsson, Ltd., price 1s. net), in which the author deals with the subject as an electrical engineer in the interests of those afflicted with deafness. In a foreword Lord Charnwood sympathetically commends the work. The author, who is honorary consulting electrical adviser to the National Institute for the Deaf, deals with the principles of sound and hearing, and after outlining the causes of deafness, treats of the remedies that are available—most of them physical not medical, and many of them, of course, dependent upon electrical appliances, some of which he has described in our pages. A useful bibliography is appended to the brochure, which itself forms a very welcome addition to the rather meagre literature on this important but neglected subject.

"Year Book and Directory of the *South African Mining and Engineering Journal*, 1927." (460 pp.) London: Argus South African Newspapers, Ltd. Price, 12s. 6d., post free.—This book deals with the whole of the Union of South Africa, Rhodesia, and the Congo. It is, of course, mainly devoted to mining and industry, and there are several sections of interest to our readers. Probably the most useful is the directory and buyer's guide section, giving the names and particulars of the principal firms in the engineering, electrical, machinery and other trades. The electrical section deals with the activities of the Victoria Falls and Transvaal Power Co., Ltd., and other supply undertakings, and includes a full list of public undertakings with details of prime movers, voltages and frequencies, &c.

"The Colliery Year Book and Coal Trades Directory, 1927." Pp. 104+1032. London: The Louis Cassier Co., Ltd. Price 1 guinea net.—One effect of the prolonged coal dispute of last year is indicated in this 5th edition of the Colliery Year Book by the reduction in the list of colliery owners. Several additions have been made to the Statistical Section, including some data of the coal-mining industry in foreign countries. Several new articles are contained in this edition, including "The Future of the Coal-mining Industry," by Austin Hopkinson, M.P. "Some Notes on Machine Mining," by Lionel C. Maitland, contains much interesting information concerning the use of electricity in mines. A list of the electricity supply undertakings in the country is given. As usual the constitution of the various representative bodies in the industry is given, including the Mines Department and the employers' and employés' associations.

"Post Office Electrical Engineers' *Journal*," Vol. XX. Part I. April, 1927. London: Electrical Review, Ltd. Price 1s. 6d. net.

"Kempe's Engineer's Year Book for 1927." Pp. xliii+3101. London: Crosby Lockwood & Son. Price 30s. net.

"Selected Papers from the *Journal* of the Institute of Electrical Engineers of Japan." No. 11, "Temperature rise of Electrical Machinery and Comparison between Single and Double Ratings." No. 12, "Measurement of Acoustic Constants of Cloth." The Institute, 21, Mitsubishi Building, Marunouchi, Tokyo.

The Spring List of Sir Isaac Pitman & Sons, Ltd., contains particulars of a number of works upon business subjects, including accountancy, salesmanship, &c., as well as several technical and scientific books.

Scientific Papers of the U.S.A. Bureau of Standards. Vol. 21, No. 543, "Linkage-current Diagram for Representing Magneto Operation" (20 cents). Vol. 21, No. 554. "Effect of Eddy Currents in a Core consisting of Circular Wires." (10 cents.)

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVI, No. 3. March, 1927. New York: The Institute. Price $1.

The German Electrical Industry.

According to the reports issued by the Prussian Chambers of Commerce, a revival of business took place to a moderate extent in almost all branches of the electrical industry in March. The increase in the consumption during the winter months has induced the supply works to begin placing orders for the next season on a larger scale, while various tramways have undertaken extensions and replacements. Further orders were given out by the Reich railways in connection with the electrification of the Berlin City and Circle railways. Orders were placed by the industrial districts, and a confident tone prevails which is manifested not so much in an increase in the orders as in the preparation of large schemes. The increase in building operations is also acting as a stimulus. Business in telegraph apparatus, fire alarms and clocks, and automatic exchanges, again improved, but the turnover in telephone apparatus was unsatisfactory. A slight improvement took place in the sale of electromedical products, and the sale of glow lamps also made progress.

Recent Contract.

The Wallasey Electricity Department has recently placed with Messrs. Simon-Carves, Ltd., an order for two of their water-tube boilers, each designed for a maximum evaporation of 70,000 lb. per hour at 300 lb. per sq. in. pressure, together with economisers, superheaters, chimneys, grit catchers, induced draught plant, coal bunkers, automatic coal weighers, unit type pulverisers, boiler feed pump, and all necessary valves and instruments.

Lighting and Power Notes.

Accrington.—Revised Electricity Charges.—The Town Council has revised the electricity charges from April 1st as follows:—Lighting, 5d. per kWh; heating and domestic purposes other than lighting, 0.7d. per kWh. On the ratable basis there will be a fixed charge of 15 per cent. per annum on the ratable value up to £100, plus 10 per cent. over £100, with a charge of 0.6d. per kWh. For power, rates vary from 2¾d. for the first 100 kWh per quarter to 0.75d. to the largest power users. For shop window lighting after shop hours one-half the flat rate is charged.

Bath.—Electricity in Small Houses.—Regarding the supply of electricity to the new houses at Newbridge and Larkhall, the electrical engineer has submitted a proposal to the Electric Lighting Committee for a special tariff to be applied to consumers of electricity in the Corporation houses, where the houses have been wired by the Housing Committee, as follows:—A standing charge of 48s. per year, plus 1d. per kWh for all electricity consumed for any purpose. The accounts would be collected with the rent at the rate of one shilling per week, and a debit or credit, as the case may be, given at the end of each quarter. The committee has approved the report and instructed the engineer to put the scale into operation.

Birkenhead.—Loan.—The Electricity Committee has recommended the Town Council to apply for sanction to a loan of £41,597 in connection with the electricity supply to Wirral.

Brentwood.—Institution Lighting.—In accordance with the requirements of the Board of Control, the Essex County Council proposes to convert the lighting of Brentwood Mental Hospital from gas to electric lighting. The cost of the installation of the necessary plant and wiring will be £22,750.

Bromley (Kent).—Electricity in Bulk.—The Town Council has applied for an Order authorising it to supply electricity in bulk to the Chislehurst Electric Supply Co., Ltd.

Canada.—Electrical Development.—The Ontario Hydro-Electric Power Commission will this year make considerable extensions to its system, the estimates of the Provincial Government including an appropriation of $14,970,000 for this purpose. The increase of transformer capacity in several of the leading cities and towns of Western Ontario will cost $5,500,000. The sum of $7,225,000 will be required for the construction of transmission and distribution lines, of which $5,000,000 will be devoted to the erection of a 220,000-V line to Eastern Ontario, including the cost of transformer stations. The development of the Thunder Bay system will cost $4,045,000, of which $3,875,000 will be spent on the Alexander Landing scheme now under construction. Bonuses for the construction of rural transmission lines, half the cost of which is borne by the Government, will be substantially increased, the estimate for this purpose ($750,000) being $250,000 in excess of the vote last year.

The Commission's operations during 1926 yielded a surplus of $565,000 on investments aggregating $203,000,000. During the year additional plant with a capacity of 100,000 h.p. was installed, and the Commission contracted for the future delivery of 340,000 h.p. from the Ottawa River.

In order to supply the growing requirements of the Rouyn Copper goldfield of Quebec, where active work is being carried on by many mining companies, the Canada Northern Power

Company is installing two additional units at its Quinze Falls plant, at a cost of $1,250,000.—*Reuter's Trade Service* (Ottawa).

Cheltenham.—Revised Electricity Charges.—The Corporation Electricity Committee has revised the electricity charges as follows:—Lighting (maximum demand): For the first 125 hours' use per quarter of the maximum demand, 6d. per kWh; for all additional energy, 2d. per kWh; flat rate, ordinary consumers (other than special supplies), 5d. per kWh; larger consumers (subject to guarantee and discounts as before), 4d. per kWh; churches and chapels, 4d. per kWh; kinematograph halls, combined rate, 2¾d. per kWh. Power (other than special contracts), 1½d. per kWh. Meter rents, 9d. per quarter for each meter not exceeding 1,000-W capacity, and 1s. per quarter for each meter above 1,000-W capacity. Slot meters, 7d. per kWh.

Crewkerne.—Electricity Supply.—It was reported at a recent meeting of the Urban District Council, that the promoters of the electricity undertaking had now complied with all the Council's requirements. A letter was read from Mr. J. A. Purves, joint promoter of the undertaking, pointing out that they were prepared to agree to the Council having the option to purchase at 22, 32, or 42 years. A draft of the proposed scheme was now being prepared, but no action had been taken regarding the inclusion of any area outside the urban district. The promoters thought, however, that it would be desirable to include certain of the adjacent parishes, which could get their electricity supply from Crewkerne, as a centre, more easily than from any other place.

Douglas (I. of M.).—Electricity Supply.—In the Tynwald Court recently the Corporation applied for sanction to the borrowing of £83,000 for plant extensions, buildings, mains and services, &c., in connection with the supply of electricity within the borough. According to the *Isle of Man Times*, Col. T. C. Ekin, Inspector to the Electricity Commission, questioned the present site's suitability for steam engines on the grounds (1) that there was not room for coal storage; (2) that there was not sufficient water available; and (3) that the dust would be a nuisance. The Corporation suggested that another expert should be called in. A resolution was ultimately carried "that the Tynwald approve of the Corporation raising a sum of £42,650, and that the question of the erection of further plant be deferred until further information be obtained from an expert nominated by the Governor at the cost of the Insular Government."

Leave was given the Corporation to supply electricity to an area two miles outside the town boundaries, including Onchan, Braddan, and Marown.

East Ham.—Street Lighting.—The Corporation Works Committee has recommended that the existing 300-W lamps on main roads be changed for 150-W lamps and that additional 150-W lamps be installed on all remaining standards which are now without lamps.

Guildford.—System of Supply.—In connection with the erection of the new generating station now in progress, the consulting engineer to the Guildford Corporation reports that it is necessary that the pressure of supply under that system should be formally fixed. He therefore recommends that the a.c., 3-phase, 50-cycle system be declared at 230 V between phase and neutral, and 400 V between phases. When the new system is put into operation the supply to the parish of Shalford, which is now a.c., single-phase, 50 cycles at 220 V, will have to be changed over. In order that the Corporation should be in a position, as circumstances permit, to develop the 3-phase a.c. system in any other part of the area of supply, it is desirable that powers should be obtained to change any parts of the existing 220/400-V, d.c. supply to the new system. The Electricity Committee has decided that application shall be made to the Electricity Commissioners accordingly.

Loan Sanctioned.—The Corporation Electricity Committee has received sanction to a loan of £14,700 for the installation of converting plant at Onslow Street central sub-station.

Mains Extensions.—The Committee is to extend the mains to Burnham housing estate, at an estimated cost of £1,126.

Iceland.—Water Power.—The extensive water-power resources of Iceland have recently attracted the attention of foreign capitalists, and preliminary work has been done with a view to the industrial exploitation of some of the most important waterfalls on the island. Norwegian, Danish, German, and English interests have been very active in Iceland since the war, and several concessions have been granted, including a notable one to the Dansk-Islandsk Anlaegsselskab for the exploitation of waterfalls in the Vestfjord. Another concern has for some time been investigating the possibility of the exploitation of certain other falls for the production of saltpetre, and is at present negotiating with the Iceland Government for a concession to exploit one of the largest waterfalls on the island.

Knaresborough.—Transfer of Undertaking.—The Urban District Council has decided to transfer its electricity undertaking to Harrogate Corporation, which has agreed to pay all outstanding capital liability, and revenue liability, and to place Knaresborough consumers on the same basis as the Harrogate consumers. The purchase figure is approximately £13,000. In addition Harrogate will take over the entire electricity staff.

Leeds.—Cable Subways.—The Corporation has arranged for the various committees to consider the question of the construction of subways for mains, cables, &c., with a view to the avoiding the constant breaking up of highways.

Loan.—The Electricity Committee is applying for sanction to a loan of £10,000 for assisted wiring installations.

Liverpool.—Loan Sanctioned.—The Corporation has received sanction to the borrowing of £145,000 for the erection of buildings and civil engineering works at the Lister Drive power station.

New Scale of Charges.—The Corporation has approved the following new tariff for the districts of Waterloo, Seaforth, and Great Crosby:—Flat rate for power (including heating and cooking) up to 3,000 kWh per annum, 2d. per kWh; 3,000 to 10,000 kWh, 1½d.; and over 10,000 kWh, 1d. Maximum demand system: For power a fixed quarterly charge of £1 10s. per kW of the maximum demand and 0.4d. per kWh, plus the present increase of 25 per cent.

London.—Battersea.—The London Power Co. has applied for sanction to erect a power station on a site about 15 acres in extent on the south bank of the River Thames, and is to purchase 3½ acres from the Metropolitan Water Board at a cost of £175,000.

Bermondsey.—The Electricity Committee has received sanction to the borrowing of £22,000 for mains and services, £5,000 for meters, and £10,000 for wiring installations.

St. Marylebone.—The Borough Council has received a communication from the Electricity Commissioners regarding its scheme for plant extensions and further bulk supply, in which they state that they propose to defer further action for six months.

Fulham.—The Electricity and Lighting Committee has recommended to the Borough Council that a new sub-station be erected in Barclay Road in substitution for the Granville Road sub-station and fitted with the necessary transformers, switchgear, &c., at an estimated cost of £8,100.

Maidstone.—New Plant.—The Town Council has applied for sanction to a loan of £60,247 for extensions to the steam raising and generating plant at the electricity works.

Assisted Wiring Scheme.—It has been decided to put into operation a scheme for the assisted wiring of premises, and to apply for sanction to a loan of £3,000 for this purpose.

Maldon.—Electricity Supply.—The Rural District Council has consented to an application by the Colchester Town Council to extend its area of electricity supply so as to include Tollesbury, Tolleshunt Knights, Tolleshunt D'Arcy, and Tolleshunt Major.

Manchester.—Progress during February.—During the month of February the Corporation electricity undertaking showed an increase in connections of 2,534 kW, bringing the total to 304,468 kW; and the number of applications received for supply, including consumers for additional supplies, was 927, representing a total of 2,178 kW. The number of hired cookers connected increased by 129, bringing the total actually on circuit to 2,917. Applications for the hire of cookers totalled 101. A new 150-kVA transformer was put into commission at Nuthurst sub-station.

New Zealand.—Auckland.—According to the *Electrical Engineer of Australia and New Zealand*, when the Arapuni hydro-electric station comes into operation next year, the greater portion of the Auckland Power Board's supply will be purchased from this source, and preparations are now being made for taking the larger supply. At present energy is transmitted from Waikato at 50,000 V to a Government sub-station at Penrose, where it is stepped down to 6,600 V for supply to Auckland. The new supply will be conveyed to Penrose at 110,000 V over three circuits, one of which is now operating at 50,000 V, while the other two are under construction. At Penrose the supply will be stepped down to 22,000 V for the Auckland Power Board, while there will also be a transformation to 50,000 V for transmission to the Waitemata Power Board. The Penrose sub-station at present accommodates a bank of transformers of 15,000-kVA capacity, 50,000/6,600 V. The building is being extended and two additional 15,000-kVA banks of transformers are to be installed. The transformers will step down from 110,000 to 22,000 V. In addition there will be another bank stepping up from 22,000 to 50,000 V for the Waitemata supply. A 10,000-kVA synchronous condenser will be installed to regulate the voltage. The Auckland Board purchases its bulk supply at the sub-station and is making preparations to convey it to the city by 22,000-V underground cables, an order for which has been placed. In addition to the power cables there will be a 12-core pilot cable for protective purposes. The work of opening up a trench to lay these cables has already been commenced.

Plymouth.—Loan.—The Town Council, on April 4th, approved a recommendation of the Electricity Committee that application be made for sanction to borrow £20,996 for electricity extensions. It was reported that an additional 3-phase h.p. feeder cable should be provided from the electricity works at Prince Rock to St. Budeaux, in order to meet the increasing demand in the Swilly and St. Budeaux districts, and to complete a ring main for the greater security of the supply throughout the district, in which there are now over 1,870 consumers.

Preston.—Main Extension.—At a cost of £2,235, the Corporation Electricity Committee proposes to extend the main in Tag Lane, Cottam.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Maidstone.—Lighting of business premises: From 7½d. to 7d. per kWh. First charge under the "telephone" system from 8s. to 7d. 4d. per 30-watt lamp.

Leyton.—The temporary increase of 10 per cent. has been removed.

Blackpool.—The increase of 10 per cent., imposed during the coal dispute, has been withdrawn.

South-East Lancashire Electricity Advisory Board.—New Transmission Line.—The Engineering Advisory Committee has recommended the Board to sanction the laying of a third 33,000-V main transmission line between Barton and Hill Top by the Lancashire Electric Power Co.

Special Order.—The Board has considered the application of the Altrincham Electric Supply, Ltd., for a Special Order to extend its area of electricity supply so as to include parts of the urban district of Altrincham and the rural district of Bucklow, and has resolved to defer expressing an opinion until the Central Electricity Board's scheme is made clear.

Power Station Extension.—The Committee has received an application from Altrincham Electric Supply, Ltd., for approval to the extension of its power station by one 6,000-kW turbo-alternator, and one additional 40,000 lb. water-tube boiler, with accessories, at an estimated cost of £44,615. The company reports that the Manchester Corporation's estimate for a duplicate main from Barton to Altrincham for a bulk supply is £100,000, to which would have to be added £33,284 for a sub-station with transformers and switchgear. Consideration of the matter has been deferred.

Bury Power Station.—The Bury Corporation has applied for sanction to install a 50,000-lb. boiler, together with economiser, stoker and chimney, at a cost of £14,800, to meet the requirements of 1927-28, and the replacement of certain existing plant by two 60,000-lb. boilers and one 10,000-kW turbo-alternator at an estimated cost of £99,000, to meet future requirements. The committee has recommended the Board to approve the boiler extensions required for the winter of 1927-28, and to adjourn consideration of the further extensions.

Fringe Orders.—The commitee has also recommended the Board to approve the application of the Cheadle and Gatley Urban District Council for a Fringe Order to supply electricity to certain premises outside its area.

The minutes of the proceedings of the Engineering Advisory Committee have been approved by the Board.

Southport.—Electricity Supply.—Extensions to the Corporation generating station having become necessary, information has been furnished the Electricity Commissioners as to the cost of a bulk supply from Preston or Liverpool, and the cost of local generation. It is hoped to obtain powers for extensions to the power station.

Assisted Wiring Scheme.—The assisted wiring scheme referred to in our issue of March 1st, p. 435, has now been approved by the Town Council.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by Mr. W. T. Warren for the supply of electricity in the urban district of Brightlingsea and the parish of Thorrington, and the Urban District Council of New Mills to supply electricity in its area.

Torpoint (Cornwall).—Power Station Fire.—A fire broke out at the local electricity works on April 7th. It started in a building containing the engine, and some oil tanks became ignited.

York.—Electricity Charges.—The Corporation Electricity Committee has fixed the following scale of electricity charges:—Lighting: Flat rate, private lighting, 4½d. per kWh. public houses, &c., 3½d. per kWh; maximum demand, 7d. and 1½d. per kWh; rateable value, 15 per cent., plus ½d. per kWh. Power: Varying from 1½d. per kWh for 1,000 kWh per quarter to ½d. per kWh for over 10,000 kWh per quarter.

Electricity Supply.—The Electricity Committee is to extend feeders at a cost of £9,000 and to renew mains at a cost of £2,750.

Tramway and Railway Notes.

Blackburn.—Fares.—At a meeting of the Town Council, on April 7th, a recommendation to reduce all fares within the borough to 1½d. was discussed. Ald. Higham criticised a motion for penny fares, and said it would mean a loss of £10,000 per year. The proposal to introduce penny fares was defeated by a large majority, and the recommendation for 1½d. fares was adopted.

Bradford.—Railless Cars.—The Estimates Sub-Committee has approved expenditure proposed by the Tramways Committee for the purchase of 10 new railless cars and additional overhead equipment, for the extension of the Oakenshaw-Ordsal railless-car service to the centre of the city.

Continental.—Hungary.—The Vienna correspondent of the *Daily Mail* reports that the English Talbot financial group's contract with the Hungarian Government for electrifying the railway trunk line from Budapest to Hegyeshalom, on the Austrian frontier, includes 55 electric locomotives and a power plant with a capacity of 75,000 kW. The Government reserves the option to cancel the contract before June 30th if unforeseen difficulties arise. This railway electrification will make Hungary almost independent of foreign supplies of coal. The contract has been awaiting the Commerce Minister's signature for several months, and this has now been obtained.

Holland.—Good progress is being made with the electrification of the Dutch railways. Electric trains are about to commence running between Haarlem and Rotterdam and between Haarlem and Ymuiden, and it is expected that the electrification of the Amsterdam-Rotterdam line will be completed by October next.

Switzerland.—The first of a new and improved type of electric locomotive has just been completed at the Brown, Boveri works at Munchenstein for hauling heavy express trains between Berne and Zurich. The engine, which runs on seven pairs of wheels and weighs 115 tons, is stated to have attained a speed of 62½ m.p.h.

Austria.—The work of electrifying the first stretch of the second section of the State Railways has recently been completed, and electric trains are now running between Woral and Innsbruck, a distance of 45 miles.

Egypt.—Railway Electrification.—It is announced that the necessary funds for the electrification of the Cairo-Helouan railway are to be provided in the Egyptian Government's Budget for 1927-28.

Hull.—Track Renewal.—The Corporation Tramways Committee is to reconstruct the track at Newland Avenue, at an estimated cost, including rails and accessories, of £11,300.

Japan.—Railless Cars.—Mr. G. Yamane, of the Yamaguch Prefectural Assembly, proposes to introduce a railless-car service between Ogi station and Koshigahama, a distance of five miles.

It is proposed to form the Inari Muki Densha K.K. for the purpose of running a railless-car service between Mito and Kasama Shrine, a distance of 13 miles.

Another railless-car scheme is proposed in Totte-machi, in the Ibaraki Prefecture, which will be 30 miles in length. The Kokuso Mukijo Densha K.K. is being formed at Soma-machi for this purpose.

Electric Railways.—New electric railways are to be constructed, and existing lines extended this year in the six Prefectures of Central Japan, which will increase the total mileage of electric railways by 241.

London.—Fares.—The Highways Committee of the L.C.C. has recommended that the 1s. daily tickets, at present in operation on the Council's tramway, be extended to local routes in East Ham, West Ham, and Walthamstow, on the same conditions as obtain on the Council's tramways, and that, as an experiment during the months of June to September, inclusive, 6d. daily tickets for children under 14 years of age, with the same availability as the 1s. tickets, be issued.

Telegraph and Telephone Notes.

France.—Speculation by Wireless.—According to the *Daily Telegraph*, for some time the official wireless research authorities in France have been puzzled about certain messages sent in code, but eventually direction-finding tests enabled them to locate an unregistered transmission station in a private house in the Rue de l'Assomption, Paris.

It is alleged that a group of financiers, having provided funds for the installation of this transmitting set, used it to send messages in code to stations in Amsterdam, Berlin, and certain places in Russia, where their agents, acting on their instructions, engaged in exchange operations. Summonses have been issued against five bankers and two wireless operators, who are to explain to an examining magistrate their reasons for the alleged infringement of the laws which subject wireless transmission to State control. The only charge against them at present is that they have robbed the State of revenue by sending eighty messages a day for several months without payment of any tax or licence fee.

Gibraltar.—Telephone Communication.—Telephone communication with Spain was established for the first time on April 4th in the presence of the Governor of Gibraltar, officials, the Spanish Consul-General, and representatives of the Spanish Telephone Company.—*Reuter* (Gibraltar).

Guernsey.—TELEPHONE STATISTICS.—The balance sheet and statistics for the year ended December 31st, 1926, relative to the State Telephone Department (engineer and manager, Mr. E. H. Bennett) show the gross revenue to have increased by £1,380 to £18,110, and the net profit (£762) to have been £487 greater than in the previous year. The total number of lines increased by 225 to 3,955, including 90 junction lines; the mileage of circuit wire overhead was 2,434, and underground 4,486, being increases of 49 and 558 miles respectively; the single wire mileages are double these figures. The number of switchrooms remained at five. The total number of calls increased by 75,909 to 2,393,121; trunk calls to and from Sark numbered 14,227. Telegrams and letters telephoned to the Post Office reached 22,954, an increase of 1,456. The staff, including 46 operators, increased by 2 to 85.

Submarine Telegraphy.—PROGRESS IN 1926.—The Bureau International de Telegraphie reports that during 1926 new submarine telegraph cables were laid between Bay Roberts (Newfoundland) and Plymouth (England); between Borkum (Germany) and the Azores; in the Pacific Ocean between Bamfield (British Columbia) and the Fiji Islands, and between the Cocos Isles and Australia.

Transatlantic Telephony.—NEW RECEIVING STATION.—The tuning-in of the first of the three three-mile long aerials of the new transatlantic telephone receiving station at Kemback, near Cupar, Fife, is now complete. Daily messages from the United States are received by the staff, which includes several American experts; reception is satisfactory, and the tuning of the other aerials will soon be complete; the three aerials radiate towards Denham, St. Andrews, and Pitscottie.

Radio Notes.

Lithuania.—STRICTER REGISTRATION.—The first sitting of the Exploitation Commission of the Kaunas wireless station was held recently to examine the activities of the station. Owing to lack of resources it has not hitherto been possible to develop; the number of registered subscribers in Lithuania at present is 1,500, of whom 1,000 are in Kaunas. Notwithstanding the regulations regarding the registration of apparatus, there are still many unregistered sets, it being estimated that the total number is 10,000. On the basis of the recent Cabinet decision, 75 per cent. of the receipts is assigned to programmes; the Commission therefore intends to introduce measures for the registration of all radio apparatus. Strict control will be enforced, and those who fail to register in time will be fined. Moreover, in shops dealing in wireless accessories, all apparatus and parts sold will be registered. It is proposed periodically to relay from the Kaunas station the more interesting programmes of the principal European stations.—*Reuter's Trade Service.*

New Continental Stations.—HUNGARY.—It is understood that the Radiotelefono Hirmond Co., of Budapest, is to build a 60-kW station similar to that at Langenberg; the scheme has the approval of the Hungarian Post Office authorities.

JUGO-SLAVIA.—A company has definitely obtained a licence for the erection of a transmitter of 6 kW. The company began its activities with a capital of 2,500,000 dinars, says *World Radio*. The station will be installed on the top of the Académie des Sciences at Belgrade.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Ausralia.—MELBOURNE.—May 10th. Postmaster-General's Department. Telephone relays. (B.X. 3333.)*
May 17th. Resistances and reactances. (B.X. 3307.)*
May 23rd. State Electricity Commission. Switchgear and accessories. (B.X. 3285.)*
May 9th. 6,600-V transformers and spares. (B.X. 3331.)*
July 5th. One 15,000-kW steam turbo-generator and accessories. (B.X. 3369.)*
SYDNEY. — May 9th. Electricity Department. Station auxiliary switchgear. (B.X. 3338.)*
April 26th. A.C. electricity meters. (B.X. 3407.)*

Barking.—May 9th. County of London Electric Supply Co., Ltd. Cables and accessories for the Barking power station. (April 1st.)

Bolsover.—April 19th. Urban District Council. Cables, boxes, pillars, &c. (April 1st.)

Clayton.—April 18th. Urban District Council. E.h.p. feeder cables, l.p. distributing mains, fuse pillars and transformer kiosk. (April 1st.)

Colombia. — BOGOTA. — April 30th. Ministry of Public Works. Two electric lifts. A.X. 4433.)*

Dartford.—April 22nd. Electricity Department. 2,098 yd. l.p. cable. (See this issue.)

Dublin.—April 30th. Electricity Department. E.h.p. and l.p. cables, cast-iron and stoneware troughing, section pillars, compound and other materials and accessories. (See this issue.)

Dundee.—April 18th. Tramways Department. Stores for a year, including armature and field coils, insulating tapes, lamps, &c. Specifications, &c., from Mr. Duncan P. Morrison, general manager.

Edinburgh.—April 18th. Electricity Supply Department. De-aerating plant and boiler feed pumps. (March 25th.)

Glasgow.—April 19th. Lighting Department. Materials, including electrical fittings, &c., for one year. Particulars from the office of Lighting Department.
April 23rd. Parish Council and District Board of Control. Stores, including electrical fittings and lamps, for six months. Forms, &c., from Mr. A. Reynard, inspector and clerk, 266, George Street, Glasgow.

Grimsby.—May 2nd. Electricity Department. E.h.p. and pilot cables; l.p. feeder cables. (See this issue.)

Ilford.—April 26th. Electricity Department. One 1,500-kW motor-convertor or rotary-convertor and transformer, 6,600-V switchgear cubicles and alterations to existing switchgear. (April 8th.)

India.—India Store Department. April 26th. 66-kVA motor-driven alternator sets, transformers, switchgear, &c. (April 1st.) Telephone cable. (April 8th.) 53,825 inert electric cells. (See this issue.)

London.—LONDON COUNTY COUNCIL.—April 22nd. Electrical installation at the Stonhouse Street elementary school, Clapham (approx. 167 points. (April 8th.)
April 26th. Wiring and fitting for electric lighting in two blocks of tenements at the Ring Cross housing estate, Islington (approx. 274 wiring points). (April 8th.)
G.W.R. April 21st. Stores, including electrical wires and cables and telegraph ironwork. (April 1st.)
ST. MARYLEBONE.—May 18th. Electricity Department. L.p. and e.h.p. cables for 12 months. (See this issue.)
METROPOLITAN ASYLUMS BOARD.—April 25th. Installation of electric lighting, telephone, fire alarm and domestic bells in the engineer's house at the Western Fever Hospital, Seagrave Road, S.W.

New Zealand.—WELLINGTON.—May 31st. Public Works Department. 50-kVA transformers for the Waikaremoana electric power scheme. (B.X. 3294.)* 50-kVA transformer for Arapuni scheme. (B.X. 3293.)*
June 21st. Sub-station switchgear and metering equipment for Arapuni. (B.X. 3398.)*
June 7th. Railway sub-station equipment, Lake Coleridge electric power scheme. (B.X. 3295.)*
May 4th. General Post Office, Stores Division. Sub-station protectors. (B.X. 3286.)*
June 13th. New Zealand Railways. Machine tools, workshop equipment and overhead electric travelling cranes. (A.X. 4344.)*
June 6th. Six electric locomotives. (A.X. 4355.)* Overhead equipment for the Christchurch-Lyttelton electrification scheme. (B.X. 3301.)*
INVERCARGILL.—May 31st. Southland Electric Power Board. Transformers. (B.X. 3379.)*
June 15th. 66,000-V, oil circuit-breakers. (B.X. 3378.)*

Oldham.—April 30th. Electricity Department. Coal-handling and conveyor plant. (See this issue.)

Plymouth.—April 25th. Electricity Department. Electricity meters, cables, and transformers. (April 1st.)

South Africa.—JOHANNESBURG.—May 7th. Municipal Council. Electric street lamp fittings and globes. (B.X. 3395.)* Cables. (B.X. 3406.)*
CAPE TOWN.—June 1st. The University. Electric cooking utensils for the new residences at Groote Schuur. (B.X. 3393.)*

Southend-on-Sea.—April 19th. Light Railways and Electricity Department. 4,000 joint boxes. (March 25th.) 1,400 current limiters. (April 1st.)

Spain. — MADRID. — Ministerio de Fomento. Six electric cranes for the port of Alicante.

Stafford.—April 30th. Staffordshire Education Committee. Electric wiring and fittings for the new infants' department of the Slater Street Council school and in the additional class rooms, laboratory, &c., in the Salisbury Street central school. (April 8th.)

Uruguay.—Montevideo.—June 15th. State Electricity Supply Works. 15 transformer sub-station equipments (6,600/220 V., 50 cycles). (B.X. 3371.)*

Wrexham.—April 19th. Electricity Department. One 250-kW rotary-convertor equipment and d.c. switchgear. (April 1st.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Electricity Committee. Accepted:—
Switchgear for two sub-stations and 12 kiosks (£5,136).—English Electric Co., Ltd.
One 100-kVA transformer (£117), two 200-kVA ditto (£384).—General Electric Co., Ltd. Three 500-kVA ditto (£1,149).—Hackbridge Electric Construction Co., Ltd.

Bradford.—Tramways Committee. Accepted:—
Ten 36-seater railless electric trolley cars (£14,012).—English Electric Co., Ltd.
24 pairs of manganese steel points (£2,340).—Hadfields, Ltd.
30 tons cast-iron brake blocks (£292).—Yorkshire Repetition Castings Co., Ltd.

Brecon.—Town Council. Accepted:—
Plant, &c., in connection with the electricity scheme: Plant (£4,667).—Petters, Ltd. Battery and accumulators (£1,665).—Chloride Electrical Storage Co., Ltd.

Canterbury.—Town Council. Accepted:—
Automatic switchgear at £2,845.—A. Reyrolle & Co., Ltd.

Cheltenham.—Electricity Committee. Accepted:—
Cables for Cleeve Hill extension (£2,087).—British Insulated Cables, Ltd.

Dover.—
Installation of electric lighting, heating and power in the garages, workshops, &c., of P. J. Niblett & Son.—J. L. Etheridge & Co.

Hatton, near Warwick.—Warwickshire County Mental Hospital. Consulting engineer: Mr. A. B. Mallinson.
Boilers, mechanical stokers, feed pumps, &c. (£4,200).—H. & T. Danks (Netherton), Ltd.
Two 75-kW Belliss-G.E.C. engines and dynamos and one 35-kW ditto (£1,813).—G. N. Haden & Sons, Ltd.
Main switchboard (£445).—Erskine, Heap & Co., Ltd.
Storage battery and booster (£1,338).—Chloride Electrical Storage Co., Ltd.
Electric wiring (£6,693).—J. Collier & Co., Ltd.
Electric motors and tools (£994).—G. N. Haden & Sons, Ltd.
Heating and hot-water services (£7,343).—G. N. Haden and Sons, Ltd.
Complete laundry equipment, with dryers and calender (£3,118).—T. Bradford & Co., Ltd.

Hull.—Baths Commitee. Accepted:—
Electrical wiring and fittings at vapour and electrical baths:

Miller & Garness	£120
H. Hyde & Co.	117
James V. Coonan Co.	109
A. Shaw & Sons	106
King & Co., Ltd.	99
City Electric Co.	97
J. Wright	96
Clark & Graham	92
Wm. Broady & Son. (Accepted.)	**90**
City Engineer's estimate	110

London.—L.C.C. Education Committee. Recommended:—
Wiring and fittings at Drayton Park school, Islington:—

A. Shaw	£275
Bailey & Incledon, Ltd. (Recommended.)	**290**
Anderson, Angell & Co.	294
Alpha Manufacturing & Electrical Co., Ltd.	315
A. Meckhonik	325
Pinching & Walton	338
P. M. Braidwood	348
R. Hunt & Co., Ltd.	355
Smith & Hammond, Ltd.	360
A. Hawkins & Sons	392
City Electrical Co.	397
L. G. Tate & Co., Ltd.	408
G. Hopkins & Sons (Clerkenwell), Ltd.	450
Dalziel Engineering Co.	543

Metro-Vick Supplies, Ltd., has received contracts for the supplies of electrical accessories, &c., from the Islington, Paddington, and Stepney Boards of Guardians.

War Office.
Receiving, transmitting and rectifying valves.—Edison Swan Electric Co., Ltd.

Hull.—Tramways Committee. Accepted:—
Extension Hessle Road tramways (£3,330).—Sangwin, Ltd.

Lamp Contracts.—Metro-Vick Supplies, Ltd., has received a 12 months' contract for "Cosmos" lamps, &c., from the London & North-Western Railway Co. The North-Eastern Railway Co. has placed contracts for 12 months' supplies of electric lamps with the British Thomson-Houston Co., Ltd., and Siemens & English Electric Lamp Co., Ltd. Edison Swan Electric Co., Ltd., has received a contract for electric lamps from the London, Midland & Scottish Railway Co. Hull Corporation Tramways Department has placed a 12 months' contract for carbon and metal-filament lamps with Siemens & English Electric Lamp Co., Ltd.

Leeds.—Tramways Committee. Accepted:—
Track reconstruction, Woodhouse Lane (£640).—J. Speight.
Two pairs points, chrome steel, for experimental purposes (£150).—Thermit, Ltd.
Two lay-outs (£1,030), six pairs points (£726), eight crossings (£232).—Edgar Allen, Ltd.

Lichfield.—Town Council. Accepted:—
Electrification of a set of pumps at the Trent Valley Pumping Station (£101).—J. Richards & Co.

Liverpool.—Electric Power and Lighting and Tramways Committee. Accepted:—
Twelve months' supply of electricity meters.—Ferranti, Ltd.
Cables and accessories for street mains.—W. T. Henley's Telegraph Works Co., Ltd.; Callender's Cable and Construction Co., Ltd.; Dussek Bitumen Co., Ltd.; Penmaenmawr and Trinidad Lake Asphalte Co., Ltd.
Insulated cables.—Liverpool Electric Cable Co., Ltd.; Mersey Cable Works, Ltd.
One electrically-driven traverser for the Edge Lane car works (£409).—S. H. Heywood & Co.
Circulating-water, suction and discharge pipes for Lister Drive (£5,792).—Staveley Coal & Iron Co., Ltd.
H.p. switchboards for sub-stations.—Ferguson, Pailin, Ltd. (£10,805); Metropolitan-Vickers Electrical Co., Ltd. (£26,565).
Additional switchgear (£44,405).—Metropolitan-Vickers Electrical Co., Ltd.

Manchester.—Baths Committee. Accepted:—
Installation of electric lighting at Pryme Street baths.—R. H. Clampett & Co.
Housing Committee. Accepted:—
Installation of electricity at houses on various estates.—J. W. France & Co.; S. Dickinson; Fletcher and Turley; and Hanchett, Parratt & Currie.
Electricity Committee. Recommended:—
Cable.—Standard Telephones & Cables, Ltd.; and British Insulated Cables, Ltd.
Renewal of turbine blades at Stuart Street sub-station.—Richardsons, Westgarth & Co., Ltd.
1,500-kW motor-convertor.—Ateliers de Constructions Electriques de Charleroi.
750-kW motor-convertor.—British Thomson-Houston Co., Ltd.
Weldless steel lamp columns and fittings.—British Mannesmann Tube Co., Ltd.; and the Bromford Tube Co., Ltd.
33,000-V switchgear.—British Thomson-Houston Co., Ltd. 420-V ditto.—Metropolitan-Vickers Electrical Co., Ltd.; and 240-V ditto.—Whipp & Bourne, Ltd.

At the meeting of the City Council on Wednesday last week, Ald. Dagnall, chairman of the Electricity Committee, drew attention to the recommendation of the Committee to accept the tender of the Ateliers de Constructions Electriques de Charleroi for a 1,500-kW motor-convertor, switchgear, &c., for the Ancoats sub-station at £4,030. Three British tenders have been received for the same specification. The prices of the English firms were all within £1 and less, and they were 25 per cent. higher than the Belgian quotation. The lowest suitable British tender was £5,045 6s., the others being £5,045 10s. and £5,046. The chairman of the Electricity Committee, after giving these figures, said the Committee thought it time to let the British manufacturers know that while it was prepared to pay a good price and prices commensurate with the value of the machine, it was not going to pay artificial prices. The decision of the Council to give the contract to the Belgian firm was unanimous.

Preston.—Electricity Committee. Recommended:—
Duplicate of No. 3 generating set (£48,000).—English Electric Co., Ltd.

Oldham.—Electricity Committee. Accepted:—
Cable.—Union Cable Co., Ltd.
Education Committee. Accepted:—
Re-wiring and encasing electric mains at Clarksfield School. S. Charlesworth & Co.

Rotherham.—Town Council. Accepted:—
Three railless electric vehicle chassis (£995 each).—Clough, Smith & Co.
Three bodies (£520 each).—Charles H. Roe, Ltd.

South Africa.—Cape Town.—Accepted:—
Rewiring the Mount Nelson Hotel for a 220-V supply (£5,560).—E. A. Shaw & Co. (Cape Town).

Wallasey.—Electricity Committee. Recommended:—
12,500-kW turbo-alternator (£38,345).—English Electric Co., Ltd.
Two boilers (50,000 lb. per hour normal rating) and auxiliary plant (£46,840).—Simon Carves, Ltd.

Wimbledon.—Electricity Committee. Accepted:—
Two 10,000-V switch panels (£607).—A. Reyrolle & Co., Ltd.

Forthcoming Events.

Electrical Power Engineers' Association (Glasgow Section).—Friday, April 15th. Reed's Restaurant, Glasgow. 7.30 p.m. "X-Ray Plant and Practice." Mr. W. S. Weir.

Institution of Electrical Engineers.—Thursday, April 21st. London. 6 p.m. Kelvin Lecture, "High-frequency Currents." Prof. E. W. Marchant.

(Sheffield Sub-Centre).—Wednesday, April 20th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "Some Magnetic Problems." Mr. A. Tustin.

(Tees-Side Sub-Centre).—Monday, April 18th. Cleveland Technical Institute, Middlesbrough. 7 p.m. Annual general meeting.

Birmingham Electric Club.—Friday, April 22nd. Grand Hotel. 7 p.m. "Radiation Effects." Mr. J. B. Kramer.

Association of Mining Electrical Engineers (North of England Branch).—Saturday, April 23rd. Durham. 3 p.m. "Accumulators (Lead-type)." Mr. A. W. Bridges; and "Electrical Testing Gear for Collieries." Mr. H. J. Fisher.

Notes.

Electrical Association for Women.

About 80 members of the above Association visited the new Tricity Restaurant, Strand, on April 6th, when Mr. A. F. Berry gave a very interesting talk on the history of the development.

At the last of the series of E.A.W. evening lectures, on April 6th, Mr. J. W. Beauchamp, Director E.D.A., spoke of the work which women are doing in the American electrical industry; a very interesting discussion followed.

Appointments Vacant.

Charge engineer for the East Sussex County Mental Hospital, Hellingly. Engineer-in-Chief for the County of London Electric Supply Co., Ltd. Two shift engineers for the Penang Municipal Commission. Inspectors for the Lift and Crane Department of the National Boiler and General Insurance Co., Ltd. City electrical engineer (£1,500), for the City of Salford Electricity Department. (See our advertisement pages to-day.)

The Largest Diesel-Electric Ship.

A contract was placed in March last with Scotts' Shipbuilding and Engineering Co., Greenock, by the Atlantic Refining Co., of Philadelphia, U.S.A., for an oil tanker of 12,500 tons deadweight. The vessel will be the largest in the world employing Diesel-electric propulsion; her length will be 469 ft., beam 63 ft., and moulded depth 36 ft. 9 in. The designed speed is 11 knots, and the oil engines driving the dynamos are to be of the Carels-Ingersoll-Rand four-cycle airless-injection type, built by the Carels firm (S.E.M.) in Ghent, Belgium. There will be four units of 750 b.h.p., each having six cylinders and running at 225 r.p.m. Each engine will drive an auxiliary generator of 75 kW mounted on the same shaft. The electrical machinery will be supplied by the British Thomson-Houston Co., Ltd., Rugby, and four 250-volt dynamos will run in series, supplying one 1,000-volt main propelling motor of the double-armature type, rated at 2,800 s.h.p. at 95 r.p.m. The auxiliary machinery will only require 1½ per cent. of the total horse-power installed.

The cargo pumps will be of the rotary displacement type, each coupled to an 80-h.p. electric motor installed in the engine-room and operated by remote control from the pump-room. The machinery will be controlled from the pilot house, and a gyroscopic compass is to be fitted. The Atlantic Refining Co. owns the largest fleet of Diesel-electric vessels in service, as there are five, the largest being the *J. W. Van Dyke*, with a capacity of 7,500 tons deadweight. The owners are now converting three additional tankers to Diesel-electric drive, each of which will be equipped with three 600-b.h.p. Ingersoll-Rand engines.

The *Motor Ship* also reports that the *District of Columbia*, which has been purchased by the Standard Oil Co., California, for conversion, will be equipped with four 1,000-h.p. Busch-Sulzer engines coupled to dynamos and running at 275 r.p.m. The vessel is a tanker of 7,641 tons gross, built in 1921, and she has a tank capacity of 83,146 barrels. The Parsons geared turbines originally installed developed 2,800 s.h.p. at 90 r.p.m., and gave a speed of 10 knots. Each of the new Diesel engines will drive a 700-kW d.c. generator supplying a double-armature propelling motor rated at 3,200 b.h.p. at 90 to 105 r.p.m. Excitation for the generators will be supplied from two 175-kW machines directly connected to the wing Diesel engines. The electrical plant is of the Westinghouse type. Auxiliary power in port will be obtained from a 60-kW generator, except when cargo is being handled, when one of the main generators will be run. All the deck equipment will be electrically operated.

A Week-End Engineering Conference.

The Manchester Engineering Council has organised a week-end engineering conference for employers and employés in the industry from April 22nd to 24th, inclusive. It is to be held at the University, Manchester, and will be opened with a public meeting in the Whitworth Hall, on Friday evening, April 22nd, at 7 p.m. The Lord Mayor and the President of the Council (Mr. L. E. Mather, chairman of Messrs. Mather and Platt, Ltd.) will hold a reception, followed by a public meeting, when Messrs. W. L. Hichens and W. M. Citrine (Electrical Trades Union) will open a debate on "Economic Production." The subjects for Saturday will be the "Future of Industry" (Mr. J. Rowan, of the Electrical Trades Union, presiding); "Arbitration in Industry"; and "Aspirations of Trade Unions" (Mr. S. Mavor in the chair). On Sunday morning Mr. E. J. Fox will speak on "Works Committees" (with Mr. C. G. Renold in the chair), while after luncheon Mr. Mather will sum up the proceedings and a service at the Cathedral will follow.

The Council was founded in 1918, and it has, as a result of its activities during nine years, secured a membership of 650. We learn from the honorary secretary, Mr. Gerald Webb (c/o Messrs. Mather & Platt, Ltd., Park Works, Manchester) that the movement has been well supported by prominent employers and trade union leaders in the district, and the average attendance at its ordinary monthly meetings is 250, drawn from all ranks of the industry, including shop workers. The Council is anxious that districts other than Manchester should be well represented, and we recommend employers, foremen, and trade unionists to communicate with Mr. Webb. We have attended many conferences which have been more or less representative of the different parties interested in industry, but discussions have often lacked an atmosphere of reality and seriousness, and we welcome the assurance that the present joint gathering of the engineering industry is such a one as has never before taken place. We wish the organisation every success, and shall watch the movement with interest and sympathy.

Cheap Electricity.

"Cheapest Electricity—How to Obtain It!" is the title of a brochure recently received from Messrs. Ruston & Hornsby, Ltd., of Lincoln, who introduce it as the considered opinion of an independent electrical engineer who is concerned only with the problem of cheap power supply. In effect it is a criticism of the Electricity Supply Bill (now an Act) on the basis of the relative costs of production in large and small stations. For this purpose the working costs and capital charges of a number of stations in each class are compared, and it is shown that while the large steam station can show a small economy over the oil-engine station at the bus-bars, this advantage is lost at a radius of six or seven miles owing to the capital charges on the transmission lines. The cost of transformation further handicaps the big station. It is suggested that the expenses of the Central Electricity Board will be out of proportion to the economy effected by centralisation of plant, and that bulk supply will have to be very cheap to justify the conversion of a small station into a distribution centre. As regards the small power user, he can generate electricity for himself with oil-driven plant so cheaply that it is difficult to secure him as a customer of the electricity works, and the elimination of the air-compressor by the use of cold-starting solid-injection engines reduces the capital cost, the risk of breakdown, and the cost of maintenance; actual experience shows that the fuel cost at 0.7 lb. of oil per unit generated, with fuel oil at 85s. per ton, is only 0.32d. Supplementing the article, the publishers give certified figures of running costs obtained in practice, showing that in one case where the cost per unit generated (excluding capital charges) was 0.614d., the owners (Crittall Manufacturing Co.) saved nearly £3,000 a year by substituting oil for coal. At another factory the plant cost £3,542 and generated 176,390 kWh per annum, at an inclusive cost of 1.43d. per kWh; and at a foundry where half this output was produced, the annual saving compared with the cost of public supply was £635—sufficient to pay for the plant in a little over two years. There is no doubt that public electricity supply undertakings must offer very low tariffs if they wish to compete with these small installations, which, though working at a load factor apparently much less than 20 per cent., show such low costs.

The I.E.E. Wiring Regulations.

We are indebted to the courtesy of the general secretary of the Association of Supervising Electrical Engineers for an advance proof of an article that will appear in the April issue of the Association's journal, *Contact*, with regard to the I.E.E. Wiring Rules. It is stated that in November, 1924, the Board of Control of the Association set up a special committee to examine the eighth edition of the Rules, which was issued in June, 1924, and on February 2nd, 1925, the Board submitted proposed amendments and suggested that an abridged version should be issued for the use of wiremen; in reply, the I.E.E. Wiring Rules Committee asked the N.A.S.E. to prepare one and submit it for consideration. This was quickly done, and on August 26th, 1925, the completed suggestions were delivered to the I.E.E. Thereafter nothing happened until May 4th, 1926, when the N.A.S.E. was informed that the I.E.E. Committee was "still waiting to receive the proposals of the Electrical Contractors' Association," which also wished to submit suggestions for an abridged copy. On February 25th, 1927, a printed abstract of the Regulations was submitted by the E.C.A. to the Committee; the N.A.S.E. representative claimed that as it was first in the field, its version should be dealt with first, and as certain items in the E.C.A. booklet which the I.E.E. Committee could not accept were absent from the N.A.S.E. proposals, the E.C.A. and the N.A.S.E. agreed to confer on the subject. In the meantime the I.E.E. Committee has decided to publish immediately a ninth edition of its Regulations, and the Association of Supervising Electrical Engineers (formerly N.A.S.E.) is examining the E.C.A. booklet and its own version in the light of this decision. It is urged that the abridged copy should be published on the authority of the Institution of Electrical Engineers, rather than that other authorities should issue their own abridgements. "The sooner the abridged edition is an accomplished fact the sooner will there be general adoption of the Regulations and efficient standards."

The last sentence suggests that the Regulations have not secured general adoption. It would be interesting to know the percentage of installations carried out during 1925 and 1926 in full compliance with them.

Irish Free State Electricity Supply.

Considerable indignation is manifest throughout the Irish Free State at the decision of the Government to take over control of the municipal and other electricity undertakings in the State and to work them in conjunction with the Shannon hydro-electric scheme.

During the Committee stage of the Electricity Supply Bill in the Dail Eireann, strong protests were made against the proposal, which was described as confiscatory, immoral, and economically unsound, more particularly as the Minister for Industry and Commerce (Mr. P. MacGilligan) announced that no compensation would be paid to the owners of existing municipal undertakings. Mr. John Good, a member of the Dail, spoke of the Government's attitude as that of wiping out valuable vested interests built up at the expense of the ratepayers, and instanced the case of Dublin, where the Corporation had achieved great success with its electricity undertaking and had given great satisfaction to all classes of the citizens by its electricity supplies for power, heating, and lighting.

The Minister's arguments that municipal authorities should not make big profits, and that using the profits of an electrical undertaking to relieve the rates was not viewed with favour by the Government, created much surprise. The Dublin undertaking cost £1,300,000, which, he said, had been paid by the electricity consumers, and if the Corporation was given compensation it would mean that the ratepayers would receive a further gift from the consumers. An amendment to the effect that compensation be provided for was, after discussion, rejected by 43 votes to 11.

Since then, some of the leading electrical experts in Dublin and elsewhere have joined in the protest against the confiscatory bearing of the Bill; in one quarter the proposal is bluntly referred to as "barefaced robbery," and in others it is feared that the result will be injurious to the Shannon scheme and may lead to serious complications in its operation and in the distribution of electricity. The scale of compensation, it is urged, could be drawn up on the basis of the market value of each undertaking, thus recognising the importance of the achievements of the local authorities and companies and private owners during a long series of years. There appears, however, to be little hope that the Minister will change his mind.

Mr. MacGilligan announced that he saw no reason why the distribution of electricity from the Shannon should not begin in February, 1929. He believed that the annual consumption then would be 75,000,000 units, and that this would be increased to 110,000,000 units in 1932, in which year it was expected the Board of Control would be able to pay the sinking fund and meet all working expenses out of revenue. He accepted an amendment under which electricity could be supplied from the Shannon scheme to consumers in Northern Ireland.

Major Bryan Cooper protested against the tendency on the part of the Minister not to give information called for by the House, remarking that at times one would think the Shannon scheme was the Minister's private property and that it was an impertinence on the part of the Dail to ask for details.

Civil Service Commission.

Regulations and particulars for the forthcoming examinations for probationary assistant engineers and probationary inspectors in the Engineering Department of the Post Office can be obtained from the Secretary, Civil Service Commission, Burlington House, W., together with the form on which application must be made. The latest dates for the receipt of application forms are July 14th and 28th respectively. (See our advertisement columns to-day.)

Boiler Explosion Report.

We have received a copy of the report on a preliminary inquiry into the cause of the explosion of a water-tube boiler at the London County Council's tramway power station at Greenwich in September last. The clamp retaining one of the header caps at the back of the boiler fractured around the bolt head, allowing the cap to be forced off and the contents of the boiler to escape. A crack appears to have formed in the clamp and gradually developed until the section of material left was insufficient to resist the stress imposed upon it.

Reinforced Concrete.

A booklet entitled "The Relative Value of Mild Steel and High-tensile Steel in Reinforced Concrete Construction," containing correspondence between Mr. H. Weston (of the Weston Concrete Engineering Co., Ltd.) and the Ministry of Transport, and reports on the subject by eminent experts, leads to the conclusion that the grade of steel used for reinforcement is of no importance; once a crack is formed it will soon reach the surface of a slab, whatever the kind of reinforcement.

The Budget.

Mr. Winston Churchill, the Chancellor of the Exchequer, introduced his Budget on Monday last. In the changes of taxation which he announced there appears to be nothing of direct electrical interest. The part of his speech likely to concern our readers was that relating to the disappearance of three departments—the Ministry of Transport, the Mines Department, and the Department of Overseas Trade. In Mr. Churchill's own phraseology, the Ministry of Transport is to be abolished as a separate department; the functions of the Mines Department are to be distributed; and the separate existence of the Department of Overseas Trade is to be terminated. No direct reference was made regarding the future of the Central Electricity Board and the Electricity Commissioners; presumably these will come under the *ægis* of the Board of Trade.

The Batti-Wallahs' Society.

On Tuesday, April 26th, at a luncheon at the Hotel Cecil, London, Sir Arnold B. Gridley, K.B.E., M.I.E.E., will deliver an address on "How to Reconcile Relations between the Consumer, the Producer, and the Wage-earner."

Educational.

Northampton Polytechnic Institute, Engineering Day College.—The entrance examination in connection with the Engineering Day College will be held on Tuesday, April 26th. Further information can be obtained on application to the Principal. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.

North-Western Centre.—The annual meeting of the North-Western Centre of the I.E.E. was held on April 5th, at Manchester, Mr. W. J. Medlyn presiding. The report of the Committee showed that the aggregate membership was 1,108, made up of 112 members, 440 associate members, 12 associates, 149 graduates, and 390 students. Compared with last year, there was a decrease of 37 in the number of students, and increases of 2 members, 23 associate members, and 23 graduates, the net increase being 11. The chairman announced that Mr. Ratcliff, who, in the ordinary course, as senior vice-chairman, would have become the chairman of the Centre this year, did not wish to do so. Mr. Lunn, the hon. secretary, found that pressure of business compelled him to give up the position, and the Centre was to lose Mr. Watson, who had been appointed chief engineer of the London and Home Counties Electricity Authority. The election of officers resulted as follows:—*Chairman*: A. B. Mallinson; *vice-chairmen*: W. J. Wood and T. E. Herbert; *hon. secretary*: J. D. Peattie; *new members of the committee*: Messrs. O. Howarth, H. Hawkins, G. A. Juhlens, A. L. Lunn, and Cobden Turner.

North-Western Students' Centre.—On Tuesday last, at the annual general meeting of the Students' Centre, an address was to be given by Mr. J. A. Robertson, M.I.E.E., on "The Electricity Supply Act, 1926—and After." The nominations for election of committee, to take place at the meeting, included the names of Mr. G. R. Millward (hon. secretary) to be chairman, and Mr. W. L. England to be vice-chairman of the Centre.

Institute of Metals.

At a general meeting to be held on May 11th, the seventeenth annual May Lecture will be delivered by Sir Henry A. Miers, F.R.S., on "The Growth of Crystals in Supersaturated Liquids."

The Faraday Society.

On April 22nd and 23rd a general discussion is to take place on the theory of strong electrolytes, at the University Museum, Oxford, under the chairmanship of Prof. C. H. Desch. Some 24 papers are to be submitted. Admission will be by ticket. The annual general meeting will be held in London on May 25th, and is to be followed by an ordinary meeting.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. D. R. Wilson has been unanimously nominated by the Council of the Illuminating Engineering Society as President. Mr. Wilson has done much valuable pioneering work on industrial lighting; the reports of H.M. Chief Inspector of Factories from 1911 onwards contained special contributions by him on the lighting of factories, and he took an active part in the subsequent formation of the Home Office Departmental Committee on Lighting in Factories and Workshops, of which he became secretary. He is also a member of the Illumination Research Committee, working under the Department for Scientific and Industrial Research, by which important researches bearing on industrial lighting have been carried out.

The Reading Borough Council has advanced the salary of Mr. Arthur Higson, who has charge of the electrical and mechanical gear in the Borough Engineer and Surveyor's Department, by £28 per annum to £340, plus £26 per annum car allowance.

The Spenborough Urban Council has made a special grant of £75 to the electrical engineer in respect of past and prospective special services in connection with the "change over" at the works.

Mr. R. H. Wilkinson, city tramway manager, Bradford, has been authorised by the Tramways Committee to take part in the visit to Budapest, as a member of the Committee of the Municipal Tramways Association, which is going there to inspect overhead equipment methods and other tramway matters.

The Accrington Town Council has considered a recommendation that the salary of Mr. Clegg, the electrical engineer, should be increased from £866 to £913 per annum, with a further advance from April 1st, 1928, when the basic salary should be £750, plus the prevailing bonus. After discussion the proposal was referred back by 13 votes to 11.

The engagement is announced of Mr. S. Dickson Moyse, only son of Mr. and Mrs. Leon Moyse, of New York and Paris, and Miss Kathleen Railing, younger daughter of Mr. and Mrs. M. J. Railing.

Mr. A. J. Waring, distribution engineer at the Torquay Electricity Works, who is leaving to become borough electrical engineer at Newark-on-Trent, has been presented by the staff with an eight-day clock.

On April 6th, the staff and employés of the Paisley Corporation Electricity Department met to honour seven of their number who have completed 25 years' service. Mr. W. Blair Smith, engineer and manager, presided, and Miss M. R. Hart made suitable presentations to the following employés:—Messrs. J. M. Barbour, G. A. F. Allison, R. Mitchell, Joseph Thompson, John Hogg, John Cunningham, and James Lawrie.

Confirmation has been received of the recent rumours that Mr. P. N. Rand, the general sales manager of the Metropolitan-Vickers Electrical Co., Ltd., is severing his connection with that company. He will officially terminate his connection with the M-V Co. on September 30th next (by which time he will have completed nearly 19 years with them), but will relinquish his active representation about the middle of May and indulge in a well-earned rest. He will be at Buxton during the I.M.E.A. Convention and in Newcastle for the I.E.E. Summer Meeting, after which he expects to travel abroad for a few weeks before taking up new duties. We join with Mr. Rand's many friends in wishing him success in his future activities. His address from the middle of May until further notice will be c/o Royal Automobile Club, Pall Mall, London.

Obituary.—Mr. A. R. Hardie.—We regret to learn from the *Financial Times* of the death, which occurred suddenly on April 8th, at the age of 74, of Mr. A. R. Hardie, who had been associated with submarine cable enterprise for 57 years. "Mr. Hardie came from Scotland, and as a very young man joined the old British Indian Submarine Telegraph Company under the late Sir John Pender in 1870. Two years later took place the great amalgamation of submarine telegraph companies, known to-day as the Eastern Associated Telegraph group—the largest cable undertaking in the world. He was appointed chief accountant of the Eastern Telegraph Company in 1886 at the early age of 33, becoming secretary in 1903 and a director in 1922." He leaves a son (Lieut.-Col. Claude Hardie, D.S.O., of the English Electric Co., Ltd.).

Lt.-Col. P. W. d'Alton.—We learn with feelings of deep regret of the death, which occurred on April 10th, at Westcliff, at the age of 71 years, of Lt.-Col. Patrick Walter d'Alton, M.Inst.C.E., M.I.Mech.E., M.I.E.E. We shall refer to the career of the deceased gentleman in our next issue.

Financial Section.

New Companies. Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Dionoid Battery Co., Ltd.—Private company. Registered April 6th. Capital, £10,000 in £1 shares. Objects:—To manufacture and repair electric accumulators of all types; to carry on the business of electricians, mechanical engineers and manufacturers, manufacturers of, and dealers in telephones and telegraphs (wireless or otherwise), dynamos, magnetos, &c. The subscribers (each with 100 shares) are:—G. H. Trotter, 17, Broomhall Road, Sheffield, engineer; H. H. Barton, 17, Broomhall Road, Sheffield, instructor captain, R.N. (retired). G. H. Trotter is the first director. Qualification, 100 shares.

S. L. Electrical Co., Ltd.—Private company. Registered April 6th. Capital, £200 in 1s. shares. Objects:—To carry on the business of electricians, manufacturers, generators, accumulators, suppliers and distributors of electricity and electrical energy for lighting, heating, telegraphic and telephonic communications, &c. The directors are:—C. H. Morrell, 1, The Terrace, Champion Hill, S.E.5; E. J. Evershed (managing director), address not stated. Secretary: C. H. Morrell. Solicitors: Helliwell, Harby & Evershed, Thanet House, 231, Strand, W.C. Registered office: Thanet House, 231, Strand, W.C.2.

Cleartron (1927), Ltd.—Private company. Registered April 6th. Capital, £10,001 in £1 shares (7,501 "A" and 2,500 "B"). Objects:—To carry on the business of manufacturers of, and dealers in wireless apparatus and accessories of all kinds, &c. The subscribers (each with one "A" share) are:—Elsie E. Styles, 29, Rosetta Street, Stockwell, S.W., clerk; L. H. Gurney, The Den, Priory Avenue, Harlow, Essex, clerk. Directors: M. F. Mieville and others to be appointed by the subscribers. R. J. Ireland also signs as director. Registered office: 21, Cumberland Street, Birmingham.

Berkeley Electrical Engineering Co., Ltd.—Private company. Registered April 2nd. Capital, £15,000 in £1 shares. Objects:—To adopt an agreement with F. G. Minter, Ltd., and to carry on the business of electrical engineers and contractors, suppliers of electricity, carriers of passengers and goods, manufacturers of, and dealers in railway, tramway, electric, magnetic, galvanic, and other apparatus, &c. The first directors are:—F. G. Minter, 26, Norfolk Street, Park Lane, W.; F. A. Minter, "Greystock," Peek Crescent, Wimbledon Common; C. J. Goldsmith, "The Nook," Well Lane, East Sheen, S.W.14; A. E. Williams, "Callancrags," Woodcote Valley Road, Purley; A. H. Beatty, "Chellow Dene," Putney Hill, S.W.15 (directors of Balfour, Beatty & Co., Ltd., and other companies). Qualification, 100 shares. Solicitors: Walter Burgis & Co., 31, Budge Row, E.C.4. Registered office: 29, Buckingham Gate, S.W.1.

Dental and General Radiography, Ltd.—Private company. Registered April 7th. Capital, £100 in 99 "A" shares of £1 and 20 "B" shares of 1s. each. Objects:—To carry on the business of dental and general radiographers and radiologists, including also any curative, remedial, or therapeutic treatment by the employment of long or short wave-lengths, whether of light, heat or electricity, &c. The permanent directors are:—F. Daphne (chairman), 10, Charterhouse Square, E.C.1; L. F. E. Johnson, 9, Highbury Grange, N.5. Solicitors and registered office: Daphnes, 10, Charterhouse Square, E.C.

Loewe Radio Co., Ltd.—Private company. Registered April 1st. Capital, £100 in £1 shares. Objects:—To carry on the business of producers, manufacturers, importers and exporters of, or dealers in radio devices, instruments and apparatus of all kinds, &c. The subscribers (each with one share) are:—J. F. H. Kempler, 3 and 4, Clement's Inn, W.C.2, solicitor; G. M. Down (same address), articled clerk. Directors' qualification, 5 shares. Secretary (*pro tem.*): F. J. Wright. Solicitors: Brown, Turner & Co. Registered office: 3 and 4, Clement's Inn, Strand, W.C.2.

Ashworth & Smith (Electrical Supplies), Ltd.—Private company. Registered April 2nd. Capital, £1,500 in £1 shares. Objects:—To carry on the business of electrical, mechanical, civil, agricultural, or other engineers, &c. The first directors are:—R. Nette, 13, Hulme Hall Avenue, Cheadle Hulme, Cheshire; S. Gillett, 426, Buxton Road, Stockport. Qualification, 50 shares. Secretary: R. Nette. Solicitors: Pattinson and Harrison, Macclesfield. Registered office: 27, Blackfriars Street, Manchester.

Logan Electric Supplies, Ltd.—Private company. Registered in Edinburgh April 2nd. Capital, £1,000 in £1 shares. Objects:—To carry on the business of distributors of all kinds of electrical goods, &c. The subscribers (each with one share) are:—R. Logan, "Knocknair," Kilbirnie, retired school teacher; J. Logan, "Knocknair," Kilbirnie, wireless representative. Registered office: 144, West Regent Street, Glasgow.

Graver, Cousins & Co., Ltd.—Private company. Registered April 4th. Capital, £255 in £1 shares (250 5 per cent. cumulative preference and 5 ordinary). Objects:—To carry on the business of electrical, lighting, heating, ventilating, wireless, mechanical and general engineers and engineering contractors, &c. The subscribers (each with one share) are:—C. H. Cousins, 58, Mount Gold Road, Plymouth, general clerk; C. H. Pearn, 1, Spenser Terrace, Lipton Road, Plymouth, builder and contractor; H. F. Cousins, 58, Mount Gold Road, Plymouth, electrician; J. Graver, 27, Burleigh Park Road, Plymouth, electrician. Secretary: C. H. Cousins. Solicitor: C. L. Croft, 13, Princess Square, Plymouth.

Official Returns of Electrical Companies.

Nalder Bros. & Thompson, Ltd.—Capital, £30,000 in 15,000 preference and 15,000 ordinary shares of £1 each. Return dated December 29th, 1926. 12,000 preference and 11,881 ordinary shares taken up. £13,881 paid. £10,000 considered as paid. Mortgages and charges, £5,738.

Vaca Falls Co., Ltd.—Capital, £50,000 in 15,000 preference and 35,000 ordinary shares of £1 each. Return dated December 31st, 1926. 5,000 preference and 35,000 ordinary shares taken up. £25,000 paid. £15,000 considered as paid. Mortgages and charges, nil.

Townlea Electrical Co., Ltd.—Capital, £1,000 in 300 preference and 700 ordinary shares of £1 each. Return dated January 11th, 1927. 500 ordinary shares taken up. £500 considered as paid. Mortgages and charges, nil.

Sussex Electricity Supply Co., Ltd.—Capital, £20,000 in £1 shares. Return dated December 8th, 1926. 18,049 shares taken up. £18,049 paid. Mortgages and charges, £10,000.

English Freeholds and Industrial Undertakings, Ltd. (formerly Water, Gas and Power Undertakings, Ltd.).—Capital, £4,000 in £1 shares. Return dated December 31st, 1926. 1s. per share called up. 700 shares taken up. £35 paid. Mortgages and charges, nil.

John Richards & Co. (Electrical Engineers), Ltd.—Capital, £6,000 in £1 shares. Return dated March 18th, 1927. 4,802 shares taken up. £2 paid. £4,800 considered as paid. Mortgages and charges, nil.

London Electric Stores, Ltd.—Capital, £1,000 in £1 shares. Return dated March 2nd, 1926 (filed January 1st, 1927). 750 shares taken up. £750 considered as paid. Mortgages and charges, nil.

Power and Traction Finance Co., Ltd.—Capital, £250,000 in £1 shares. Return dated January 14th, 1927. 6,002 shares taken up. £6,002 paid. Mortgages and charges, nil.

Credenda Conduits Co., Ltd.—Capital, £50,000 in £1 shares. Return dated January 14th, 1927. All shares taken up. £30,000 paid. £20,000 considered as paid. Mortgages and charges, nil.

Simmonds & Stokes, Ltd.—Issue on March 29th, 1927, of £50 debentures, part of a series already registered.

Rangoon Electric Tramway and Supply Co., Ltd.—Satisfaction to the extent of £9,528 on December 29th, 1926, of debenture stock dated February 1st, 1906; December 22nd, 1908; November 5th, 1913; and January 25th, 1924, securing £250,000.

Electric Supply Co. of Victoria, Ltd.—Satisfaction in full on June 30th, 1925, of debenture stock trust deeds dated July 7th, 1905, and May 9th, 1907, securing £160,000 and £40,000 respectively.

Small Electric Motors, Ltd.—Satisfaction in full on March 15th, 1927, of mortgage dated October 29th, 1918, securing £2,500.

Hellyar & Sons, Ltd.—T. H. Hellyar, of 169, Church Road, Barnes, was appointed receiver and manager on March 11th, 1927, under powers contained in mortgage dated August 23rd, 1912.

English Electric Co., Ltd.—Satisfaction to the extent of £35,000 on February 24th, 1927, of first mortgage debentures, secured by trust deed dated September 15th, 1919, securing £1,000,000.

W. P. Love & Sons, Ltd.—Mortgage on certain freehold land, fixtures, &c., at Brenchley, Kent, dated March 24th, 1927, to secure all moneys due or to become due from the company to the National Provincial Bank, Ltd.

City Notes.

Babcock & Wilcox, Ltd.

The report for the past year records a net profit of £716,576; to this is added £188,774 brought forward, making £905,350. It is proposed to transfer £150,000 to the reserve fund (making £702,000) and £20,000 to the staff pension fund, and to pay a final dividend of 8 per cent., free of tax, on the ordinary shares (the interim dividend was 5 per cent.), leaving £161,442 to be carried forward. The death of Sir James Kemnal, the managing director, is recorded, and it is stated that during the year Sir Coles Child, Bt., and Mr. H. W. Kolle joined the board. Extensions were made to the factories and plant at Renfrew and Dumbarton, but the increased production which should have resulted was prevented by the general strike and coal stoppage. Considerable loss to the company and inconvenience to customers were caused by these disputes. The associated companies in this country and abroad were profitable in the aggregate. The Spanish company was fully employed, the French company paid a good dividend, and the German company has been well employed and has increased its dividend. The Italian company has not yet had time to develop fully and meet the unusually severe competition in Italy. The Japanese works have progressed and their extension is contemplated. The Australian works are now working under more favourable conditions; considerable progress has been made and large contracts are in hand. The Canadian company has suffered from the trade depression in Canada, but there are signs that the long overdue improvement is about to take place. Business in China is, of course, at a standstill. The advances in design have caused unusual demands on the staff during the year, but the company has demonstrated its ability to meet all its customers' requirements. The meeting is to be held on April 20th.

Metropolitan-Vickers Electrical Co., Ltd.

The 27th annual meeting was held on April 5th, Major-Gen. Sir Philip Nash presiding. In moving the adoption of the report, the chairman said that the profit for the year showed an increase of £3,153, which might be considered satisfactory in view of the industrial interruptions during the year. The actual output from the works during 1926 was slightly less than in 1925, which was a record year for the company, but bearing in mind the dislocation and interruption to industry which the coal dispute caused, the result was good. Moreover, relations between their workpeople and the management continued to be of the most cordial nature throughout the whole period. They experienced, however, during the prolonged coal stoppage considerable difficulty in obtaining certain classes of raw material essential to their business, and the general conditions which prevailed rendered the task of maintaining output abnormally difficult. Due to those industrial conditions in 1926 the home market for electrical plant, &c., was adversely affected, but towards the end of the year they were fortunate in obtaining a fairly large amount of business which brought the value of orders for the home market in 1926

nearly up to the total of the previous year. On the other hand, they had a considerable increase last year in orders obtained in the overseas markets, and measured in terms of tonnage the export orders obtained by the company last year were far in excess of any previous year in the company's history, though the prices obtained were barely remunerative. At the same time the obtaining of a large volume of work in the export market was essential to the well-being and progress of the company, and looking back over a term of years in which they had consistently carried out a policy of expanding their export business, he had no hesitation in saying that the results had fully justified the policy. Referring to the Central Electricity Board, he said that its work would be watched with close interest by all connected with the electrical industry, and he trusted that whatever might have been the opinions or criticisms of the Bill during its passage through Parliament, all sections of the industry would now combine to assist the Board to make the new Act a success. All were agreed that our country was behind other countries in the use of electricity, and the new Board, by an active and well-considered policy, had a great opportunity before it to undertake developments beneficial alike to the industry itself, and to the country as a whole. One of the important works which the Board would have to carry out was the installation of apparatus in connection with the high-pressure transmission lines contemplated in this country, a work which was outside the more standard lines of apparatus hitherto utilised in this country. The experience which their company had gained in the export field rendered it peculiarly adapted to undertake this class of work. Speaking of some of the larger contracts which were under process of being carried out by the company, he said that for the home market they were manufacturing large power house equipment for the Bristol and Liverpool Corporations. They were manufacturing to the order of the Manchester Corporation the largest turbo-generator set that had ever been installed in Great Britain. The new set was of a capacity of 40,000 kW, which would be installed at the Corporation's power station at Barton, which already contained three 25,000-kW sets of their manufacture. Their railway electrification business continued to expand, and in addition to a large order from the Southern Railway in this country, they were also manufacturing traction equipment for India, Brazil, Australia, South Africa, Spain, Czecho-Slovakia, Italy, Holland, and Argentina. They also had under manufacture at the present moment large pieces of heavy generating plant for New Zealand, Sydney Corporation, Shanghai, Rumania, and Russia, and other important contracts for h.p. apparatus of the most modern design for Argentina, Rhodesia, New South Wales, and other countries. He had referred earlier to the good relations which existed between the management and the workers. They had at their Trafford Park works a Works Committee, which had been operating for the last ten years, and the key-note of whose work was to create the right spirit in their workshops. That committee was composed of 15 delegates of the workmen drawn from the various departments of the works, and elected by the workmen themselves. In addition, four representatives of the management and one senior foreman served on the committee. The committee elected its own chairman each year, and it was interesting to record that for the last seven years the chairman of the committee had been one of their workers—Mr. Sam Ratcliffe—a man who was held in the highest respect by all ranks in the company, and was one of the trade unionists selected to visit America last year with the *Daily Mail* Mission. There was no question at all to his mind that the works committee was as necessary and as important a section of organisation as any in the company. They also had a staff committee and a women's committee. In another direction the company also endeavoured to make the conditions of its workers as attractive as possible, and with this object they had for many years had in operation a system of payment by results whereby the workers employed could earn without restriction substantial increases on their basic rates, depending on output. At the present time about 86 per cent. of the workers employed by them participated in those arrangements. Referring to the future, he said they commenced this year with a satisfactory volume of orders on their books, and, together with those which they might expect to obtain in the ordinary way during the year, their manufacturing facilities should be well occupied, provided there were no industrial or other interruptions. He did not see that the home market was, in the near future, likely to provide as much business as they had hoped it would do. It was clear to him that industry was recovering from the effects of the coal strike at a slower rate than was generally anticipated, and that at the termination of the strike, opinions generally were too optimistic. On the other hand, he saw no reason why conditions should not gradually improve so that later in the year this market might regain its former activity. In the meantime they would continue their activities in the export market which offered promise. Competition, however, in this market was as severe as ever, and it was there that the British manufacturer felt most the greatly increased costs arising from taxation. In addition to the increased burdens of national taxation the company was paying nearly three times as much in local taxation as it paid in 1914. He renewed the plea which industry made to the Government to enforce economy in national and local expenditure.—The report was adopted without discussion.

Automatic Telephone Manufacturing Co., Ltd.

Sir Alexander Roger presided at the annual meeting on April 7th, and in moving the adoption of the report and accounts (Elec. Rev., March 18th, p. 445), referred to the death of Sir J. S. Harmood Banner. He said that although the profit for the year appeared to be slightly lower, it was in fact higher owing to the disappearance of an item of debenture interest. Notwithstanding the difficulties of the past year, the company had achieved the largest output in its history, and although it was not yet working to the limit of its extended capacity, the prospects of the current year were encouraging. Referring to the company's contracts for the conversion of London telephones to automatic working, he said that it was hoped to introduce the service in the coming autumn. In addition to the progress made in London, the company had completed automatic exchanges at Shrewsbury, Gosport, Hayling Island, Ipswich, Cheltenham, Cosham and Marton, besides two manual exchanges at Weston-super-Mare and Upton. Considerable progress had also been made with the automatic equipment for Southport and Nottingham. In addition to those home contracts, several overseas orders had been completed, including those from Buenos Aires, Tokio, Sydney and Canberra (the Australian Federal capital). They had continued to receive valuable assistance from the Automatic Electric, Inc., Chicago, the pioneers of the Strowger system, which was now represented by over 3,000,000 stations. In the foreign market the company had demonstrated its ability to compete successfully in quality and price with the rest of the world. Dealing with the domestic apparatus branch of the business, the chairman said that the coal dispute had stimulated the demand for electric heating and cooking appliances and the company had secured a good share of the business. All steps were being taken to increase sales further by the improvement of the existing appliances as well as the production of new ones. The demand for their telegraph products maintained a steady level, but the mine-signalling branch naturally suffered. The company had developed a sub-station automatic control system; four examples of that system had been installed for Colonial railways, and several comparatively large schemes were under consideration. The building extensions had been completed, and those and the constant introduction of improved methods maintained production at a high level of efficiency. In conclusion, Sir Alexander referred to the work of the Telephone Development Association, the training of students at the works, and employés' welfare.

International Automatic Telephone Co., Ltd.

The annual meeting was held on April 8th. Sir Alexander Roger presided, and in the course of his speech dealt with the progress which had been made by the Automatic Telephone Manufacturing Co., Ltd. He said that it was seven years ago since the company undertook the exploitation of the foreign business of the manufacturing company and during that period a substantial business in many important centres abroad had been secured. The chairman then referred to the proposal to cancel the option which Messrs. Theodore Gary & Co. held on the issued preference capital of the company. (This was outlined in our issue of March 25th, p. 485.) He said that Messrs. A. F. Adams, Theodore Gary, and H. L. Gary (all American directors) had resigned from the board, being unable to give sufficient time to the company's business, although they promised the continuance of their support. Mr. H. L. Harris (a director of Theodore Gary & Co.) and Mr. G. W. Moore (manager of the Automatic Telephone Manufacturing Co., Ltd.), had been appointed to the board. Sir Alexander then dealt with the work of the Telephone Development Association and claimed for it a substantial part of the 8-11 per cent. increase in telephones during 1926. In conclusion, the chairman said that the A.T.M. Co. had invited the company's staff to participate in the benefits of the pensions fund, and arrangements were being made to give effect to that. The report and accounts were adopted, and at a subsequent extraordinary meeting resolutions were approved giving effect to the cancellation of the option upon the preference shares referred to above.

St. James' and Pall Mall Electric Light Co., Ltd.

The annual meeting was held on April 5th, Mr. G. W. Balfour (chairman) presiding. In presenting the report and accounts (Electrical Review, March 25th, p. 486), Mr. Balfour first referred to the death of the late chairman (Mr. Walter Leaf); to the resignation of Sir A. B. W. Kennedy from the position of chief engineer; to the appointment of Messrs. Andrews and Rowland as joint engineers; and the election of Mr. C. P. Sparks to the board. Turning to the accounts, he explained the altered form adopted, and said that the cost of energy had increased owing to the coal dispute, and the rates had also risen to a large extent. Special charges had to be met on account of the general strike, but absolutely no interruption had occurred in the supply. Owing to the reduction in the tariff, &c., the revenue had fallen by £11,000, although the sales had risen by 2.41 per cent. The growth of the demand was satisfactory. In the Regent Street and other areas additional converting plant and mains were being installed. Mr. Balfour then referred to the handing over of the Grove Road station to the London Power Co. The Central Co., he said, would continue as a separate entity; it had capitalised and distributed £225,000 of its free reserves in the form of £5 ordinary shares between the St. James'

and the Westminster Companies; in the case of the former the amount thus received was included in its free reserves and formed part of the £440,000 capitalised last year. They looked to the London Power Co. to effect economies in generation. A pension fund had been established for the employés, and to it the company had transferred £30,000 fully paid £1 ordinary shares. The report and accounts were adopted.

Metropolitan Electric Supply Co., Ltd.

Mr. G. Balfour, M.P. (deputy-chairman) presided at the annual meeting in the absence, through illness, of the Chairman, Mr. A. W. Tait. In presenting the report (*vide* Elec. Rev., April 1st, p. 528), Mr. Balfour referred to the altered method of producing the accounts, and said that they had a contract for nine years with the London Power Co. to take their requirements for the London area in bulk. With regard to the Western area, they were free to make their own arrangements. In the latter area they operated under a special Act enjoying perpetual tenure for the supply of electricity in bulk. They also owned the Uxbridge, Chesham and Brentford undertakings. The active policy of expansion adopted by the directors was indicated by the fact that during the past four years, £642,815 had been spent on mains and distributors. During the current year, £64,000 would be spent in the London area and £183,000 in the Western area for similar purposes. The output during the year was 84,800,000 kWh, of which 51,200,000 kWh was supplied to the Western area. The increase in business was larger than the increase in revenue indicated, for reductions amounting to £46,000 were made to consumers. Mr. Balfour quoted figures to show that during the past year no advantage had been gained by the company under the altered conditions. Other figures presented showed that the increase in gross receipts during the last five years had been a little over 2 per cent. in the London area and 200 per cent. in the Western area. After referring to the exchange of the 3½ per cent. mortgage debenture stock for Government loan stock, Mr. Balfour said that notice had been served on the holders of the 5 per cent. extension debentures that these would be redeemed on April 1st. The dividend paid for last year amounted to 12 per cent. on the original capital as against 11 per cent. for 1925. In seconding the motion for the adoption of the report, Mr. G. Verity said that the publicity given to the new Electricity Act had stimulated the sale of energy, and the company had experienced an increased demand from domestic consumers; the board was encouraging the growth of that business by the introduction of a two-part "all-in" tariff. The report and accounts were adopted.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The annual meeting was held on March 29th, Mr. R. P. Sloan, C.B.E. (chairman) presiding. In presenting the report (*vide* Electrical Review, March 25th, p. 486), the chairman said that 1926 was the worst year that the North-East Coast had ever experienced. At the commencement of the coal stoppage the company had three months' supplies in stock; during the remainder of the period, in preference to buying foreign coal, they had purchased locally supplies of cheap coal, some of which had been lying about for 50 years. They had taken less than 50,000 tons from abroad. There was a serious reduction in output, but an immediate recovery when work was resumed at the mines. The stoppage involved the loss of the waste heat with which they generated much energy, and working costs were increased all round. Since 1914 local rates paid by the company had increased by 516 per cent., while the capital had only risen by 156 per cent. The amount paid was about sufficient to pay a dividend of 1½ per cent. on the ordinary shares. There seemed to be no prospect of relief from that burden. During the past year the new connections amounted to 30,762 h.p.; the proportion of that represented by domestic supplies far exceeded anything experienced before. They had only aimed at connecting up 12,000 new consumers, whereas the actual number connected was over 16,000. It had been thought prudent to reduce the amount transferred to reserve, and although the dividend was reduced from 7 to 5 per cent., it was paid on a larger capital and could not be considered unsatisfactory. Capital expenditure during the year totalled £413,655. A considerable portion of that had been spent on h.p. transmission and the 66,000-V system between the Tyne and Tees areas had been completed; £79,147 represented expenditure upon generating station plant. Dealing with the prospects of the current year, Mr. Sloan said that there had been a considerable revival, and they could look forward with some degree of confidence. At the beginning of the year they had orders for a further supply representing 25,331 h.p., and 2,840 new domestic consumers had been connected. It was hoped to occupy the new offices before the end of the year. The report and accounts were adopted.

City of London Electric Lighting Co., Ltd.

The annual meeting was held on April 6th. Mr. J. B. Braithwaite presided, and in moving the adoption of the report and accounts (Elec. Rev., April 1st, p. 527), said that the condition of electricity supply in this country had reached a definite and important stage. The effect of the London Electricity Acts, 1925, was to define the position of the London companies and get rid of the vagueness and uncertainty which prevailed. The companies were bound down to certain charges and dividends; in their own case they had decided to adopt the 1922 dividend as a standard, and that would remain in force until 1932. They were also entitled to retain—if they could earn it—a sixth of the difference between the standard price and the actual sums charged to consumers, and the employés were entitled to a similar amount under a co-partnership scheme. Already the power stations of the East End group of companies had been connected in accordance with the provisions of their Act. With regard to the Electricity (Supply) Act, 1926, Mr. Braithwaite said that that measure should result in a general impetus in the use of electricity; there was a boundless field open for the supply of electricity if it could be made reasonably economical to employ electrical appliances. Although the company's sales of energy had increased by about 4,000,000 kWh during 1926 the revenue was over £20,000 lower; that was due to the reductions made in the charges to consumers. The results of the first quarter indicated that the year was going to be a prosperous one. The company was capitalising £400,000 of the reserves and each ordinary shareholder would receive a bonus representing 50 per cent. of his holding. That, of course, would not make any difference to the actual amount of dividend received.

South London Electric Supply Corporation, Ltd.

This company's accounts were reviewed in our issue of April 1st. (p. 528). Sir Harry Renwick, K.B.E., presided at the annual meeting on April 5th, and explained the alterations effected by the London Electricity (No. 1) Act, 1925. He said that the standard price and dividend had not yet been settled, and £33,874 was carried forward. The capital expenditure during the year was heavy owing to the installation of new mains to take additional supply in bulk from the County of London Co., but the money had been well spent. In spite of the troubles of the past year the sales had increased by 750,000 kWh, and the number of new consumers had shown a satisfactory rise. Referring to the new Electricity (Supply) Act, Sir Harry said that at no time was the company hostile to it, but every assistance was rendered to make it a workable and useful measure. The Act as passed was a marked improvement upon the Bill as deposited, and should give a tremendous impetus to the demand for electricity supply. The Act had possibilities for conferring untold blessings on the industry, and the Central Board would have the wholehearted support of the company. Dealing with the reorganisation of the London electricity supply industry, the chairman said that the company was now taking practically the whole of its supply in bulk from the County of London Co., and it was hoped that that would have a good result in the accounts. A considerable sum had been written off in respect of machinery which would not now be required. The prospects for the current year were good, and the progress made so far was excellent. The shareholders now had a gilt-edged security—a thoroughly sound investment for the next forty years. The report and accounts were adopted.

Para Electric Railways and Lighting Co., Ltd.

Sir Francis M. Voules, C.B.E., presided at the annual meeting on April 5th, and in the course of his speech said that the revenue from both tramways and power had improved and that, combined with a higher exchange rate, had increased the sterling gross receipts by nearly 42 per cent. It was expected that the current year would compare favourably with that under review, although the majority of British public utility companies operating in Brazil would feel the effect of the low rate at which the milreis had been stabilised (5⅞d.). There should, however, be a general improvement in trade which should bring greater income to the company. Just before the fall of the milreis to its present low value the new fares became operative; the uniform tariff was popular with their patrons and fair to themselves. The company had incurred expense upon the track and equipment, but it should earn a good return. He believed that the time was not far off when arrangements would be made to deal with the arrears of preference dividend; that had been retarded by the fall in the exchange.

Marconi's Wireless Telegraph Co., Ltd.

On April 7th an extraordinary meeting was held to confirm the resolutions for the reduction of the capital, &c., passed at the meeting on March 15th. Senatore Marconi presided and, in moving the confirmation, said that he had received a letter from Mr. Nordon's committee stating that it had been decided not to use the proxies at that meeting, but to make a protest when the proposals came before the Court. Mr. F. G. Kellaway seconded the motion, and Mr. Nordon then criticised the directors' proposals at some length. He contended that the resolutions before the meeting had not been passed effectively; a three-fourths majority had not been obtained. Dr. Sherlock (Dublin) supported the proposals on behalf of the Irish shareholders, and Major White also expressed his approval. Mrs. Farquhar Smith raised the question of the directors' remuneration and expenses, and Mr. Kellaway said that the figures quoted were greatly exaggerated. Eventually the confirmatory resolution was carried on a show of hands.

Bournemouth and Poole Electricity Supply Co., Ltd.

In moving the adoption of the report and accounts (Elec. Rev., April 1st, p. 528) at the annual meeting on April 7th, the chairman (Mr. J. A. Hosker) said that the output was

larger last year in spite of the coal dispute and general strike. The company had incurred extra expenses, but did not on that account increase its charges to consumers, although in March last year substantial reductions had been made. Dealing with the various items of expenditure, the chairman paid special attention to the amount of rent, rates and taxes paid, which, he said, was equivalent to 0.85d. per kWh. Rates, taxes and insurance absorbed £8,000 more than they paid for coal. Their efforts to reduce the costs by increasing the efficiency were largely negatived by the increase in those items. The business obtained so far this year was very satisfactory. In conclusion, he said that he had nothing further to report with regard to the acquisition of the undertaking by the local authorities.

London Electric Wire Co. & Smiths, Ltd.

The annual meeting was held on April 8th. Sir George H. Fisher-Smith (chairman), who presided, said that the company was in a very sound position. The troubles of the past year had reduced the output and lowered the profit by £12,437. The result was not unsatisfactory and was partly due to the provision of oil fuel in lieu of coal. The company's factories could have produced far more than they did in 1926, but the prevailing conditions restricted the amount of business available and the result was severe home and foreign competition. In conclusion, Sir George said that the Electricity (Supply) Act would not make itself felt for some time, but there was tremendous scope for development in this country.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Pinchin, Johnson & Co., Ltd.—17,500 ordinary shares of £1 each, fully paid, Nos. 522,501 to 540,000.

Shawinigan Water and Power Co.—72,816 shares of common stock of no par value.

The undermentioned have been ordered to be officially quoted:—

Ericsson Telephones.—99,980 (cumulative 7 per cent.) preference shares of £1 each, fully paid, Nos. 200,001 to 299,980.

Nigerian Power and Tin Fields, Ltd.

This company recently issued, for information only, a statement of its capitalisation and objects. It was formed on March 10th to generate and supply hydro-electric power to tin-mining companies and others operating on the Bauchi Plateau of Northern Nigeria. It is proposed to acquire a lease of the Kurra Falls (Gnar River) from the Nigerian Government for power purposes, as well as leases of other water and mining rights. The authorised capital is £500,000, of which the vendors, the Nigerian Base Metals Corporation, Ltd., are allotted £250,000, and will provide the working capital.

Richmond (Surrey) Electric Light and Power Co., Ltd.

Sir Harry Renwick, K.B.E., who presided at the annual meeting on April 7th, opened his speech with a reference to the death of Sir James Szlumper. Turning to the accounts (*vide* our issue of April 1st, p. 528), he said that, although expenses were greater on account of the coal dispute, the gross profit was slightly higher. There had been an increase in connections and output, although the directors' anticipations had not been fulfilled. They could look forward to better results in the current year, however, particularly if the present improvement in the country's trade continued.

German Companies.

The *Felten & Guilleaume Company*, Cologne-Mulheim, recommends a dividend of 6 per cent. for 1926, as in the previous year.

The *Transradio Company for Wireless Oversea Communication* reports that the extensions and improvements carried out in 1925 worked well during the past year. Considerable progress was made in the transmission of news to great distances by means of short waves, and a special building was established to deal with this service. The total of transmarine telegraphic traffic again experienced an increase. The accounts show net profits of 1,372,000 marks, as against 1,371,000 marks, and the dividend remains at 8 per cent.

The *Bergmann Electricity Works Company*, Berlin, reports net profits of 3,155,000 marks, as against 2,599,000 marks in 1925. It is proposed to increase the dividend from 6 per cent. to 8 per cent. The directors state that since the middle of last year business has improved and promises to extend further in the current year. It is proposed to raise the share capital from the 33,000,000 marks nominal to 44,000,000 marks.

The *United Aluminium Works Company*, Lauta, which is the controlling undertaking in this branch in Germany, and whose share capital is held entirely by the Reich, reports net profits of 4,250,000 marks, as compared with 3,930,000 marks in 1925. It is proposed to raise the dividend from 7½ per cent. to 8 per cent. Special appropriations are made to reserve as it is intended eventually to change over to the electro-thermic process for the production of alumina, so that it will then be necessary to write off the existing plant. The investigation of the bauxite mines in Hungary has revealed the existence of large deposits, and for this reason purchases from the Italian mines have been discontinued.

Belgian Company.

The *Société des Constructions Electriques de Belgique*, Brussels, reports a net profit of 1,775,621 fr. for the last financial year, as compared with only 109,140 fr. in 1925.

Cork Electric Tramways and Lighting Co., Ltd.

The revenue for the past year amounted to £138,900, and after providing for debenture interest, transferring £15,000 to depreciation and renewals reserve and £5,000 to general reserve, and adding £9,455 brought forward, there remains a balance of £29,994. It is proposed to pay a final dividend of 5 per cent. on the ordinary shares, making 8 per cent. for the year (against 6 per cent.), and to carry forward £14,630. The expenses were increased by the coal dispute, but the increase was more than offset by the rise in revenue. Meeting: April 22nd.

La Plata Electric Tramways Co., Ltd.

From the profits of the past year £8,500 is transferred to reserve and £5,000 to renewals, while a dividend of 1¼ per cent. is paid on the preference shares in respect of arrears, in addition to the year's dividend. £1,116 is carried forward.

Indo-European Telegraph Co., Ltd.

The directors recommend a final dividend of £1 2s. 6d. per share, free of tax, making 7 per cent., tax free, for the year. In addition, a bonus of 15s. per share, free of tax, is to be paid. This distribution is the same as for 1925.

Shropshire, Worcestershire and Staffordshire Electric Power Co.

The directors recommend dividends at the rate of 8 per cent. and 7 per cent. on the "A" and "B" ordinary shares respectively in respect of the past year.

Major & Co., Ltd.

The dividend for 1926 has been declared on the 6 per cent. preference shares, but the directors are unable to recommend any distribution upon the other classes of shares.

Wood & Cairns, Ltd.

The directors recommend a dividend of 7½ per cent. on both preference and ordinary shares for 1926.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets look forward to what may be expected to happen after Easter. For there is little enough business doing in the markets just now. Business is affected not only by the close approach of Easter, but by the still critical condition of affairs in China. The Budget is not so bad as might have been expected. The enormous deficit facing the Chancellor in connection with the year just ended has been known, of course, for the past fortnight, and its magnitude caused a good deal of uneasiness in the City. The manner in which the Chancellor has met the crisis came as a pleasant surprise to the many people who feared he would call for most of the loss to be met by heavy additions to income-tax.

The prices of investment stocks and shares maintain a firm front. Notwithstanding all the outpouring of new issues that has occurred during the past three months, there remains plenty of money available for investment. This seems anomalous, having regard to the fairly high Bank rate of 5 per cent. that has ruled over the past 16 months and the industrial conditions current during nine months of 1926. Practically every company report which appears nowadays contains references to the coal stoppage and the General Strike, blaming both for curtailment of profit or for working at an actual loss which the disputes entailed.

Nevertheless, prices keep up, for the reason that investment regards the events of last year as impossible of recurrence, and looks forward, as is its wont, to better times in the near future. It is on this impression that substantial rises have been reared during the last few business days in the prices of Home Railway stocks. The Undergrounds have failed to benefit to any marked extent, Districts and Metropolitans continuing at the same levels as before, while the Underground £1 shares have receded a trifle on selling by profit-takers who wanted to get their books clear before Easter. The steam stocks are strong, on expectations that the holiday traffics will show up very well against those of a year ago, and the further consideration that, for the next few months, every week will contribute to the extraordinary recovery which is likely to occur in the Home Railway industry as compared with the corresponding period last year.

The market for electricity supply shares is a good one, and the rises which have recently been achieved by Metropolitans, County of London and others are well maintained. There is a fair amount of supply obtainable in the list of ordinary shares, but amongst preferences the choice is more limited, owing to the ready manner in which shares are absorbed when they come to market. Brokers are frequently

asked to buy shares of which, when the market is tested, no supply is found obtainable, and it may prove of service to set out some of the amounts now on offer, or which were on offer at the time these paragraphs were written, giving the yield and other particulars. We draw these from a useful list issued by one of the principal firms in the electric lighting market of the Stock Exchange.

Stock. Offering.	Preference £1 shares.	Price.	Yield on last year's Dividend.	Dividends usually paid.
1,000	Adelaide Elec. 6½ p.c. "C" ...	21/9	5 19 6	M. & S.
5,000	Atlas Light and Power 7 p.c.	20/9	6 15 0	J. & D.
500	British Elec. Transformer 7 p.c.	18/9 xd	7 9 3	M. & S.
1,000	Calcutta Elec. Supply 5 p.c. (Tax Free).	21/3	4 14 0 net	M. & S.
1,000	City of London 6 p.c.	22/9 xd	5 5 6	M. & S.
2,000	Clyde Valley 8 p.c. (2nd) ...	27/6	5 16 6	J. & D.
5,000	County of London 6 p.c. ...	22/9	5 5 6	J. & J.
500	Edison Swan 7½ p.c. (1st) ...	23 9	6 6 3	F. & A.
2,000	Electric Supply 6 p.c. ...	21/3	5 13 0	J. & J.
1,000	General Electric 6½ p.c. "A"	23/9	5 9 6	J. & D.
1,000	Llanelly & District 6 p.c. ...	17/-	7 1 3	F. & A.
2,500	Midland Counties Elec. 6 p.c.	21/9	5 10 3	M. & S.
1,000	Newcastle-upon-Tyne Elec. 7 p.c.	24/3 xd	5 15 6	M. & S.
2,500	St. Maurice Valley (Red) 7 p.c.	20/4½	6 17 6	J. & A. J. & O.
1,000	Scottish Power 8 p.c.	25/-	6 8 0	F. & A.
2,000	Sevenoaks & Dist. 8 p.c. ...	25/-	6 8 0	M. & N.
1,500	South Metropolitan 7 p.c. (1st)	25/9	5 8 9	F. & A.
5,000	Yorkshire Elec. Power 6 p.c.	23/-	5 4 3	F. & A.

Babcock & Wilcox are repeating the previously-paid 13 per cent. free of tax dividend on the ordinary shares, the net profit for 1926 of £716,600 contrasting with £785,000 in 1925 and £760,300 in 1924. The capital during the three years has remained unchanged at £4,576,712. The company's reserves now stand at £952,000, this including the dividend equalisation fund of £400,000. The extensions which were made to the plant, &c., did not fulfil the expectations formed of increased production owing to the General and Coal strikes. The figures in the balance-sheet are, however, very good, and the price of the shares has risen 1/16th to 53s. 9d.

Johnson & Phillips recovered to 47s. 6d., after having dipped to 46s. 3d. Amongst various shares marked ex dividend last week are British Aluminium, British Electric Transformer preference and Metropolitan-Vickers shares of both classes. The Telegraph Construction Company has declared a dividend making 10 per cent. for the year, the same as that for 12 months ago, and the Great Northern Telegraph dividend of 20 per cent. repeats the distribution paid for 1925.

The Marconi market is quiet, though a little disposition is noticeable to buy the shares of the subsidiary companies. Marconis themselves touched 18s. before reverting to 17s. 6d., at which the price appears to have settled down, and which it is thought may mark the probable level of the shares between now and the time when anticipation will start discussing the expected dividend. In the cable group, the changes are mostly upwards. Westerns have risen to 17, and Eastern ordinary, ex dividend, is 172½, recovering part of the deduction made last Thursday, the Stock Exchange pay-day. Automatic Telephones are weak, the price giving way to 48s. 9d., and this in its turn influenced Internationals, which are a somewhat dull market at 2 1/16. The deferred stand about 1s. less. Telephone Manufacturing have hardened a trifle to 7s. 3d.

The list of home and foreign tramway stocks is quiet and somewhat uninteresting. Brazilian Tractions fell a point; Barcelona Tractions, on the other hand, keep good at 48. Anglo-Argentine Tramways preference shares are steady, in spite of a rumour to the effect that the expected settlement between the company and the Buenos Aires municipality is by no means reached even yet. The report of the La Plata Tramways shows the company to have turned the corner after a good many years of unprofitable working. The dividend of 6 per cent. on the preference shares is to be met, plus 1½ per cent. on account of arrears, which at the moment stand at 71 per cent. The price of the preference is 20s. 6d. cum eighteenpence dividend, and a little speculation has developed in the ordinary, which stand at 4s. 1½d.

Some little talk has arisen, as mentioned here before, of low-priced tramway shares offering scope for speculative possibilities. Nobody would think of buying the shares as a serious investment, but, taking the ground that the L.C.C. has far too much money locked up in tramways for the Council to abandon the latter altogether, it is contended that the day must come when, agreement having been reached on traffic control, the London tramways will be taken seriously in hand and set upon a paying basis. This is the reason that inspires a little inquiry for such shares as London United Tramways ordinary and preference, London and Suburban Traction ordinary and preference, and one or two others. There is not much market in these shares, and anybody who buys them does so in the full expectation of having to put them away for some considerable time, the aim being not so much a present profit of a shilling or so per share, but of doubling the money in days to come. For people who like this kind of speculation, it must be admitted that the low-priced tramway shares hold a certain amount of attraction, but clearly they are not for the widow or for the orphan.

Pennsylvania Water and Power shares are 5 dollars higher at 194½: Mexican Light and Power first mortgage bonds shed 3. The Rubber share market is quiet and featureless. Iron and steel descriptions show a harder disposition, on the hope of more favourable trade in the ensuing months of this year.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Apr. 11 1927.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	60/9	—	4 12 0
Brompton Ordinary	£1	10	8⅜	25/6	+6d.	7 5 3
Charing Cross Ordinary	£1	15	8⅞	25/-xd	—	5 12 0
do. do. 4½ Pref.	£1	4½	4½	17/-	—	5 6 0
Chelsea	£1	12	8⅞	25/-	—	5 12 0
City of London	£1	15	10	2⅜xr	—	5 1 10
do. do. 6% Pref.	£1	6	6	22/6xd	—	5 6 8
Clyde Valley	£1	8	8	31/-xd	—9d.	5 3 3
County of London	£1	15	7⅞	27/6xd	—	5 1 10
do. do. 6% Pref.	£1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	£1	7	8	26/3	—	6 2 0
do. 7% Pref.	£1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	£1	10	10	31/3	+9d.	6 8 0
Kensington Ordinary	£1	15	8	25/-xd	—6d.	5 12 0
Lancs. Light and Power	£1	7½	7½	26/-	—	5 15 5
London Electric	£1	10	8½	24/-xd	+6d.	5 16 8
do. do. 6% Pref.	£5	6	6	5⅞ xd	+⅛	5 10 4
Metropolitan	£1	11	8	28/-xd	+3d.	5 0 0
do. 4½% Pref.	£1	4½	4½	17/-	—	5 2 10
Midland Counties	£1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary	£1	7	5	22 6xd	+9d.	4 9 0
do. 5% Pref.	£1	5	5	17/6xd	—	5 14 3
do. 7% Pref.	£1	7	7	24/- d	+6d.	5 16 8
Notting Hill 6% Pref.	£10	6	—	10	—	6 0 0
North Met. Elec. 6% Pref.	£1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	£5	17½	8	25/6xd	—	5 9 10
South London	£1	15	8½	25/-xd	+6d.	5 12 0
South Metropolitan Pref.	£1	7	7	1¼	—	6 3 0
Urban Ordinary	£1	4	7	25/6	—	5 9 10
do. 6% Pref.	£1	6	6	1⅛	+9d.	5 13 0
Westminster Ordinary	£1	15	8⅝	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	20 3	—	7 8 2
Yorkshire Elec.	£1	8	8	29/6	—	5 8 4
Home Rails.						
Central London Ord. Assented	Stock	4	4	70	—	5 14 4
Metropolitan	,,	5	3	62½	—	4 16 0
do. District	,,	3½	3½	59	—	5 18 8
Underground Electric	£1	Nil	1½	16/-	-6d.	1 17 6
do. do. Income	Bonds	6	6	102	—	*5 17 8
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	100	—	6 0 0
do. Def.	,,	1½	1½	23⅞	—	6 6 0
Automatic Telephone	£1	3	10	48/9	—1/3	4 2 4
Chili Telephone	£5	5	6	6⅜	+⅛	4 11 6
Cuba Sub. Ord.	£10	5	5	7	—	7 2 10
Eastern Extension	£10	10	10	17⅜xd	—	*5 14 10
Eastern Tel. Ord.	Stock	10	10	172½xd	+1	*5 15 10
Globe Tel. and T. Ord.	£10	10	10	18½	+¼	*5 8 1
do. do. Pref.	£10	6	6	10⅞	+⅛	5 10
Great Northern Tel.	£10	20	20	27	—	7 8 2
Indo-European	£25	8½	10	46½	—	*5 7 6
Marconi	£1	Nil	Nil	17 6	—	... ...
Marconi-Marine	£1	10	7½	23/9	—	6 6 4
Oriental Telephone Ord.	£1	12	12	52/-	—	*4 12 4
United R. Plate Tel.	£5	8	8	8⅛	+1/16	*4 11 5
Western Telegraph	£10	10	10	17	+⅛	*5 17 8
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	3⅜	+⅛	8 2 6
do. do. 2nd Pref.	£5	6	6	3 5/16	—	9 1 2
do. do. 5% Deb.	Stock	5	5	71½	—	7 0 0
British Electric Traction Ord.	,,	8	—	142½	+1	5 13 8
do. do. 6% Pref.	,,	6	6	109	—	5 10 1
Brazil Traction	£100	5	6	136	—1	4 8 3
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	6¾	6¼	115½	—1	*5 8 3
do. do. Deferred	,,	8	—	156	—	*5 2 9
do. do. Deb.	,,	4¼	4¼	79½	—	5 7 0
London & Sub. Trac. 5% Pref.	£1	Nil	Nil	7/9	+6d.	Nil
London United Tram. Deb.	Stock	4	4	51	—	7 16 10
Mexico Trams, 5% Bonds	—	5	5	21	—½	6 18 0
Mexican Light Common	£100	Nil	Nil	45	—1	Nil
do. Pref.	£100	Nil	Nil	99½	—	Nil
do. 1st Bonds	—	5	5	68½	—3	7 6 0
Yorkshire (West Riding)	£1	5	—	8/9	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	£1	13	13	53/9	+1/3	*4 16 9
British Aluminium Ord.	£1	12½	10	43/9xd	—3d.	4 9 5
British Elec. Transformer Pref.	£1	Nil	7	18/ xd	—9d.	7 9 0
British Insulated Ord.	£1	15	—	70/-	—	4 5 9
Brush Ord.	£1	10	—	28/3xd	—	7 1 7
Callenders	£1	15	—	3½	—	4 5 9
do. 6½% Pref.	£1	6½	6½	23/9	—	5 9 5
Crompton Ord.	£1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	£1	10	—	80/-	—	6 13 4
Enfield Cable Pref.	£1	7½	7½	1½	—	6 6 4
English Electric	£1	Nil	Nil	10/-	—	... ...
do. do. Pref.	£1	3	—	12/6	—	... ...
Gen. Elec. Pref.	£1	6½	6½	23/6	—	5 10 8
do. Ord.	£1	7½	—	30/6	—	4 18 4
Henley	£1	20	—	90/-	—	4 8 11
do. 4½% Pref.	£5	4½	4½	4½	—	5 6 0
India-Rubber	£1	5	5	18/9	—	*5 6 8
Johnson & Phillips	£1	17½	—	2⅜	—1/16	7 7 4
Met.-Vickers Ord.	£1	8	8	27/6xd	—	5 11 4
do. Pref.	£2	8	8	2⅜xd	—1/16	6 14 9
Siemens Ord.	£1	7½	—	26/9	—	5 12 2
Telegraph Construction	£12	10	10	29	—	*4 2 9

* Dividends paid free of Income Tax.

French Industrial Progress.

The Export Position Strengthened.

THE Department of Overseas Trade has recently published a report (through the Stationery Office, 7s. 6d. net) upon the economic and industrial conditions in France, 1925-26, by Mr. J. R. Cahill, Commercial Counsellor at the British Embassy, Paris.

The introduction to this report deals with the recovery of France from the effects of the war, with particular reference to the reconstruction of the devastated provinces. This reconstruction has been assisted by the employment of efficient up-to-date machinery; in the mining industry, especially, the equipment has permanently enhanced efficiency. The shortage of agricultural labour has been met by the "importation" of foreigners and by State aid for the installation of electricity in rural districts—a movement which is making immense progress. State aid has also been accorded to the great electrification schemes of the Paris-Orleans and Southern Railways. The supply of electricity is being universalised by the co-operation of private persons and public authorities, and the eventual realisation of the great Rhône and Rhine canal and water-power schemes and other projects held in abeyance through lack of funds will further endow permanently the national economic equipment. The introduction includes a table showing the advance made since 1913 in the direction of plant and equipment. The increase in generating capacity is indicated. Hydro-electric installations have risen from 647,000 kW in 1913 to 1,900,000 kW in 1926; and "thermic" stations from 1,000,000 kW to 3,500,000 kW. The electrified mileage of the railways rose from 153 in 1913 to 820 (estimated) in 1926.

A large portion of the report is devoted to the financial situation and the efforts of the Government to stabilise and restore the currency are dealt with. Other matters which receive attention are the proposed tariff revision (a translation of which was recently published by the Board of Trade), trade fairs, commercial treaties, &c.

The Electrical Industries.

Mr. Cahill says that the French engineering industries, which are stated to employ a total of 800,000 workers, have, with few minor exceptions, enjoyed full prosperity during the last eight years, broken only for a time in 1920-21. The automobile and electrical industries together probably employ half of the total number of workers and have had a brilliant course. The transformation brought about during the war has placed France in the front rank of industrial countries, an evolution which is testified to by the expansion of engineering exports. As regards the electrical branches, while the railway electrification and hydro-electric programmes were not proceeded with so rapidly as had been anticipated, owing to financial stringency, steady progress was made. The general advance in the utilisation of electricity in factory, farm, office and home, however, provided ample compensation. Out of a total of 38,000 communes in France, the number supplied with electricity has grown from 2,000 in 1911 to 6,820 in 1918, 8,200 in 1922, and 16,000 in 1926. The consumption per head of population has been increasing at the rate of 15 per cent. per year. In Paris itself the consumption (140 kWh per head) represents an increase of 370 per cent., as compared with 1913. The consumption in Lyons is 516 kWh, in Marseilles 216 kWh, in Strasbourg 230 kWh, and in Annecy 630 kWh. The advance of radio has also afforded much additional employment to the industry, and the development of the telephone services has had a similar effect. In foreign trade France has made astonishing progress. According to the French Federation of Electrical Associations, the share of France in the international trade in electrical material rose from 6 per cent. in 1913 to 11 per cent. in 1924. That of Germany had diminished, that of Switzerland had slightly increased, and the share of the United States had increased by 50 per cent. In actual figures, French exports rose from 10,400 tons in 1913 to 16,700 in 1923, and 23,600 in 1924. There was a fall to 20,200 tons in 1925, and the total for the first nine months of 1926 was 15,460 tons. The fall is said to be due to the shortage of labour and the keen home demand.

The capital invested in the electrical industries is computed at 8 milliards of francs. The leading position is held by the supply industry with an investment of 5 milliards. In the manufacture of electrical material the capital employed is stated to be 2.2 milliards. The heavy material branch shows a capital of 400 millions, and an annual output valued at 350 millions. The light material branch raised the value of its output from 45 millions in 1913 to 250 millions in 1925, and its exports increased five-fold during the same period. The value of the output of accumulators and dry batteries is five-fold (100 million fr.) for that of 1913, and of exports four-fold. The output of porcelain insulating material rose from 5,000 tons in 1913 to 20,000 tons in 1925. The comparatively new radio industry has an investment of 250 million francs.

A table showing France's foreign electrical trade indicates that the imports rose from 7,600 tons in 1913 to 7,800 tons in 1925; and the excess of exports over imports from 2,600 to 12,400 tons.

Electricity Production and Distribution.

At the beginning of 1925 the total installed capacity was put at 5,042,108 kW (3,228,848 kW "thermic" and 1,813,260 kW hydro-electric). Of the latter there were officially stated to be 213 stations with a power of 1,000 kW or over, representing a total of 1,263,260 kW, and 42,000 stations of less than 1,000 kW making up the balance. The normal capacity of the large stations was given as 683,750 kW. As expressed in h.p., an official return assigns, out of a total of 2.4 million h.p., 1.35 million to general distribution, 0.85 million to electrochemical and electrometallurgical industries, 0.1 to traction, and 0.1 to miscellaneous uses. The increase of one million h.p. since 1914 is almost entirely due to the creation of large stations. France now ranks second to Italy in the list of European hydro-electric countries, but development in Italy is proceeding more rapidly. Among the thermic stations there are at least 11 with a capacity of over 50,000 kW, of which five are in the Paris area (including Gennevilliers—340,000 kW). The principal developments in this direction have taken place in the north of France. In 1926 France possessed 7,000 miles of e.h.p. and h.p. lines. The State has spent nearly 200 million fr. on the distribution of electricity in the devastated areas.

Reverting to hydro-electric power, it is estimated that the potential water power in France amounts to 10 million h.p., of which 5 million h.p. is in the Alps, 2 million in the Pyrenees, and 2 million in the Central Plateau, Eastern France, and the Jura. Schemes are in hand for the development of 330,000 kW, of which 90,000 kW can be in operation by January 1st, 1928. Owing to the tightening of money and the more plentiful supply of coal construction has slackened and little progress has been made with certain of the larger schemes. In 1925 State assistance to the extent of 10,800,000 fr. was given to water-power projects.

Railway Electrification.

The report says that slow but steady progress has been made in the electrification programmes of the two railways which have definitely adopted the policy of electrification on a large scale, namely, the Paris-Orleans and the Midi (Southern) Railways. The Paris-Lyons-Mediterranean Railway appears to be confining its construction to the Culoz-Modane line (84 miles). Electric trains are now operating on several sections of the Paris-Orleans line and the company's auxiliary, the Union Hydro-Electrique, has opened its 80,000-kW station at Eguzon. The Midi Company has completed two long stretches, Toulouse-Dax and Bordeaux to the Spanish frontier and several branch lines. Three power stations in the Western Pyrenees and three in the Eastern Pyrenees, out of five and seven, respectively, are now in operation. The programme of the three railway systems mentioned provided for the electrification of about 2,000 miles in each case. At the date of the report the following proportions had been executed:—Midi, one-third; Paris-Orleans, one-eighth; and Paris-Lyons-Mediterranean, one-twentieth. In addition to these many smaller lines have undertaken electrification.

Telephones and Radio.

The latest figures available show that the number of telephone subscribers in France had risen from 310,000 in 1913 to 635,000 at the end of 1924. Many improvements and extensions have recently been effected. In April, 1926, an underground cable between Paris and Strasbourg (494 km.) was opened; this was to be followed by cables connecting Paris with Rouen, Havre, Lille, Lyons, and Marseilles.

A great deal of work has been done in the direction of linking up France with her colonies by means of radio-telegraphy, and a number of important stations are now working, while others are in hand. With regard to broadcasting, the report states that the number of persons with receiving sets is large and increasing.

General.

Among other matters, the report refers to the rapid development of the French aluminium industry, and says that the home demand is still greater than the output. Rapid progress has also been made by the electrochemical and electrometallurgical industries, which at the beginning of 1926 had an estimated capital of 1,155 million fr. Reference is also made to the proposed revision of the tariff; pending this the Government made two increases of 30 per cent. in specific duties during 1926, while *ad valorem* duties were left unaltered. (Since the report was issued the Board of Trade has published a translation of the proposed new tariff.)

A Railway Signalling School.

The newly-established school of the London Underground Railways at South Kensington, which is equipped with all types of electric signalling apparatus at present in service.

A SCHOOL for the training of signal linemen, fitters, and installers of the London Underground Railways has recently been established at South Kensington, Piccadilly Line, where classes are held and opportunities afforded for voluntary technical and practical training. The school, which is accommodated in a tunnel adjacent to the station, is laid out part as a laboratory and part as a lecture room, the latter having a capacity for about 60 students. The laboratory is equipped with every class of signalling apparatus actually employed on the railways so as to represent as nearly as possible actual working conditions.

A miniature track has been arranged over a bench running the whole length of the room, fig. 1. To this track is connected track-circuiting apparatus standing on the bench below, so that the whole is completely exposed for inspection and demonstration. On the left of the gangway running in front of the bench are arranged signals and train stops controlled from the miniature track, the whole representing a length of line equipped for automatic signalling. Five different types of track circuit are installed to work in conjunction with the miniature lay-out, and the whole shows clearly the operation of the signals corresponding to the positions of the trains on the line. The track circuits include the following types: diagram, condenser-feed, resistance-feed and impedance-bond, all for a.c. operation and working in conjunction with various types of signals.

One end of the room is fitted up to represent a signal cabin complete with a 7-lever power frame and illuminated diagram, fig. 2. The frame controls five signals and one pair of points;



Fig. 1.—Signal School, showing Miniature Track.

a king lever is fitted, which, when reversed, allows certain of the signals to work automatically. The various relays working in conjunction with the signals controlled from the power frame are exposed for inspection, and the whole of the apparatus is wired up and operates exactly as in actual service.

A length of full-size permanent-way, fig. 3, runs along the school on the lower level, and in conjunction with this signals and apparatus are fitted in the same manner as on the railways. The permanent-way is complete with a pair of points, to which a full-size point lay-out of the L.E.R. electro-pneumatic type is fitted. The layout is equipped with an escapement and a lock and detector box, and does not allow the signals reading over the points to be cleared if the switches are not closed to within $\frac{1}{8}$ in. of the stockrail in the right direction. This means that should the points become jammed through any foreign matter getting into the switches, the lever in the cabin would be held half-way over, the signal remaining at danger. This is carried out by means of a relay situated in the signal cabin and worked through the detector box on the points. An additional safeguard fitted to this layout is a special track lock which fixes the bolt of the points in the locked position so long as there is a train running over the track circuit in the vicinity of the points, thus preventing the possibility of the points being thrown whilst a train is

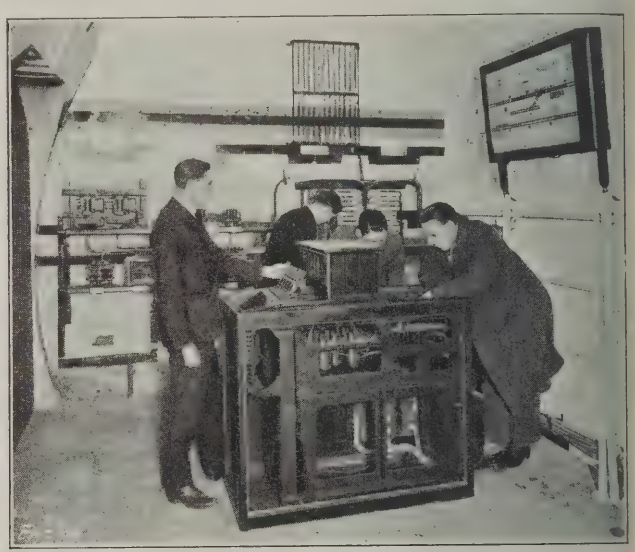


Fig. 2.—Signal Cabin.

passing over them. An a.c. electric point machine and controller is connected up so that it can be operated from a tumbler switch and the functioning of the machine watched.

Every type of track-circuit and other signalling apparatus employed on the railways is represented on the permanent-way.

An interesting feature of the equipment is an experimental track circuit for showing the effect of wet or dry weather on a track circuit. The apparatus is arranged in a tank and

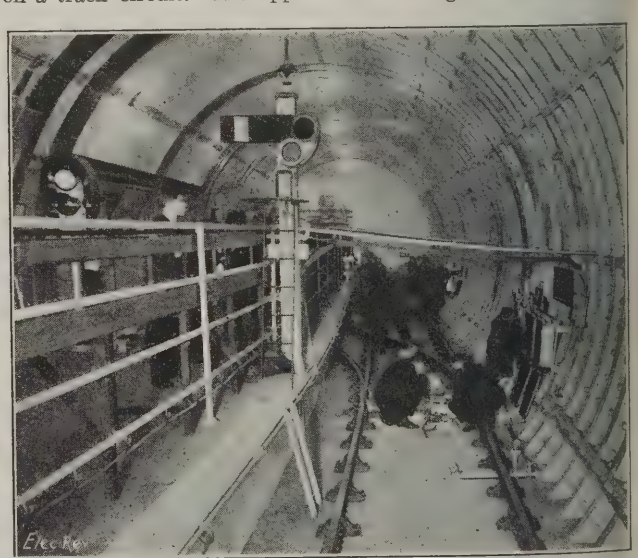


Fig. 3.—Permanent Way.

a number of wire tails hanging from a pair of "rails" vary the leakage resistance of the circuit according to the depth of water, representing various weather conditions.

Examinations are held at the end of each session, so as to gauge the progress of the students. The school is also used for the examination of each individual lineman before he is placed in charge of a section on the railways.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

An Electric Safety Kettle.

A recent production of MESSRS. SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, London, E.C.4, is the "Xcel" safety kettle. This is fitted with an automatic cut-out which breaks the circuit at a temperature a little above boiling point. The cut-out embodies a bridge contact which is normally held across two spring terminals by means of a fusible nut engaged with a screw in the kettle bottom. When the kettle runs dry the nut fuses and releases the bridge, which

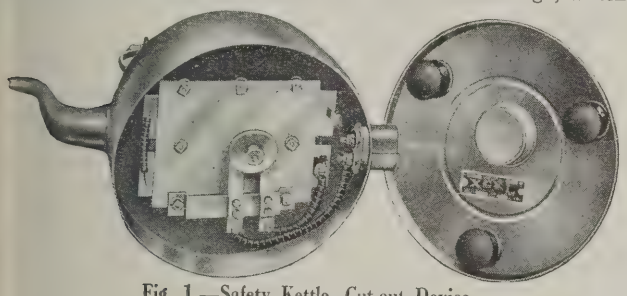


Fig. 1.—Safety Kettle, Cut-out Device.

is dropped into a small well pressed into the bottom cover. The break is assisted by a spring. A new collar can be screwed on without the aid of any tools, when the kettle is ready for service again. Each kettle is supplied with one spare fuse, and the cost of new fuses is negligible. Fig. 1 shows the automatic arrangement in the bottom of the kettle, the cover being removed. The appliance is made in capacities of 2¼ and 3¼ pints, with respective loadings of 650 and 800 W, and is made up in polished copper, nickel-plate or silver-plate.

An Electric Lawn Mower.

We illustrate in fig. 2 an electric lawn mower, the "Electra," which has been recently put on sale by MESSRS. RANSOMES, SIMS & JEFFERIES, LTD., Orwell Works, Ipswich. This is an entirely new model, and is fitted with a totally enclosed electric motor. The special features claimed for it are the independent drives to the cutting cylinder and land rollers, and the simplicity and ease with which it is operated. The cable is manipulated and controlled by a patented cable arm. The cable connection is similar to that for an ordinary electric fire or vacuum cleaner, and the motor is started by

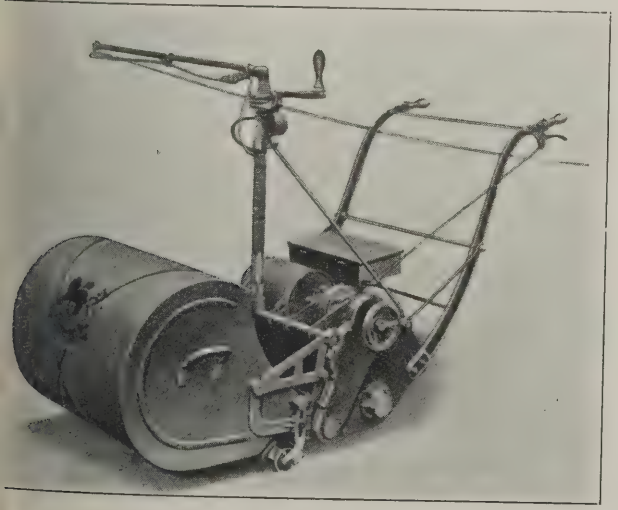


Fig. 2.—Electric Lawn Mower.

means of a simple switch. The machine is constructed with rolled-steel side-frames, ensuring, it is claimed, rigidness and efficiency in work on all classes of lawns. The high-speed cutting cylinder and the vibrationless electric drive should make this machine an ideal power mower for bowling greens.

A New Electric-Bell System.

In order to provide a means of using the ordinary signalling bell in conjunction with the electric lighting installation, without the introduction of expensive transformer apparatus, Mr. W. K. LEWIS, 54, Muswell Road, Muswell Hill, London, N.10, and Mr. A. J. ANIDO, 60, Chancery Lane, London, W.C.2, have brought out a new system which is intended to be installed at the same time as, and in conjunction with, the electric lighting system. Fig. 3 shows the arrangement for a simple system for a single bell (*g*) wired up with an indicator (*f*). One wire (*e*) only is employed for the bell which connects this, through the indicator, to a special 2-way switch or push (*c*) wired up in series with the ordinary lighting switch (*b*) on one way. The bell terminals

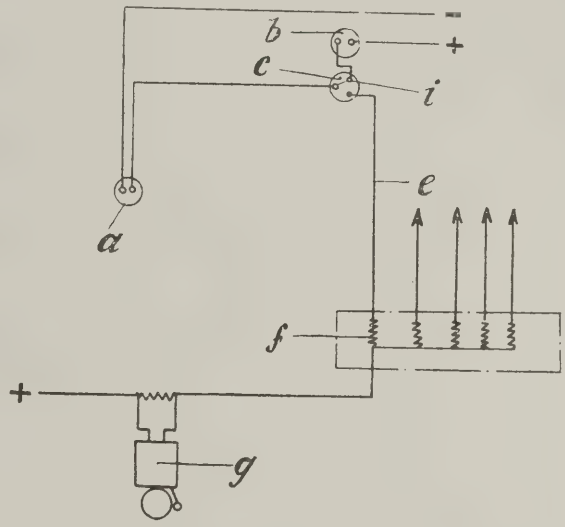


Fig. 3.—Novel Bell System.

are shunted so as to give a small volt-drop across the operating coil. With the 2-way switch in the lower position the bell shunt is put in series with the lamp (*a*) which indicates whether the bell receives the necessary operating current or not. The system is suitable for ordinary electric lighting pressures for which the wire and push are, of course, suitable. The indicator coil consists of only a few turns of low-resistance wire. It will be realised that the additional cost of the system over that for an ordinary bell circuit with batteries, the bell wire being drawn in with the lighting wires in the first place, is negligible.

An Improved Switch.

In our issue of September 17th, 1926, p. 479, we described a circuit breaker which had recently been introduced by MESSRS. J. G. STATTER & Co., Queen Anne's Chambers, Westminster, S.W.1. A modified design of this apparatus, which

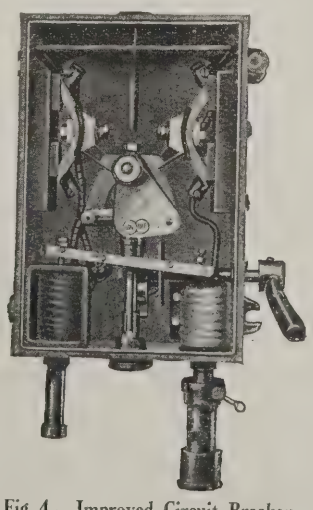


Fig. 4.—Improved Circuit Breaker.

still embodies the scissors movement of the laminated contact brushes, has now been produced, fig. 4. The main alteration is the provision of a side operating handle in place of a pull-down knob, enabling, it is claimed, the breaker to be more easily operated.

Electricity in Warships.

A survey of the applications of electricity on board British naval vessels.

By W. McCLELLAND, C.B., O.B.E., M.I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers.)

(*Concluded from page 576*).

Heating, Cooking and Baking.—Many types of electrical heating apparatus are being fitted in warships in increasing numbers, and in submarines general use is made of electrical methods as they are the only ones permissible when submerged. A standard radiator is used and electric fires of the imitation coal-fire type also are fitted in principal cabins and ward rooms. Two main types of elements have been standardised: the first consists of wire or tape wound on a mica former, and is intended for hot-plates, urns and kettles; the second consists of a coil of wire supported in a fireclay former and is a low-temperature element for use in ovens and hot-cupboards. Manufacturers, however, are permitted to supply approved low-temperature elements of their own design in lieu of the second type mentioned, but such elements must conform to specified dimensions and fixing centres. For radiators, a luminous type of element is generally required.

Two sizes of electric hot-cupboards have been designed for use in all types of ships. They are constructed of aluminium alloy, and are provided with lagging 2 in. thick, and the elements are mounted on the inside wall of the cupboard, being merely protected from damage by a perforated shield; elements can be readily renewed, the dimensions representing the clear space inside the cupboard :—

Size 1.—20 in. wide, 16 in. deep, 27 in. high—1,000 watts.
Size 2.—32 in. wide, 20 in. deep, 27 in. high—2,000 watts.

Electric bread-baking ovens of full-sack capacity are being fitted in the latest ships. Tried against a steam-heated oven, the electric oven showed marked superiority in the time required to attain baking temperature, both from the cold

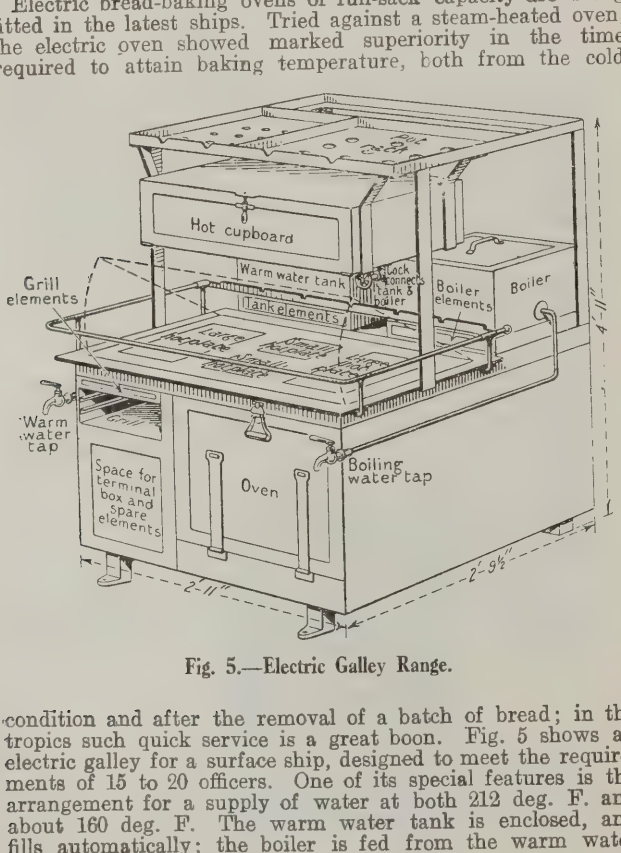


Fig. 5.—Electric Galley Range.

condition and after the removal of a batch of bread; in the tropics such quick service is a great boon. Fig. 5 shows an electric galley for a surface ship, designed to meet the requirements of 15 to 20 officers. One of its special features is the arrangement for a supply of water at both 212 deg. F. and about 160 deg. F. The warm water tank is enclosed, and fills automatically; the boiler is fed from the warm water tank.

Cables.—The total length of single conductor in a large warship is of the order of 300 miles, and the importance of obtaining cables which will satisfactorily withstand the severe conditions of naval service needs no emphasis. Single-conductor cables are used throughout for the electric light and power circuits, but multi-core cables are extensively used for the low-power installation and for the control of circuit breakers. A very wide range of patterns is covered by the standard sizes; rubber-insulated, lead-sheathed cables were adopted as the standard in the British Navy almost from the beginning of naval electrical work, and still form the bulk of those used in H.M. ships. Wire armouring is sometimes used over the lead where additional mechanical protection is required, *e.g.*, the multi-core cables for circuit-breaker control wiring. The important ring main and certain other cables which are paper-insulated and lead-sheathed are also steel-wire-armoured. In submarines tough-rubber-sheathed cables are largely employed on account of weight and flexibility in comparison with the stiffer lead-sheathed cables.

Considering rubber-insulated cables as a class, their most serious fault for warship work is the inability of the insulation satisfactorily to withstand the high temperature to which it may be subjected in service; it may reach 170 deg. F. on the lead with an environment of 150 deg. F., and with varying humidity of atmosphere the layer of pure rubber, which it has been the practice to use next to the conductor, becomes plastic, whilst the compound rubber in many instances becomes either plastic or hard and brittle, depending on the materials used and the conditions of manufacture. It is doubtful whether the pure rubber next to the conductor is of any real value for cables liable to be operated under the conditions mentioned, and it might be preferable to protect it by other means. It is specified that no dripping shall occur when a sample of the cable is suspended vertically for 24 hours at a temperature of 75 deg. F.; the viscosity of the impregnating compound is very important in warship work. With the ordinary commercial types of compound chamber for sealing the ends of cables feeding switches the impregnating compound tends to leak into the switch, especially if the box is situated below the level of the ring main. Instances are also on record owing to loss of impregnating compound, of short-circuit between cores occurring in multi-core, paper-insulated cables run vertically; the paper at the top of the run became dry and brittle and vibration caused it to flake away sufficiently to allow neighbouring cores to make contact. To overcome difficulties of this character it is necessary to design sealing arrangements capable of remaining oiltight under resin oil pressure of 50 lb. per sq. in. for 2 hours at a temperature of 200 deg. F. The introduction of paper-insulated cables for warship work, and the precautions taken in connection with them, have been fully justified by experience.

In addition to the fixed cables, a large amount of flexible cable is used in warships: it is rubber-insulated, but the mechanical protection depends on the service for which it is to be used and may be cotton braiding, cord braiding, phosphor-bronze braiding, tough-rubber sheathing, &c. For certain purposes, *e.g.*, gun-firing circuits, owing to run-out recoil of guns, &c., the conditions are particularly severe, and considerable trouble has been experienced by breakage of the conductors. Tough-rubber-sheathed cables have been used in which tinned steel wires have been incorporated in the conductors to secure additional strength and also in the sheathing itself for the same purpose, but more satisfactory results are being obtained with cables in which a canvas reinforcement is embedded in the tough-rubber sheathing.

Formerly the bulkheads were drilled and tapped for fixing purposes, and perforated plating was employed to a considerable extent in order to reduce to a minimum the drilling of bulkheads. With the development of satisfactory method of electrically welding studs to steel plates* the drilling objection does not apply, and cables are now secured direct to bulkheads unless obstructions, temperature of bulkhead, or other considerations render plating necessary.

Insulating Materials.—About 1904, an important departure was the introduction of the skeleton frame method of switch gear construction, the electrical gear being clamped to steel bars insulated by tight wrappings of micanite; it has been satisfactory in service, and has been standard practice in the British Navy for over 20 years. The main objection to micanite is the liability of the varnish binder to soften at comparatively low temperatures. The introduction of the phenol-formaldehyde varnishes, generally known as bakelite varnish, gave rise to the hope that this defect would be overcome, since this type of binder does not again soften after the initial baking process, but it is not yet easy to obtain consistent grades of bakelite to withstand the onerous conditions of naval service. Other insulating materials used in naval

* L. J. Steele and H. Martin: "The 'Cyc-Arc' Process of Automatic Electric Welding," *Journal I.E.E.*, 1922, vol. p. 136.

work, such as tapes, oils, varnishes, &c., are, in the main, the same as those used in ordinary commercial work.

Secondary Batteries.—The use of batteries in surface warships is comparatively limited. The electricity supply to the gunnery and torpedo control circuits, telephones, and certain navigational instrument circuits necessitates small batteries as a stand-by; they are also employed for auxiliary lighting in certain important spaces, such as gun houses, while they are also used for wireless purposes and for portable hand-lamps; for the last-named apparatus alkaline cells are being used to some extent. In submarines the whole of the power for underwater propulsion is provided by this means, and the onerous conditions of working make the provision of a reliable battery an extremely difficult problem. In a modern submarine the number of cells varies in different navies

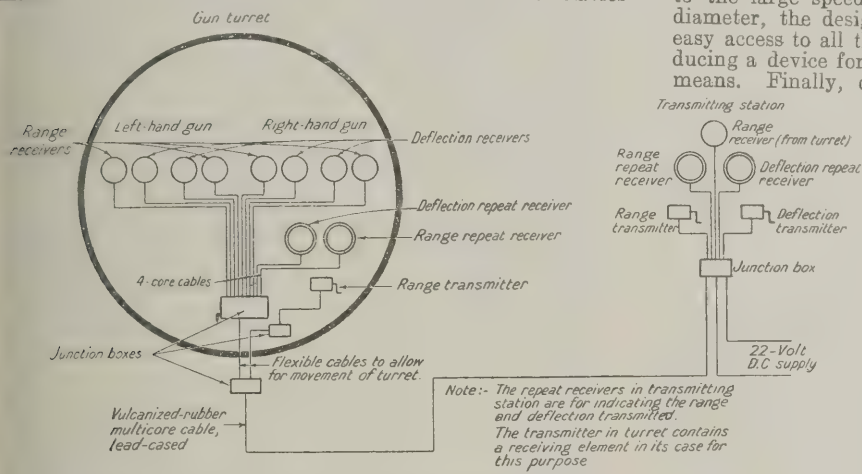


Fig. 6.—Range and Deflection Circuit.

according to the voltages used, the capacity of the cells ranging from about 2,000 to over 10,000 ampere-hours (5-hour rate).

The limited floor space available has necessitated the adoption of a cell of great length, compared with its lateral dimensions, totally enclosed except for a ventilation hole at the top. The plates are supported by the terminal lugs from the lids of the containers. All navies have experienced difficulty in obtaining satisfactory containers. Later types are of a special quality of ebonite, and in one case a bakelite product is being used successfully. Some difficulty has been experienced in so adjusting the composition that the containers will not deform when carrying the weight of the plates at temperatures up to 140 deg. F. and will not be brittle at lower temperatures. The necessity for packing the cells very tightly together imposes quite rigorous limits of accuracy in the manufacture of containers, the tolerance allowed being only 1/16th in. on any of the overall dimensions. Since 1911 pasted plates have been employed, and the rapid increase in the capacity/weight ratio which occurred about the year 1914 resulted in a battery with a very short life, from about 2 to 3½ years, although in especially good cases a life of 5 years has been obtained. The average condition of condemned pasted positive plates may be represented as follows:—

The lower third of the plate—all active material gone.
The middle third of the plate—50 per cent. of active material gone.
The upper third of the plate—25 per cent. of active material gone.

Although no satisfactory explanation is forthcoming, it may be connected with the very uneven current distribution consequent on the use of long, narrow plates; unless a cell is provided with some reliable mechanical means of preventing this shedding, it cannot be expected to give satisfactory service in a submarine. In proximity to the engines and in the tropics sulphation troubles sometimes arise, and there is increasing evidence that with the new types of cell, in which support is given to the positive paste, ultimate failure may be due to sulphation of the negative paste. It is customary in different navies to employ a lower acid density in the tropics than in temperate climates, the figure adopted generally corresponding to 1,210-1,220 at 60 deg. F.

It is desirable to regard ventilation as separate from the cooling, although they may be combined. In the later batteries used by several navies the closed cell is employed, the gases from each cell being led by small pipes into larger ones and thus exhausted. At the same time, air is drawn over the tops of the cells; very little cooling effect can be obtained through the container walls owing to their low heat conductivity, but the large mass of metal exposed at the top of the cell in the terminals and inter-cell connectors enables a considerable cooling effect to be obtained by this means.

Submarine Problems.—The submarine is an electrical ship, the electric motor having provided the best solution for underwater propulsion. To indicate the amount of electrical apparatus installed in a submarine, it may be stated that its weight is not less than 14 per cent. of the underwater displacement of the ship; the weight of the battery is about 7 per cent. A normal electrical output would be of the order of 1,400 s.h.p. developed on two propellers. When separate battery-charging generators are used, this output would be maintained at all speeds of the ship; that is to say, a propelling motor would be installed on each shaft to develop 700 b.h.p. at all speeds from, say, 250 to 400 r.p.m. at 300 volts. The motors are usually double-armature machines, with series-parallel battery grouping, which arrangement is well suited to the large speed-range necessary. Of an unusually small diameter, the design has also to incorporate some method of easy access to all the field poles and windings, either by introducing a device for turning the field frame on rollers, or other means. Finally, dissipation of the heat has already been satisfactorily accomplished by totally enclosing the motors and water-cooling the circulating air. The number of electrically-driven auxiliaries may be about 60, of capacities of 70 b.h.p. down to very small powers. Distribution is effected on the ring-main principle. Pressures of 120 to 230 volts, according to the type and nationality of the submarine, are used, and in consequence the currents to be dealt with are very high, and a number of large cables per pole may be required for portions of the ring-main system; power cables are usually tough-rubber-sheathed outside the pressure hull of the submarine, and special designs of glands and fittings have to be used to withstand high water pressures during submergence. Various warning alarms and the usual telegraph indicators and telephones are usually similar to those used in surface ships, and are operated from the 22-volt supply obtained from motor-generators.

Wireless Telegraphy and Telephony.—A large ship contains a number of wireless sets designed for different purposes; spark sets, arc sets, and valve sets, for both Morse and telephony, are used, the transmitting circuits ranging from about 15 kW to a fraction of 1 kW. The necessary power is usually obtained from the ship's d.c. supply through motor-alternators or rotary convertors, and step-up transformers. The high pressures and frequencies employed introduce special problems: examples are the special aerial trunks between decks, and the very thorough bonding and earthing (*via* the lightning conductor) of all isolated metal work on masts and yards, and the ends of wire stays and shrouds.

"Low-power" Apparatus.—A large amount of apparatus in a warship cannot conveniently be supplied direct from the lighting and power circuits. Some of this requires alternating current and some direct current; the pressure may be anything up to 100 volts, but by far the greater part is supplied at 22 volts d.c. by motor-generators *via* control

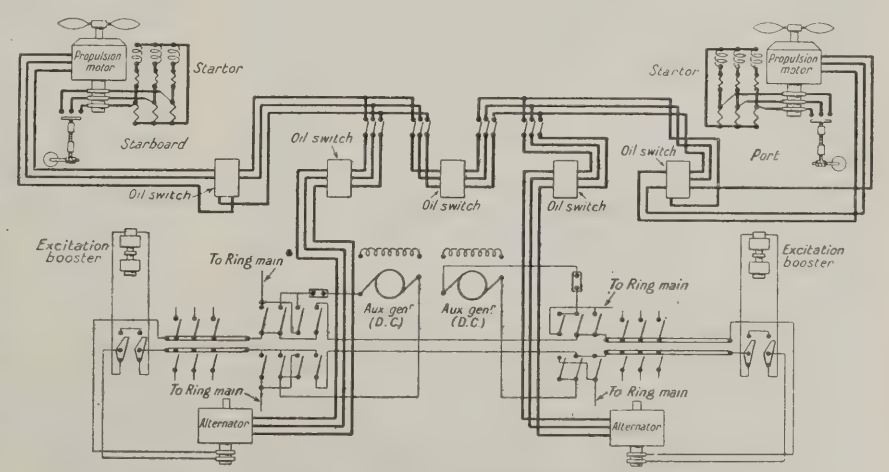


Fig. 7.—Auxiliary Diesel-electric Equipment, H.M.S. "Adventure."

apparatus and distributing panels feeding circuits grouped as follows:—

(1) Fire and torpedo control circuits; (2) telephone circuits; (3) miscellaneous low-power circuits such as bells and gongs, buzzers, rattlers, turbine and telegraph direction tell-tales, &c.; (4) gun and torpedo firing circuits.

In some cases any generator can feed any group normally run independently, and batteries, which normally float in parallel with their associated generators, can take over the load in the event of failure of the motor-generators. In the largest ships the capacity of these batteries may be some 500 ampere-hours at the 5-hour rate. Examples of low-power apparatus which is not supplied from the 22-volt installation referred to, but has its own motor-generator, are (1) hummers;

(2) bearing indicators for guns and searchlights; (3) turret danger signals; (4) gyro-compass and repeater circuits.

The control of guns, torpedoes and searchlight is complex, of great variety, and confidential.

The type of instrument most largely used is a simple step-by-step motor with unwound armature, in the stator of which a rotating field is produced by means of a commutator type of transmitter supplied with direct current. The rotor moves in steps of 15 deg., so that it has to be geared down considerably to obtain the accuracy required. The main installation consists of a multiplicity of such instruments and the necessary circuits of multi-core cables with their connection boxes, change-over switches, &c. For searchlights and certain other purposes where the accuracy required is not quite so high as for the guns, another method works on the Wheatstone bridge principle. In addition, numerous step-by-step indicators are employed for the passing of orders, ranges, and other information; a simple range and deflection circuit is shown in fig. 6.

For the electrical firing of guns by current growth to the value required to heat a fusible bridge and the surrounding pad of inflammable material to the ignition point, the circuits are usually made single-pole with an "earth" return. A most elaborate system of auxiliary apparatus, mostly electrically operated, into which the gyroscope enters to a large extent, is usually provided to assist the gunnery officers to make good practice.

Telephone communication is provided between all important stations and, in addition, between offices, cabins and other compartments. In a large modern warship there may be up to 700 telephones, of which some 370 are on the various exchanges with "trunk line" connections. All telephones are supplied from the low-power board; two wires per instrument are now generally used, and to prevent communication noises and cross-talking, inductive "line coils" are included in the supply to each pair of telephones, which also serve as relay coils; non-inductive shunts, or condensers, provide a path for the oscillating currents. Special loud-speaking telephones are used in particularly noisy compartments, or for "broadcasting" purposes.

Electric Propulsion.—The chief considerations are flexibility, weight, space and economy. The geared turbine drive certainly lacks flexibility. The economy of an electric drive can be made to approximate to that of a geared drive. At full power the efficiency of turbo-electric transmission is usually somewhat lower than that of a geared turbine drive. At lower powers, such as are required for cruising, the efficiency of the electric drive is usually higher than that of the geared turbine. The ability to drive all propellers at low speed from one generating unit only, appears to be an advantage from the military standpoint as well as from that of economy. The fullest use of science and skill must continue to be made by electrical engineers, in conjunction with marine engineers, if the well-established and efficient mechanical transmission is to be more than equalled with regard to (*a*) full speed of the ship, (*b*) weight, (*c*) space occupied, and (*d*) cost.

In *H.M.S. Adventure*, an auxiliary ship of approximately 8,000 tons displacement, Diesel-electric propelling machinery for cruising speeds has been installed, fig. 7. The power developed on each shaft is approximately 2,100 s.h.p. at a propeller speed of 160 r.p.m. A three-phase a.c. system is adopted, the pressure being 1,100 volts between phases. Two three-phase high-speed induction propelling motors are used, one for the port and one for the starboard side of the ship; each is normally supplied from its own alternator, which is directly coupled to a Diesel engine. The two 343-r.p.m., 1,650-kW alternators do not run in parallel; under emergency conditions, however, it is possible to run both motors from one alternator, or the port motor from the starboard alternator, or *vice versa* The motors have wound rotors and are brought up to speed by the use of reactance-resistance starters. Special provision is made for over-excitation of the alternators by the use of a novel type of automatic booster to meet the conditions of temporary or periodic overload due to heavy weather or similar causes.

The control of the motors and alternators is carried out by oil-break switches, with operating mechanism on the control platform in the Diesel-engine room. The control and operation of the plant has been so arranged that the whole sequence of operations is carried out by means of a single hand-wheel for each side of the ship, the usual protective devices being fitted. The paralleling of the alternators is prevented by mechanical interlocks. The installation is as simple as can be arranged; instruments of various types have been provided to supply all possible information for the study of the performance under varying conditions.

Miscellaneous Electrical Appliances.—There remain a number of miscellaneous applications which, although not large in themselves, are none the less important. Included in this category are gyro-compasses, hummers, rattlers, buzzers, turbine and telegraph direction tell-tale, Forbes log, turret danger signals, Röntgen-ray apparatus, electrically-driven domestic machinery, such as kneading machines, mincers, and laundry machines, electric torches and portable accumulator hand-lamps, electrically-driven printing machines, &c. The accumulator hand-lamps resemble miners' lamps, and are used for magazines and danger spaces; the alkaline cell is finding increasing favour for portable apparatus of this character.

Finally, as a last example of the extent to which a large variety of modern electrical apparatus has been adapted to naval needs, electric starting and lighting sets at 12 volts, on the general lines of motor-car equipment, find their application afloat in the motor boats of the fleet.

Conclusion.—Electricity is not only an invaluable adjunct, but has become an integral part of a fighting fleet's structure. It is recognised that the greatest progress is made by a proper understanding of when and how co-operation with research and other workers should be effected, and by a vigorous development of experimental work; but, in the selection of the most suitable equipment for warship work, caution is necessary, for any defect arising at a critical period in action in machines or apparatus fitted in large numbers in vital parts of a warship's installation may cause consequential damage to the community which may have very far-reaching effects.

The author emphasises the difficulties imposed by limitation of space and weight, sea conditions, extremes of heat and cold, the claims of other services in the ship, and the difficulty of fitting in one requirement with another. So far as the British Navy is concerned, all these conditions are reflected in the detailed requirements of the Admiralty specifications. It is desired to place on record the willingness with which manufacturers in this country have co-operated in matters of investigation and development when invited to do so, and it is encouraging to know that much of the effort to meet naval conditions is not without its benefit to the electrical industry and is often reflected in commercial practice.

[The paper, which was illustrated with lantern slides depicting apparatus which has been devised for testing lamps and electrical gear for use in ships, and indicative of the damage ships are liable to sustain in action, includes instructive data in tabular form, together with a digest of the arguments for and against electric propulsion, which are, however, too lengthy for reproduction.—Eds. Elec. Rev.]

Electrical Development in Spain.

A Review of the Progress Made During 1926.

In a recent issue of *La Energia Electrica*, of Madrid, Señor F. Gallego gives an interesting summary of the electrical progress in Spain during 1926. The most notable feature of the year was the decision of the Spanish Government to assist financially in the development of hydro-electric stations, which had previously had to be borne entirely by private enterprise. One of the first schemes to be assisted on a "fifty-fifty" basis is that of the Sociedad Canalizacion y Fuerzas del Guadalquiver, which is not only rendering the section of the river between Cordoba and Seville navigable, but will also provide electric power to the extent of about 62,000 h.p. The Government is also assisting, among others, a scheme of the Sociedad Hispano-Portuguesa de Transportes Electricos to utilise the power of the river Douro.

Among the new hydro-electric stations which were completed during the year is that known as La Vid, belonging to the Sociedad Hidroelectrica Legionese. The plant utilises the water power of the river Porma, and although only 700 h.p. is so far available, this is to be extended to 1,400 h.p. in the near future. At La Jorquera, in the province of Albacete, the plant which utilises the power of the Dornajos falls was extended from 2,000 to 4,000 h.p. At Olloniego (Asturias) the Sociedad Electra de Olloniego completed a 1,000-h.p. station on the river Nalon, the power generated being transmitted to Mieres and Tudela-Veguin. The Sociedad Hidroelectrica de Navarra completed a 1,500-h.p. plant on the river Garganta de Tormes, in Avila Province, while at Bidasoa (Navarra Province) the Sociedad Hidroelectrica de Lombilla put a 3,200-h.p. plant into operation. A small 300-h.p. hydro-electric station was also completed by the municipal authorities of Deva (Guipuzcoa).

Many of the old-established electricity supply undertakings also carried out further extensions. The Sociedad General Gallega de Electricidad extended its 70,000-V transmission lines to Santiago, Villagarcia, Pontevedra and Vigo. The Sociedad Sevilla de Electricidad is making good progress with the establishment of its new 4,000-h.p. hydro-electric station at Cala, 20 miles from Seville, and it is expected that the plant will shortly be put in operation. The Sociedad Hidroelectrica de Castilla is engaged on the construction of a dam to collect the water of the Villalba de la Sierra falls, which will render 15,000 h.p. available. The Sociedad Salto del Cortigo is establishing a hydro-electric station on the river Ebronea, near Fuenmayor (Province of Logrono). The Sociedad Hidroelectrica Espanola is increasing the plant at its station at Villora (Cuenca Province) up to a capacity of 47,400 h.p.; the transmission line between the station and Madrid is being altered to transmit power at 130,000 V instead of at 25,000 V. The Sociedad Energia y Industrias Aragonesas, whose station at Biescas, on the river Gallego, has a capacity of 10,000 h.p., has established a 60,000-V transmission line to supply a number of industrial works in the Sabinago district. During the year the Sociedad Hidroelectrica del Cantabrico installed two further 3,300-kVA turbines and generators at its station at

Sorniedo, bringing the capacity up to 14,000 kVA; three 5,000/50,000-V transformers, one of which is held in reserve, were also installed. The company has also erected a 50,000-V transmission line between the power station and the State gun factory at Trubia. A transmission line is also being erected between the sub-station at Naranco (Oviedo) and the distribution system of the Sociedad Co-operativa Electrica de Langreo, with the view of an interchange of power between the two concerns, whenever it becomes necessary.

La Sociedad Union Electrica de Cataluna completed a 40,000-V transmission line between the hydro-electric stations at Tremps and Pobla de Segur in Catalonia. The Sociedad Fuerzas Motrices del Ville de Lecrin completed a number of 6,000/220-V transformer stations for the supply of power to seven small towns. A 25,000-V line, about 20 miles in length, has also been completed between the sub-station at Santafe de Mondujar (Almeria) and the mines of the Sociedad Minera en Lucainena de la Torres, where a 25,000/2,100-V transformer plant has been installed. La Sociedad Electrica Industrias Coruuesa has added a new 1,200-kVA transformer to its power station at Capela, and one of 500 kVA at the sub-station at La Coruna. A second transmission line has also been erected on the existing masts. The Co-operativa de Fluido Electrico of Barcelona is establishing a steam-operated station at Adrall, and also proposes to erect a plant to utilise the water power of the Cadi falls. Work has also been commenced by the Sociedad Electrometalurgica Iberica on a 30,000-h.p. plant to utilise the power of three falls at El Burguillo.

As regards electric traction a new 3¾-mile section of the underground railway in Barcelona was completed, as also were a local electric railway 12½ miles in length between Vigo, Romallosa and Bayona; a new branch line between Palma de Mallorca and Establishment, and a cable railway between La Reineta and San Salvador del Valle, 1,312 yards long, with a rise of nearly 400 ft. The electric traction work in progress comprises further extensions of the Barcelona underground railway, the Vitoria-Estella railway, and the electrification of the Spanish section of the Trans-Pyrenéen railway from Ripoll to Aix-les-Therms and from Bilbao to Las Arenas and Plencia. The Northern of Spain Railway Co. is also electrifying the line between Barcelona and Manresa.

Señor Gallego concludes with a table showing that there are now one hundred hydro-electric stations in operation in Spain with a capacity of over 1,000 h.p. each, the total power at present utilised in the country being 758,150 h.p., while in a second table he gives brief particulars of further hydro-electric projects totalling 3,199,900 h.p. for which concessions have already been granted or in respect of which plans are in course of preparation.

Indian Electrical Notes.

(From Our Indian Correspondent.)

Electrical Trade in 1926.

THE year 1926 has again recorded a notable increase in the imports of electrical machinery and apparatus into India. The imports of electrical machinery increased in value from 209 lakhs in 1925 to 248 lakhs. Generators and dynamos increased from 34 to 52 lakhs, transformers from 13 to 28 lakhs, and turbo-generator sets from 15 to 20 lakhs; but control and switchgear declined from 38 to 36 lakhs, and motors from 36 to 31 lakhs. The United Kingdom's share of the trade rose from 174 lakhs to 203 lakhs. The United States and Germany have also recorded increases, the former from 17 to 20 lakhs, and the latter from 9 to 10 lakhs. The trade in electrical apparatus amounted in value to 240 lakhs, as against 227 lakhs in the previous year. This trade has shown steady increase during the last three years. The share of the United Kingdom, however, remains the same as in 1925, *i.e.*, Rs.158 lakhs, but compared with 1924 shows an increase of 20 lakhs. All other countries were able to increase their shares, notably the United States, imports from which rose from 20 lakhs to 33 lakhs. Germany also increased her share by about 1 lakh to 23 lakhs. It appears that the increase in the trade is taken up almost entirely by the United States. The imports of electric wires and cables amounted to Rs.80 lakhs, almost the same as in the previous year, but the United Kingdom's share declined from 73 to 69 lakhs. Electric fans increased from 28 to 31 lakhs, electric lamps from 21 to 30 lakhs, and accumulators from 12 to 14 lakhs. The imports of radio apparatus amounted to 5 lakhs in value, almost the same as in the previous year. About 4½ lakhs' worth came from the United Kingdom.

Radio Apparatus Import Regulations.

The following instructions regarding the importation into India by private persons, of apparatus for radio-telegraphy have been issued by the Government of Bengal:—

1. Radio apparatus may not be imported into British India without an import licence, which is issued by the Director-General of Posts and Telegraphs. 2. Persons, who are not dealers in radio apparatus, may, however, be allowed to import on temporary permit apparatus not exceeding one complete receiver (or its component parts) and necessary spares. This temporary permit may be obtained from the competent Customs officer on presentation of an application in the prescribed form to which postage stamps to the value of 10 rupees have been affixed. 3. This fee of Rs.10 is the annual fee for an import licence, and is additional to any Customs duty which may be leviable on the imported apparatus. 4. The import licence will be forwarded subsequently to the applicant by the Director-General of Posts and Telegraphs, and will be valid until December 31st of the year of issue, unless dated on or after November 1st in any year, when it will remain valid for the whole of the following year. Item 4 in the application form should therefore include all apparatus that the applicant intends to import during the validity of the licence and not merely the apparatus in respect of which the temporary permit is required. 5. Transmitting apparatus may not be imported on a temporary permit, and Customs officers are not authorised to accept application forms except on the conditions contained in para. 2 above. In all other cases the application form, after completion, should be forwarded by the applicant to the Director-General of Posts and Telegraphs (Wireless Branch), Simla, to whom all other inquiries regarding importation of radio apparatus should be addressed.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Wessex Electricity Bill.

This Bill, the purpose of which is to incorporate and confer powers upon the Wessex Electricity Co., was before the Unopposed Committee of the House of Lords on April 5th, and was ordered to await report. The Bill authorises the company to raise capital to the extent of £750,000, and to borrow to the extent of half the amount of capital issued. The basic dividend is to be 8 per cent. per annum, and power is given to increase the dividend paid in accordance with decreases in the price charged for electricity. The first directors will be Sir Philip Dawson and Messrs. G. I. Phillips, F. M. Rogers, G. C. H. Hamilton, H. W. Couzens, J. H. Edwards, F. N. Curzon, and H. C. Hambro. The company's area of supply will include parts of the counties of Oxford, Bucks, Berks, Southampton, Wilts, and Gloucester.

Yorkshire Electric Power Bill.

The Unopposed Committee of the House of Lords, on April 5th, ordered this Bill to be reported for third reading. The main purpose of the Bill is to enable the company to raise additional capital of £2,000,000 (nominal), and power is also given to borrow up to one-half the nominal amount of the additional capital which at the time of borrowing has been raised and of which not less than one-half has been paid up. The borrowing powers in respect of the existing capital are also increased from one-third to one-half the amount. (The capital authorised by the company's existing Acts is £4,000,000.)

Pacific Cable Bill.

On March 30th, Mr. Amery, Secretary of State for the Dominions, moved the second reading of the Pacific Cable Bill, which consolidates, with amendments, the Pacific Cable Acts, 1901-1924. He explained that the Bill embodied agreements arrived at during the Imperial Conference by the Governments concerned in the administration of the Pacific cables on certain matters affecting both the constitution and organisation of the Pacific Cable Board and the financing of the undertaking. The two main points on which the present measure changed previous legislation affected the constitution of the Pacific Cable Board and the building up of the reserve fund. The Board was an organisation on which the Governments of Great Britain, Canada, Australia, and New Zealand were represented. On the Board the interests of Great Britain were represented by three members out of seven, and also by the right of the Treasury to appoint the chairman. This preponderance of British control in a joint venture was due partly to the fact that the original capital of £2,000,000 required for the construction of the first cable was advanced on loan by the Treasury, and it also reflected the conception of 25 years ago with regard to the natural position of dominance which the Government should occupy. When the first cable was completed in 1902, it was provided that £77,000 a year should be devoted to payment of interest and sinking fund on the original advance of £2,000,000 made by the Treasury. During the early years between 1902 and 1914, there was a regular loss, which amounted to £713,000, but in 1914 and 1915 the situation changed, and since then the Pacific cable system had shown a regular and substantial profit. In 1911 the Board thought it was desirable to supplement the original cable by an additional cable between Australia and New Zealand, and an Act of Parliament was passed enabling the reserve fund to be used for that purpose. It became evident

that a further cable would be required, linking Fiji with New Zealand, and also with Australia, and that the system would have to be duplicated owing to the increased volume of traffic. In 1922 it was decided to lay a cable of the newest type, and it was completed, linking Australia and New Zealand with this country, *via* Canada. After the present year, the sum of £10,000, or one-tenth of the year's surplus, whichever was the larger, was to be placed in the reserve, subject to the provision that the reserve might be further increased or diminished by consent of the partner Governments. In the next two years, after the present year, after that contribution was paid over to reserve, the surplus, if any, would be distributed among the partner Governments. After the next two years the surplus would be equally divided between repayment of the original capital and distribution among the partner Governments. They were now in a position to accelerate the repayment of the original £2,000,000, a sum that was now reduced to a total of £1,270,000. By so doing they would set free a larger surplus, either for a further reduction of rates or for a distribution of profits among the Governments concerned. The service was an invaluable asset to the commercial development and the security of the British Empire. The Bill was read a second time.

London Joint Electricity Authority Bill.

The Standing Orders Committee of the House of Lords, on April 7th, considered an application that Standing Orders be dispensed with in the case of the London and Home Counties Joint Electricity Authority (No. 2) Bill. The Examiner had reported that the Standing Orders had not been complied with, inasmuch as the notices were not published and the deposits were not made until March, 1927, instead of the dates prescribed. The application was opposed by the Barnes Urban District Council.

Mr. Harry G. Pritchard said that one of the main difficulties with which the Authority had to contend was that its area was divided into no fewer than 86 different electricity areas, each with its separate electricity undertaking; the supply of electricity in the area was derived from 60 generating stations, many of which were old and very uneconomical to run. It being recognised that the proper method of providing a supply was to have well-situated, well-equipped generating stations, where generation could be carried on in large units in a wholesale manner, the Authority had decided to erect a station, as, indeed, it was bound to do. It was advised that the station should be in the western part of the area, as that was the centre of the greatest demand at present; that it must be situated on the Thames, in order that there should be an adequate supply of water; and that it must adjoin a railway. The Authority considered that the site which it had selected was the only really suitable one. It was about 45 acres in extent, and was situated at Duke's Meadows, Chiswick. The Chiswick Urban District Council had agreed to sell the land, but had imposed certain conditions. One condition was that, inasmuch as the land was intended to be used as playing fields, the Joint Authority must provide another open space in substitution for it. The Joint Authority had made a provisional agreement with the Duke of Devonshire, who owned that land, for its purchase, if Parliament agreed to the proposal in the present Bill. Another condition was that the Joint Authority should provide a promenade walk between the station and the river. There was a town-planning scheme for the area, and the proposed site could not be used unless that scheme were amended. The Joint Authority had anticipated that these arrangements could be carried through under the general law and without further statutory authority, and it had applied to the Electricity Commissioners for approval of the erection of the station. The Chiswick U.D.C. applied to the Ministry of Health for its approval, but after inquiry the Minister decided that he could not give his consent to the modification of the town-planning scheme, and, in effect, he had invited the Authority to put the matter before Parliament. The Authority had been pressed for time, and steps had to be taken somewhat hastily. When its first Bill came before the Examiner a memorial was presented by the Barnes U.D.C., and the Examiner held that the Standing Orders had not been complied with in some respects. After consideration, it appeared that the best course would be to discontinue the promotion of the Bill and to commence the proceedings *de novo* by the promotion of a late Bill, in regard to which the Standing Orders would be complied with in their entirety, except, of course, with regard to the dates of deposits and notices. The Examiner was satisfied with the present Bill, and he (Mr. Pritchard) asked the Committee to allow the Bill to proceed. The only opponent was the Barnes U.D.C., which was not the local authority for the area in which the site was situated. Finally, he pointed out that if the present Bill were not allowed to proceed, another Bill would be promoted next session for the same purpose. That would lead to additional expense.

Mr. H. E. Swallow, on behalf of the Barnes Council, said that the fact that the Barnes U.D.C. was the only opponent to the proposal to dispense with Standing Orders was no indication whatever of the magnitude of the opposition to the Bill itself which would be forthcoming in Committee if the Standing Orders were dispensed with. The land on which it was proposed to erect the generating station had been the subject of inquiry previously. In 1914 the Brentford Gas Co. had sought powers to acquire compulsorily part of the land for the erection of gasworks, but the proposal was rejected by Parliament. In 1918 the Brentford Gas Co. proposed to use a site in the same neighbourhood for the erection of gasworks, but the proposal was opposed by various interests, and was withdrawn. Again, in October last, the Ministry of Health had decided not to amend the town-planning scheme. That scheme was designed just as much in the interests of Barnes as of Chiswick. The Minister of Health did not consider that the land should be allowed to be used unless no other suitable site could be found for the purpose without involving a material increase in the cost of the proposed electricity service, and it did not appear to him that that had been demonstrated. If Standing Orders were dispensed with, there would not be sufficient time remaining in the present session to enable Parliament to consider the substantial opposition that there would be to the proposals in the Bill. If promoters of private Bills, which did not comply with Standing Orders, were to be entitled, even on the ground of urgency, to promote a late Bill, it might lead to serious laxity in giving proper notice to persons interested, and would greatly reduce the protective value of the Standing Orders.

Mr. Pritchard said that there were many Bills which had not yet been passed by Committees of the House of Commons, and would have to come before Committees of the House of Lords, and he considered it highly probable that the present Bill would catch them up. So far as he knew, there were no precedents for the procedure now suggested in *recent* times, but there were, in fact, precedents. The promoters of previous schemes had not undertaken to provide an alternative site for public pleasure grounds, and had not received the approval of the local authority, as the Joint Authority had done in this case.

The Committee agreed to recommend that Standing Orders be dispensed with.

Private Bill.

The Hastings Tramways Company (Trolley Vehicles) Bill has been read the third time in the House of Commons.

Electrical Artificers.

On April 1st, Mr. Hore-Belisha asked the First Lord of the Admiralty what was the strength of the electrical artificer branch.

Lt.-Col. Headlam, Financial Secretary to the Admiralty, said that the numbers borne on March 15th were:—Electrical lieutenants, 4; commissioned electricians, 26; warrant electricians, 31; chief electrical artificers, 197; electrical artificers, 760; apprentices, 138; total, 1,156.

Answering a further question, Lt.-Col. Headlam said that an examination for the rank of warrant electrician was held on March 31st and April 1st, and it was the intention that normally an examination should be held annually in future. The last previous examination was held in March, 1922.

Electricity Charges at Pontefract.

On April 5th, Brigadier-General Brooke asked the Minister of Transport whether he was aware that the Yorkshire (West Riding) Electric Tramways Company, which supplied electric light and power in the Pontefract area, was still charging the increase of 15 per cent. which was imposed in November last; and whether, seeing that the price of coal had been in process of reduction since that period, and in view of the lower comparative charges in towns neighbouring on Pontefract, he would refer the matter for inquiry to the Electricity Commissioners.

Colonel Ashley said that the question of electricity charges in Pontefract had already been the subject of correspondence between the Electricity Commissioners and the company, which had intimated that the 15 per cent. increase would be withdrawn on April 30th. The Commissioners were still in communication with the company on the question of comparative charges in the neighbouring towns.

Coal-Handling Plant in India.

Among the equipment of the new Garden Reach plant of the Calcutta Electric Supply Corporation, Ltd., is a complete electrically-operated coal-handling plant supplied by Messrs. W. J. Jenkins & Co., Ltd., Retford. According to *Commerce* (Calcutta), the coal upon arrival is discharged into a specially-constructed pit with a capacity of about 100 tons. At regular intervals an electric 2-ton grab transfers the coal by way of a telpher to receiving hoppers, which feed a breaker. Upon being broken to suitable size, the coal passes through a rotary filler into the buckets of an endless conveyor. Reaching a specially-constructed tower, the coal is elevated to a height of 40 ft., and then continues horizontally until it reaches the bunker hoppers, being automatically weighed in the process. Here the buckets are mechanically tipped. Immediately beneath each bunker hopper is a raised platform complete with track on which run two weighing and delivering machines electrically driven. These machines receive the coal from the bunkers and deliver it to the respective furnaces as required. The whole plant is capable of dealing with 50 tons per hour. The ash is removed by a similar labour-saving arrangement.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Testing Three-wire A.C. Networks.

A correspondence on the testing of three-wire a.c. networks would be very useful. One can test d.c. networks by Raphael's method, which reveals neutral faults very efficiently, but this does not appear to apply to alternating-current systems. The usual method is to put first one side of the system directly to earth and then the other side. This can only be done by breaking the neutral connection to earth, an undesirable thing to do, as the neutral ought properly to be bonded very strongly to earth so that if the high-pressure windings should happen to come into contact with the low-pressure windings in the transformer, the circuit breaker would be opened at once. Perfect safety is best assured when there is no switch between the neutral and the earth connection.

The method of putting the outers to earth at frequent intervals has other objections. It is crude and unscientific, and will tend to breed faults by putting an undue stress on the installations connected. Yet if there are no other methods available one must just do it.

April 6th, 1927. **Faults.**

Municipalities and Foreign Tenders.

The decision of the Manchester Corporation to place a contract with a foreign firm, and the report of the proceedings leading to this decision, make interesting reading, and confirm the opinions expressed by the writer in your "Correspondence" columns some time ago.

It is about time that our municipalities woke up to the fact that price-fixing associations are taking undue advantage of the specious plea that placing orders at home provides more employment. The fact is that groups of manufacturers artificially fix prices which bear no relation whatever to the cost of production, and the ratepayer is "fleeced" in order to swell profits and subsidise shareholders.

Further, to encourage the formation of price-fixing groups is to put a premium on inefficiency, at a time when every means should be adopted to reduce costs of production if we are to compete in the world's markets.

Those who talk glibly of the glories of free and open competition seem to be the very people who wish to eliminate competition by the formation of rings and combines.

It is to be hoped that Manchester, true to its traditions, will have set a good example to other municipalities in the struggle for economy.

April 9th, 1927. **Salesman.**

River Water—or Cooling Towers?

We have read with interest the article published on January 7th, 1927, in your paper on "River Water or Cooling Towers?" by Mr. J. N. Waite, M.I.E.E.

We should like to communicate with the author, as we have had considerable experience in cooling towers and have also some data on the cost of operating with river water as compared with cooling towers.

We might state that here, in New York, one of the large ice manufacturing companies has plants in different sections of the city, and in one case it operates its ammonia condensers with river water and in the other case with cooling-tower water; in both cases the power is obtained from the electric service company. The cost of energy figured on the basis of kWh per ton of ice produced shows a considerable reduction in favour of the cooling tower. We have monthly records in both plants, which make a very interesting comparison.

Referring to Mr. Waite's article, we note that he bases his calculation on the temperature of water from cooling towers being 75 degrees with 45-degree wet bulb, or 30 degrees difference between the wet bulb and the water. In a modern efficient cooling tower the difference should not be over 10 degrees.

He also does not state that the temperature of river water may be higher in the winter time than cooling-tower water, and lower in temperature in the summer. In many cities the current requirements are greater in the winter than in summer. We believe a closer study on the part of Mr. Waite, covering average yearly conditions, might show a cooling water more efficient than river water; this may not be true in every case, but is probably very certain in many cases, especially in the South. The most important consideration is to have the cooling tower properly designed and of *ample* size to cool to within 5 to 10 degrees of the wet bulb under the worst atmospheric conditions.

Edwin Burhorn Co.

New York, U.S.A., *March 31st*, 1927. E. Burhorn, *Pres.*

The Salaries of Engineers.

Following with interest the correspondence which has been published by you during the past few weeks, relative to the low salaries in the engineering profession, one of the most pertinent phrases—to my mind—in any of the letters was in that written by "P.W.," in which he stated "that he was referring to engineers' salaries outside the E.P.E.A." He has, in that phrase, pointed with no uncertain finger to the remedy for low salaries—*i.e.*, organisation.

The definition of an Association is "A body of men banded together to do something." This the E.P.E.A. has taken to heart, and it has worked unceasingly towards raising the status of engineers, first, by claiming on their behalf an adequate salary for services rendered and successfully negotiating the present National Joint Board Schedule for the electricity supply industry.

The E.P.E.A. has a strong nucleus of members who are *not* electricity supply engineers, of which I am one, and it has been successful in raising their salaries and improving their conditions of employment.

Until engineers realise that it is only by becoming active members of an association that they can work out a solution to their own problems, "Poor Blighter" and others will be able to pen such a series of letters as those which have appeared under the above heading.

If these gentlemen would spend their time and energy in an association, bearing in mind the definition previously quoted (and "P.W." has pointed to the appropriate organisation, *i.e.*, the Electrical Power Engineers' Association), then the writer is convinced that they would—in time—be able to subscribe themselves similar to himself—

April 8th, 1927. **Satisfied E.P.E.A.ite.**

Legal.

Lord & Shand v. Webb.

At the Plymouth County Court, on April 6th, Messrs. Lord and Shand, electrical contractors, sued Mr. W. H. Webb, builder, for moneys due for alterations and repairs to electrical installations in two of the defendant's houses. For the plaintiffs it was stated that the installations were put in by them, the original quotation being £16. The defendant later ordered two-way switching for which an extra charge of 7s. 6d. per house was made. A payment of £16 only had been made. Subsequently, complaints were made that the installations were faulty, and it was discovered that at one house a nail had been driven through the cable; the damage was repaired at a cost of £1 12s. 6d. At the other house the faults were found to be due to the dampness of the walls and for work in connection with that installation a charge of £2 8s. 6d. was made. The plaintiffs were now claiming the three amounts mentioned which the defendant refused to pay.

The latter stated that he understood that two-way switching was included in the original quotation. He had given no instructions for the remedying of defects in the wiring and said that he had never had complaints of dampness in houses which he had built.

His Honour Judge Gurdon accepted the plaintiffs' evidence as to the repairs and awarded them £4 1s.; the claim for two-way switching was dismissed.

Wareham Electric Supply Co., Ltd.

Mr. Justice Romer, in the Companies Winding-Up Court on April 5th, again had before him the petition of Mr. W. E. Weston, of Hounslow, for an order for the compulsory liquidation of the Wareham Electric Supply Co., Ltd. It had been arranged that witnesses should attend for cross-examination if necessary, and that the whole of the facts concerning the company should be investigated. Mr. Wilfred Hunt, for the company, asked, however, for a further adjournment on the ground that his leader, Mr. C. A. Bennett, K.C., was unable to be present owing to illness, and also that the principal witness, whom it was desired to cross-examine—Mr. Eaton—was also too ill to attend that day, and would not be able to do so next week.

Mr. R. J. Willis, for the petitioner, said he was very anxious to have the whole matter thoroughly gone into, but he did not want to do it in bits, and he could not object to an adjournment on the ground of illness.

Mr. Galbraith, K.C., said he appeared for Mr. Edwards, a former voluntary liquidator of the company, who was present for the purpose of giving evidence if necessary. He agreed that it was a matter that must be disposed of once and for all.

Mr. Willis said that he would want to cross-examine Mr. Eaton.

Mr. Hunt suggested that the petition should stand over until the first company winding-up day next sittings. He said he would let the other side know in good time whether Mr. Eaton would be able to be present then.

His Lordship agreed to that course.

General Electric Co., Ltd., v. Currus Motor Accessories, Ltd.

A motion for judgment in default of defence in this action came before Mr. Justice Tomlin in the Chancery Division on April 5th.

Mr. Tookey, for the plaintiffs, said that the defendants had put in no defence. The action was for an injunction to

restrain passing-off in connection with the plaintiffs' trade mark "Osram" as applied to incandescent electric lamps and electric arc lamps.

His Lordship granted an order.

British Thomson-Houston Co., Ltd., v. Fox.

Mr. Justice Tomlin, in the Chancery Division on April 5th, had before him a motion by the British Thomson-Houston Co., Ltd., for an injunction restraining S. Fox, Bethnal Green Road, E., from infringing its patent for electric gasfilled lamps by selling lamps not of the company's manufacture.

Mr. Tookey, for the company, said that last Friday his Lordship granted an *ex parte* injunction. The defendant did not appear.

His Lordship granted the order.

Birkenhead Electrician Fined.

Summoned by the Birkenhead Corporation for preventing an electricity meter from registering the quantity of electricity supplied, Leonard H. Jackson, electrician, Birkenhead, was fined 40s., or 21 days, at Birkenhead recently. Evidence was given to the effect that when an inspector visited defendant's house he switched on the electric light, but found that whilst the power meter was "on" the light meter was "off." Defendant was running lights from the power meter and was only paying the power price.

Defendant said that a rod had dropped on the lighting wires, which became broken. He gave instructions for their repair, but the man who did the work evidently mistook the meters.

Reviews.

High Vacua. By G. W. C. Kaye, M.A., D.Sc., F.Inst.P., Superintendent of the Physics Department of the National Physical Laboratory. Pp. xii+175; figs. 91. London: Longmans, Green & Co., Ltd. 1927. Price 10s. 6d. net.

This volume is based on the Cantor Lectures which were delivered by the author during 1926. He has given an account both of the theory and of the appliances that are used in connection with high-vacua practice, which has not previously been done in so systematic a manner. The author's special training leads now and then to the introduction of valuable observations from his long experience.

If the history of scientific discovery is to a great extent the history of instruments, important discoveries have certainly followed every advance in vacuum technique. Those advances have been momentous during the last 20 years, chiefly owing to the researches of Gaede, Langmuir, and Dushman, of Knudsen in Denmark, and of Dewar and Campbell in England. The two fundamental principles of the physicist to-day are the structure of matter and the nature of radiation. The discovery of Röntgen rays, Coolidge tubes, hafnium, electrons, protons, isotopes, X-ray and positive-ray analysis, the cathode-ray oscillograph, thermionic valves, radio-communication, photoelectric cells, Dewar flasks, and even ordinary glow lamps would have been impossible without the improvement of vacua. It is difficult to state what the highest attainable vacuum may be, as all our measuring devices ultimately cease to operate, but it is assumed at the present time that the highest measured vacuum is of the order of 10^{-8} mm.

The main contents of the book consist of an introduction comprising a full survey illustrating the widespread utility of high vacua in the scientific and everyday world; an historical account of the development of vacuum pumps, vacuum tubes, and high-vacuum technique in general; a number of chapters dealing with backing and high-speed pumps and absorption methods of exhaustion; and, finally, two chapters dealing with high-vacuum gauges and the measurement of high-speed pumps.

The author exemplifies the large scale industrial applications of high-vacua pumps by referring to Sir Charles Parsons's pump and to the mercury-vapour pump used by Brown-Boveri for maintaining their high-power mercury-arc rectifiers at 0.01 mm. pressure; the rectifiers range up to 2,000 kW at 1,800 volts. The pump is of the bottle type, and is backed by a rotary oil pump; the whole system is insulated for high voltage, and is automatically controlled by a manometer and relays which start the heating and water-cooling and the backing pump. The "cleaning-up" of residual gases is effected by "getters," which are vaporised *in situ*. The evaporation probably produces intense ionisation and chemical activation, and the condensed film, afterwards deposited on the walls, holds the gas by absorption or trapping. In the case of electric lamps, the "getter" is an alcoholic soluti of red phosphorus and a salt (sodium silicate), into which o end of the filament is dipped; the filament is then flashed. valves a tiny strip of magnesium is volatilised by hig frequency induction; barium nitride is used in dull-emitt valves. Coming to high-vacuum gauges, they are describ in considerable detail and are classified into five groups: Those which depend on Boyle's law; (2) those which utili the frictional drag of molecules on a moving surface; those which measure molecular bombardment due to tempe ture differences; (4) those which depend on the fact that t thermal conductivity of a gas at low pressures becomes function of the pressure; and (5) those which make use the electrical conductivity of a gas. The chapter on pur speeds arrests attention by reason of its admirable discussi of many imperfectly explained operations, and is also rich suggestions for further research. Evidently the whole proble interests the author intensely, the various methods and pr cedure that have been suggested being described accurate and in detail.

On the matters of which he treats the author offers t fruits of a ripe and unique experience, and he has also t faculty, which those who are masters of their subjects not always possess, of describing essential features in simp terms. Dr. Kaye has made the best use of his wide kno ledge, and has handled the subject not only with skill discrimination, but also in a sober, scholarly, and scienti fashion.

The book is clearly printed, and some excellent illustratio and plates are included in the text, and much valuable inf mation has been brought together in an attractive setti and in a form convenient for reference purposes. The auth is to be congratulated on its compilation.

Makers of Science, Electricity and Magnetism. By D. Turner, M.A., B.Sc. Pp. xv+184; figs. 65. Londo Oxford University Press. Price 7s. 6d. net.

This small volume is not confined exclusively to biographic sketches of the great outstanding personalities who ha left their impress on the development of electrical scienc but gives, in addition, brief outlines of the principal contrib tions which they have made to this development. Beginnin really, with Petrus Peregrinus in the thirteenth century, t author deals in chronological order with the work of Gilbe of Colchester, and that of each of his successors who ha carried the torch of science up to our own times. It is fascinating record, and one which will bear re-reading ov and over again, because of the personal and human eleme with which the author has invested it. It would seem in dious almost to select one or more of those whose work dealt with here for illustrative purposes; but the mann in which the contributions to science by Faraday and Ma well have been treated is all that one could expect within t limits to which the author has restricted himself.

The field covered includes electrostatics, the electric curre electromagnetism, electromagnetic induction, the developme of electrical theory, electrolysis, the conduction of electrici through gases, and the electrical constitution of matter. the last chapter we are brought right up to the work of J. Thomson, Bragg and Moseley on the connection between ele tricity and matter; but, in the words of the author, "if v ask 'What is electricity?' we are left with an unanswer question." It is somewhat surprising to find, however, reference to the work of Eddington or of Jeans in the sphe of astrophysics, and the bearing that such work is having our knowledge of the constitution of matter and of its relati to radiation; but probably it is of too recent a date to adm of its incorporation in the book.

An introductory chapter on the need for a History Science is furnished by Dr. Charles Singer. There are illustrations throughout the text, including a number portraits; that of Faraday is particularly good. We hearti recommend the book as one which will be appreciated by t layman as well as the student of science.

The Elements of Radio Communication. By O. F. Brow M.A., B.Sc. (Oxon.), B.Sc. (Lond.). Pp. viii+216; fig 146. London: Oxford University Press. Price 10s. 6 net.

Mr. Brown is connected with the Radio Research Boar and is thus in an excellent position for reviewing the late developments of radio communication from the scientif point of view. He takes advantage of this fact by givir us in the last 50 pages an excellent summary of the up-to-da theories regarding directional reception, short-wave workin the propagation of waves and atmospherics. He says, v notice, in the directional portion, that the error of refractic in the case of waves crossing the boundary between surfac of different conductivity can be allowed for; this is hard so in practice as it varies with the distance between th stations. The remainder of the book consists of a non-math matical summary of the theory of radio telegraphy and tel

phony with a short summary of the principles of alternating currents as applied to radio circuits.

The author's difficulty is obviously how to cover the ground in the space at his disposal, and there is necessarily much omitted, such as machine telegraphy, methods of measurements, tuning-fork control, &c., which might be considered as coming within the scope of so comprehensive a title. We notice on page 43 that an earth screen is said to give better results than a buried earth, though it is known that this was not found to be the case in practice at the Rugby station.

The explanations are as a rule concise, lucid and free from mathematics except of the simplest kind. Some err, we think, from being so concise as to become sketchy, such as that of the Reinartz circuit on page 181, and we must confess to having difficulty in following the explanation of the magnetic amplifier on pp. 66 and 67, where a misprint of core for coil occurs, and of the elimination of distortion on pp. 160 and 165, where some of the letter references seem mixed. On p. 168, at the bottom, B is misprinted for B^1.

But these are minor criticisms; the book gives a good up-to-date summary of the principles of radio communication, and should be especially useful to electrical engineers who have not yet made a study of that branch of their profession. Admiral of the Fleet Sir Henry Jackson, who is chairman of the Radio Research Board, in an appreciative foreword, confidently recommends this book "to those who wish to get a clear understanding of this useful and fascinating art."

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be published and abridged, and all subsequent proceedings will be taken.

1925.

22,793. "Alternating-current signalling systems." F. E. Pernot. September 12th, 1925. (267,189.)

23,668. "Automatic timing mechanism." Igranic Electric Co., Ltd., and H. Abbink Spaink. June 16th, 1926. (267,328.)

28,073. "Radio-telegraphic direction-finding and similar methods and arrangements." R. A. W. Watt and J. Robinson. November 7th, 1925. (267,575.)

28,456. "Electric switches." F. B. Cox. November 12th, 1925. (267,576.)

30,868. "Electric meters." F. H. Rogers (Republic Flow Meters Co.). December 7th, 1925. (267,583.)

30,978. "Dynamo-electric machines." D. Suchostawer. December 8th, 1925. (267,584.)

31,340. "Electric heaters." Thermo Path Co., Ltd., and A. E. M. Van der Meersch. December 11th, 1925. (267,585.)

1,494. "Electric accumulators." H. Leitner. December 14th, 1925. (267,588.)

1,601. "Sparking plugs." A. J. Pearce. September 15th, 1926. (267,589.)

1,706. "Controllers for electric motors." A. West & Co., Ltd., and A. West. December 15th, 1925. (267,591.)

1,734. "Electric fusible cut-outs." W. H. Isherwood and R. T. Norton December 16th, 1925 (267,593.)

1,860. "Cord or cable gripping devices for use with electrical sockets and plugs and the like." Walsall Hardware Manufacturing Co., Ltd., A. E. Reid and C. G. Maisey. December 17th, 1925. (267,602.)

1,930. "Telephone systems." Automatic Telephone Manufacturing Co., and W. O. Passmore, and L. M. Simpson. December 17th, 1925. (Cognate application 15,624/26.) (267,606.)

1,959. "Telephone systems." Automatic Telephone Manufacturing Co., and W. Saville, and W. O. Passmore. December 17th, 1925. (267,608.)

1,961. "Flexible conductors." Standard Telephones & Cables, Ltd., and R. Pheazey. December 17th, 1925. (267,609.)

1,962. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables Ltd (G. Deakin). December 17th, 1925. (Addition to 267,726.) (267,610.)

1,963. "Adjustable telephone ear-pieces." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). December 17th, 1925. (267,611.)

1,998. "Current generating and controlling appliances, particularly applicable for use in electric arc welding." Quasi-Arc Co., Ltd., and A. P. Chmenger. December 18th, 1925. (267,612.)

2,027. "Distribution and regulation of electrical energy." W. J. R. Ewert. December 18th, 1925. (267,613.)

2,080. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (G. Deakin). December 18th, 1925. (267,616.)

2,081. "Radio-receiving systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). December 18th, 1925. (267,617.)

2,091. "Electrolytic system." J. E. Noeggerath. December 19th, 1924. (267,619.)

2,245. "Electric transformers for wireless purposes." A. E. Watkins. December 21st, 1925. (267,619.)

2,262. "Illuminated signs." R. E. Ollerenshaw. December 21st, 1925. (267,622.)

2,297. "Oil-immersed electrical apparatus." A. Reyrolle & Co., Ltd., and H. W. Clothier. December 22nd, 1925. (267,624.)

2,357. "Electric connection devices." W. A. Brooke. December 30th, 1925. (267,640.)

2,381. "Loud-speaking telephones." G. Pelletier. December 31st, 1924. (267,647.)

1926.

"Dynamo-electric machines." Diamond Coal Cutter Co., Ltd., and P. Higgins. January 1st, 1926. (Patent of addition not granted.) (267,644.)

"Loud speakers for wireless receiving apparatus." F. M. T. Reilly. January 6th, 1926. (267,647.)

"Telephone systems." Automatic Telephone Manufacturing Co., Ltd., Williams, and H. D. Sharpe. January 7th, 1926. (Cognate application 1926.) (267,648.)

"Method and arrangement for braking the wheels of a tramcar from the driver's seat on the motor-car." J. Schlagenhauf. January 11th, 1926. (267,3.)

1,107. "Electrical signalling or remote control systems." General Electric Co., Ltd., and C. C. Garrard. January 14th, 1926. (267,655.)

1,647. "Electric motor control systems." British Thomson-Houston Co., Ltd., D. E. Jewitt and C. J. H. Trutch. January 20th, 1926. (267,659.)

2,146. "Electrically-operated indicating devices." E. S. C. Betteley. January 25th, 1926. (267,663.)

2,197. "Electric switches or connections of the plug-in type." J. B. Tucker. January 26th, 1926. (267,664.)

3,138. "Asynchronous electric motors." English Electric Co., Ltd., R. L. Cleaver and R. D. Ball. February 3rd, 1926. (Cognate application 19,491/26.) (267,670.)

3,490. "Electric switches." A. E. Mason. February 8th, 1926. (267,674.)

5,792. "Rectifying and smoothing or ripple-elimination of alternating currents." W. Diggle. March 2nd, 1926. (267,701.)

5,973. "Electric switches or circuit-breakers." Electrical Improvements, Ltd., R. W. Gregory and L. C. Grant. March 3rd, 1926. (267,703.)

6,016. "Heating of metals by electricity." D. F. Campbell. March 3rd, 1926. (267,704.)

6,257. "Telephone sets." Sterling Telephone & Electric Co., Ltd., N. Blades and L. V. Marks. March 5th, 1926. (267,705.)

6,368. "Electric boiling rings, electric radiators, and the like." F. J. Wineberg. March 8th, 1926. (267,706.)

8,001. "Electric heaters, particularly for cooking purposes." S. D. White and T. H. Leak. March 23rd, 1926. (267,716.)

11,009. "Direct-current dynamos." T. A. Lemaster. April 26th, 1926. (267,735.)

11,341. "Train control systems." T. E. Clark and J. E. Clark. April 29th, 1926. (267,738.)

11,559. "Apparatus for transmitting or reproducing sound." S. G. Brown and S. G. Brown, Ltd. May 1st, 1926. (267,742.)

11,682. "Automatic electric temperature responsive alarms." E. W. Meyer. May 3rd, 1926. (267,744.)

12,437. "Electric motor control systems." British Thomson-Houston Co., Ltd. May 16th, 1925. (252,189.)

12,719. "Contacts for electric switches, in particular starters for electric motors and the like." K. Muller and Celos Anlasserbau Ges. May 18th, 1926. (267,752.)

13,219. "Electric control systems." British Thomson-Houston Co., Ltd. May 25th, 1925. (252,408.)

15,638. "Arrangement for producing a neutral tapping-point in three-phase networks for connecting up neutral point choking coils." Akt. Ges. Brown, Boveri et Cie. June 20th, 1925. (253,944.)

16,220. "Fault-indicating devices for transformers." Allmanna Svenska Elektriska Aktiebolaget. July 27th, 1925. (255,836.)

18,233. "Electrical apparatus for the testing of internal-combustion and other engines." F. W. Highfield and Highfield Electrical Co., Ltd. July 21st, 1926. (267,777.)

18,234. "Electrical apparatus for the testing of internal-combustion and other engines." F. W. Highfield and Highfield Electrical Co., Ltd. July 21st, 1926. (267,778.)

18,235. "Electrical apparatus for testing motor vehicle and other mechanical power-transmission mechanisms." F. W. Highfield and Highfield Electrical Co., Ltd. July 21st, 1926. (267,779.)

18,749. "Contact plugs for electrical connections." C. R. Forth. July 27th, 1925. (255,910.)

19,605. "Loud speakers for wireless receiving apparatus." F. M. T. Reilly. January 6th, 1926. (Divided application on 267,647.) (267,790.)

19,835. "Electric switches for liquid-fuel burners." E. C. R. Marks (Williams Oil O-Matic Heating Corporation). August 11th, 1926. (267,793.)

20,713. "Dirigible headlights for motor vehicles." S. R. Densem and J. Hart. August 23rd, 1926. (267,799.)

21,053. "Contacts for electric switches, fuses, and the like." Callender's Cable & Construction Co., Ltd., and J. F. Watson. August 26th, 1926. (267,800.)

21,055. "Variable air electric condensers." Igranic Electric Co., Ltd. August 29th, 1925. (257,617.)

21,553. "Electric railway signalling devices." F. Matuscheck. September 1st, 1926. (267,805.)

22,347. "Protective means for electric furnaces." British Thomson-Houston Co., Ltd. September 10th, 1925. (258,277.)

22,639. "Electric slowly-acting relays for use with automatic circuit-breakers for protecting electric circuits." Siemens-Schuckertwerke Ges. September 15th, 1925. (258,588.)

22,764. "Current transformers." Metropolitan-Vickers Electrical Co., Ltd. October 1st, 1925. (259,198.)

24,059. "Means for reproducing position." British Thomson-Houston Co., Ltd. September 29th, 1925. (259,215.)

24,840. "Copper conductors for electric power cables." Felten & Guilleaume Carlswerk Akt. Ges. April 12th, 1926. (267,822.)

25,943. "Dynamo-electric machines." International General Electric Co., Inc. October 16th, 1925. (259,996.)

26,101. "Aerials for the transmission and reception of electro-magnetic waves." E. Geles. October 19th, 1925. (260,005.)

26,450. "Multiplex telegraph systems." Automatic Telephone Manufacturing Co., Ltd., and H. H. Harrison. October 22nd, 1926. (267,830.)

28,769. "Gaseous electric conduction devices." Raytheon Manufacturing Co. December 21st, 1925. (263,109.)

29,829. "Thermionic valves." M.-O. Valve Co., Ltd., G. C. Marris, and M. Thompson. November 25th, 1926. (267,849.)

30,426. "Electric current collectors." British Thomson-Houston Co., Ltd. December 1st, 1926. (Convention date not granted.) (262,430.)

31,250. "Electric furnaces." International General Electric Co., Inc. December 9th, 1925. (262,796.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 6th:—

Columbus. No. 477,580. Class 6. Electric floor polishing machines and vacuum-cleaning machines.—Columbus Suction Polisher Co., Ltd., 4, Broad Street Buildings, E.C.2.

K.G. (lettering and design). No. 475,841. Class 8. Electric batteries and apparatus and parts thereof for use in radio-telegraphy and telephony.—K.G. Battery Co., 16-18, Moult Street, Cross Street, Manchester.

Desmo. No. 477,415. All goods in Class 8.—Desmo, Ltd., 31, Stafford Street, Birmingham.

Supervox. No. 476,238. All goods in Class 9.—Société Française Radio-Electrique, 79, Boulevard Haussmann, Paris. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, W.C.2.)

Pipon. No. 475,322. Class 13. Bulb and electric horns and similar audible warning devices.—C. Haseler & Son, Ltd., 94, Bridge Street West, Birmingham.

Lissen. No. 477,380. Class 13. Sparking plugs and electric irons.—Lissen, Ltd., Friar's Lane, Richmond, S.W.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BILLINGHAM (Stockton-on-Tees).—Houses (233), for the Synthetic Ammonia and Nitrates, Ltd.

BILSTON (Wolverhampton).—Girls' high school, Wellington Road, for the governors; the clerk.

BIRMINGHAM.—Central fire station, junction of New Corporation Street and Aston Street (cost, including demolition of existing buildings and providing fresh offices for the Corporation Weights and Measures Department, &c., £200,000); city engineer and surveyor. Juvenile Court, Steelhouse Lane; Watch Committee. Treatment centre, General Hospital; city engineer. Extensions, Witton Babies' Hospital; city engineer. Hall, Alum Rock Road; Salvation Army.

BOLTON.—Kinema, Churchgate; G. E. Tong and F. Holt. Palais de Danse, Bridge Street; F. W. Meredith. Offices and transformer house, Moss Lane Colliery; S. Scowcroft & Sons, Ltd. Extensions, Temple Bleachworks; T. Cross & Co., Ltd. Extensions, Settle Street; Ocean Spinning Co., Ltd. 40 houses, Castlewood Square; Leigh Bros., Ltd.

BRIERLEY HILL (Staffs.).—Housing scheme (68), for the U.D.C.; John Yorke, surveyor.

BRIGHTON.—Zoological gardens, London-Brighton Road (£50,000); G. Bruce Chapman, proprietor of Barnet Zoo.

BROADSTAIRS.—Houses (36), for the U.D.C.; Gilbert Bros., builders, Bradstow Way.

BROMLEY (Kent).—School, Bromley Common, and two practical instruction centres, for the borough E.C.; Director of Education.

CAMBERLEY (Surrey).—Church, for the trustees of the Congregational Church; Rev. C. H. Pugh, B.A., pastor.

CHESTERFIELD.—Additional 50 houses, St. Augustine's estate, for the T.C.; borough surveyor.

CHESTER-LE-STREET.—Bazaar premises, for F. W. Woolworth & Co., Ltd., Kingsway, London.

CREWE.—Extensions to Memorial Hospital (£15,000), for the governors; P. Temperley, hon. sec.

DUKINFIELD.—Additional 105 houses, Clarendon Fields site, for the T.C.; borough surveyor.

DURHAM.—Additional housing schemes (108), Sherburn and Ludworth, for the R.D.C.; surveyor.

GLASGOW.—Factory in Kirkintilloch Road, for Blackie and Sons, Ltd., printers and publishers; the manager. Conversion of mansion house into mental institution (lighting and heating); clerk, Parish Council. Cinema, Summerfield Street, for Strathclyde Cinema Co.; the secretary. Factory in William Street, for James Templeton and Co.; the manager. Hall in Partick, for Salvation Army; Army Headquarters. 500 houses and 12 shops at Bilsland Drive, for Corporation; city architect.

GRAYS.—Girls' and boys' schools, with hostel and laundry (£84,000), for the governors of Palmer's schools; J. Stuart, county architect, Springfield Old Court, Chelmsford.

GUILDFORD.—Factory, The Bars; Guildford Glass Works.

GUISELEY.—School; Education Department, County Hall, Wakefield.

HARTSHORNE AND SEALS.—Housing scheme (60), for the R.D.C.; A. C. Clarke, architect, 73, Wood Street, Church Gresley, Burton-on-Trent.

HOLMFIRTH.—32 houses, Woodlands, Thongsbridge; P. Williams, clerk to the Council.

HULL.—Admission hospital and nurses' home, Mental Hospital; city engineer. Central library extension; city architect. 60 houses, Loveridge Avenue; W. H. Loveridge.

INCE.—Central schools, Rose Bridge, for Lancs. E.C. (£40,591); education architect, Preston.

IRISH FREE STATE (Cork).—200 houses; City Commissioner. Hospitals at Macroom, Bandon, Kanturk, Clonakilty, Bantry, and Skibbereen, including electric lighting (£100,000); South Cork Board of Public Assistance.
(Killarney).—Technical school; Kerry County Technical Committee.

KEMPSTON.—Extensions to works, for Cryselco, Ltd.

LANCASTER.—72 houses, for Corporation; F. Moore and Co., Morecambe.

LEICESTER.—Building for artificial light treatment, Groby Road Sanatorium; Symington & Prince, architects, for Corporation.

LEYLAND (Lancs.).—Additional 60 houses for the U.D.C.; surveyor.

LONDON (Becontree, E.).—Two additional schools, London County Council housing estate, for Essex C.C.; J. Stuart, county architect, Springfield Old Court, Chelmsford.
(Mile End, E.).—Elementary school, Cephas Street; A. E. Symes, for L.C.C. Education Committee.
(Stepney, E.).—Roman Catholic central school, Lucas Street; T. R. Ring.
(E.C.).—Buildings for *News of the World*, Bouverie Street and Whitefriars Street; A. A. H. Scott.
(Marylebone, N.W.).—Central library, Marylebone Road (£50,000); borough engineer. Reconstruction of premises, Oxford Street, Henrietta Street, Vere Street, and Marylebone Lane; Marshall & Snelgrove.
(Bermondsey, S.E.).—School for tuberculous children, Fort Road; L.C.C. architect.
(Eltham, S.E.).—Roman Catholic church, Well Hall housing estate; Rev. Abbot White.
(Aldwych, W.C.).—Offices, for the Indian Government (£300,000).
(Piccadilly, W.).—Theatre, corner of Denman and Sherwood Streets, for E. Laurillard; Messrs. B. Crewe and E. A. Stone, architects.

MARKET HARBOROUGH.—36 houses; U.D.C. surveyor.

MIDDLESBROUGH.—Constantine College (£65,894), for the borough E.C.; Stephen Easten, Ltd., builders, Newcastle-on-Tyne.

MOORTHORPE (South Elmsall).—Roman Catholic church and presbytery (£8,000); Holton & Fox, architects, Dewsbury.

NEWCASTLE.—Housing scheme on 432 acres, near city boundary; city engineer. Pavilion, Walkergate Hospital; city engineer. Sheds at Quayside; Wright, Anderson and Co., Ltd.

NEW MALDEN.—Extensions to mental hospital (£10,000), for Middlesex C.C.; W. H. Gaze & Sons, builders, Kingston-on-Thames.

NORTHAMPTON.—Improvements, Harboro Road hospital; borough engineer. Works extensions, Kingsthorpe Hollow; Northampton Foundry Co. Timber mill and store, Old Towcester Road; E. T. Trenery & Sons.

OXFORD.—Extensions, Merton Street; Corpus Christi College Wardens.

PLYMOUTH.—Education offices, Cobourg Street; Education Committee. Electric lighting improvements, Museum and Art Galleries; borough electrical engineer. Extensions, Municipal Offices, Guildhall; borough engineer. 52 houses, Mount Gold; Astor Housing Trust. Additions, depôt, Manor Street; Dunlop Rubber Co., Ltd. Motor showrooms, stores, &c., Stuart Road; W. S. Reed.

RAMSGATE.—Dance hall, &c., with electrical equipment, Harbour station site; William Thompson, 2, Burleigh Mansions, Charing Cross Road, London.

REIGATE.—Printing works, off Cavendish Road, Redhill, for the Surrey Fine Art Press. Additional housing scheme (44), for the T.C.; borough surveyor.

ROTHERHAM.—Additional housing schemes (66), Dalton and Bramley, for the R.D.C.; surveyor.

ST. HELENS.—Secondary school, for the borough E.C.; Biram & Fletcher, architects, George Street.

SEDGEFIELD.—Additional 50 houses, for the R.D.C.; surveyor.

SHERBURN (Co. Durham).—Extensions to hospital; Joseph Potts & Son, architects, 57, John Street, Sunderland.

SOUTHPORT.—Houses (52), for the T.C.; Leonard Livesey and Peter Sutton, builders.

STOCKTON-ON-TEES.—Shops, Leven Road, Norton, for the Co-operative Society; secretary.

UPMINSTER.—School (£11,965), for Essex E.C.; J. Stuart, county architect, Springfield Old Court, Chelmsford.

WAKEFIELD.—County offices, Wood Street; clerk of the County Council.

YORK.—Warehouse, Wiggington Road; Rowntree & Co., Ltd.

The

Electrical Review

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Contents:

	PAGE
The Chancellor and Oversea Trade	625
London's Traffic	626
Improving the Load Factor	626
Wireless "Beam" Communication (*illus.*)	627
The Domestic Load, by E. G. Ross (*illus.*)	630
The Trade Unions Bill, by W. Eric Jackson	633
The Ordinary Engineer and his Remuneration	634
Electric Water Heating, by J. W. Meares	635
An Automatic Telephone Switch (*illus.*)	637
Business and Industrial Notes	638
Lighting and Power Notes	642
Tramway and Railway Notes	643
Telegraph and Telephone Notes	643
Radio Notes	644
Contract Information	644
Forthcoming Events	646
Notes	646
Institution Notes	648
Our Personal Column	648
Financial Section—	
New Companies Registered	649
Financial Section—*continued.*	
Official Returns of Electrical Companies	650
City Notes	650
Stocks and Shares	651
The Electrical Industry and Market	653
New Electrical Devices, Fittings and Plant (*illus.*)	654
The Electrical Imports of Ceylon	655
Turbo-Generator Construction in Russia	655
New Drum-Type Controllers and Motors (*illus.*)	656
Mercury Contact Motor Starters (*illus.*)	657
Some Recent "Metrovick" Contracts (*illus.*)	658
Oil-Immersed Circuit Breakers, by E. B. Wedmore, W. B. Whitney, and C. E. R. Bruce	660
Parliamentary News	661
Correspondence—	
Machine Tools in the Power Plant	662
Legal	662
Reviews	662
Published Specifications	663
Trade-Mark Applications	663
New Work for Contractors	664

The Chancellor and Oversea Trade.

OUR comment regarding the future of the Department of Overseas Trade had gone to press last week when the Chancellor of the Exchequer delivered his Budget speech.

Successive governments have in their search for economy turned their attention to the new Departments created since the outbreak of war in 1914, and for some reason or other their eyes have turned upon the Department of Overseas Trade with a distinctly reproachful look—an unnecessary member of the family, a late arrival, a small, harmless, comparatively inexpensive creature, but *such* a millstone round the neck of its parents!

How did this unwanted child come into existence? Was it not once the puny offspring of two Departments of State, namely, the Board of Trade (Commercial Intelligence Branch) and the Foreign Office? Was it not felt that by such a combination, efforts of a divided and scattered character could be concentrated and that a necessary service could be rendered to the trading interests of the nation—a service for which there was a need, they having been sadly neglected in earlier years? And does not the business world in 1927 pay unmistakable tribute to its usefulness?

The Ministry of Transport is to be abolished "as a separate department," while some of its activities will be continued; the functions of the Mines Department are "to be distributed," and, says the Chancellor, "The Prime Minister has also decided that arrangements shall be made during the present financial year to . . . *terminate the separate* existence of the Overseas Trade Department." Note that our Herod does not propose

to present three heads on a charger for the delectation of the modern Salome, who dances for economy at all costs. The precise words may possess special significance. It is one thing to abolish a Ministry as a separate department; another to distribute the functions of an unwanted department; and may be something else altogether to "terminate the *separate existence*" of a third. We shall have to wait and see exactly what is meant when the promised legislation relating to them is brought before Parliament for consideration. But we do hope that somebody who remembers what happened in the old days when trade intelligence matters received such poor attention under the divided control of the Board of Trade and the Foreign Office will have an influential voice in settling what the future shall bring. The last thing in the world that anybody ought to want is a return to pre-war inefficiency in this connection as in the days when the Commercial Intelligence Branch of the Board of Trade was the Cinderella in a Basinghall Street kitchen.

Sir Eric Geddes with his axe wanted to cut off the Department of Overseas Trade's head years ago; yet he was once a president of the Federation of British Industries. It used to be said in those days that the F.B.I. had no use for the Department—that its own organisation sufficed. But since the Chancellor made his speech, one of the most important objectors to the proposed change has been Sir Max Muspratt, the present president of the Federation. The Chambers of Commerce of the United Kingdom, whose voice should also carry weight, are strongly in favour of its retention. We cannot think that either the Prime Minister, whom the Chancellor credits with the decision, or the Chancellor himself, can be alive to the overseas trade information-getting activities of governments in competing industrial countries, or they would not advocate a reduction of operations by this country when we are faced with a very stiff competitive contest for our so essential export trade.

We do not criticise the policy of abandoning unnecessary departments and striving after economy; nor should we object to the reorganisation of the Department of Overseas Trade if it were found to have added needlessly to the number of ornamental officials. What we are anxious about is that the useful service that experience proves it able to render shall not be scrapped; that the future of the work of our Trade Commissioners shall not be of less but of greater value; that the British Industries Fair shall be developed still further from year to year; and that the ceasing of a "separate existence" shall not mean that the experience accumulated by and recorded in the Department will be smothered among the multiplicity of interests in a department which, like the former Board of Trade and a distinguished old woman living in a shoe, had so many children that none of them received the proper share of attention.

In doubt as to what the Chancellor means, the first impression is that, if the worst comes, it may be necessary for the individual manufacturer and trader more earnestly to seek out his own information to the best of his capacity; for trade associations to organise themselves for more efficient collection of information from oversea markets for the benefit of their members; and for organised and unorganised traders alike to enable the trade Press to increase still further its trade information-collecting services.

London's Traffic.

All who have read the recent report of the Royal Commission on Cross-River Traffic will agree that, so far as road transport is concerned, their recommendations embody a far-sighted and effective scheme for the relief of many of London's traffic difficulties. We were glad to read the Prime Minister's announcement that the Government proposed to support the main outlines of the scheme, and had asked the Southern Railway and the L.C.C. to co-operate in the appointment of engineers to prepare designs for the proposed double-deck road and railway bridge at Charing Cross.

While we admit the comprehensive nature of the scheme, as far as road transport is concerned, it must be a matter of regret that, with regard to railways, the proposals might (with one exception) have been made in the days of steam traction. The only reference to electrification (embodied in the thirteenth appendix to the report) is that the Southern Railway Co. regards it as "a temporary palliative." The only development in this direction is that the double-deck bridge at Charing Cross excludes steam traction from this small section of railway which, under the present policy of the Railway Co., is of decreasing importance. A wider conception of the advantages which electrification offers, particularly in the way of underground traction, would surely have given rise to some scheme by which the present congestion, both on rail and road, at the many terminal stations of the Southern Railway could have been reduced or even removed.

It is proposed to spend £12,500,000 in the central area, in which is included the cost of a new railway bridge and station at Charing Cross, and a new station and a considerable length of new track at Holborn Viaduct and Blackfriars. In spite of this very substantial expenditure, the railway facilities will not be in any way improved, but rather, if the fears of the Southern Railway are justified, slightly restricted.

At the present time there is a tendency to think of development almost exclusively in terms of road transport. Certainly since 1921, the 'bus passengers have increased from 932 million to 1,671 million passengers per annum, while railway passengers (including the tubes) have fallen from 912 to 875 millions. At a time when road traffic is increasing at such a rate that it is difficult to see how the roads are to be made adequate for their task, it is as much to the advantage of the roads as of the railways that rail facilities should be so developed as to induce as many passengers as possible to return to the trains. If, as seems possible, a practicable scheme can be developed to achieve this, it is to be hoped that it will secure the support of the engineering industry and, in due course, of the general public and the traffic authorities.

Improving the Load Factor.

The secret of cheap electricity does not reside in power stations or mains or any other engineering device—it is above all a question of management. The aim should be to produce the maximum output of energy with a given capital outlay; to fill up the valleys of the daily, weekly, and monthly load curves, so that the plant is used at full load for, if possible, the whole time. Then the cost of the kilowatt-hour is little more than the cost of fuel, which is not much even in a small station—and under such conditions of loading, old and inefficient plant can be replaced by new without materially affecting the unit cost.

In considering the probable future character of the domestic load, elsewhere in this issue, Mr. E. G. Ross is somewhat concerned because, according to his synthesis, that load appears to be "peaky"; but we would point out that the shape of the curve of each class of load is immaterial provided that the peaks of one class are not superposed upon those of another. In other words, search should be made not necessarily for loads with good load factors of their own, but for loads which occur or can be made to occur at times when other demands have fallen off. The heating of water during the night is a typical example of a most desirable load in this respect, as Mr. J. W. Meares points out, and we may add that whilst the heating of houses throughout by electricity is at present neither satisfactory as a fill-up load nor, in general, commercially practicable, the heating of the water supply is both, even under existing conditions. Hence station managers should do their utmost to develop this valuable load by offering attractive terms.

Wireless "Beam" Communication.

Details of the short-wave stations built for the Imperial Telegraph Service between England and Australia.

THE short-wave "beam" wireless-telegraph stations built for the British Post Office by Marconi's Wireless Telegraph Co., Ltd., for communicating with Australia have fulfilled the conditions specified, for their guaranteed capability of maintaining communication at a speed of 500 letters per minute



Fig. 1.—The Grimsby "Beam" Telegraph Station.

each way (exclusive of repetitions necessary to ensure accuracy) during a daily average of seven hours, was demonstrated by actual working for seven consecutive days, between March 7th and 14th.

Amalgamated Wireless (Australasia), Ltd., which is operating the service in Australia, reported that during the first six days of the test the average number of words telegraphed each way per day amounted to 148,000, which is equivalent to a speed of 103 five-letter words per minute each way throughout the whole 24 hours. This average was raised to substantially 150,000 words per day, and on many occasions traffic was dealt with at a speed of 225 words per minute, whilst high-speed duplex communication was carried on during the seven days for an average period of over 13 hours per day.

The engineer-in-chief of the Post Office (Col. T. F. Purves) has issued to Marconi's Co. an official preliminary certificate to the effect that the stations have satisfactorily fulfilled the conditions required, *viz.*, "of being capable of sending and receiving at the same time to and from the Australian stations 100 words of five letters each per minute during a daily average of seven hours in accordance with Clauses 6 and 17 of the 'beam' agreement."

In a letter to Mr. R. N. Vyvyan, engineer-in-chief to Marconi's Co., Mr. E. H. Shaughnessy, assistant engineer-in-chief of the Post Office, states that the Post Office scrutiny of the results of the seven days' trials indicated that effective both-way communication in accordance with the terms of the contract was maintained for a total time of 88.5 hours during the week (the contract required a total time of 49 hours only).

The receiving station in Australia is situated at Rockbank, near Sydenham, 15 miles from Melbourne, and the transmitting station near Ballan, 50 miles north-west of Melbourne. The service was opened for public use on April 8th, the English stations being similar to the Canadian service stations*; as the latter will be shared by the South African service when ready, so will those illustrated herewith be utilised for the service to India also.

The Grimsby Station.

The transmitting station at Tetney, six miles S.S.E. of Grimsby town, is 25 ft. above sea level: the aerial for the Australian "beam" extends N.N.W., and that for the Indian system extends south. Fig. 1 is a view of the station, the machinery hall being on the left and the transmitter room to the right; the left of the picture faces east. The transmitter delivers 20 kW to the valves of the main, or last, stage of magnification, which feeds the aerials.

Power Plant.—Electricity is obtained from the Grimsby Corporation by an underground cable, delivered as 3-phase, 50-cycle power at a normal pressure between phases of 6,300 volts, and is transformed by a delta-star 250-kVA bank of three single-phase transformers to 3-phase, 400 volts between phases and 230 volts single-phase to neutral for lighting and heating the station buildings. The transformers (by Messrs. Johnson & Phillips, Ltd.) feed through an l.p. switchboard in the machinery room: (*a*) Three alternators (by Crompton & Co.), each of 50 kVA, single-phase,

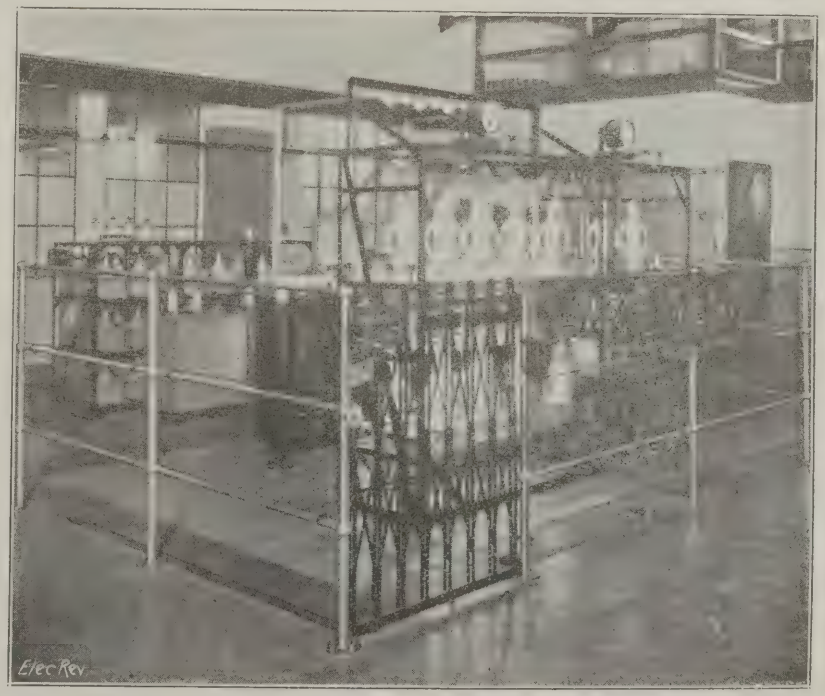


Fig. 2.—The Valve Rectifier Plant; "Smoothing" Condensers Behind.

* Elec. Rev., October 29th, 1926.

at 1,000 volts, 300 cycles, for supplying from 8,000 to 10,000 volts to the anodes of the transmitting valves, after passing through special single-phase, step-up transformers, and the valve rectifying and smoothing apparatus; (*b*) three alternators (by the Electric Construction Co.) each of 1.5 kVA single-phase at 220 volts, 500 cycles, for energising at 2,000 volts the anodes of the valves in the drive (or master oscillator) panels of the transmitters, through special single-phase, step-up transformers and valve-rectifying and smoothing apparatus; (*c*) three alternators (by the Electro - Dynamic Construction Co.), each of 10 kVA single-phase at 500 volts, 300 cycles, for heating the filaments of the main and drive rectifying valves at 11 to 12 volts through step-down transformers; (*d*) three generators (by Messrs. E. R. and F. Turner, Ltd.), each of 7½ kW d.c. at 24 volts, one for each transmitter, to supply the filaments of the oscillator and absorber valves and also to charge the batteries which heat the filaments of the master-oscillator valves; (*e*) two d.c. generators (by E. R. & F. Turner, Ltd.), each of 12 kW at 110 volts for exciting the alternators and the control and signal relays. The motor control pillars were supplied by the Airedale Electric Manufacturing Co., Ltd., the switchboards by the Harland Engineering Co., Ltd., and cables by W. T. Henley's Telegraph Works Co., Ltd.; Stanley Cooper & Co. carried out the electric lighting installation, and a two-ton hand-operated travelling crane by Herbert Morris, Ltd., spans the machinery room.



Fig. 3.—The Transmitter Room: Australian Service Plant on Left and Indian Service Gear on Right.

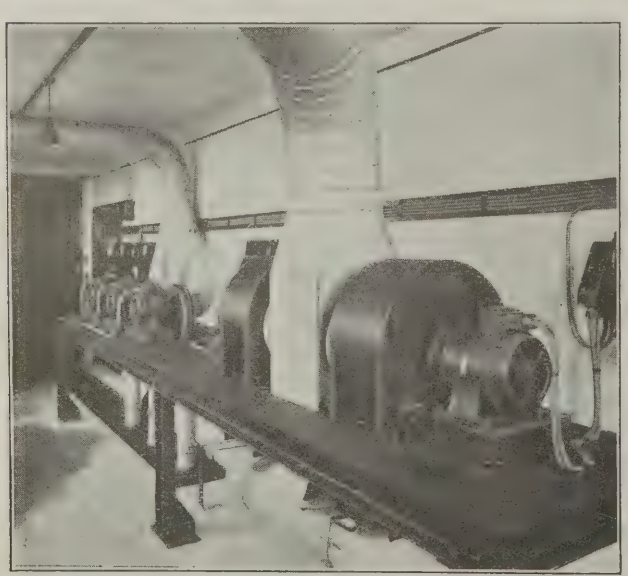


Fig. 4.—Valve and Absorber Mat Cooling-air Blowers.

Batteries.—Four 8-cell, 16-volt, 420-amp.-hour batteries by the Hart Accumulator Co. (two being used alternately for each transmitter) supply the filaments of the oscillator valves in the drive and No. 3 magnifier panels. Two 400-volt, 5-amp.-hour unpasted lead batteries, each consisting of 220 cells, supply negative voltage to the grids of the magnifier and sub-absorber valves. Two 200-volt batteries and 6-volt portable ones work the local heterodyne oscillator listening set.

Radio Plant.—One main and one drive rectifier (two sets) provide the high-voltage d.c. anode supplies for each transmitter: each main rectifier carries a bank of 16 MR7a valves, and each drive rectifier two MR7a valves. The main power transformers were manufactured by Ferranti, Ltd., and the main rectifier-filament transformers by Johnson & Phillips, Ltd. Control tables are mounted between the two transmitters, which face each other. In the case of the Indian transmitter (fig. 3, right) isolating links have been provided for changing over the anode supplies to either of the two "drive" panels, each of which is tuned to one of the two wave-lengths for which the transmitter is designed.

The two high-speed keying relays are of the A.T.M. standard type, and a 4-pole change-over switch enables one or the other to be put into use instantly. The wireless transmitting apparatus and rectifiers were designed and constructed at the Chelmsford works of the Marconi Company, and the valves used were manufactured at the M.O. Valve Co.'s works in London. The brick buildings were constructed by Holloway Brothers, Ltd. Water for the requirements of the station is obtained from a well. Fig. 4 shows, in the background, the three Sturtevant blowers which supply cooling air for the seals of the main magnifier valves, whilst in the foreground can be seen the two blowers which furnish air for cooling the absorber mat resistances through which the load is shunted from the magnifiers when the transmitting key is "spacing." This method of keying has the great advantage of needing only one small relay between the land-line and the transmitter, which means only one small mechanical motion.

Controls.—On the control tables (fig. 3, centre) are three potentiometer-type regulators, one controlling the voltage of each main power alternator, and three similar regulators for the voltage of the drive-power alternators, thus giving complete control in the transmitter room of the high voltages from the power house. There are also two filament control tables, one for each transmitter, carrying variable resistances for varying the filament current in easy stages; they are completely cut out during the normal working of the set. Variable resistances on the transmitter panels themselves allow for slight differences in filament voltages of similar types of valves and for minor variations on the main

filament busbars; there is a separate control for each valve.

Other tables carry land-lines controlling instruments and the local heterodyne oscillator set by which the outgoing signals can be checked or listened to. There is also a standard wave-meter for checking the length of the wave being radiated.

Call Letters and Wave-Lengths.—The Indian transmitter is arranged for signalling on two wave-lengths of approximately 35 and 16 metres, one of which will be used for night and the other for daylight communication. The call-letters of the England-India service are GBI. The Australian transmitter is arranged for transmission of signals to Australia on a single wave-length of approximately 26 metres. The call letters of the England-Australia service are GBH.

Masts.—In the case of the Indian service, there are five masts in a straight line, at right angles to the great circle bearing to India; they carry the vertical aerial and reflector wires which project the beam. In the case of the Australian service, there are three masts only in a straight line, at right angles to the great circle bearing to Australia; they carry two parallel rows of vertical aerial wires with vertical reflector wires fixed between them, which arrangement makes it possible to project a beam along the great circle to Australia in either easterly (evening, 9,000 nautical miles) or westerly (morning, 12,000 miles) directions.

The masts (manufactured and erected by Messrs. Francis Morton & Co., Ltd.) are of steel lattice construction and weigh 38 tons; they are of square section 12 by 12 ft. The overall height of the masts is 287 ft. in the case of the Indian masts, and 260 ft. in the case of the Australian masts; the top steel cross-arms, weighing 3 tons, are 90 ft. long. The masts are spaced 650 ft. apart, and the total length of the line of the five Indian masts is 3,150 ft., and 1,300 ft. less in the case of the three Australian masts.

Aerials and Reflectors.—For the Indian service (two bays for each wavelength) each of the two 35-metre bays has 16 vertical aerial and 32 vertical reflector wires; in each of the 16-metre bays there are 24 vertical aerial and 54 vertical reflector wires. For the Australian system there are two parallel aerials, back to back, with one reflector fixed between them, each having 16 vertical aerial wires per bay, and the reflector, common to both aerials, consists of 32 vertical wires per bay; in the aerial wires phasing inductances are inserted at intervals. The reflector wires are made up of insulated lengths, and the distance between the aerial wires and between the aerial and the reflector wires bears a definite relation to the wave-length employed. The wires are suspended on the "double-catenary" system, and the lower end of each is made fast to a balance-weight structure.

Feeder System.—The high-frequency current from the transmitter-house is conveyed to the aerials through a feeder system consisting of two concentric copper tubes, the inner one centred in the outer by porcelain insulators. The outer tube is earthed and carried on iron standards driven into the ground. Very careful attention was needed to ensure mechanical and electrical symmetry within fine limits throughout its length.

The Skegness Station.

The "beam" receiving station at Winthorpe, about two miles N.N.W. of Skegness, has open country around it in all directions. Power is generated by two 18-h.p. Aster two-cylinder petrol-paraffin engines directly coupled to two Metropolitan-Vickers 10-kW dynamos supplying a 110-volt main switchboard for charging the battery used for lighting the station and for driving four motor-generator sets (by the Crypto Electrical Co.), two of which sets charge the 4-cell filament batteries and two the 110-cell anode batteries; the plant is thus duplicated throughout. The batteries are of Tudor make. The receivers stand near the wall where the feeders enter the building. At one end of the room is a table for the recording apparatus and land-line apparatus (fig. 5): on the left can be seen a key and P.O. "omnibus" sounder for communicating with the transmitting station and the Central Radio Office in London for control purposes; next are two sets of high-speed recording apparatus (Marconi UG.2 type), with tape pullers to the left of each (fig. 6 is a close-up view of one set); and on the right is a Wheatstone transmitter for land-line testing purposes. The received signals are put direct to line through A.T.M. high-speed relays, and can be checked for formation by means of undulators.

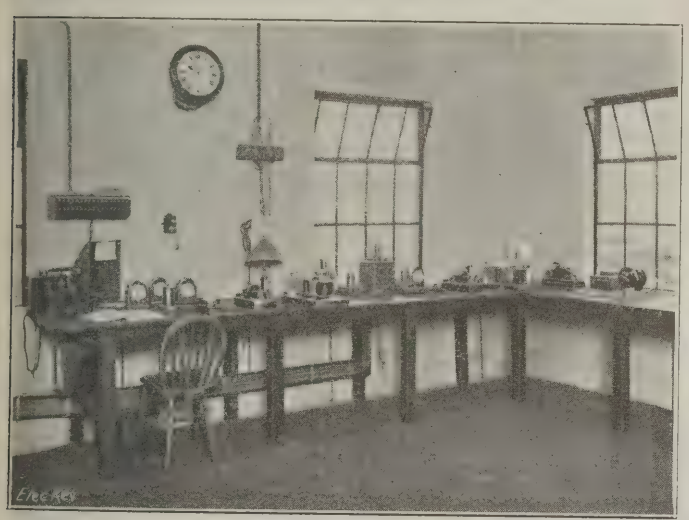


Fig. 5.—Receiver Room; Land-line Apparatus.

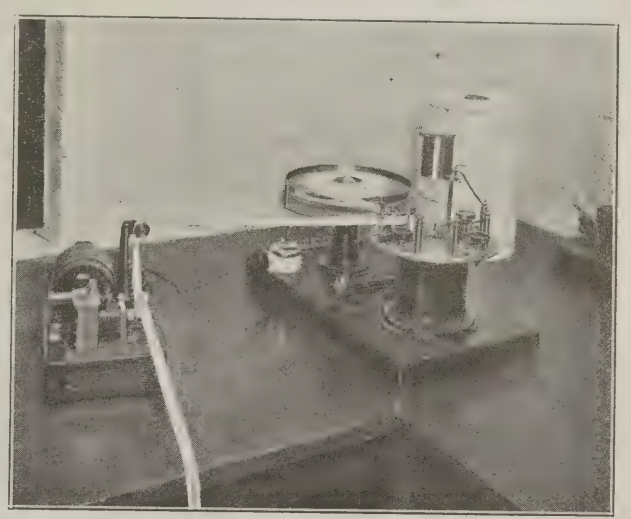


Fig. 6.—High-speed Automatic Siphon Recorder.

Aerials.—The masts, receiving aerials, reflectors, and feeder system are duplicates of those at the Grimsby transmitting station. The masts are at right angles to the direction from which the signals are received, the effect of the reflector wires being not only to screen the aerial from signals coming from behind, but also to reflect back to the aerial energy received from the front of the system exactly in phase with that directly induced.

Receivers.—Each of the two Marconi short-wave beam receivers consists of 10 units, each contained in a copper screening box to obviate interaction. They are mounted in a vertical iron rack, enabling them to be adapted for any special purpose by simply replacing one or more units.

The receiving and recording apparatus was designed and manufactured at the Chelmsford works of Marconi's Wireless Telegraph Co., Ltd. The valves were manufactured by the M.O. Valve Co., cables were supplied by W. T. Henley's Telegraph Works Co., Ltd., and motor starters by Veritys, Ltd.

The Domestic Load.

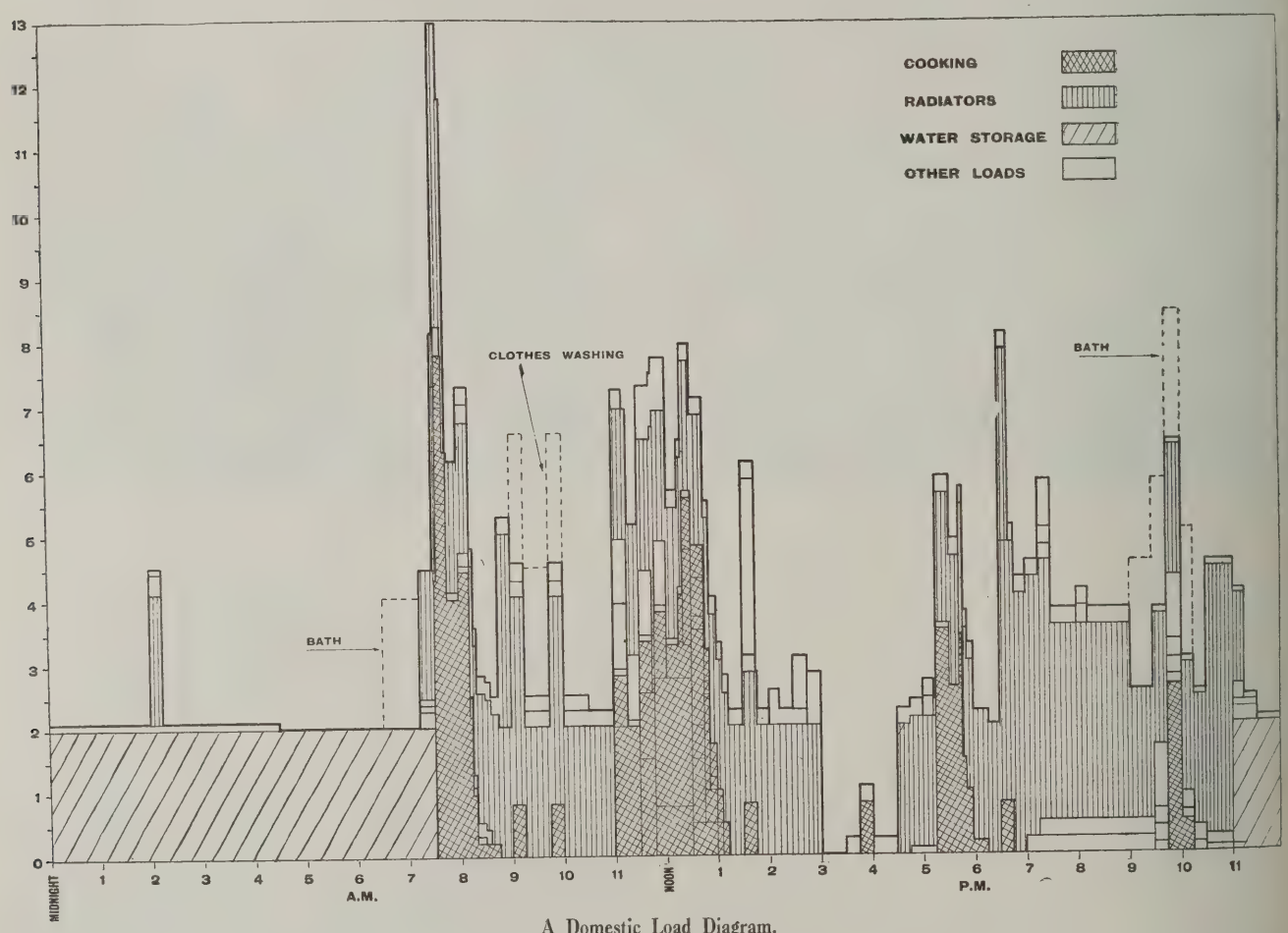
Suggestions for its improvement based upon a detailed analysis of its constituents, and of the periods during which electrical apparatus is in operation in the home.

By E. G. ROSS, A.M.I.E.E.

THE country's Domestic Electrification Scheme reaches out to secure the conversion of a load, the exact dimensions of which, as a whole, are probably beyond computation at the present time, and of which, in its individual parts, not nearly enough is yet known. It is, however, already time to look to the future, particularly having regard to the Ministry of Health's tendency towards the subsidising of cheaper houses than hitherto, and to the similar tendency of private building schemes.

so forth, while the larger-sized dwellings are decreasing purely on account of first cost, and the more efficient expenditure of money. It is, therefore, safe to say that the average electrified house of the approaching future will comprise four residential apartments plus a kitchenette (*i.e.*, two bedrooms, living or dining room, drawing room, and kitchenette).

The daily load of such homes must develop primarily in proportion as electricity is regarded as a convenience. The present margin between "all-electric" and other



A Domestic Load Diagram.

Also, the effects of the E.D.A -E.L.M.A. campaign are beginning to be felt. Although the gross results will not be known for some time, they are undoubtedly certain.

Again, however unpopular the Government's electricity measure may be with the profession, that it *is* popular with the lay mind is apparent to the veriest electrical tyro. Electric power, generally, could not have had a better advertisement, and the exceptional psychological effect of the Bill on the lay mind will be felt in trade circles before very long.

The potential consumers concerned at present occupy residences of from three to seven apartments (including kitchenette, &c.). The lower-sized homes are expanding on account of desire, prevention of overcrowding, and house costs is too fine to influence domestic electrification as much as is desired; but the "convenience" load must, in time, alter this state of affairs. American development has shown that immediately the "convenience" movement began to take effect, practically every power undertaking of note had its hands full (day load). Human nature being much the same the world over, it is reasonable to apply the same principle to this country. Consequently "convenience" load will ultimately result in "cheap power" load, other factors being equal; and this, in its turn, will influence still greater "convenience" loading.

Therefore any daily-load characteristic that is considered should take account of the "convenience" aspect of the home, and it is suggested that provision

must now be made in mains, to accommodate a future average connected load made up as follows:—

Lighting	.950 kW
Radiators	5.000 ,,
Cooker	7.000 ,,
Hot water (heat storage) ...	2.000 ,,
Kettle (two pint)	.800 ,,
Coffee jug	.500 ,,
Child's milk heater	.300 ,,
Toaster	.600 ,,
Table hot-plate	.200 ,,
Bed warmer	.100 ,,
Iron (5½ lb.)	.450 ,,
Wash boiler	3.000 ,,
Washing machine	.350 ,,
Vacuum cleaner	.250 ,,
Fan	.070 ,,
Refrigerator	.250 ,,
Curling-tongs heater	.750 ,,
Hair-drying blower	.200 ,,
Violet-ray apparatus	.060 ,,

giving a total connected load of nearly 23 kW; not a negligible load by any means! Nor an impossible one; for at the present time the same average "all-electric" house has a connected load of:—

Cooker	7.000 kW
Lighting	.750 ,,
Iron	.450 ,,
Kettle	.800 ,,
One radiator	2.000 ,,
Vacuum cleaner	.250 ,,

or about half the suggested future connected load figure.

Already that figure has been variously estimated at between 17 kW and 25 kW, the lower figure relating to this country (see several I.E.E. discussions). This is probable if such things as refrigerators, washing machines, and similar apparatus are left out of account, but only first cost will rule them out, not convenience, which is again accented as the immediate domestic pulling point.

Should the reader question the necessity for certain of the items cited, he must remember that the house is considered to be quite "all-electric,"—no coal or gas whatever being used. Further, the effect of the new law relating to foodstuffs cannot be ignored, as it is probably only the thin end of a powerful wedge. Nor can the constant upward tendency of the general standard of living be neglected. Each of the stated items has only been included in the light of some years' experience in a large city.

Average power consumption figures have been taken. Makers are so diverse in their power requirements for any given type of utensil that average figures, indeed, afford the only possible basis. Thus, while .95 kW of lighting is fairly definite, and the 7-kW cooker is almost universal, radiators and fires to heat the same cubic space may vary between 3.5 kW and 6 kW according to type. Allowance has been made for five portable 1 kW radiators arranged two in the drawing room, two in the dining or living room, and one for bedroom use, to be supplemented by one of the others if and as necessary. Experience shows the greatest convenience to result from this arrangement.

A point arises in connection with the cooker. The most modern cookers utilise enclosed, or solid type boiling rings, and these are rated at about 10 per cent. less wattage than for the older open type. Further, the new rings cook the same amount of foodstuffs in but 60 per cent. of the time taken by the open rings. Hence the total power consumption is very appreciably less than obtained hitherto, so that 7 kW might be thought an outside figure. For some areas this may hold. However, a decided inconvenience in the old cookers is the lack of a *third* boiling ring. The demand for a third, low-power boiling ring now becomes insistent, and it is gratifying to note that some makers are incorporating the extra ring in their latest products. With more efficient boiling-ring construction, and, particularly, much needed improvement in the (heat) insulation of them from the top plate of the cooker, it may be presumed safely that in the near future three boiling rings per cooker will be the regular feature, and these rings will not consume any more power than is now taken by two. Thus 7-kW cooker maximum demand is a reasonable figure.

The geyser type of water heater is not included. As a station load, it is not regarded with favour, the ideal for domestic purposes being an all-night automatically heated and well lagged tank. The very large improvement in station load factor with many such tanks as connected night load must oust the geyser ultimately for most domestic purposes. As it is, the storage tank in conjunction with a kettle and an electric wash-boiler suffices amply for usual needs. For washing greasy dishes, it is usual, and indeed, proper, to fill either the kettle or the wash-boiler with the requisite amount of water already made hot in the storage tank, thereby connecting the intermittent water-boiling load for the shortest possible time. Such an arrangement is advantageous to both station and consumer. Two kilowatts of night load for water storage is thought to meet most needs, although for bathing, a booster heater of 2 kW is sometimes necessary. Some comments are made later on this point.

The coffee jug and child's milk heater have already made great strides, the latter especially proving of very considerable value in the early morning hours where young families have to be attended to. Power here again varies widely with make (and also size).

The toaster is likewise a great convenience, although economy sometimes results if the cooker grill is used. Generally, however, toast made under a grill is less satisfactory than that made in an enclosed receptacle designed for the purpose (which method, by the way, has medical approval).

The undeniable convenience of the table hot-plate is already reflected in its sales, although were ovens used properly, it could be done without. Unfortunately perfection on both sides of the house being the exception rather than the rule, an auxiliary is rather necessary to take care of "lost my train," "detained at the office," &c. With a cover over the foodstuffs, 200 W is sufficient to keep most articles palatably hot after removal from the cooker.

The bed warmer begins to be appreciated. It is a great convenience to have no "skittling" with hot-water bottles, red flannel, and so forth. Incidentally, as a night load, even though a small one, it is valuable to the power station. The principle of "many pennies to the pound" is too important to be neglected where night load is concerned.

The iron needs little comment, except perhaps that its future size is likely to increase rather than decrease. The beautifully smooth action of the electric iron lends itself to a rather heavier iron being used, with its corresponding advantages.

The wash boiler is a necessity, as will be seen from the above remarks about geysers and, like the storage tank, it may require an auxiliary heater of an extra kilowatt.

The refrigerator is a new thing for domestic use, but it must, in time, become essential. The tendency of all legislation is towards the sale of "natural" foodstuffs only, which keep but for a short time, and, while a point of controversy arises as to whether the home or the grocer's shop will contain the refrigerator, preference has here been given to the home, having regard, primarily, to convenience. Power consumption varies according to type, compressor apparatus naturally taking considerably more power than the purely thermo-chemico-static type. Probably the latter will find favour on account of first cost, and a low power figure has therefore been taken.

The last three items belong to my lady's perquisites. Has any engineer the temerity to doubt the future demand for these articles? The violet-ray apparatus may be slower in gaining appreciation than the others,

but to draw attention to the fabulous amount of money spent by womankind on hairdressing and beauty culture is surely sufficient answer.

The lighting load figure is not high, having regard to artistic sense, and the certain raising of the general standard of living and illumination all over the country.

Certain loads cannot be properly reckoned as regular daily features. These are (1) provision of water for baths, which, with a household of four, may be taken as necessary every second day; (2) water for clothes washing, &c., which involves the use of the extra heaters in the boiler and storage tank, and also the use of the washing machine; (3) the fan, which is very intermittently used in this country and of less account than any of the other loads; and (4) the iron, used on an average not more than twice weekly. Individual personal characteristics reflect upon these loads more than anything else, and it is therefore difficult to allocate to them a definite time per day. It is quite conceivable that they may all come on together. Their approximate position on any day's load curve, however, is indicated by the dotted lines in the diagram, two alternative times for bathing being shown.

Thus the suggested connected load could hardly be termed grandiose. Criticism of it must vary, depending upon the customs and habits of the reader. A South Wales reader lives differently from a London or Glasgow reader, and his ideas of necessity and convenience differ accordingly. But it is thought that the suggestions will cover fair average instances.

How are these loads disposed throughout twenty-four hours' working?

The load diagram on p. 630 has been computed on the basis of some years' observation and experience of a number of users residing in "all-electric" homes, and a measure of its accuracy may be gained if the cessation of the properly mid-day load at 1.15 p.m. be noted. The daily load curves of most large power stations in this country show very definite clefts about 1 p.m., *i.e.*, when most industrial establishments have closed down for the mid-day meal. (Typical curves for the Dalmarnock station are to be found in Vol. 64, p. 294, *Journal*, I.E.E.) The two times tally sufficiently well for the present comments. The diagram refers to an average spring day.

Probably the most striking point is the exceptional irregularity of the loading. From the disturbance caused by baby at 2 a.m. until lights out at 11.30 p.m., the succession of peaks is quite unique. The main trouble (if such it may be called) originates in the cooking load and in the use of the smaller intermittent loads, the latter having a very disturbing effect. The staple loads are the water-storage load during the night, and the radiator load during the day, the latter being broken only from 3 p.m. to 4.30 p.m. It is conceivable that in many instances the radiator load is rarely broken at all.

The diagram might have been improved had it been built upon these loads as foundations, but, originally, it was particularly desired to examine the cooking load conditions, and these were first plotted. The final shape of the curve holds, of course, either way.

The cooking load (which includes kettle and coffee jug, &c.) is very complex, as will be seen from that part of the curve representing the mid-day position, in which the constituent parts of the load have been fully indicated. The actual switching operations here are as follows:—

11 a.m.	Large boiling ring ...	full
	Kettle	on
11.15 a.m.	Kettle	off
11.30 a.m.	Large boiling ring ...	med.
	Small boiling ring ...	full
	Kettle	on
11.45 a.m.	Oven	full
	Kettle	off
11.50 a.m.	Small boiling ring ...	med.
12.00 noon	Large boiling ring ...	low
12.15 p.m.	Kettle	on
12.20 p.m.	Grill	full
12.30 p.m.	Small boiling ring ...	low
	Kettle	off
	Coffee jug	on
	Oven	med.
	Table hot-plate	on
12.45 p.m.	Large boiling ring ...	off
	Oven	low
12.50 p.m.	Grill	off
1.00 p.m.	Small boiling ring ...	off
	Table hot-plate	off
1.05 p.m.	Oven	off
1.10 p.m.	Coffee jug	off
1.30 p.m.	Kettle	on
1.45 p.m.	Kettle	off

The remainder of the diagram has been built up similarly.

A probable danger point is 7.30 a.m., at which time circumstances may arise to cause annoyance. By far the largest peak occurs here, as will be seen from a case in point. A friend converted his establishment by degrees to one almost wholly electrical. That is, he installed a cooker, followed it later by a radiator, and so on, some months elapsing ere the change-over was complete. One morning he decided to have a hot bath immediately after rising. The weather being frosty, all the radiators were in use. Practically the full connected load was switched on at one time. The cable drop was sufficient to delay the cooking operations by about fifteen minutes, likewise the hot bath, which cost the bather his train and his temper. Conceivably, the point could be of importance in a given area, and, it is thought, to avoid the cost of excessively heavy main and sub-cables to cope with a very short high-peaked load, the time switch on the hot-water tank might be arranged to switch in the booster heater from, say, 6.30 a.m. to 7 a.m. At the appropriate time the cable would then be free to take the normal cooking and heating load.

The morning load appears to be the least favourable. The mid-day load is much better, and the evening load between the two. (Where late dinner is the rule, the mid-day and evening loads shown will, of course, be interchanged.)

On the whole, the domestic load peaks occur synchronously with the station load clefts, which is satisfactory. But the domestic load itself leaves room for improvement. Thus its own load factor is not brilliant, and there is scope for at least two methods of improving it.

One is to alter the rationale of cooking; rather a tricky job from the human nature point of view, but the Seves cooker points the way. A reversion to the "paper-bag" or "hay-box" method would be welcome from both the load factor and the consumer's points of view. Thus, if the morning's breakfast were put into an electric "hay box" or similar arrangement, and heated by the *night load*, inestimable advantage would accrue all round. The consumer would be saved much trouble in the morning, and given very little last thing at night. The food would be cooked ideally from the medical aspect, power would be very cheap, and station load factor would benefit enormously.

The idea is far from being impracticable. All that is necessary is a thermostatically controlled "hay box" and a time-temperature cooking chart. The former is an easy practical proposition, and the latter is already made quite feasible in an ordinary electrically-heated oven. The suggestion is made in all seriousness, for the question of load factor is vitally important. Electrical education ought to be directed with all the energy possible toward the attainment of cheap power through the improvement of station load factor, more particularly in view of the enormously costly transmission network about to be erected. From some years' experience and observation of electric cooking operations, the writer considers the electric "hay box" to be a perfectly practicable proposition, particularly when the

feminine mind realises the large decrease in power bills which would result from its use.

The second means of improvement lies in the sale of "convenience" apparatus designed to be used between the cooking peaks. The vacuum cleaner is an example, but is, in itself, a peak load, and therefore not of the best. To those who can afford them, low-power electro-decorative effects point the way here. The psychology of decoration is slowly widening in appreciation. A variation of colour "tone" here, a sudden contrast there, and so on, are easily obtainable by suitably disposed low-wattage tinted lamps, bowls, festoons, &c. True, at present they are luxuries, but with power price reduction, time will alter that. The subtle, but vital, influence of colour upon general health is being recognised, which, in itself, is almost sufficient. Already it is quite usual to dine in a room in which the colour scheme is peculiarly appropriate. No one would partake of a heavy meal in a drawing room. After the evening meal, to recline for an hour in a quiet colour atmosphere not only pleases, but indicates good psychological sense. A visitor to any electrical showroom, on a brilliant summer day, is, far from being disconcerted by the sunlight, deliberately, if sub-consciously, encouraged by discreet interblending of sunlight and coloured electric light.

Such a load, small in itself, but large in the aggregate, would, if judiciously used, effect a great improvement in load-factor conditions.

Finally, the diagram clearly shows that the peaks, exclusive of cooking, are the result of the summation of the small intermittent loads. This is to be expected as a result of convenience, and will be difficult, if not impossible, to eradicate. However, if in the aggregate they tend immediately to the cheapening of power (and it is confidently thought that they do), this in turn will be followed by a more general use of long-period loading, such as lighting, radiators, clothes-drying apparatus, towel rails, &c. When these become more universal, the intermittent non-cooking load peaks may be neglected.

The Trade Unions Bill.

Illegal Strikes; Picketing; and Political Funds.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

THE Trade Unions and Trade Disputes Bill may be expected—like most short Acts of Parliament—to provoke long and bitter discussion. The aim of the Bill appears to be to restore the strike weapon to its original position and function, namely, as a mode whereby employés may withdraw their labour pending a satisfactory settlement between themselves and their own employers. The Bill makes illegal all sympathetic strikes and strikes in trades in which there is not at the moment a trade dispute. The use of the strike as a political weapon, or as a direct road to social reforms in general, is forbidden. The necessity for such provisions in the Bill has, in the opinion of many, been apparent from the industrial events of the last few years.

During recent strikes the right of peaceful picketing or peaceful persuasion—conferred upon workers by the Trade Disputes Act of 1906—has more than once been disregarded or evaded in such a way as to nullify the protection given to non-strikers. Moreover, the refusal to strike has been visited with dismissal from the Union or other penalties imposed by the Union ordering the strike.

Sections 2 and 3 of the Bill are framed to remedy these matters as regards strikes which the Bill makes illegal. An "illegal strike" is one which has an object besides the furtherance of a trade dispute, and which is designed to coerce the Government or intimidate a substantial portion of the community. Hence a strike in an industry in which there is no trade dispute is illegal if it is meant as a political move to frighten the public. If it is not so meant (and it is difficult to see what sympathetic strikes will not be so designed) it is not "illegal," but it is unlawful in the sense described by Sir John Simon at the time of the last general strike—namely, dismissal from the Union cannot follow a failure to strike, and damages may be claimed by the employers against the Union calling the strike.

An "illegal" strike under the Bill must not be visited with penalties upon trade unionists who refuse to take part; they are to lose no benefits and may take any legal action against their Union to enforce their right to continue to be members and to receive benefits. The latter provision extends to all strikes *past and future*; hence any person expelled from a Union through failure to strike in May last will be able to claim reinstatement or damages.

It is to be illegal for anyone to contribute funds towards any "illegal" strike, and any person taking part in or supporting such a strike is visited with a fine not exceeding £10 or three months' imprisonment, which in special cases may be anything up to two years.

Under the Act of 1906 and the Emergency Powers Act, 1920, protection was given to persons who committed acts in furtherance of a trade dispute even though such acts might otherwise have been illegal. Such protection is taken away as regards "illegal" strikes.

Peaceful picketing is not prohibited by the Bill; but stricter provisions are made to ensure that picketing shall be peaceful in the proper sense. No intimidation of any kind is to be allowed. By intimidation is meant not only apprehension of physical violence, but fear of mental injury, boycott, or exposure to ridicule. Picketing is to be allowed so long as the number of persons engaged is not such that they obstruct or intimidate. By a special clause, watching and besetting any person's house is punishable with fines up to £20 or imprisonment up to three months.

As regards the political fund of a Union, the rule is to be "contracting in" and not "contracting out," as it now stands. Where a member contracts to contribute to the political fund, his fees are to be paid separately from his other subscription, and only the amount specifically subscribed to the political fund is to be used for political purposes. The rules of each trade union are required to be altered to conform to this provision.

Section 5 applies to permanent civil servants. They must not in future belong to a Union which is in any way given to political objects. But if a civil servant already is a member of a Union which is to give benefits on his death or disablement, he is not to be required to resign, provided he has been a member for the last six months. And civil servants who have work outside their

Government duties may belong to any Union dealing with such outside work.

Section 6 provides that public authorities must not force their employés to join or abstain from joining a Union. Hence a Labour Borough Council or a Conservative County Council can have no influence over employés either way. And non-union workers are not to be treated any differently from union workers.

Lastly, the Conspiracy Act of 1875 (which made it unlawful for a worker to break his contract of service so as to endanger life or property) is extended to cover breaches of contracts of service which will "prevent the discharge of the functions of the authority." Hence dustmen, tramdrivers, and gas workers will be unable to strike at all except under pain of fines or imprisonment.

It remains to be seen what success the Bill will meet with, and what alterations will be made in it as criticism is levelled at it. So far the opinion in Government circles as to its success is very optimistic, and one may feel confident that in some form or other the Bill will shortly become law.

The Ordinary Engineer and his Remuneration.

A review of the conditions which have resulted in the present low salaries for the bulk of the electrical engineers in this country.

By P. B. E.

THE correspondence which has recently appeared in the ELECTRICAL REVIEW inspired in me a desire to analyse the reasons for the meagre salaries paid to highly-trained electrical engineers.

In the first place, it is unfortunate, but none the less true, that the majority of skilled technicians, whilst possessed of practical knowledge and experience, are rarely men of great executive ability. There are those in the industry who are highly paid, some who are adequately paid, and a vast majority who receive salaries quite insignificant in comparison with their attainments, and with the work on which they are engaged. What are the broad divisions governing the classification? The first class comprises men with little technical training—or with none at all—who are possessed, or believed to be possessed, of outstanding business acumen. This class is composed of those who direct and manage our companies. Sometimes they possess their posts through merit, sometimes through pure cheek, and sometimes through unblushing influence exerted by someone higher up the tree. Whatever their deserts, such men are highly, even magnificently, paid. The second class, those who are adequately paid, consists of men of outstanding technical attainments; of men having ordinary technical attainments, and a knack of presenting them advantageously, and of men with exceptional personalities or influence. These two classes can be dismissed from our consideration. If dissatisfied with their remuneration, they can easily get it raised. The third class comprises probably 90 per cent. of the technical workers in the industry, and the question of their remuneration constitutes an extremely intricate problem. This class consists largely of men with University training and wide engineering experience; of men with the engineering instinct strong in their bones; and of men who, unable to afford a University education, have taken junior posts in engineering firms, and by dint of much private study and the help of evening classes, have eventually worked their way, after the expenditure of much time, to the engineering staff. There are others with no engineering instincts, no training, and no initiative, who slowly progress until their employers think that they can be employed on technical routine work and thus be used to dilute the engineering staff. With the last named we are not concerned, excepting to agree that their elimination would be highly desirable. The remainder of the class are usually hard-working and ill-used individuals. A few of the causes of their unjust treatment are enumerated below.

(1) The Britisher has a natural aptitude for engineering, and in consequence there is an inexhaustible supply of recruits, who, eager to get their feet on the first rung of the ladder, accept salaries far below what they ought. As they progress to positions increasing in importance, their salaries rise only at an insignificant rate, due to the low salaries of those coming along behind. This "negative" effect is naturally felt all along the line until the executive posts are reached. As the number of recruits far exceeds the expansion and wastage in the industry, it follows that stagnation—both as regards positions and salaries—is the result.

(2) Salary-fixing individuals are invariably well paid themselves. At all events, they have enough to live on. They forget their own experiences on the lower rungs of the ladder—or if they remember them at all, they do so in terms of pre-war salaries. They think, in effect, "Oh, well, 'X' ought to be satisfied with £350 per annum. At his age I was only getting £400, and he *can't* be as clever as I was." What Salary Fixer, Esq., forgets is that Mr. Jones's £350 to-day is equivalent to only about £220 pre-war—a most disgraceful salary to offer to any man with any pretensions to technical ability.

(3) There is no society in existence whose main object it is to secure adequate remuneration for electrical engineers. The Institution of Electrical Engineers holds itself placidly aloof. The National Union of Scientific Workers certainly includes remuneration as one of its objectives, but fails to exercise any pressure in that direction except in one or two isolated instances. Its very existence is unknown to most engineers, and its recently-issued appeal will fail in its object, since it gives no hopes of the salary question being seriously attacked.

So far as I am aware, the Society of Technical Engineers does not claim to deal directly with this question. Its declared object is to raise the status of the engineer, believing that this method of indirect attack will lead to the desired result. It is self-evident that the engineer's status does require protection and elevation, but as a means of effecting an improvement in salaries, this method is altogether too slow. Swift action is essential if thousands are to be saved from penury.

Moreover, no society will obtain effective support until it is prepared to take swift action.

(3) The inherent nature of the engineer, who generally is modest and retiring and is possessed of a modicum of proper pride. The mere asking for an increase in salary is repugnant to him, and the idea of exerting pressure, nauseating. He takes pride in his work for its own sake, consequently the quality of his work is independent of the inadequacy of his salary.

(4) Specialisation, which, it appears, is generally regarded as an asset. Perhaps to some extent it is, but it has its drawbacks—and very serious ones they sometimes prove to be. For instance, a man may have spent several years on large machine design, but he will find the utmost difficulty in obtaining a post in any other branch of design unless he can—and will—lie scientifically and convincingly.

(5) The fact that the engineering concerns of the country are scattered over a large number of localities is a serious contributory cause of low salaries. The engineer of to-day is a specialised unit. Those firms which can employ his knowledge and experience may be located, broadly speaking, anywhere between London and Glasgow. It is a serious matter for a man with a family, and no financial reserves, to uproot his home and start afresh in a new town. He may find considerable difficulty in disposing of his house without financial loss, and in procuring another. The costs connected with his removal may, in fact, neutralise for a number of years the increased salary attached to his new post. Employers are well aware of this fact, of which they take full and unfair advantage.

(6) The collaboration which exists between firms engaged on the same class of work. Although it is vigorously denied, it is a fact that certain firms will not engage a man unless his present employers are prepared to release him.

These are a few of the reasons why the ordinary engineer receives a salary on which he can barely exist, let alone educate his childen. The remedy can be summarisd in one word—education—and elucidated in very few more. The full power of the Press, both technical and public, must be enlisted. The coming generation must be shown the true position: that hoary fable of the many "plums" waiting for suitable men must be ruthlessly exploded; young engineers must be taught that the acceptance of salaries so low as to deserve the appellation "nominal," will affect not only the whole of their own careers, but those of the whole profession. Employers must be educated. They are more in need of that than are most of their employés. If they will not accept education, it must be forcibly thrust upon them. The Americans have found that high production follows high remuneration. It is time our employers were asked to experiment in the same direction. They can begin by paying fair salaries to their engineering staffs. Whereas one engineer is but a unit, the whole body, when united, could bring the employers into line with a relentless jerk in the course of a few weeks. The use of force, or forcible methods, is to be greatly deprecated, and should only be used when employers persistently refuse to act justly, after having been shown that the salaries they pay are unjust. The query arises whether employers are not, even now, fully aware of the inadequacy of the remuneration of their technical staffs. There are many who believe that they are; what employers probably do not know is that, beneath a placid surface, the whole technical side of the industry is seething with unrest. It would be well, as a starting point, if the Institution of Electrical Engineers could be galvanised into educating the multitude of employers in its own ranks. Of course the idea of that august body being galvanised by anything short of an earthquake strikes one as ludicrous, but, after all, though the awakening might be a matter of great difficulty, it is by no means impossible. Education must also be carried to shareholders, so that they may realise that the concerns they own are dealing most unjustly with one branch of the employés. The public also must be shown that it is both wrong, and uneconomical, to starve that section of the community on which the prosperity, and indeed the very existence, of the country so largely depends.

It is only from continuous, active, and public pressure that any beneficial results can be expected. When engineers realise their power as a body, they will find means of forming an organisation to protect their interests and be under their control. On that day the injustices to which we are now subjected will be on the way to being rectified.

Electric Water Heating.

A consideration of the possibilities of load-factor improvement in connection with the electrical thermal storage of water with time control by motor-meter switches.

By J. W. MEARES, C.I.E., M.Inst.C.E., M.I.E.E.

In the Electrical Review of March 4th, Mr. E. E. Sharp expressed the view that time-controlled water-heating will eventually help to fill up the hollows in our load curves—a possibility that the present writer has been putting forward for years without much effect. It has been done successfully at Simla, in India, even without time-switches, by voluntary co-operation between the supplier and consumer; but that is too much to expect here, so that it comes down to the bed-rock cost of the *additional* units generated and the cost of the time-switch. So long as clock-controlled time switches are essential their cost will be a serious obstacle to progress, though of course any great extension of their use would cheapen them.

Any one who has been much about the world knows that we British, whether rightly or wrongly, are universally debited with the characteristic of waiting till the other fellow has done it before taking action ourselves. At present, if the politicians are right, we are entering upon a new golden era of "cheaper and more abundant electricity," and we all hope they *are* right, whether we agree with their panacea or not.

Now when all has been said about grids and standard frequencies and super-stations, the plain fact remains that in improved load-factor lies the only real prospect of cheapening supply; because the additional output spreads the standing charges without increasing them, while only enhancing the running costs fractionally. (Our present-day central station load factors average about 20 per cent. only).

This has long been recognised, and many tariffs are specially devised to benefit the most useful class of

consumer; but the correspondence in the lay Press from our masters, the public, which knows nothing of load factors, but pays for the supply, shows that there is much high feeling about the discrepancies in the ultimate cost of a unit in adjoining areas. The grievance is a real one, an *argumentum ad pocketum*, which no amount of perfectly correct technical explanation will in any way allay.

Of late years the more progressive undertakers have been busy improving their heating and cooking loads by means of special tariffs, and at the same time improving their load-factors and reducing their total costs per unit generated. It is perhaps not always fully realised that if the public responded, and really boomed these special supplies, they would soon become predominant and swamp all other uses; in which case higher, rather than lower, rates would have to be charged in order to redress the balance. An oft-quoted example, in a "Report on the Heating of Houses" by the Hydro-Electric Commission of Ontario, shows that if the 80,000 houses in Toronto alone were electrically heated this would require eight times as much power as the present total demand of that City; so that heating would have to bear the whole cost and provide all the profit, leaving other uses of power as the by-products.

Up till now domestic water-heating, except in a few places supplied by water-power, has been considered prohibitive in cost; and, if it were not so, the Ontario objection would still apply if it became universal. Economic conditions, however, make it certain that there is no immediate danger—or shall we say prospect—of any inordinate run on our stations for any form of heating. Therefore, the more such loads are developed as paying loads, or even as overhead-cost-spreading loads, the better.

Now the diversity factor of cooking loads is generally bad, and that of house-warming loads indifferent; the peak times of the former necessarily coincide as a rule, and the demand for heat varies with the climate and so is fairly uniform in any one area. And when power is wanted for these purposes it must be available; no one will alter his hour of breakfast or dinner, or sit in cold storage, in order to improve the load factor of one undertaker (and perhaps the business of another) and to obtain a slight reduction in the tariff.

With water heating it is different. Hot water must, it is true, always be available, but with properly lagged tanks it can be kept hot for hours with the power cut off—and, unlike a chop, with little deterioration. Whereas electric cooking and house warming require the full power (or nearly so) to be in use during the whole period of operation, and no power at other times, it is otherwise with water heating. Here, with properly designed thermal storage, there can be a uniform consumption of power throughout most of the 24 hours, regardless of the time at which hot water is actually drawn off. This is, or could be made, an immense advantage to the suppliers, as the amount of plant—and capital—per kWh sold for the purpose becomes the minimum.

In order to obtain the full advantage power must *not* be used throughout the whole 24 hours; it must be cut off at times of peak load. If the morning peak is much smaller than the ordinary evening peak, the latter alone need be considered; if there are two or more comparable peaks, all must come into the reckoning. Now it is abundantly clear that the consumer cannot be induced or trained to cut off the water-heating apparatus before the peak and to restore it afterwards, so if it is to be done at all it must be done automatically. The advantages of so doing it, both to undertaker and consumer, are incalculable; and considerable capital expenditure would be justified in supplying a reliable time-switch in each installation. Practical examples are always useful in these cases. Let us assume a small house requiring 110 gals. a day at 100 deg. Fahr. and it will be found that with modern apparatus this requires some 5,500 kWh per annum. If a time switch costing 60s. were employed, 15 per cent. on its cost would amount to 0.02d. per kWh; and, as the prime cost would be fairly independent of the consumption, this figure would be far less in large houses. The gain to the undertakers in additional output without increased maximum demand would clearly be far more than this sum, and they could install the apparatus free of vexatious rent charges; but we are not progressive in such matters.

It may be assumed that a charge of a halfpenny a unit *over all*, coming to nearly £12 per annum for 5,500 kWh, would be near, if not beyond, the limit obtainable from a small householder; and at present there are not too many stations in which the cost of fuel alone is less than this, though it would be less for *additional* units taken by themselves. Still, we must look forward to better times, while reckoning that from both the average supplier's and the average consumer's points of view a halfpenny may prove practicable.

But is it necessary that a time-switch costing even as much as 60s. should be required? Some years ago, in a case where an immediate and assured market existed, the present writer addressed several leading manufacturers suggesting that a cheap and efficient time-switch could be evolved on the basic lines of an ordinary motor-meter, which at the pre-arranged time would operate a relay to open and close the circuit; he was told that it could not be done. The difficulty is said to lie in the fact that the best of these meters are bad timekeepers, and that only a clock is effective. The permissible error of motor meters, as laid down by the B.E.S.A., is 2 per cent. either way at from one-fifth to full load; that would be half an hour a day, and no such error is allowable. But over so wide a range there is necessarily a large departure from straight-line accuracy; and under service conditions, for which the B.E.S.A. caters, the meter is stationary and cold for hours in the night, and varying its load and temperature without cessation at other times. Surely if the motor were designed for *constant operation at one load only*, across the supply mains, the rate of rotation would necessarily be practically uniform? (The slight changes in the supply voltage would average out in the course of a day). At any rate, has any maker ever tried this out? The writer can find no evidence that any one has put out a fiver-sprat in definite research for a way of catching this million-whale.

As matters now stand such a motor time-switch could be reset once a quarter, at the time of meter reading; an error of ¾ hour in that time could be compensated for by adding it to the switched-off period, for it would be definitely either a gaining or a losing error, and not an erratic one. This would involve an inaccuracy not exceeding one-tenth of one per cent. in the rate. Perhaps that is too much to expect. But the time of peak load also varies with the seasons, so that even with a clock-switch it would be necessary to reset the gear from time to time. It would seem as though, in order to improve the load factor by a matter of 20 to perhaps 40 per cent. it would be worth while to have all the time switches set by hand once a month, or even once a week; large interests are at stake when a single small house may be worth 5,000 extra units. Clearly, when starting the system each individual switch would have to be adjusted to the mean pressure conditions of its locality; but that is merely a matter of changing a wheel in the gear train after a week's trial.

The Electrical Development Association and kindred bodies might think over all this with advantage, for a fraction of the money and brain power spent on boosting electric cooking would probably show a far greater eventual return.

[The Warren synchronous motor—a simple little device, which is widely used in the United States for driving electric clocks—could perhaps be used to close a switch at, say, 9 p.m. and open it at 5 a.m., on a.c. circuits, all the year round, without attention (see Electrical Review, February 18th, 1927, p. 276).—Eds.]

An Automatic Telephone Switch.

A quick-acting switch which can be manufactured on a large scale very cheaply: it can be constructed and arranged in a very simple manner to act as a line-finder, call-distributor with many outlets, group selector, or final-selector.

ALTHOUGH the Strowger switch is used extensively in telephone exchanges, there are others which differ considerably from that pattern, in that they are power-driven. Many rotary switches are thoroughly efficient in comparison with the Strowger type; nevertheless, they cannot be employed in the simplest manner as line-finders, call-distributors, group-selectors, and final-selectors, as desired. For example, if connected as line-finders in installations whereof the groups contain 100 subscribers each, then, in the case of most of them, several switches must be arranged in parallel with one another for each junction; and, if the switches have a 50-point contact bank, the contact arms must also be crossed, the calling line is to be connected through quickly. Those switches that have 100-point (and larger) contact banks often need a long time to reach a calling line; a "quick-acting" switch is capable of testing with certainty at least 100 individual lines in succession in less than 0.5 second.

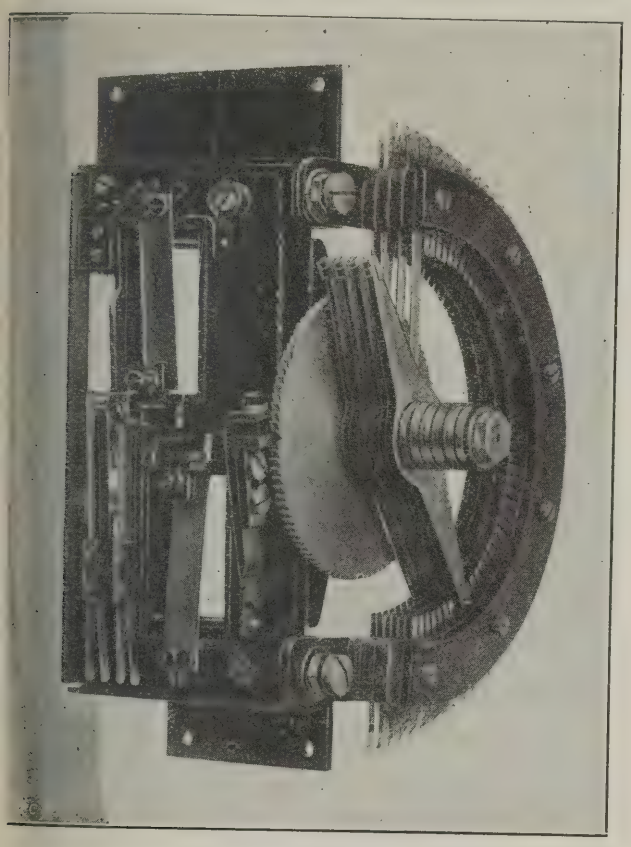
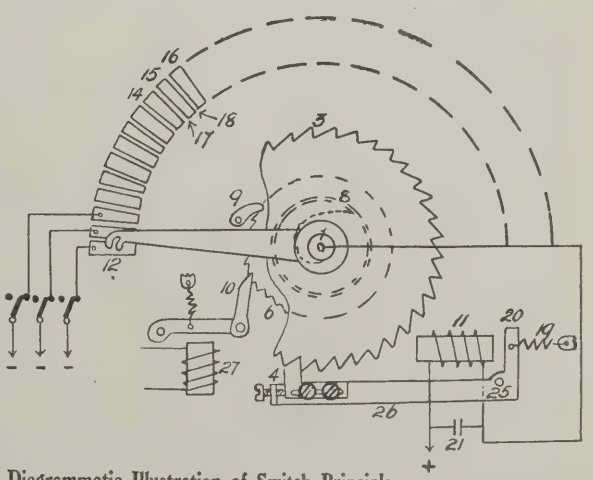


Fig. 1.—Quick-acting Telephone Switch.

That simplification of apparatus should be aimed at, especially by devising a less complicated and more efficient type of switch, has always been recognised, and in this connection our attention has been drawn by Dictograph Telephones, Ltd., to a quick-acting switch (fig. 1), the principle of which is indicated by figs. 2 and 3. It has a spindle 1 on which the brushes are mounted, insulated, only one brush being shown; a sleeve 5 is rotatably mounted on the spindle, which carries at its upper end a ratchet wheel 6 and at its lower end a spring box 7; one end of the spring 8 is connected with the spindle and the other end with the casting of 7, so that when the spring-box is rotated in the direction of the arrow the spring 8 tends also to rotate the brush spindle in the same direction. The consequent winding up of the spring is effected by a propelling pawl 9 oscillated by an electromagnet 27, the pawl rotating step-by-step the ratchet wheel 6 attached to the spring-box until the spring 8 is completely tensioned. Rotation of the wheel 6 in the reverse direction is prevented by a locking pawl 9; the brush spindle 1 is held against the action of the spring 8 by stopping pawl 4, which engages in the teeth of a wheel 3 secured on the spindle.

In order to set the brushes 12 on any bank contact the stopping pawl is moved out of the wheel 3 by the control magnet 11, and so soon as the brush leaves the bank contact lying in front of the desired bank contact the magnet is de-energised so that the pawl 4 again engages the wheel 3 and stops it. The current passing through the magnet flows through the brush 12 and the bank contacts wiped over by it; all the bank contacts up to that one (for example, 15) whereon the brushes are to stop are connected with the battery, and the adjustment of 12 in relation to the bank contacts and of 4 (which is movable on the armature lever 26) in relation to the teeth of 3, is such that the point of the pawl at the moment when the brush just leaves bank contact 14 (lying in front of the desired bank contact 15) stands in front of the tip of a tooth of the stopping wheel 3; thus the total time which the brush needs to wipe over the desired bank contact 15 and the air gap 17 separating it from the adjacent bank contact 14, is obtained for the dropping of the stopping pawl 4 into the correct tooth slot; the time of dropping of the pawl 4 can be adjusted by regulating the tension of the armature return spring 19. An important means for the shortening of the time of falling of the armature 20 (*i.e.*, for the rapid engagement of the stopping pawl 4 in the correct tooth slot) is the condenser 21, which reacts on the magnet coil 11 and can be connected in parallel with the coil 11 or the brush 12; by this means the current in 11 on opening its circuit is not only made to decrease quickly, but also up to a certain degree to reverse its direction, the residual magnetism of the control-magnet core being obliterated. It has been found in practice that the switch stops its brushes, or catches with sufficient operating certainty, when the brushes wipe over their bank contacts at a speed of 300 contacts per second: a 100-point line-finder of this construction, therefore, reaches the 100th bank contact furthest removed from the position of rest of the brush in one-third of a second, so that the use of a dialling tone (which indicates to a calling subscriber that his line is connected through to the next selector, and that consequently he can operate his dial) can be dispensed with.

When working as a line-finder for subscriber groups up to 50 lines, two groups of brushes displaced by 180 deg. are used, of which each reaches the beginning of the row of bank contacts before the other group of brushes leaves the last bank contact of the same row. In groups of 100 lines the groups of brushes are also displaced by 180 deg., but are so displaced that when the one group of brushes has wiped over 50 contacts, the other group wipes over a further row of 50 contacts.



Figs. 2 and 3.—Diagrammatic Illustration of Switch Principle.

When working as a group selector, the contacts are divided into groups; at the beginning and centre of each arc embracing a group are located controlling bank contacts, and between each such pair is a third long intermediate contact, which

may be composed of several ordinary bank contacts connected with one another. In each arc are located the bank contact sets for the junction lines leading to the next group selectors, or the connectors: the dimensions of each arc jumped over by the brushes can be selected within limits merely by connecting, as initial and central contacts, such bank contacts whose distance from one another is greater or less. The possibility is thus obtained of making the number of junction lines in the different trunks proceeding from the group selector different, without leaving bank contacts unoccupied.

When arranged as a final selector or connector, the long or "ten" steps of the brushes are determined by an inner row of bank contacts which is wiped over by a brush, whilst the short or "unit" steps are determined by outer bank contacts wiped over by another brush. The long steps may, as in the case of the group selector, be of different lengths, that is to say, any one may correspond with a bank contact arc which contains 10 or more lines; this is very valuable for multiple connections.

It is declared that the selector will last for at least 20 years in a busy exchange. The soldering tags of its contact bank are so formed that the contact banks can be multiply connected by straight wires or cable bands. In the group and final selecting stages it is contended that about 20 per cent. of the present selector cost can be saved by using the new quick-acting switch, which enables a subscriber, after taking down his receiver, to operate his selector immediately, and makes it unnecessary for him to first wait for a signal. A new starting circuit is employed, and is so arranged that several subscribers calling at the same time can be connected through simultaneously. The new switch also makes economies possible in the pre-selecting stage: the number of line-finders employed in the first pre-selecting stage can be reduced, and, in comparison with the 100-point line-finders hitherto known, it is not only quicker, but also cheaper. Without splitting the multiple, over-lapping, or staggering the multiple connections on the contact banks which make inspection difficult, calls can be distributed perfectly uniformly on group selectors, which may be as large as desired, so that the greatest utilisation of all switches can be readily obtained.

The switch described, the invention of Mr. Fritz Aldendorff, has already been incorporated in several private automatic branch exchanges placed on the market by Messrs. Dictograph Telephones, Ltd.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

An E.D.A. Film Display.

The British Electrical Development Association proposes to run a display of E.D.A., British and American kinematograph films at Australia House on May 3rd. About 200 seats will be reserved for members of the Electrical Association for Women, the remainder being available for persons engaged in the electrical industry.

The Department of Overseas Trade.

The proposed "termination of the separate existence" of the Department of Overseas Trade has called forth protests from many quarters. Col. F. V. Willey, ex-president of the F.B.I., characterised the proposal as a "grave mistake," and expressed the hope that there would be no curtailment of the activities carried on by the Department, and also that the Foreign Office would not be allowed to interfere with the work, which, he said, it had never regarded with a sympathetic eye. Sir Stanley Machin, ex-president of the Association of British Chambers of Commerce, said that the Department was a live and useful body of great value to exporters, and nothing should be done to impair its efficiency. Mr. H. T. Humphries, general secretary of the Incorporated Society of British Advertisers, stated that the Department provided a constant stream of information called for by the members of the Society, and suggested that it might be made a trading department charging for its services like the Post Office. Mr. Churchill himself admitted that the transfer of work to other departments would not in itself effect any large saving; the extent to which functions could be discontinued would be examined in detail when the necessary legislation was presented to Parliament.

Lord Sandon, M.P., according to *The Times*, put down a motion in defence of the Overseas Trade Department in the following terms:—That this House regards with alarm the Government's intention to discontinue the separate existence of the Department of Overseas Trade, in that, while involving a negligible, if any, apparent saving in expense, it will not prove an economy, but is bound to create a loss of revenue to the State, due to the lack of prosperity in industry, resulting from the loss of new markets and trading openings such as are constantly being discovered under the auspices of the Department; and that the House believes this to be owing to the Department's unique atmosphere of vitality, enterprise, and helpfulness, attributes which of necessity and in fact cannot be found in any other department, and which would certainly be lost if it were placed under one of the older departments, a fact fully appreciated by all sections of industry in this country, for the benefit of which its submergence is urged.

Local Exhibition.

Stepney.—An electrical exhibition is to be held at the People's Palace, Mile End Road, E., from April 29th to May 7th. Messrs. Wingrove & Rogers, Ltd., intend to exhibit a "Midget Whippet" electric battery truck. This truck has a carrying capacity of half a ton, and the particular model to be shown is fitted with an elevating platform operated by hand mechanism, but it is also supplied with a plain platform. This type of truck is made to carry up to 2½ tons. The truck will be demonstrated during the exhibition.

Telephone Development.

A further publication has reached us from the Controller of the London Telephone Service extolling the advantages of the telephone as "The Speediest Way of Doing Business." Particulars of trunk call charges are given, notably the fees for regular daily use. On the back of the pamphlet the use of extensions is advocated; the daily cost is small and installation is free.

An Economic Survey.

Among the documents prepared for presentation at the International Economic Conference which is to be held at Geneva in May, is a "Summary Memorandum on Various Industries." This is a study of the principal industries of the leading industrial nations and in a broad way links up with the B.E.A.M.A. survey which is reviewed elsewhere in this issue. It differs, however, by reason of its wider scope and more general nature. It is interesting to note that many of the main conclusions arrived at agree with those of the B.E.A.M.A. report.

Lighting in Schools.

Realising the importance of adequate and correct lighting in schools, the Cardiff Corporation is at present engaged in re-fitting the schools in its charge with up-to-date lighting equipment. Mr. C. G. Morley New, the city electrical engineer, is acting as consultant and the work is being done by local contractors to his specification. Thirteen schools have already been dealt with and seven of these have been equipped wholly with B.T.-H. "Veluria" shades, three with "Holophane" shades, and three with mixed types of reflectors in conjunction with obscured gasfilled 60-W and 100-W lamps. The "Veluria" shades have an excellent appearance, both by day and by night.

Indian Electrical Imports.

The imports of electrical equipment into India during January last attained a value of 4,300,000 rupees, as compared with only 1,627,000 rupees in the first month of 1926.

Engineering Employés' Wages.

On April 12th a conference of representatives of the engineering trade unions and of the engineering employers was held in London. Mr. J. T. Brownlie, president of the Amalgamated Engineering Union, presented a request that the employers would again consider the question of an advance in wages in the light of the improvement which had occurred in the position of the industry since the unions decided to postpone further action in the matter last August. Mr. Brownlie reviewed the course of the previous negotiations and then mentioned specific examples of the increased business which the industry had recently secured. He pointed out that his union's records showed that the percentage of members who were unemployed had fallen from 12.80 in December to 8.06 at the end of March. The wages of skilled engineering workers, he said, were totally inadequate and compared very badly with those paid in other industries. That fact was driving skilled men from the country and preventing boys from entering the industry. Sir Allan Smith, in expressing his appreciation of the way in which Mr. Brownlie had presented his case, promised that the question would receive the earnest consideration of his federation. In accordance with its rules, the district associations would first have to be consulted. It was decided to resume the conference on May 19th.

Hopkinson's Display at Blackpool.

Engineers notoriously can never get away from "the job," even when on holiday, and this propensity is catered for, so far as northern engineers are concerned, by Messrs. Hopkinsons, Ltd., of Huddersfield. They have again opened their display at Blackpool for the season, and a view of this



Engineering Exhibits at Blackpool.

s reproduced herewith. The display is purely an exhibition f the company's latest products and not a sales office. A omplete range of safety boiler mountings and valves for the ighest pressures and superheats is on view, and most of the xhibits are in section to enable a complete examination to e made.

The Timber Market.

Our timber trade correspondent writes that during the past nonth the market for softwood timber for house, packing-ase, and general construction work has shown a firmer tendency, after easier times, owing to the good consumption, aving stocks comparatively light. The opening of navigation n Northern Europe next month, however, will release very rge quantities for immediate shipment, but as these have een purchased at higher rates than winter supplies, the arket is expected to continue firm. Hardwoods of American escriptions keep in good supply, owing to increased shipents, but forward business remains firm, and spot conmption is increasing. For mahogany and other hard and ncy woods in the log, stocks in first hands are light, and rates rm for all descriptions. With the general increase in housebuilding and other industries the timber trade appears to e in for a very busy time, hence sellers will have the market little more in their favour than for some months past.

The Italian Radio Market.

The United States Consul at Milan says that a good market isted for crystal sets immediately after the opening of the ilan broadcasting station in 1925, but the demand fell to considerable proportions. Now it is proposed to erect a ew station near Milan, and this is expected to open up a ew and larger market. A great deal of interest has been own in valve sets; the cheapest are of Italian make, but erman, British, French, and American sets are available.

Australian Electrical Imports.

The imports of electrical machinery into Australia during nnary last attained a value of £589,000, as compared with 577,000 in the corresponding month of 1926.

New Italian Companies.

Among the concerns recently formed in connection with electricity supply in Italy are the Società Elettrica Buonalbergo-Casalbore, formed at Buonalbergo with a capital of 300,000 lire; La Società Idroelettrica Val d'Argri di Missanello, of Missannello (Potenza), capital 100,000 lire; La Società Elettrica di Maccarese, Rome, capital 20,000 lire; La Società Elettrica Val Breggia, Milan, capital 55,000 lire; La Consorzio Distribuzioni Elettriche "CDE," Genoa, capital 5,000,000 lire; and La Società Distribuzioni Elettriche Liguri, Genoa, capital 100,000 lire.

Catalogues and Lists.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—April stock list of motors and dynamos.

The B.E.N. Patents, Ltd., 96-98, Victoria Street, S.W.1.—An illustrated and priced pamphlet dealing with a universal saw and sanding machine.

Electradix Radios, 218, Upper Thames Street, E.C.4.—An illustrated catalogue of radio apparatus, electric drills, heaters, &c.

Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.—Leaflet No. 81, illustrating and describing the company's h.t. supply unit for connection to d.c. mains. Priced.

The Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.—A leaflet announcing reduced prices of "Memette" switches.

The Benjamin Electric, Ltd., Brantwood Works, Tottenham, N.17.—The "Benjamin Reflector" for March-April, containing illustrated articles on industrial lighting, &c. Also a folder, "The Boyce Moto-Meter Vindicated," containing a *résumé* of the proceedings in a recent patent infringement action.

Messrs. S. G. Brown, Ltd., North Acton.—The "Brown Budget" for April, containing notes and news relating to the company's loud speakers, telephones, &c.

Messrs. Warren Bros. (Middlesbrough), Ltd., Electric House, Grange Road West, Middlesbrough.—An illustrated pamphlet dealing with a moisture separator for steam installations.

Superlamp, Ltd., 92 & 94, Paul Street, E.C.2.—April net trade price list of electrical material, accessories and appliances. Illustrated.

The Consolidated Pneumatic Tool Co., Ltd., 170, Piccadilly, W.1.—A catalogue of "Boyer" pneumatic tools.

The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.1.—A coloured showcard illustrating the construction of the Marconi "D.E.P.215" valve. Priced. Also a coloured poster depicting the company's 410 series of valves, with prices, and a folder dealing with these.

Trade Announcements.

Messrs. L. Apple, Ltd., 13, Brewer Street, W.1, and 79a, Tottenham Court Road, W.1, state that they have no connection with any firm trading under a similar name.

Messrs. Buglass & Jamieson, Ltd., Dundee, state that Mr. J. F. Buglass, formerly a director and latterly a manager, has now left their employment. Mr. T. C. Donald, Stirling, has been appointed director in place of Mr. Buglass, and Mr. W. E. Jamieson has been appointed managing director.

The British B.A.G., Ltd., has removed its head office and stores from Manchester to 23, Farringdon Avenue, E.C.4. The sales organisation will in future be conducted from London under the management of Mr. H. W. Dauncey.

Messrs. R. Stirling & Co. have recently removed from 85, Douglas Street, to 167, Holm Street, Glasgow. The telephone number is unaltered.

Mr. C. P. Abraham, wireless engineer, has opened new premises at 32, Castle Street, Hastings.

Messrs. G. Dikkers & Co. (England), Ltd., have been appointed sole agents in the British Isles for Messrs. Willem Smit & Co., Ltd., and have moved to new premises at Avenue Chambers, Southampton Row, W.C.1 (Telephone: Holborn 3100; telegrams: "Dickavalve, Westcent, London.").

The New Italian Art Association, Ltd., has moved to larger premises at 57-58, Wells Street, W.1. Telephone: Museum 0383.

Messrs. Ward & Goldstone, Ltd., have purchased the plant, machinery, and goodwill of the Knivetown Electric Wire Co., late of Ponders End, and they are now able to supply all the specialities previously manufactured by that company.

Coventry Electrical Accessories, Ltd., has appointed Messrs. Harwell, Ltd., 28, John Street, Theobald's Road, W.C.1, as selling agents for its appliances.

Bankruptcy Proceedings.

O. Walker, trading as the Albion Electric Co., Albion Street, Wallasey.—The public examination of this debtor was held at the Birkenhead Bankruptcy Court on April 6th. The liabilities were stated to be £1,056 and the assets £54. Debtor stated that he commenced business in April, 1923, with £50 borrowed from his mother. The business was successful for two years, but then negotiations for a partnership fell through, and he borrowed further sums from relatives. During the first two years the turnover was about £3,000 and the profit between £150 and £200. He admitted that the loss of £1,000 had occurred during the last year, and said that he had kept no books or accounts of receipts and pay-

ments. The Registrar censured the debtor, stating that he was not satisfied with his statements, and adjourned the examination *sine die*.

P. J. White, 5, Dyer's Buildings, Holborn, merchant, trading as P. J. White & Co.—The first meeting of creditors was held on April 7th, at the London Bankruptcy Court, when accounts were presented showing liabilities of £5,849 and assets consisting of office furniture £40, and a bad debt £821. The Official Receiver reported that the debtor had been connected with various electrical companies. He was a director of the Anglo-Colonial Engineering Co., Ltd., which was registered in March, 1914, to carry on business as electrical and general engineers, and to which he introduced various agencies. In 1915 the company went into liquidation. The debtor continued business, and in August, 1919, formed P. J. White & Co., Ltd. He attributes his failure to inability to recover £820 from the Radio Equipment Co., Ltd., which went into liquidation in 1926; also to general trade depression. The case was left in the hands of the Official Receiver.

J. D. Chisholm, 34, Gordon Square, W.C.—This debtor came before Mr. Registrar Warmington at the London Bankruptcy Court on April 13th for his adjourned public examination. He formerly carried on an agency at Leeds for a London firm of electrical engineers, and in October, 1924, formed a company to which he transferred his various radio and electrical inventions. A receiving order was made against him in October, 1925, when he returned liabilities of £976, against assets valued at £4,154. Mr. Waterer, Official Receiver, reported that the debtor recently obtained an order to rescind the receiving order on the ground that all the debts had been paid in full. It transpired later that certain debts had not been included, whereupon the rescinding order was cancelled and the debtor was directed to amend the statement of his affairs and attend at the Court for further public examination. The debtor was not in attendance, and his examination was adjourned *sine die*.

A. H. Hughes, Eckington Road, Coal Aston, Derbyshire, wireless and electrical merchant.—The public examination of this debtor was held on April 8th, at the County Court, Chesterfield. According to the statement of affairs there was a deficiency of £2,836. Debtor said that he had suffered losses through ill-health, and he attributed his failure to lack of capital and loss of commission on over £30,000 worth of orders which had to be cancelled on account of his health. The examination was adjourned.

V. Reed, electrical engineer, 10, Chapel Road, Eastville, Bristol.—Trustee, Mr. F. W. Darley, Official Receiver, 26, Baldwin Street, Bristol, released April 4th.

J. Benson, electrical engineer, late of 2a, Wade Street, Leeds.—Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds, released April 1st.

E. Cowley (trading in co-partnership with G. Hill and G. Noble as G. Hill & Co.), electrical engineer, 22, Chantry Lane, Great Grimsby. Discharge suspended for 12 months.

A. T. K. Moir (Moir & Watts), electrical and mechanical engineer, Weardale Road, Lee, Kent.—Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C., released March 24th.

J. R. Barker, wireless dealer, Tanshelf House, Front Street, Pontefract, and 183, Kirkgate, Wakefield.—Trustee, Mr. B. S. Briggs, Official Receiver, 21, King Street, Wakefield, released April 5th.

Company Liquidations.

Kingsway Radio, Ltd., radio and electrical dealers, 92, Cannon Street, E.C.4.—A meeting of creditors was held on April 12th, at the Institute of Chartered Accountants, E.C. The chair was occupied by Mr. W. Cranstoun Todd, C.A., 3, Cannon Street, E.C., the liquidator in the voluntary liquidation of the company. The statement of affairs presented showed ranking liabilities of £1,044, and the assets were estimated to realise £428 net, leaving a deficiency so far as the creditors were concerned of £616. As regarded the shareholders, there was a deficiency of £2,894. The business was originally carried on by Mr. H. L. Percy, and the company was registered on October 2nd, 1925, the nominal capital being £3,000, in £1 shares. The shareholders were: Mr. Percy, 400 shares, Mr. W. J. Mather, 650 shares, Mr. Butler, 500 shares, and Miss Sutherland, 300 shares. The purchase price for the business was £1,007, which was discharged by the allotment to the vendor of 1,000 shares and the payment of the balance in cash. The remaining shares were issued for cash. A balance sheet prepared at the end of the first year's trading showed sales of £2,840, with a net loss of £570. There had been a slump in the wireless business, and the trading of the company had been considerably affected. If the stock was forcibly realised at auction there would probably be very little for the creditors. The liquidator was therefore continuing the business for the time being in order to dispose of the stock at reduced prices. It was not possible to sell the business as a going concern. The business could not stand the heavy expenses with which it had been faced. Mr. Percy had lectured on wireless in the City, and it had been hoped that the connection of the company would be largely increased. A resolution was passed confirming the voluntary liquidation of the company with Mr. Todd as liquidator. The following are creditors:—

	£		£
Dickinson, C. B., Ltd....	182	Ever Ready Co., Ltd. ...	38
Burndept Wireless, Ltd.	42	Edison Swan Electric Co., Ltd.	22
General Electric Co., Ltd.	44	Ericsson Telephones, Ltd.	45
S.T., Ltd.	33	Browning, H. S. ...	37
Pathé of France, Ltd. ...	34		

Foolproof Patent Accumulator Co., Ltd.—The joint liquidators in the voluntary liquidation have issued a statement as at March 25th, the date of the winding-up resolution, showing ranking liabilities of £3,044 and assets estimated to produce £1,028, leaving a deficiency of £2,016. The issued capital is £1,000, making the deficiency, so far as the shareholders are concerned, £3,016. A trading account shows a net loss of £1,942, and the balance of the deficiency is attributed to the writing down of machinery, plant, &c. A meeting of creditors was held at Market Harborough on April 11th. The statement of affairs and trading account were explained by Mr. John S Bullivant for the liquidators. Mr. Bullivant said that the company was incorporated in October, 1925, to carry on a business commenced by Mr. Judd in Market Harborough. Mr Millington, Senr., provided the capital of £1,000, shares being allotted: 900 to Mr. Millington, Senr., 50 to Mr. Millington Junr., and 50 to Mr. Judd, the Messrs. Millington leaving the conduct of the business practically entirely in the hands of Mr. Judd. Nothing at all was done in the way of production or experimental work until February, 1926; from that date until August, two hands were employed in addition to Mr Judd. No sales appeared in the books until August. From August until the date of winding up of the company, the personnel was increased and the average weekly wage paid was between £30 and £40; the whole of the output of the factory was manufactured during that period. The records of the transactions were very incomplete. Mr. Millington, Senr., had advanced £591 for payment of the company's debts. The deficiency was attributed to wages, materials, and sundries expended in experimental work, &c., useless advertising, difference between cost price and estimated realisation price of plant and stock, non-productive expenses, patents, &c., and trading loss. The liquidators were in touch with five applicants to purchase part or whole of the assets, and it was hoped to find a purchaser who would take over the whole of the assets.

Radi-Arc Electrical Co., Ltd.—Winding up voluntarily Liquidator, Mr. E. James, St. Lawrence House, Trump Street E.C. Meeting of creditors, April 27th, at the Institute of Chartered Accountants, Moorgate Place, E.C.

Private Arrangements.

P. M. Braidwood, Somerset Road, New Barnet, and 1, High Street, Barnet, electrical contractor.—A meeting of creditors was held on April 12th, at the offices of Messrs. Goodman Sons & Co., Broad Street House, E.C., when a statement of affairs was presented which disclosed liabilities of £1,885 and net assets of £355, leaving a deficiency of £1,530. A deficiency account was presented which showed that during the seven years to April, 1927, the drawings had totalled £1,068, while there had been an estimated loss on the trading during the period of £337, and for the purposes of the statement the assets had been depreciated by £125. The debtor consulted his accountant during the previous week owing to two writs having been served upon him. The largest creditors suggested that a meeting should be called. The debtor started trading in 1921 with a capital of only £10, and he carried out a number of small contract jobs. He then realised investments amounting to about £200, the money going into the business, and from that time onwards the business increased, and he took on larger contracts. He was also assisted financially by his mother and sister, who were cash creditors. In reply to questions, the debtor stated that he had a contract in connection with a school on which a substantial balance was due, the work having been completed six months ago. He also had a contract in connection with the East Barnet Housing Scheme, where fifty dwellings were being erected. He had been doing a fairly substantial turnover, which during the last nine months had totalled £2,139. He did not think that the business could be continued profitably by him, but relatives were willing to assist him to pay a composition of 5s. in the £, by two equal guaranteed instalments at three and six months. A resolution was passed accepting the offer, and it was decided that Mr. W. A. Osborne, of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C., should act as trustee, together with a committee consisting of Mr. C. Latham, and the representatives of Messrs. Poppleton, Appleby & Hawkins, and Fall Stadelmann & Co., Ltd. The following are creditors:—

	£		£
W. T. Henley's Telegraph Works Co., Ltd.	230	Weinbaum Incandescent and Electric Co. ...	4
Falk, Stadelmann & Co., Ltd.	138	Brown Bros.	2
Young & Wildsmith, Ltd.	87	General Electric Co., Ltd.	2
Charlesworth, Peebles, Ltd.	67	Smith, J. & W. B., Ltd.	2
Macintosh Cable Co., Ltd.	47	Jeary Electric Co. ...	2
		Supra Electric Co. ...	2
		British Thomson Houston Co., Ltd	5

Dissolutions of Partnership.

J. R. Dunkley & Co., electrical engineers, 17, Station Street, Huddersfield.—Messrs. K. Levell and J. R. Dunkley have dissolved partnership. Mr. Dunkley will attend to debts and continue the business under the same style.

S. and S. Radio & Electrical Co., & Exide Battery Service Station, radio and electrical experts, 149, Ewell Road, Surbiton.—Mr. S. C. Slaughtern and Mr. N. P. Sparks have dissolved partnership. Mr. Slaughtern will attend to debts.

E. J. Stiell & Co., electrical engineers, Coatbridge.—The partnership existing between Messrs. E. J. Stiell, D. M. Miller, and W. C. Cullen, has been dissolved by the death of the first-named, and the retirement of Mr. Miller. Mr. Cullen will continue the business under the same style and attend to debts.

Book Notices.

In view of the importance of the paper read by Major E. I. David last year on electricity in mining, the South Wales Branch of the Association of Mining Electrical Engineers has decided to publish it in book form at a price of 1s. 6d. to members, and 3s. to non-members. Copies can be obtained from Mr. H. J. Norton, 11, Windsor Place, Cardiff, at these prices, plus 3d. postage.

"Technology Reports of the Tôhoku Imperial University, Sendai, Japan." Vol. VI, No. 3, "On the Design of an Inductance Coil for Audio Frequencies, having Iron Core with Air Gap." Maruzen Co., Ltd., Tokyo and Sendai.

The Marconi Gramophone Reproducer.

Hitherto the Marconiphone Co., Ltd., has only supplied its gramophone reproducer in conjunction with a special two-stage amplifier. Owing to the demand, however, it has been decided to make the two instruments available separately.

A "Rawlplug" Handbook.

The Rawlplug Co., Ltd., has produced a very useful handbook dealing in detail with the various uses of "Rawlplugs." The methods of boring various materials, such as brick, plaster, tiles, &c., are set out, and the book contains numerous illustrations of typical and special "Rawlplug" jobs.

For Sale.

Yorkshire (West Riding) Electric Tramways Co., Ltd., invites offers, two 320-h.p. four-cylinder Diesel engines, two 200-kW Dick, Kerr generators, switchboard, &c., one reversible booster, and one 10-ton overhead travelling crane. By order of the Liquidator of the New Trafalgar Collieries, Cinderford, Glos., Sir I. Thomas will sell by auction at the Collieries, on April 26th and 27th, the plant and machinery, including electric generators, transformers, motor convertor switchboards, &c. Halifax Tramways and Electricity Committee invites offers for two Weir steam turbo-driven boiler-feed pumps. (See our advertisement pages to-day.)

Chinese Notes.

A considerable business in electrical irrigation is done by the Cheng Hwa Electric Power Supply Co. in the Kiangsu province. The company has a 6,400-kW generating plant and hires out complete pumping plants, including the necessary pole lines, to the farmers. Originally the charge was based upon the area of the fields operated upon, but later the company substituted an electricity consumption basis with a minimum per *mow* (⅙ of an acre) of 10 kWh.

The Pu Hwa Hsing Chi Electric Co. (Wenchav, Chekiang province) now supplies electricity to about 20,000 16-c.p. lamps. It recently reorganised and raised its capital from $100,000 to $150,000. The promoters also run a telephone service (the Tung Wu Telephone Co.), which has over 200 subscribers.

Great Britain's Radio Exports.

The *Wireless Trader* of April 9th published details of our radio export trade during February. The total (excluding re-exports) was £119,767 (valves £23,006), as compared with £88,765 in January (valves £11,532). Japan was again the chief customer, taking goods to the value of £51,904 (as against £14,684); Australia retained second place with £13,132 against £12,980); but the Netherlands succeeded Russia in the third place with a total of £6,830.

Our Foreign Electrical Trade.

The following were the values of imports and exports of electrical goods and machinery during March:—

	March, 1927.	Inc. or dec.
Imports.—	£	£
Electrical goods and apparatus ...	327,988	+40,033
Machinery	1,344,470	+65,865
(Electrical machinery)	138,728	+21,573
Exports.—		
Electrical goods and apparatus ...	959,787	−35,067
Machinery	4,134,580	−11,763
(Electrical machinery)	577,604	+93,191
Re-exports.—		
Electrical goods and apparatus ...	13,494	− 7,066
Machinery	143,492	+22,089
(Electrical machinery)	8,785	− 2,973

Robust Automobile Lamps.

Another example of the survival of an automobile lamp from the effects of a collision is reported by the General Electric Co., Ltd. Although the headlight in which it was fitted was badly hit, the "Osram" lamp still shone out when switched on.

Unemployment.

The reduction in the number of unemployed, which received a check in the previous week, continued during the week ended April 4th, a fall of 7,930 being registered. The actual total was 1,073,800, as compared with 1,081,730 on March 28th and 1,049,790 on April 5th, 1926.

Registered Contractors.

At its meeting on April 8th the Executive Committee of the National Register of Electrical Installation Contractors accepted the following applications for registration. At the same meeting one application was withdrawn and four were declined:—

Anderson & Penny, Ltd., South Shields.
Gee & Brown, Sunderland.
Bulsen, W., & Co., Newcastle-on-Tyne.
South Shields Plumbing Co., Ltd.
Mohan, T. G., Sunderland.
Webber & Hudgell, Hastings.
Foreshaw & Bradshaw, Belfast.
Clark, O., South Shields.
Foote, Milne & Co., London, S.W.9.
Taylor, T. A., Chester-le-Street.
Wight, B., & Co., London, N.10.
Worksop Co-operative Society, Ltd.
Clarke, W. T., & Co., Ltd., London, W.C.1.
Rosson, A. C., Croydon.
Ormerod, W., Todmorden.
Gordemer, A., London, E.5.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.	Price April 19th.	Fortnight's inc. or dec.
a Acid, Oxalic ... ... per lb.	5¾d.	...
a Ammoniac, Sal ... ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£13 10s.	...
a Sulphur, Commercial ... ... ,,	£9 10s.	...
a ,, Roll ... ... ,,	£9 10s.	...
a Soda, Chlorate ... ... per lb.	3½d. to 3¾d.	...
a ,, Crystals ... ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots... ... ... per ton.	£107 to £112	...
b ,, Wire ... ... per lb.	1/6 to 2/-	...
b ,, Sheet ... ... ,,	1/8 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net.	£272	...
Grade II ... ... ,, ,,	£189	...
Grade III... ... ... ,, ,,	£97	...
Brass (rolled metal 2" to 12" basis) per lb.	9⅝d.	...
c ,, Tubes (solid drawn) ... ,,	11½d. to 11¾d.	...
c ,, Wire, basis ... ... ,,	9⅝d.	...
c Copper Tubes (solid drawn) ... ,,	1/0½	...
c ,, Bars (best selected) ... per ton.	£86	...
c ,, Sheet ... ... ,,	£86	...
c ,, Rod ... ... ,,	£86	...
d ,, (Electrolytic) Bars ... ,,	£63	...
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ,,	£73	...
d ,, ,, H.C. Wire per lb.	9 5/16d.	...
f Ebonite Rod ... ... ,,	2/3 to 2/6	...
f ,, Sheet ... ... ,,	2/3 to 2/6	...
n German Silver Wire ... ... ,,	2/2	...
h Gutta-percha, fine ... ... ,,	8/-	...
h India-rubber, Para fine ... ... ,,	1/5½	...
i Iron Pig (Cleveland No. 3.) ... per ton.	122/6	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English pig ... ... ,,	£28 5s.	...
g Mercury ... ... per bot.	£22 15s. to £23	20/- to 35/- dec.
e Mica (in original cases) small ... per lb.	3d. to 8/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	...
p ,, ,, rolled strip & sheet ,,	1/2¾	...
p ,, ,, wire... ... ... ,,	1/3½	...
o Platinum ... ... per oz.	£23	...
d Silicium Bronze Wire ... ... per lb.	10¾d.	...
r Steel, Magnet, in bars ... ... ,,	7½d.	...
n Tin, Block (English) ... ... per ton.	£303 to £304	£5 dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Lighting and Power Notes.

Aberdeen.—NEW SUB-STATION.—A new sub-station at the Corporation electricity works, which has cost £35,000, was formally inaugurated by Lord Provost Lewis on April 9th.

Accrington.—HIRE-PURCHASE SCHEME.—It was announced at the April meeting of the Town Council that it is proposed to sell electrical appliances on the hire-purchase system, goods to be paid for on the basis of 1s. per quarter for every £1 in value.

Ashford (Kent).—LOANS.—The Urban District Council has applied for sanction to the following loans:—£5,000 for mains and services; £500 for meters; £900 to cover excess expenditure on generating plant; £500 for domestic apparatus to be let out on hire; and £500 for assisted wiring installations. Street lamps in three portions of the town are to be converted from gas to electricity.

Australia.—VICTORIA.—The *Industrial Australian and Mining Standard* reports that satisfactory progress is being made with the construction of the Rubicon (Vic.) hydro-electric scheme, and the main channel work is now nearing completion. The construction of the diversion weirs on the Royston and Rubicon rivers is well in hand and work on the transmitting sub-station is progressing well, all the foundational construction being completed. The system is to be in operation by 1928, but at the present rate of working the lower power stations will be in operation much earlier.

Canada.—MANITOBA.—A recent Government survey of the water-power resources of Manitoba has revealed the existence of over 3,000,000 continuous h.p. which is available for development. At the present time a total of 225,800 h.p. of turbine plant is in use, with provision to increase this to an ultimate capacity of 310,000 h.p.

Chatburn.—PROTEST AGAINST CHARGES.—At a recent ratepayers' meeting protests were made against the charge of 2d. per kWh, over and above the amount charged by Clitheroe, to consumers in the borough. A resolution was adopted refusing to take supplies except at the Clitheroe rate of 6d. per kWh for lighting and 1½d. per kWh for power.

Continental.—ITALY.—A regulation has recently been issued by the Italian Government which provides that the importation from, or exportation to, adjacent foreign countries of electricity can only be undertaken by special Government permit, which in approved cases will be granted for periods of ten years. A tax of 25 centimos per kWh is to be imposed on all imported energy.

Dover.—ELECTRICITY SUPPLY.—It was reported at a recent meeting of the Electricity Committee that the cost of changing the periodicity of the electricity supply would amount to £20,153. It was decided to engage a consulting engineer to report on the whole of the electricity undertaking, including the question whether or not there should be a change of periodicity.

Dumfries.—LOAN.—The Town Council has applied for sanction to a loan of £4,000 for a new storage battery and battery booster.

Hastings.—NEW TRANSFORMER.—The Electricity Committee has recommended the provision of an additional transformer at Bromsgrove power station, at a cost of £2,345.

India. — HYDRO-ELECTRIC DEVELOPMENT.—According to *Indian Engineering*, it is stated that the South Indian Railway Co. has agreed, subject to certain conditions, to purchase 50 per cent. of the power available from the Pykara hydro-electric scheme. A committee appointed to consider the possibilities of the scheme has reported that the Government can continue the work with confidence.

Formby.—ELECTRICITY CHARGES.—The Urban District Council has reduced the price of electricity for power purposes from 3½d. to 3d. per kWh up to 500 kWh, and introduced a new scale of 2½d. per kWh from 500 to 1,000 kWh, and 2d. per kWh over 1,000 kWh per annum. The scale of charges for lighting purposes remains unchanged.

Leeds.—NEW POWER STATION.—The Electricity Commissioners have sanctioned the erection of a new generating station at Kirkstall by the Corporation.

London.—HAMMERSMITH.—The Electricity Committee has received a report from the borough electrical engineer upon the question of augmenting the existing e.h.p. ring main in order to meet the increasing demand of consumers supplied from the Starch Green sub-station, including the Chiswick Electric Supply Corporation, Ltd., and has recommended the laying of a duplicate .075 sq. in. six-core cable from the power station to Rivercourt Road sub-station, at an estimated cost, including the provision of switchgear at the power station, of £4,659.

ST. PANCRAS.—The Borough Council has received a reply from the Electricity Commissioners regarding its proposal to install additional plant at King's Road station. The Commissioners state that the policy of inter-connection is preferable to the installation of additional plant, and suggest as an alternative that inter-connection between (1) St. Pancras Islington and Hackney; (2) St. Pancras, St. Marylebone, and the London Power Company's station at Grove Road; and (3) St. Pancras and the City Road station of the County of London Electric Supply Company, should be explored to meet the Council's requirements.

OPPOSITION TO SCHEME.—The London Power Co., Ltd., has notified the L.C.C. that it has applied for sanction to erect a power station between the south bank of the River Thames and the Great Western Railway goods depôt in Battersea Park Road. As the L.C.C. has property near the site, the Parliamentary Committee of the L.C.C. has recommended that the proposal be opposed, if necessary, with a view to obtaining protection for the Council's interests.

Macclesfield.—ELECTRICITY SUPPLY.—The Town Council has decided to engage an expert, at a fee of £700, to prepare a report with regard to the local electricity supply and its possible development in the future. This is with a view to the probable purchase of the local electricity undertaking.

Maybole.—STREET LIGHTING.—The rival claims of electricity and gas for street lighting were discussed at the last meeting of the Town Council. A report by Mr. Campbell Murray, M.I.E.E., letters from Mr R. B. Mitchell, manager, Glasgow Corporation Electricity Department, and Mr. Bexon, manager of the Ayrshire Electricity Board, were read. The last stated that he would recommend his Board to provide steel poles throughout the burgh, free of any extra cost, provided the Council agreed to take electricity for street lamps. The cost of furnishing the street lights would be approximately £12 per lamp. The Gas Company quoted an all-in price of 35s. per lamp per annum for a ten-years' contract. It was agreed to accept the Electricity Board's offer.

New Zealand.—ARAPUNI HYDRO-ELECTIC SCHEME.—The Auckland correspondent of the *Daily Telegraph* reports that it is announced officially that the Arapuni hydro-electric scheme to supply the whole of Auckland province with electricity will not be completed until the end of 1928 owing to delays caused by floods. Messrs. Armstrong Whitworth's contract date for the completion of the work is April, 1928.

Portland.—ELECTRICITY SUPPLY.—At a recent meeting of a Special Committee of the Urban District Council the report from Messrs. A. Hugh Seabrooke & Partners on a scheme for the supply of electricity at an estimated initial cost of from £9,000 to £10,000 was considered, and approved.

Pontypridd.—INAUGURATION OF EXTENSIONS.—The Earl of Plymouth has consented to formally inaugurate, on April 26th, extensions which have recently been carried out at the power station of the South Wales Electrical Power Distribution Co.

Preston.—ELECTRICITY SUPPLY.—At a recent meeting of the local Trades Council it was stated that after the fourth generating set had been installed, the Corporation intended to introduce a block system for the distribution of electricity. Instead of having a meter for each house, one meter would serve for a whole street, and in time electricity would be paid for as consumers now paid for water.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

STOKE NEWINGTON.—Lighting: Scale B, from 5d. to 4½d. per kWh. Power: Maximum demand system, from 4½d. and 1d. per kWh to 4d. and 1d.; scale E, from 2d. per kWh for the first 5,000 kWh per annum and 1½d. per kWh beyond, to 2d. per kWh for the first 5,000 kWh, 1½d. for the next 5,000, and 1d. per kWh for all further consumption. Domestic scale: From 1½d. to 1d. per kWh. Public lighting: The increase added in September last to be removed.

HENDON.—*The Hendon Electric Supply Co., Ltd.*—The surcharge of ¼d. per kWh, due to the coal dispute, has been withdrawn.

SCUNTHORPE.—Lighting: From 7d. to 6d. per kWh. Power: From 3½d. to 2½d. per kWh.

Ripon.—ELECTRICITY SUPPLY.—The City Council has accepted terms offered by the Harrogate Corporation Electricity Department to supply electricity to the city. The scheme is subject to confirmation by the Harrogate Town Council, and follows the recent purchase by the latter authority of the Knaresborough electricity undertaking. Harrogate hopes to extend its supply to a wide area in which the chief centres of population are the three towns mentioned.

Rothesay.—INAUGURATION OF SUPPLY.—A new power station was formally inaugurated by Mrs. Fisher, wife of ex-Provost Fisher, on April 12th.

South Africa.—CAPE TOWN.—A special meeting of the City Council was held recently for the purpose of adopting a proposal to borrow £500,000 for electrical development. The programme includes (*a*) land and buildings, £30,000; (*b*) machinery, £87,750; (*c*) distribution, £382,250. A meeting of enrolled owners was subsequently held and the proposals were unanimously agreed to.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Urban District Council of Portland, authorising it to supply electricity in its area, and the Woodstock Power Syndicate, Ltd., to supply electricity in the borough of Woodstock and certain parishes in the rural district of Woodstock.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them for the supply of electricity by Blackpool Corporation in the urban district of Poulton-le-Fylde, and certain townships in the rural district of Fylde, and the West Lancashire Rural District Council in the parishes of Maghull and Lydiate.

Stockport.—Electrical Development.—The Electricity Committee has recommended that application be made for sanction to a loan of £260,000, being the estimated cost of the first section of a scheme for the further development of the Millgate electricity works. This includes the installation of one 25,000-kW turbo-alternator at a cost of £65,000, four 50,000-lb. boilers (£67,000), and buildings (£60,000). According to the *Cheshire Daily Echo*, the borough electrical engineer (Mr. R. Lomax), in his report, states that the Millgate site can be developed to a capacity of from 130,000 to 140,000 kW. The extension proposed at present would increase the capacity of the station to 57,000 kW. The cost of the full development of the site is estimated at £900,000, the cost of the plant being under £10 per kW.

Torquay.—Loan Sanctioned.—The Electricity Committee has received sanction to the borrowing of £5,383 for the extension of the Upton Valley sub-station and the erection of stores adjoining the destructor.

United States.—Electrical Development.—According to the *Electrical World*, power companies in Texas are to carry out extensions of transmission lines during this year aggregating more than 500 miles, which will add 75 communities to the list of towns supplied with electricity. The Texas Power and Light Co. is negotiating for the purchase of the dam across the Colorado River at Austin, and proposes to spend $1,000,000 in rehabilitating the dam and hydro-electric plant. During 1926 the company put into operation the new Trinidad power station with an initial capacity of 50,000 kW. This station is designed for an ultimate capacity of 160,000 kW. The Dallas Power and Light Co. is installing an additional 25,000-kW set, and is to carry out extensive additions to its transmission line network. The power companies of Texas have a total of 4,500 miles of h.p. transmission lines, serving more than 350 towns and cities in an area covering the greater portion of the State. There are 33 generating stations connected to this system, which have a combined capacity of approximately 320,000 h.p.

Walsall.—Extension of Supply.—The Town Council has under consideration a proposal to extend the e.h.p. feeder to the Scott Arms and to erect a sub-station for the supply of electricity to Great Barr.

Yarmouth.—Loan Sanctioned.—The Corporation has received sanction to a loan of £50,229 for mains, buildings, plant, and works consequent upon the change of system, in addition to a loan of £120,000, previously sanctioned. The Electricity Commissioners have intimated that they will consider further loans, if necessary, when the final cost has been ascertained.

Tramway and Railway Notes.

Blackburn.—Tramway Extension.—The Town Council has referred to the General Purposes Committee the question of extending the existing tramway and the seeking of powers to run motor-'buses.

Canary Islands.—Teneriffe.—The tramway undertaking in Teneriffe, owned by a Belgian company, has been sold to a Canary Islands syndicate for 500,000 pesetas.

Continental.—Italy.—A convention has been signed between Italy and the Republic of San Marino for the construction of an electric railway between Rimini and San Marino.—*Reuter's Trade Service* (Rome).

Czecho-Slovakia.—The Austrian Schuckert Co., of Vienna, is negotiating for the construction of a narrow-gauge electric railway in North Bohemia, between Warnsdorf and Rumburg, on the Saxon frontier.

Gravesend.—Abandonment of Tramway.—The Ministry of Transport has notified the Corporation that an Order will be issued for the abolition of the Gravesend and Northfleet tramways.

Irish Free State.—Dublin-Lucan Electric Tramway.—The Dublin United (Electric) Tramway Co.'s Bill for taking over the Dublin-Lucan electric tramway and linking up the line with the city service at Parkgate Street has now passed both Houses of the Free State Legislature and will become law immediately. Work will begin shortly on the repair of the line and on the necessary alterations at the Dublin end.

Nottingham.—Railless Cars.—An innovation with regard to municipal transport arrangements has just been introduced by the utilisation of railless cars upon the Sherwood Rise route. Ten of these cars have been placed in commission and are proving satisfactory.

Sheffield.—Inauguration of Route.—The new Abbey Lane section of the Corporation tramways was formally inaugurated by the chairman of the Tramways Committee, on April 14th. This section completes the circular City-Millhouses-Woodseats-City route; the cars run on one side of the road and vehicular traffic on the other. Where it is necessary to cross over, various safety devices have been adopted, including electric signals, which can be illuminated at night to warn other traffic that a car is about to cross.

United States.—Railway Electrification.—Work on the construction of the tunnel in the Cascade Mountains, Washington, which will cost $10,000,000, is making good progress, and indications are that it will be completed before the end of next year. With its completion approximately 100 miles of the Great Northern railway will be electrified. The *Electrical World* reports that the Washington Water Power Co. has taken over and is developing the Chelan River power project with a view to the eventual electrification of the Great Northern railway east of Wenatchee and through Northern Idaho. Full development of this power, it is estimated, will cost $10,000,000. The arrangement with the Washington Water Power Co., while safeguarding future needs of the Great Northern railway for electrification purposes, provides for making power available for public use, and making possible the irrigation of several thousand acres of land now idle. The Chelan power project is unrelated to the electrification of the line between Wenatchee and Everett. Power for that part of the line will be supplied from hydro-electric plants on the west side of the Cascade Mountains. In connection with this electrification, the Great Northern already has in service two new electric locomotives of the motor-generator type built by the Baldwin Locomotive Works and the Westinghouse Electric and Manufacturing Co. They are the most powerful of their kind, each of them weighing 715,000 lb. and having a tractive force of 88,500 lb.

Telegraph and Telephone Notes.

Continental Telephony.—Long-distance Communication.—As the result of successful trials, direct telephone communication between Prague, Stuttgart, and Paris has been established, and a regular service has been opened. Tests are now being carried out between Paris and Budapest, the underground cable between Paris and Vienna being utilised, and then the overhead wire between Vienna and Budapest; so far the tests have been considered quite satisfactory.—*Reuter* (Paris).

Telephone communication by the new cables recently installed between Brussels and Antwerp and London has been satisfactorily tested, and the new lines will be opened for public use at the end of the month.

India.—"Beam" Radio-Telegraphy.—It was recently announced in the Council of State at Delhi that official "beam" radio-telegraph transmission tests from the Poona station would commence in May and that the service would actually commence in June. The Indian system consists of a transmitting station situated about six miles from Poona. The site is at an elevation of about 2,200 ft. above sea level, and the area at present utilised for the buildings and aerial system does not exceed 20 acres, but considerable space has been allowed for any extensions which may be made in the future. Heavy fuel oil is used for power production. The receiving station is situated about four miles from the small town of Dhond and about 50 miles from the Poona station, and lies in open, wide country, so that there is no screening to interfere with the reception of signals. These stations will link with the Grimsby transmitter and Skegness receiver in England (the latter are described elsewhere in this issue).

Bombay Telephones.—The Bombay Telephone Co. has earned a good profit for the year 1926 in spite of trade depression. It is proposed to introduce the message-rate system, experience of this at Calcutta having shown that in the case of business, as well as residential, areas over 65 per cent. of the users are paying less under that system of charging than they would have paid under flat rates. The slight opposition to the introduction of the message-rate system in Bombay will therefore soon be overcome.

San Marino.—New Radio Station.—A convention has been signed by representatives of Italy and the Republic of San Marino for the construction of a wireless station at San Marino.—*Reuter's Trade Service* (Rome).

Santo Domingo.—New Radio-Telegraph Plant.—The Minister of Promotion and Communications has ordered new equipment for the radio station at Santo Domingo, South America (the international call letters assigned to the Republic being HIA-HIZ), to provide direct communication with New York, 1,225 miles distant, and other stations within a radius of 1,500 miles. The old equipment will be utilised at a radio station to be erected at Puerto Plata, the principal seaport on

the north coast of the island, and it is also proposed to install a low-power station at Sanchez, on the Bay of Samaná.—*Reuter's Trade Service* (Santo Domingo).

Transatlantic Cables.—Storm Damage.—The "beam" radio-telegraph service assisted in coping with traffic congestion last week, which was caused by the interruption of operation of one of the Imperial cables across the Atlantic Ocean, which the *Evening News* explains was "cut" in bad weather off the Newfoundland coast. At the same time the aurora borealis interfered with all traffic *via* Newfoundland and Nova Scotia.

United States.—Telephone Service Growth.—Remarkable figures indicative of the growth of telephone service in America during recent years are contained in the annual report of the American Telephone and Telegraph Co. for 1926. On December 31st, 1910, there were 5,882,719 telephones in the country, by means of which 22,284,010 calls were made every day; in December, 1926, there were 17,574,252 telephones (almost a threefold increase), and 52,354,834 calls were made daily. The total value of the plant has increased from 611,000,000 dollars (about £122,200,000) in 1910 to 2,783,000,000 dollars (about £556,600,000) in 1926; more than 255,000,000 dollars (£51,600,000) was spent on plant during 1926. It is notable that, as the sphere of a telephone system widens, the cost per telephone rises: the cost per telephone in America, which was 157.16 dollars in 1910, had risen in 1926 to 218.27 dollars. In 1900, when there were some 10,000 stockholders, the revenue of the company was 45,000,000 dollars (£9,000,000); in 1926 the revenue was 844,000,000 dollars (£168,800,000) and the number of stockholders 400,000, the largest number recorded in any one business venture.

Radio Notes.

Bulgaria.—Reception Ban Removed.—Bulgarian citizens have hitherto not been allowed to use wireless, the only sets permitted in the country being those belonging to Government administrative bodies, the Ministry of War, and Bulgarian merchant vessels. The Government has now, however, decided to permit their use by the general public, although transmission will remain a State monopoly. Owners of receiving sets will be required to pay a fixed subscription and to undertake to conform to such regulations as may be made.—*Reuter* (Sofia).

Colombia.—Improved Service.—In his message to Congress, the President of Colombia, South America, announced the immediate provision of an improved broadcasting service. Twelve sets are to be used, all of high power (the international call letters assigned being HJA-HKZ). The message has attracted much favourable attention, as hitherto there has been no broadcasting in Colombia, where static is bad during most of the year in the greater part of this extremely mountainous country. The best reception is obtained from January to March. The recently-opened stations at Caracas (Venezuela) and Balbóa (Panamá) are expected to benefit broadcasting in Colombia.—*Reuter's Trade Service* (Bogota).

New Continental Stations.—Italy.—The publication is expected of a decree-law instituting a new company to take over the wireless telephony services, and appointing a supervisory committee. The decree will fix the composition of the board of the company and the staff of artists, which is to be predominantly Italian, and require the execution of the following technical plan: the replacement of the present station at Milan by another of 7 kW; the erection at Genoa of a 11.5-kW station; at Rome, one of 25 kW; at Florence, Turin, Naples, and Bari stations of 3 kW, and at Palermo one of 7 kW.—*Reuter's Trade Service* (Milan).

The new transmitter at Milan, which will deliver 7 kW to the aerial, is nearing completion.

The Italian Government Commission examining broadcasting finance has adopted a resolution recommending the Government to impose a small tax. All Italians are instinctively against the suggestion of a licence tax, says the *Financial Times*.

Sweden.—The new Motala station, which has been testing for some time, was to begin regular operation before Easter.

Finland.—A station is to be built in Lahtis at a cost of about $200,000, which is part of a loan granted the country by an American concern. At present there are only two radio stations in Helsingfors and one in each of the following towns:—Tammerfors, Bjorneborg, Lahtis, Jyvaskyla, and Jakobstad. The stations in Helsingfors belong to the Army and those in the other towns are privately owned. None of them is equipped for modern broadcasting, says *Commerce Reports*, and it is expected that the new station will stimulate interest and increase the sale of equipment.

India.—Listeners Increase.—According to the annual report of the committee of the Bombay Radio Club for the year 1926, the number of members increased during the year to 585. The Club had broadcast upwards of 300 concerts, and the programmes were received in places many hundreds of miles distant. It is intended by the Technical Committee to install in the current year small transmitters, of both long and short waves, for communication with other amateur stations in India and to start a class in Morse receiving and dispatching, if sufficient members accord their support. It is expected that the Indian Broadcasting Co. will commence its regular broadcasting services from Bombay and Calcutta in August next. Mr. Page, director of the Bombay station, and Mr. Wallace, director of the Calcutta station, have both arrived in India. The transmitting station of the company will be 120 times as powerful as the present Bombay station (2FV).

New Zealand.—New Station.—Wellington is shortly to possess a 5-kW station. In both Auckland and Christchurch there are good stations, says *World Radio*, but so far Wellington and Dunedin have each had only a very small station. The number of licensed listeners in New Zealand is at present 13,000.

Poland.—New Station.—The Polish Broadcasting Co. (Poleskie Radio) has just placed a contract for a 10-kW station to be erected at Katowice. The equipment will be manufactured in London at the works of Standard Telephones and Cables, Limited. This order follows on the recent successes of this company in obtaining contracts in face of foreign competition for broadcasting equipments for the Irish Free State, Denmark, Japan, and New Zealand.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—May 10th. Postmaster-General's Department. Telephone relays. (B.X. 3333.)*
May 17th. Resistances and reactances. (B.X. 3307.)*
May 23rd. State Electricity Commission. Switchgear and accessories. (B.X. 3285.)*
May 9th. 6,600-V transformers and spares. (B.X. 3331.)*
June 1st. Victorian Government Railways. Electric time-releasing mechanisms. (B.X. 3431.)*
July 5th. One 15,000-kW steam turbo-generator and accessories. (B.X. 3338.)*
Sydney.—May 9th. Electricity Department. Station auxiliary switchgear. (B.X. 3338.)*
April 26th. A.C. electricity meters. (B.X. 3407.)*
June 22nd. New South Wales Government Railways. Remote control switchgear. (B.X. 3442.)*

Barking.—May 9th. County of London Electric Supply Co., Ltd. Cables and accessories for the Barking power station. (April 1st.)

Belgium.—April 28th. Schaerbeek Municipal Council. 11 kilometres of h.p. and l.p. armoured cable. Particulars (Cahier des Charges), for 10 francs from Service de l'Electricité, Hotel Communal, Schaerbeek.

May 9th. The Limbourg Provincial authorities at Hasselt. 1648.5 metres of h.p. armoured cable for Eysden. Particulars (Cahier des Charges), for 10 francs from Service de l'Electricité, 27, Avenue Bamps, Hasselt.

Colombia. — Bogota. — April 30th. Ministry of Public Works. Two electric lifts. (A.X. 4433.)*

Dublin.—April 30th. Electricity Department. E.h.p. and l.p. cables, cast-iron and stoneware troughing, section pillars, compound and other materials and accessories. (April 15th.)

Edinburgh.—April 25th. Education Authority. Electric installation at North Junction Street School. Plans and schedules from office of the Authority.

May 2nd. District Board of Control. Electricians' work at new buildings at Gogarburn Institution. Mr. Stewart Kaye, architect, 14, Hill Street, Edinburgh.

Egypt.—Cairo.—May 24th. Director-General of Prisons. Twelve months' supply of electric lamps, &c. (C.X. 2268.)*

Grimsby.—May 2nd. Electricity Department. E.h.p. and pilot cables; l.p. feeder cables. (April 15th.)

Ilford.—April 26th. Electricity Department. One 1,500-kW motor-convertor or rotary-convertor and transformer, 6,600-V switchgear cubicles and alterations to existing switchgear. (April 8th.)

India.—India Store Department. April 26th. 66-kVA motor-driven alternator sets, transformers, switchgear, &c. (April 1st.) Telephone cable. (April 8th.) 53,825 inert electric cells. (April 15th.)

Kendal.—April 30th. Board of Guardians. Electric light installation at the Institution; Mr. G. Cotton, clerk, 14, Lowther Street. (Returnable deposit of £2.)

London.—London County Council.—April 26th. Wiring and fitting for electric lighting in two blocks of tenements at the Ring Cross housing estate, Islington (approx. 274 wiring points). (April 8th.)

St. Marylebone.—May 18th. Electricity Department. L.p. and e.h.p. cables for 12 months. (April 15th.)

Metropolitan Asylums Board.—April 25th. Installation of electric lighting, telephone, fire alarm and domestic bells in the engineer's house at the Western Fever Hospital, Seagrave Road, S.W. (April 15th.)

Islington.—June 1st. Electricity Department. Steel-tube lamp columns, 2,200-V feeder switchgear, rotary and/or static power factor correctors. (See this issue.)

Manchester.—May 5th. Electricity Committee. Twelve months' supply of electric kettles, potential and current transformers, electricity meters, and cable supplies. (See this issue.)

New Zealand.—Wellington.—May 31st. Public Works Department. 50-kVA transformers for the Waikaremoana electric power scheme. (B.X. 3294.)* 50-kVA transformer for Arapuni scheme. (B.X. 3293.)*

June 21st. Sub-station switchgear and metering equipment for Arapuni. (B.X. 3398.)*

June 7th. Railway sub-station equipment, Lake Coleridge electric power scheme. (B.X. 3295.)*

June 13th. New Zealand Railways. Machine tools, workshop equipment and overhead electric travelling cranes. (A.X. 4344.)*

June 6th. Six electric locomotives. (A.X. 4355.)* Overhead equipment for the Christchurch-Lyttelton electrification scheme. (B.X. 3301.)*

Invercargill.—May 31st. Southland Electric Power Board. Transformers. (B.X. 3379.)*

June 15th. 66,000-V oil circuit-breakers. (B.X. 3378.)*

Lyttelton.—July 20th. Harbour Board. Four 5-ton electrically-operated portal cranes, and ten electrically-operated capstans. (A.X. 4532.)*

Oldham.—April 30th. Electricity Department. Coal-handling and conveyor plant. (April 15th.)

Plymouth.—April 25th. Electricity Department. Electricity meters, cables, and transformers. (April 1st.)

Prestwich.—County Mental Hospital.—Supply and fixing of electrical cooking apparatus, &c., at the annexe kitchen. (See this issue.)

South Africa.—Johannesburg.—May 7th. Municipal Council. Electric street lamp fittings and globes. (B.X. 3395.)* Cables. (B.X. 3406.)*

May 12th. Transformers. (B.X. 3415.)*

Cape Town.—June 1st. The University. Electric cooking utensils for the new residences at Groote Schuur. (B.X. 3393.)*

Southend-on-Sea.—April 28th. Light Railways and Electricity Department. 12 months' supply of lubricating oils. (See this issue.)

Stafford.—April 30th. Staffordshire Education Committee. Electric wiring and fittings for the new infants' department of the Slater Street Council school and in the additional class rooms, laboratory, &c., in the Salisbury Street central school. (April 8th.)

Uruguay.—Montevideo.—June 15th. State Electricity Supply Works. 15 transformer sub-station equipments (6,600/220 V, 50 cycles). (B.X. 3371.)*

Five overhead transformer sub-stations mounted on tubular or section iron columns. (B.X. 3430.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Barking Town.—Electricity Committee.
Cable—

Power & Lighting Cables, Ltd. (Recommended)	**£469**
A.C.E.C.	606
Standard Telephones & Cables, Ltd.	668
Hackbridge Cable Co., Ltd.	674
Union Cable Co., Ltd.	683
Siemens Bros. & Co., Ltd.	695
Enfield Cable Works, Ltd.	695
W. T. Henley's Telegraph Works Co., Ltd.	706
Pirelli-General Cable Works, Ltd.	707
Johnson & Phillips, Ltd.	713
Callender's Cable & Construction Co., Ltd.	718
British Insulated Cables, Ltd.	720

Bolton.—Electricity Committee. Accepted:—
Induced draught plant at power station.—Musgrave & Co., Ltd.

Tramways Committee. Accepted:—
500 tons of Sandberg steel tram rails.—Cargo Fleet Iron Co., Ltd.

Burton-on-Trent.—Electricity Committee. Accepted:—
Switchgear (£1,252).—Ferguson, Pailin, Ltd.

Croydon.—Electricity Committee. Accepted:—
Switchgear, Lower Coombe Street sub-station (£647), one feeder and two transformer panels for Thornton Heath (£473), and one feeder panel for Drovers Road (£167).—A. Reyrolle & Co.
Switchboard, &c., at Duro Rubber Co.'s sub-station (£107), 22 switch panels for extension of switchboards at various h.p. stations (£721).—Ferguson, Pailin, Ltd.
Four banks of 6,300-V, 3-phase, Scott-connected oil-cooled transformers, one 250-kVA ditto, and one 100-kVA ditto (£2,325).—British Electric Transformer Co., Ltd.
Boiler feed pump (£337).—Mather & Platt

Dumfries.—Town Council. Accepted:—
Battery booster (£434).—Lancashire Dynamo Co., Ltd.

East Ham.—Works Committee. Accepted:—
Automatic switches for electric lamps.—British Foreign and Colonial Automatic Light Controlling Co., Ltd., Tyer & Co., Ltd., and Acme Lighting Engineering Co.

Glasgow.—Tramways Committee. Recommended:—
Gear cases (steel).—W. C. Yuille & Co., Ltd., and Metropolitan-Vickers Electrical Co., Ltd.

Lamp Contracts.—Brentford, Holborn and Belfast Board of Guardians and the London, Midland & Scottish Railway have placed 12 months' contracts for Osram Lamps with the General Electric Co., Ltd. Belfast City Council has placed a 12 months' contract for Mazda electric lamps with the British Thomson-Houston Co., Ltd. The Port of London Authority has placed a six months' contract for Siemens lamps with the Siemens & English Electric Lamp Co., Ltd.

London.—General Post Office.—Accepted:—
Rectifying valves.—Edison Swan Electric Co., Ltd.

Shoreditch.—Lighting Committee. Accepted:—
One 20-ton hand-operated crane (£199).—Vaughan Crane Co., Ltd.

Southern Railway. Accepted:—
20 rotary convertors and 60 transformers in connection with the electrification scheme (approx. £120,000).—Allmanna Svenska Elektriska Aktiebolaget of Sweden.

Manchester.—Tramways Committee. Accepted:—
Assembled commutator segments for B.T.H. and B.W. armatures; armature coils for B.T.-H. and B.W. equipments.—Manchester Armature Repair Co., Ltd.
Tramway rail bonds.—Forest City Electric Co., Ltd.

Sheffield.—Electricity Committee. Accepted:—
12,000-volt switchgear at Blackburn Meadows (£3,811).—A. Reyrolle & Co., Ltd.
Erection of new chain grate stokers and accessories for boilers at Neepsend (£3,075).—Ed. Bennis & Co., Ltd.

South Shields.—Tramways Committee. Accepted:—
30 tons of tram rails (£295).—Cargo Fleet Iron Co., Ltd.
Three movable points (£258).—Malleable Steel Castings Co., Ltd.

Torquay.—Electricity Committee. Accepted:—
Two 72-inch screens in connection with new pump house at Newton Abbot (£1,720).—Brackett & Co.
Special Larner-Johnson valves for pumps (£256 per valve).—Blakeborough & Co.
Boiler house plant (£24,226).—Stirling Boiler Co., Ltd.
6,000-kW turbo-alternator, with condensing plant (£25,949, plus £242 for an extraction pump).—British Thomson-Houston Co., Ltd.

Wakefield.—Housing Committee. Accepted:—
Wiring 150 houses on the Snapethorpe Estate.—H. Smith.

Forthcoming Events.

Junior Institution of Engineers.—Tuesday, April 26th. Monico Restaurant. 6.30 p.m. Annual dinner.

Friday, April 29th. 39, Victoria Street, S.W. 7.30 p.m. "The Design and Balancing of 3-phase L.P. Distribution Systems." Mr. W. F. Cooper.

Birmingham Electric Club.—Friday, April 22nd. Grand Hotel. 7 p.m. "Radiation Effects." Mr. J. B. Kramer.

Association of Mining Electrical Engineers (North of England Branch). — Saturday, April 23rd. Durham. "Accumulators," Mr. A. W. Bridges. "Electrical Testing Gear for Collieries," Mr. H. J. Fisher.

Institution of Electrical Engineers (Mersey and North Wales (Liverpool) Centre).—Monday, April 25th. University, Liverpool. 7 p.m. Annual general meeting. Short papers by members.

(North-Eastern Centre).—Monday, April 25th. Armstrong College, Newcastle-on-Tyne. 7 p.m. Annual general meeting.

(Scottish Centre).—Friday, April 29th. University College, Dundee.

(South-Midland Centre).—Wednesday, April 27th. University, Birmingham. 7 p.m. Kelvin lecture, "High-Frequency Currents." Prof. E. W. Marchant.

Royal Society.—Monday, April 25th. 8 p.m. Cantor Lecture. "The Measurement of Light." Mr. J. W. T. Walsh.

Illuminating Engineering Society.—Tuesday, April 26th. At 5.30 p.m. Visit to the Photometric Section of the National Physical Laboratory, Teddington. 7 p.m. "Work in the Photometry Department of the National Physical Laboratory." Mr. H. Buckley.

Batti-Wallahs' Society.—Tuesday, April 26th. Hotel Cecil. Luncheon. "How to Reconcile Relations Between the Consumer, the Producer, and the Wage-earner." Sir Arnold B. Gridley.

Institute of Wireless Technology.—Wednesday, April 27th. Engineers' Club. 7 p.m. "The Electrical Recording and Reproduction of Gramophone Records." Mr. H. J. King.

Royal Institution.—Friday, April 29th. 9 p.m. "Wireless Transmission and the Upper Atmosphere." Mr. E. V. Appleton.

Notes.

The International Electrotechnical Commission.

According to *Génie Civil*, the I.E.C. is to meet this year at Bellagio, on Lake Como, from September 5th to 12th, and at Rome on September 21st, for the final session. In the interval the members will visit Milan, Venice, Florence, and various hydro-electric works, under the ægis of the Italian Electrotechnical Committee. The sectional committees of the International Illumination Commission will meet at Bellagio from August 31st to September 3rd; many of its members belong to both Commissions, and will take part in the sessions and tour of the I.E.C.

The Electrical Trades Benevolent Institution.

The annual general meeting of this Institution will be held at the offices of the Institution of Electrical Engineers, London, on Thursday, April 28th, at 2.30 p.m.

Battery Traction in Belgium.

With M. L. Herry, director-general of the Centrales Electriques des Flandres, as chairman, there has been formed the Syndicat d'Etudes pour le Developpement de la Traction Electrique par Accumulateurs for the development of electric battery traction in Belgium. The chairmen of the various sections have been chosen as follows, says the *Electric Vehicle*:—Electricity supply: M. Lechien, president of the Union des Exploitations Electriques en Belgique; electrical materials: M. Rousseau, director-general of the Ateliers de Constructions Electriques de Charleroi; automobile: le Comte J. de Liejekerke, president of the Chambre Syndicate des Constructeurs d'Automobiles et de Cycles de Belgique; accumulator: J. Van de Wiele, of the Tudor Company. The secretary of the new Association (address: 158, Rue Royale, Brussels) recently visited England to study conditions and the activities of the British Electric Vehicle Committee.

Artificial-Light Treatment for Children.

The Artificial Light Department at the Victoria Hospital for Sick Children, Tite Street, Chelsea, was formally opened recently. According to *The Times*, Dr. Murray Levick stated that from 50 to 60 treatments were being given *per diem*; nearly 4,000 treatments had been given since the department began work. The hospital had a special batch of cases suffering from tuberculous glands, and these were doing well. The results obtained up to the present justified the conclusion that children living in their own homes and coming for a prolonged course of this treatment three times a week progressed as well as those who were sent to expensive Alpine institutions.

Better Lighting.

In the course of a lecture recently delivered at Bedford Town Hall before a large audience, under the auspices of the Electrical Power Engineers' Association, on "Better Lighting for Shop and Home," Mr. R. H. Rawll, A.M.I.E.E., of the City of Birmingham Electricity Department, emphasised that the consumer should not merely consider the cost of electricity, but should also know how much light he was getting from it. Good lighting was a business investment, for the purpose of bringing in more business. Lighting shop windows after closing hours was effective advertising and could be done very cheaply.

B.E.S.A. Publication.

A recent publication of the British Engineering Standards Association is a B.S.S. for gear wheels and pinions for electric tramcars. One of the difficulties to be overcome in preparing the work was that although the dimensions were to some extent similar, each manufacturer worked to a slightly different formula for the tooth form, in addition to making use of many different materials and heat treatments for the manufacture of the wheels. It was recognised that with the advent of high-power motors and increased speeds on tramways it was essential not only to effect standardisation to provide interchangeability, but also to collect all the available knowledge of the materials used, and committees were formed, consisting of the makers of gears, representatives of the tramway undertakings, steel manufacturers and metallurgists, to go into the whole matter. Already a large number of gear wheels and pinions have been made to this specification, and it has been established that these are superior to those previously manufactured.

In addition to standard sizes and formulæ for tooth form, specifications of materials and heat are included for case-hardened forged gear wheels and pinions, case-hardened cast gear wheels, "45" carbon-steel forged gear wheels and pinions (water-hardened and tempered), and cast gear wheels (water hardened and tempered). There should therefore be no difficulty for tramway engineers to select the material best suited to their individual requirements and conditions of running. Copies of the specification (No. 235-1927) can be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1, price 2s. 2d., post free.

Waste-Heat Recovery.

In a paper on "The Recovery and Utilisation of Heat from the Exhaust Gases of Internal-combustion Marine Engines," read recently before the Institute of Marine Engineers by Mr. T. Clarkson, the thimble-type boiler is claimed to fulfil the ideal requirements of a waste-heat boiler. It was originally designed to meet the extremely stringent conditions met with in the problem of road transport, and the remarkable properties which it demonstrated in this service led to the suggestion that it should be used to deal with the waste gases from internal-combustion engines. It is claimed that, as the boiler tubes are secured at one end only, perfect freedom of expansion is obtained for each individual tube, and consequently no strain due to varying thermal expansion is imposed upon the tube joints. By spacing the thimble tubes closer together towards the outlet end, the effect of the gradual cooling down of the gases as they pass through the boiler can be easily compensated for. The author gives 300 deg. F. as the general practical limit beyond which the gases should not be cooled. One difficulty which is met with by designers of waste-heat boilers is the fact that there are no standard diameters of exhaust pipes in relation to horse power. It is always desirable to keep the exhaust pipe as small as possible, consistently with the avoidance of back pressure. Tests by Prof. Gilbert Cook have shown that an efficiency as high as 86 per cent. of heat recovery can be obtained.

Irish Free State Electricity Supply.

At a meeting of the General Committee of the Dublin Mercantile Association, Ltd., last week, a strong resolution was passed protesting against the action of the Irish Free State Government in promoting legislation which would deprive the ratepayers of Dublin, and consumers of electricity in Dublin and elsewhere, of the undertakings built up with their money and credit without adequate compensation, and calling on the Government and members of Dail Eireann to amend those provisions by providing equitable compensation for all property, public or private, taken over. The resolution added:—"That in the event of the Dail passing the Electricity (Supply) Bill, 1927, in its present form, we call on the members of the Senate to reject it."

A Small Hydro-Electric Plant.

With reference to the article under the above heading in our issue of April 1st, describing the hydro-electric scheme of the Northern Nigeria (Bauchi) Tin Mines, Ltd., it should have been stated that the information was derived from an article, "A.S.E.A. in Nigeria," by John F. Shipley, M.I.E.E., published in the A.S.E.A. *Journal*.

Educational.

The B.B.C. announces that the 24-page programme and syllabus of transmissions to schools is about to be issued for the period May to July. All stations are well provided with interesting material.

Market-Place Lighting.

The accompanying illustration depicts the system adopted by the Aylesbury electricity undertaking (engineer and manager: Mr. W. A. Turnbull, A.M.Inst.C.E.) for supplying electricity to about 30 stalls in the Market Place for lighting. Permanent sockets in the ground between the rows of stalls accommodate poles, from which are suspended C.T.C. cables. A 3-core cable supplies each row of poles, the connections



Overhead Cables, Aylesbury Market Place.

being made by means of plugs and sockets. Sockets, with fuses, are permanently fixed on each pole, and leads to the stalls are plugged in as required. The lighting is required on Saturdays, and one man does the whole of the work of erecting and dismantling the poles and wires in an 8½-hour day. A fixed charge per lamp is made to the stallholders, who are very pleased with the arrangement.

An Overspeed Test-House.

The Metropolitan-Vickers Electrical Co., Ltd., has built an overspeed test-house at its Trafford Park works which is designed to deal with two distinct classes of electrical machines, *viz.*:—(*a*) Low-speed waterwheel generators of large diameter and weight; (*b*) high-speed turbo-alternator rotors of great length and medium diameter and weight; whilst the apparatus provided is also suitable for testing turbine rotor disks and similar apparatus which, although of light weight, necessitates the use of very high speeds. The internal dimensions are large enough to take rotors up to 14 ft. 6 in. diameter, and shafts up to 40 ft. in length. The walls are 9 ft. 6 in. in thickness, and consist of an outer casing of reinforced concrete with internal air pockets, linings of bags of sand, and rafts of timber held in place by a light steel framework. Taking advantage of lessons learned during the war in the construction of shell-resisting structures, the composite walls are designed to take out the sting of impact by bringing the flying parts to rest gradually. In the construction of the building 800 cubic yards of concrete, 30 tons of steel, 2,000 cubic feet of timber, and 7,000 cubic feet of sand were used, exclusive of the moving door, which consists of ferro-concrete lined with wood, carried on spring-mounted wheels, and weighs 17 tons. Loads of 120 tons can be handled; two special bogies, mounted on a standard heavy-gauge railway track, are provided to carry the rotors to be tested. A 500-volt d.c. motor of 1,800 h.p. is mounted in a separate chamber, together with a gear box arranged to impart speeds of from 250 to 7,200 r.p.m. on the driven shaft; provision has also been made for obtaining speeds up to 21,600 r.p.m. The coupling shaft between the gear box and the rotor to be tested has been designed to sever in the case of any serious disturbance during a test, thus acting as a safety device to save the gear box from damage. The coupling used at the test-pit end is of the large-diaphragm type, which allows for slight misalignment and damps out the transmission of vibration. A high-pressure oil system provides for lifting the rotors on to an oil film to reduce the starting effort required, besides lubrication. In a separate cabin in the main shop complete control is centred, and data can be recorded under quiet and convenient conditions.

Australian Standard Voltages.

The Australian Commonwealth Engineering Standards Association has issued a tentative Australian standard for voltages and frequencies for new systems and installations. According to the *Electrical Engineer for Australia and New Zealand*, for d.c. systems the standard l.p. voltages are 460 and 230, and for a.c. systems the standards are 230 V between phase and neutral and 400 V between phases. The station voltages are in each case 10 per cent. higher. The h.p. delivered voltages are 2,000, 6,000, 10,000, 20,000, 30,000, 40,000, 60,000, 80,000, 100,000, and 120,000, with station voltages 10 per cent. higher. The 2,000-V pressure is only to be used in systems other than public supply systems and where special circumstances warrant the adoption of voltages lower than 6,000. The standard frequency is 50 cycles, provided that a frequency of 25 cycles may be used for special industries for which it has advantages. This specification is numbered C1 (*a* and *b*)—1926T. It is issued tentatively for a period of 12 months.

The Moscow Radio Station.

The newly-built "Great Komintern" radio broadcasting station in Moscow, Russia, for the construction of which Prof. Bonch Brouevitch was responsible, was recently officially opened. The plant is claimed to have a capacity of 40 kW, and the accompanying illustration is of interest inasmuch as it shows the unusual type of aerial mast that has been adopted. The station now under construction at Zeesen, near Berlin,



"Great Komintern" Aerial Mast.

in Germany, is credited with the possession of the tallest masts in Europe; they are of the rectangular lattice steel pattern, their height being 210 metres.

Rural Supply Deputation.

On April 13th a deputation of members of Parliament, introduced by Sir Douglas Newton, waited upon Sir Harry Haward at the offices of the Electricity Commissioners to express disappointment at the delay which is taking place in providing rural areas with electricity, particularly with regard to the difficulties met with in obtaining wayleaves. It was suggested that more power should be given to supply undertakings to deal with the "final objectors," who were not always the landowners, who often raised trivial objections, but sometimes the Post Office, the railway companies, and even other Government departments. It was pointed out that as much as £200 was often spent in obtaining a landowner's consent for a supply line to be run over his land. The high costs of erecting h.p. lines were also stressed, and it was asserted that these

varied from £1,200 to £1,300 per mile. The deputation also urged that more publicity should be given to the fact that it was not practicable to use buried cables for many of the transmission schemes. The inhabitants of rural areas did not realise that there was a real necessity for overhead lines, and also thought that such lines could be diverted to suit their own conveniences without serious consequences. It was suggested that a memorandum should be issued for the guidance of local authorities and the general public concerned, explaining the new legislation. This should contain a short concise statement of facts calculated to dissuade possible objectors from entering into unnecessary legal proceedings. It was proposed that it should be made clear that it would not be possible to tap the new "grid" at any point where any prospective consumer might want a supply. It was not generally realised that it would be necessary to provide subsidiary overhead systems for the various areas. The Commissioners were also urged to compile an approved schedule of reasonable pole rentals and to make it clear that no sanction could be given for excessive charges. The schedule should be prepared on the basis of the sizes of the poles, the necessary trenching of the cables, the different types of land and crossings, and the methods of erection employed.

Electrical Association for Women.

The second annual general meeting of the above Association will this year take the form of a two-days' conference in London on May 11th and 12th next. The first day's proceedings will include the business meeting and a luncheon at the Hotel Cecil. On the second day visits will be made to the works of Standard Telephones & Cables, Ltd., Woolwich, and to the Woolwich Housing Estate.

Manchester Steam Users' Association.

The memorandum by the chief engineer of the Manchester Steam Users' Association, Mr. C. E. Stromeyer, O.B.E., M.Inst.C.E., for the year 1926, has just been issued. It contains much valuable information concerning boiler failures, and many examples are given of curious cases taken from the Association's museum. Great importance is attached to corrosion, prominence being given to uniform wasting, the most misleading and dangerous form to be met with in boilers. Instances are illustrated of the substance of plates, seams, rivets and stays having been slowly eaten away while the original shape has remained to mislead the inexperienced. Instances of corrosion at the overlapping of boiler plates show that where corrosion has removed about two-thirds of the plate thickness, and an equal amount from the rivet heads, the corners of the lap have remained sharp, but the hollow corners of the lap and the rivet heads have experienced partial protection and become rounded, a distinctive feature of this form of corrosion. It appears that sulphur dioxide does not attack cold steel, but when part of a furnace becomes overheated, due to scale or deposit, the metal is readily attacked by the gas.

An instance is quoted of a furnace ring collapsing as a result of uniform wasting. The cause was never revealed, but it is suggested that had the possibility of the trouble being brought about by thermo-electric currents presented itself at the time, the cause might have been found. It is shown that if a circuit can be established from one side of the plate, through the water and another part of the boiler and back to the starting point, weak but uniform corrosion is likely to occur.

A case of corrosion of the sides of a Lancashire boiler furnace, where the crossbar supporting the brick bridge was resting on the furnace sides, and not on angle brackets, supports the view that some forms of corrosion are due to certain strains having the power of making steel susceptible to corrosion attack.

It is recommended that cast-iron feed pipes and valves should not be fitted to boilers, as cast-iron is liable to graphitic corrosion. Referring to the corrosion found on the plates of the steam spaces of boilers, it is pointed out that now that the discovery has been made that steel creeps if overheated, the possibility of this form of corrosion being associated with creep or heat-straining should not be overlooked. The prevalence of incrustation in economiser pipes is evidenced by some illustrated examples. In one case the pipe shows a crack which occurred after removal, due to the swelling of the scale. A curious furnace-tube fracture of a l.p. boiler is illustrated. An internal bulge was created, and the scale on the tube exterior remained intact, being sufficiently porous to allow the steam to pass through it. Some useful data are given concerning steel failures with varying nitrogen and phosphorus contents, and where caustic soda had been introduced. Considerable information is also given with regard to the study of fatigue phenomena. Something of the early research work of the Association is also given, including descriptions of some of the early instruments employed.

Appointments Vacant.

Travelling meter engineer for the Electrical Apparatus Co., Ltd. Plumber-jointers for the Prestatyn U.D.C. Electricity Department. Meter mechanic (69s.) for the Darwen Corporation Electricity Department. Charge engineer for Doncaster County Borough Electricity Department. Assistant mains engineer (£366) for the Walthamstow U.D.C. Electricity Department. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.

Scottish Students' Section.—The following office bearers for the 1927-28 session have been appointed:—*Chairman*: Mr. J. Eccles; *Vice-Chairman*: Mr. A. Calder; *Hon. Secretary*: Mr. J. G. Boyne; *Members of Committee*: Messrs. J. A. Butters, T. Donaldson, A. Moir, and M. G. Say. The two remaining members of committee, one representative each from Glasgow University and the Royal Technical College, will be elected at the commencement of next session.

Junior Institution of Engineers.

At a meeting of the above Institution, on April 8th, a lecture and demonstration was given by Mr. E. Ambrose, M.I.E.E., on the subject of "Electrical Osmosis." The lecturer said that osmosis was closely related with dialysis and might be defined as "the tendency of fluids to mix or become equally diffused when in contact, even through an intervening membrane or porous structure." If a diaphragm were placed in a cell so as to divide it into two portions, each portion containing, say, acidulated water, and a current of electricity were passed through the diaphragm, then the liquid in one side of the cell would increase, showing that the water passed through the diaphragm. The phenomenon was electrical osmosis. Mr. Ambrose said that electrical osmosis was ever present in connection with rubber and fabric insulated conductors that were carrying d.c., any moisture being driven through to the copper of the negative. The dewatering of substances by electrical osmosis had been tried to a large extent in Germany. There was also a process for extracting sugar from beet, and for dewatering and purifying clays. There seemed to be much scope for the use of electro-osmotic action, as it had been demonstrated that liquids bearing narcotics or drugs could be forced through living skin and membrane by an electric current.

Iron and Steel Institute.

The annual meeting of the Institute is to be held this year on May 5th and 6th, at the Institution of Civil Engineers, when a large number of papers will be read. The annual dinner will be held at the Connaught Rooms, Great Queen Street, on May 5th. The autumn meeting will be held at Glasgow on September 20th to 23rd, at the invitation of the West of Scotland Iron and Steel Institute.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Torquay Corporation has appointed Mr. T. W. Mackay, B.Sc., A.M.I.E.E., construction superintendent to Messrs. Balfour, Beatty & Co., Ltd., for the Llanelly district, to the position of distribution engineer.

The Hastings Town Council has appointed Mr. C. Barratt, of Bradford, as salesman at the electrical showrooms at a commencing salary of £200 a year. There were 171 applications.

Upon the completion of the reconstruction of a large section of the Newcastle-Carlisle main road recently, Mr. A. C. Rayment, A.M.I.E.E., was presented by the men engaged upon the work with a case of pipes, a pouch, and an illuminated testimonial.

Mr. Henry Adam, electrical engineer and manager to Annfield Plain Urban District Council for the past seven years, has been appointed clerk of works and subsequent resident electrical engineer in connection with the Seaham Harbour electricity scheme.

Mr. Breadmore, inspector on the staff of the Reading Corporation Tramways, has retired after nearly 50 years' service with the undertaking.

On accepting an important appointment on the engineering staff of the Central Electricity Board, Mr. C. W. Marshall, M.I.E.E., has resigned the position of chief technical assistant in the Glasgow Corporation Electricity Department. Mr. Marshall joined the staff of the Department over 14 years ago, and has held the position of chief technical assistant since 1916. He has made a special study of the most modern methods of generation, transmission, and distribution of electrical energy over wide areas, both in this country and on the Continent. In addition to articles contributed to our pages, books from his pen have been published dealing with the modern generating stations, protective gear, and electric battery vehicles. Mr. Marshall takes up his new appointment early in May

The Rev. L. Van Vestraut, M.A., who has for several years been chief assistant in the Testing Department at Faraday House Electrical Engineering College, has been appointed registrar. Mr. F. A. Bell, F.C.A., has been appointed secretary.

Mr. C. R. Westlake, of the Yorkshire Electric Power Co., has been appointed district mains engineer to the Bedford Corporation Electricity Department.

Mr. John Pendreich has resigned his position with Messrs. Wood & Cairns, Ltd., Edinburgh, and has started as a manufacturers' agent at 73, Saughtonhall Drive, Edinburgh.

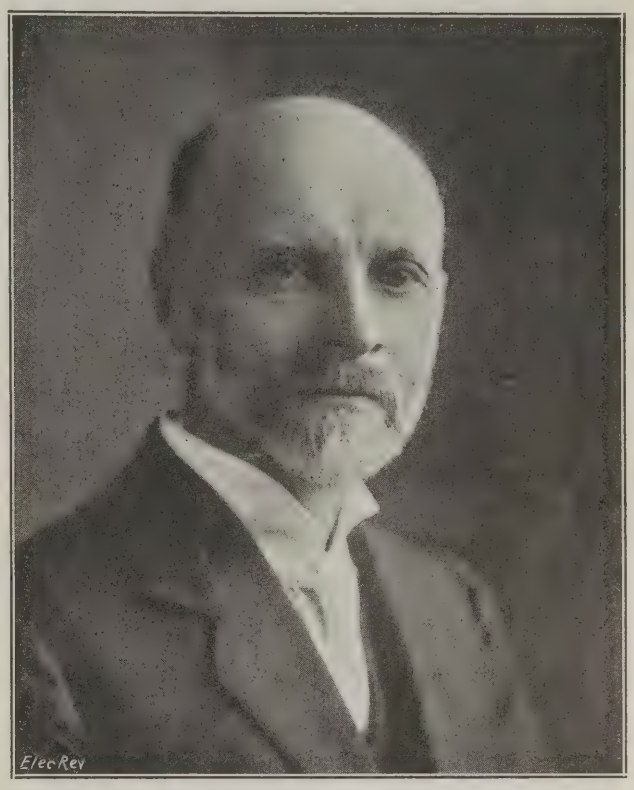
Obituary.—Lt.-Col. Patrick Walter d'Alton.—We regret to announce that on April 10th Lieut.-Col. P. W. d'Alton died at Westcliff, aged 71. Col. d'Alton, who was a member of the Civil, Mechanical, and Electrical Engineering Institutions, was educated at Dublin University and King's College, London, and first tried his hand at civil engineering, but speedily turned to the mechanical branch, and served his pupilage at the Reading Ironworks. After further experience gained at the North-Eastern Marine Engineering Works and Messrs. R. & W. Hawthorn's Works, he went to sea and eventually acquired the Board of Trade's certificate as chief engineer. In 1886 he became chief engineer to the Nordenfeldt Submarine Boat Company, but in 1889 he entered the electrical industry, as resident engineer in the Deptford power station of the London Electric Supply Corporation, and two years later he succeeded Mr. Ferranti as engineer-in-chief. During the South African war he served as major in the 6th Battalion, Royal Irish Rifles; afterwards he was appointed chief engineer to the Central London Railway, and from 1903 to 1914 he was chief mechanical engineer to Messrs. Dick, Kerr & Co., Ltd., in which capacity he carried out the conversion of the Liverpool-Southport Railway to electrical operation, and visited various parts of the world.

He took up private practice in 1914, but was chief engineer to the Valuation Committee from 1916 to 1921, with the rank of lieut.-colonel, and was responsible for advising the Ministry of Munitions and the Board of Inland Revenue on commercial questions arising out of the war. Afterwards he resumed his private practice. A man of striking personality, he was immensely popular, and was widely known in the engineering world, in which his undoubted ability made him an outstanding figure.

Mr. M. MacLeod.—The death took place at Rawmarsh on April 8th of Mr. Murdo MacLeod, who for 20 years had been traffic superintendent of the Mexborough and Swinton Tramways Co.

Capt. Reginald John Wallis-Jones.—On April 16th Capt. R. J. Wallis-Jones died, after a long illness; particulars of his career will be given in our next issue.

Mr. Albert Gay.—We have to record with regret the death, after a protracted illness, of Mr. Albert Gay, consulting and resident electrical engineer to the Islington Borough Council, at his home, on Tuesday, April 12th, at the age of 68 years. Mr. Gay was a native of Barnstaple, and entered the electrical field at the Lambeth works of the Anglo-American Brush Electric Light Company; in 1881 he joined Hammond & Co. as installation engineer, but from 1884 to 1887 he was in business on his own account. Subsequently Mr. Gay acted as chief engineer to the Eastbourne, Brighton, and House-to-House Companies in turn, before, in 1894, he was commissioned by the Islington Vestry to design and construct electricity works for the parish and to take charge of the undertaking; in that capacity he continued, under the Borough Council, until his death—a period of nearly 33 years. Mr. Gay was a member of the Institution of Electrical Engineers, and a past-president of the Associated Municipal Electrical Engineers; in conjunction with Mr. C. H. Yeaman he wrote a book, "Central Station Electricity Supply," which for many years had the field to itself, and he took an active part in literary and technical work. One of the pioneers of electricity supply in London, he was latterly a redoubtable opponent of the policy of the Electricity Commissioners with regard to the closing of the older and less efficient municipal generating stations.



Elliott & Fry] [*London.*

The late Mr. Albert Gay.

Will.—Mr. Stewart M. Banker, late superintending electrical engineer, G.P.O., left £3,167 gross and £1,094 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Siderman Electrical Supplies, Ltd.—Private company. Registered April 9th. Capital, £1.000 in £1 shares. To carry on the business of manufacturers, importers and exporters of and wholesale and retail dealers in electric lamps, electrical accessories, electric cables, &c. The first directors are:—A. Siderman, 51, Cleveland Street, Fitzroy Square, W., electrical factor; N. A. L. Stilling, 25a, Westbourne Terrace, Bayswater, W. Qualification, 10 shares. Solicitors: Hugh M. Everard & Co., 28, Maddox Street, W. Registered office: Goodwyn House, 4, Fitzroy Square, W.

Electric Agencies, Ltd.—Private company. Registered April 14th. Capital, £2.000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in automobiles, motor-cars, cycles, bicycles, aeroplanes, dynamos, accumulators, lamps, machinery, &c. The subscribers are:—S. F. Parish, 12, University Place, Cardiff, sales manager; L. J. Victor, 53, Grosvenor Street, Cardiff, builder. The first directors are to be appointed by the subscribers. Qualification, 100 shares. Secretary: I. G. Smalldridge. Registered office: 45, Caroline Street, Cardiff.

R.I. and Varley, Ltd.—Private company. Registered April 14th. Capital, £500 in 1s. shares. Objects: To carry on the business of selling agents for wireless, electrical, mechanical and other instruments, &c. The directors are:—J. Joseph, 12, Hyde Street, W.C.1; J. M. G. Rees, Cambridge Place, Burrage Road, Woolwich, S.E.18. Solicitors: Garton & Co., 21, Maddox Street, W.

Elektromekano Co. (London), Ltd.—Private company. Registered April 13th. Capital, £100 in 1s. shares. Objects: To carry on business as merchants and agents for the sale of all types of electrical machinery, apparatus and accessories, &c. The directors are:—K. A. Malmberg, 48, Copers Cope Road, Beckenham; S. G. Clarke, 59, Lavender Vale, Wallington, merchants' manager (both directors of K. Malmberg, Ltd.). Qualification, £1. Secretary: S. G. Clarke. Solicitors: Keene & Co., 15, Seething Lane, E.C.3. Registered office: 110, Cannon Street, E.C.4.

Power Lines Construction Co., Ltd.—Private company. Registered April 11th. Capital, £10,000 in £1 shares. Objects: To carry on the business of constructors of and dealers in cables, wires, lines, stations, accumulators, lamps, meters, works and engines for the purposes of supplying electricity for motive power, light, heat, &c. The first directors are:—H. H. E. Wood, 27, Onslow Avenue Mansions, Richmond, Surrey; C. W. Bloomfield, 6, Stanhope Court, Stanhope Place, W. Secretary: H. H. E. Wood. Solicitors: Frank Simmonds & Carter, 98, Salisbury House, E.C.2. Registered office: Palace House, Bridge Street, S.W.1.

N.S. Accumulators, Ltd.—Private company. Registered April 13th. Capital, £6,000 in £1 shares. Objects: To acquire the business of manufacturers of N.S. accumulators now carried on as "Bulley & Forbes," at 30, Lomond Grove, Camberwell, by W. R. V. Forbes and T. J. Bulley. The permanent directors are:—W. R. V. Forbes (chairman), Victoria Mansions, 28, Victoria Street, S.W.1; T. J. Bulley, 201, Devonshire Road, Honor Oak Park, S.E.23; G. A. Houghton, 49, Blessington Road, Lewisham, S.E.13. Qualification, £100 shares. Solicitors: Sir Henry C. Eggar, 164, Winchester House, E.C. Registered office: 30, Lomond Grove, Camberwell, S.E.5.

C.C.A. (Vacuum Cleaners), Ltd.—Private company. Registered April 13th. Capital, £3,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in vacuum cleaners, electrical implements, appliances, installations, labour-saving devices, machinery, and hardware of all kinds, &c. The subscribers (each with one share) are:—A. W. Rowoldt, 83, Queen Street, E.C.4, merchant; P. Hayter, 83, Queen Street, E.C.4, merchant; T. A. Blow, 83, Queen Street, E.C.4, cashier. The first directors are to be appointed by the subscribers. Qualification, one share. Solicitors: Cruesemann & Rouse, 40-42, King William Street, E.C.4.

Official Returns of Electrical Companies.

Goswell Engineering Co., Ltd.—R. G. Pye, C.A., of 6, Martin Lane, E.C., was appointed receiver on March 29th, 1927, under powers contained in debenture dated July 14th, 1926.

Thermionics, Ltd. (formerly G. W. I. Valves, Ltd.).—Capital, £150 in 1s. shares. Return dated December 31st, 1926 (filed February 9th, 1927). All shares taken up. £150 paid. Mortgages and charges, £1,000. L. A. Bartlett, of 639, Salisbury House, E.C.2, was appointed receiver and manager on July 16th, 1925, and was still acting as such on January 15th, 1927.

Trent Electric Wire Works, Ltd.—Capital, £2,500 in £1 shares. Return dated December 31st, 1926. All shares taken up. £1,500 paid. £1,000 considered as paid. Mortgages and charges, £1,000.

British Radio Corporation, Ltd.—Capital, £2,000 in 1,000 preference and 1,000 ordinary shares of £1 each. Return dated February 28th, 1927. 870 ordinary shares taken up. £650 paid. £220 considered as paid. Mortgages and charges, nil.

Yorkshire Electric Transformer Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1926 (filed March 21st, 1927). 3,530 shares taken up. £3,530 paid. Mortgages and charges, nil.

Galliers (Wholesale), Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926 (filed March 25th, 1927). 100 shares taken up. £1 per share called up on each. £100 unpaid. Mortgages and charges, nil.

William J. Hook & Co., Ltd.—Capital, £1,000 in 500 preference and 500 ordinary shares of £1 each. Return dated December 16th, 1926. 400 preference and 3 ordinary shares taken up. £403 paid. Mortgages and charges, nil.

Morris Electrical Co., Ltd.—Capital, £1,000 in 400 preference and 600 ordinary shares of £1 each. Return dated December 31st, 1926 (filed January 29th, 1927). 25 preference and 402 ordinary shares taken up. £177 paid. £250 considered as paid. Mortgages and charges, £200.

G. L. Electrical Supply Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926. All shares taken up. Nil called up on 2 shares. £998 considered as paid. Mortgages and charges, nil.

Unity Lamp and Accessories, Ltd.—Capital, £2,000 in £1 shares. Return dated May 25th (filed December 10th), 1926. 1,900 shares taken up. £1,187 10s. paid (being 12s. 6d. per share on each). Mortgages and charges, nil.

C. F. Palmer (London), Ltd.—Land Registration charge on 63a, Effra Road, and land in rear of 63-5-7, Effra Road, Brixton, dated March 28th, 1927, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Woking Electric Supply Co., Ltd.—Issue on March 3rd, 1927, of £700 debentures, part of a series already registered.

Electric Construction Co., Ltd.—Satisfaction to the further extent of £4,740 on March 31st, 1927, of 4 per cent. perpetual first mortgage debenture stock secured by trust deed dated December 16th, 1897, securing £200,000.

Plessey Co., Ltd.—Debenture charged on property in Vicarage Lane, Ilford, and the company's undertaking and property, present and future, including uncalled capital, dated March 16th, 1927, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd.

Howarth, Green & Co., Ltd.—Particulars filed of £2,000 debentures authorised March 25th, 1927, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Bromley (Kent) Electric Light and Power Co., Ltd.—Satisfaction in full on or before March 15th, 1927, of debenture stock dated July 7th, 1902, and June 6th, 1904, securing £70,000.

J. Marse & Co., Ltd.—C. W. J. Mason, of 41, Finsbury Square, E.C.2, ceased to act as receiver or manager on March 5th, 1927.

C. F. Elwell, Ltd.—A. White, of 34, Norfolk Street, W.C.2, was appointed receiver on April 1st, 1927, under powers contained in debentures dated June 3rd and 30th, and October 29th, 1921.

Geoffrey Boulding, Ltd.—E. C. Williams, of 107a, Mortimer Street, Herne Bay, was appointed receiver and manager on March 23rd, 1927, under powers contained in debenture dated March 29th, 1926.

City Notes.

Montevideo Telephone Co., Ltd.

It was recently reported that an offer of £2 for each of this company's shares had been made, but no mention was made of the source of the offer. The *Financial Times* now reveals that the prospective purchaser is the International Telephone and Telegraph Corporation of New York. This concern, which has a total capital of over sixty million dollars, has a number of interests in America and Europe, including Standard Telephones & Cables, Ltd. In 1925 it acquired an agreement with the Uruguayan Government for the construction of an underground telephone system in Montevideo at a cost of about $5,500,000. The completion of this system would give the Government a monopoly of the city's telephone business. Apparently the Government is unable to find the money, and our contemporary infers that the purchase by the New York concern of the Montevideo Telephone Co.'s business is due to an apprehension that the latter might secure a fresh concession. It is pointed out that the installation of modern plant will involve an expenditure of about £2,000,000. The *Financial Times* believes that the majority of the shareholders have already accepted the offer. It is announced that Mr. J. G. le Marchant has resigned from the board, and that his place has been taken by Mr. H. M. Pease.

South Wales Electrical Power Distribution Co.

The directors of this (Parliamentary) company announce that, in spite of the adverse conditions of the past year, there was a gross profit of £89,069 for the last year. After meeting the debenture interest and preference dividend, it is proposed to transfer the balance (£18,743) to the depreciation reserve, making £149,858. The South Wales Power Co., Ltd., reports a total income from the Distribution Company's and other securities of £59,362, to which is added £8,441 brought forward, making £67,803. After meeting debenture interest, preference dividend, &c., there remains a balance of £10,990, which is to be carried forward. The report states that conditions during the year prevented the company from reaping the benefit which would have accrued from the full use of the new plant. An extraordinary meeting is to be held on April 26th for the purpose of considering resolutions raising the Power Company's capital by £250,000 to £1,100,000.

Northern General Transport Co., Ltd.

The net revenue for the year was £75,620, and after providing for loan and debenture interest, renewals, &c., there remains £34,099, to which is added £7,112 brought forward, making £41,211. The dividend on the ordinary shares is 7 per cent. (of which 2½ per cent. has already been paid), and £2,440 is carried forward. During the year £51,101 was spent on capital account. The nominal values of the company's investments at December 31st last were as follows:—Gateshead and District Tramways Co., £278,410; Tynemouth and District Electric Traction Co., Ltd., £58,205; and Jarrow and District Electric Traction Co., Ltd., £59,598. These stand at a cost of £420,141. In May last an issue of 118,750 £1 ordinary shares was made at par. The meeting was to be held yesterday (Thursday).

Brompton and Kensington Electricity Supply Co., Ltd.

The report for 1926 states that since January 1st of that year the company has purchased its electricity from the London Power Co., Ltd., to which the generating station has been leased. During the year £58,466 of the reserves was capitalised and distributed as ordinary shares to existing holders of ordinary shares in the ratio of one new share for each five held. The amount of energy sold rose from 6,553,067 kWh to 6,867,875 kWh. After providing the statutory amounts for the sinking and contingency funds the net revenue is £50,288, and after paying the preference and standard ordinary dividends, a balance of £19,496 is carried forward. Meeting: April 28th.

Rhondda Tramways Co., Ltd.

The accounts for the past year show a net loss of £19,148, after providing for an operating loss of £4,924, interest, rent, &c. From this is deducted a balance of £4,283 brought forward, leaving a deficit of £14,866 to be carried to the next account. The district served is purely a mining one, and business was naturally seriously affected by the coal dispute and general strike. Since the end of the dispute receipts have been gradually improving, but some time will elapse before normality is reached. The report states that the engineer and manager, Mr. Holliday, died in June last; Mr. T. G. Richardson, late general manager of the Hartlepool Tramways, has been appointed to the position.

Western Union Telegraph Co.

The income account for 1926 shows a gross operating revenue of $134,464,886, and a balance transferred to surplus account of $15,205,049. The latter account shows a total surplus of $80,173,160, from which are deducted adjustment of surplus (net) $788,417 and dividends $7,980,700, leaving a surplus at December 31st of $71,404,042. During the year the company's authorised capital was increased from $100 to $105 millions, and an increase of $25 millions in the bonded indebtedness was authorised. At the end of the year the system comprised 213,637 miles of pole lines; 3,324 miles of landline cables; 28,821 nautical miles of ocean cables; and 24,688 telegraph offices.

Bombay Electric Supply and Tramways Co., Ltd.

The report for 1926 shows that the total revenue for the year was Rs.150 lakhs and the total expenditure Rs.80 lakhs, leaving a gross surplus of Rs.70 lakhs. After deducting depreciation, interest, &c., there remains a net profit of Rs.48 lakhs for distribution as dividends. Dividends of 7 per cent. on the cumulative preference shares and 14 per cent. on the ordinary shares have been declared. The company has decided to open at its head office in Bombay a showroom where the best means of utilising electricity for lighting, power, and cooking will be demonstrated.

Canadian General Electric Co.

After providing for reserves, taxation, and depreciation, the net profit for 1926 is $1,170,618, as compared with $933,751 in 1925. There are no loans or debentures; the preference dividend (7 per cent.) absorbed $599,042. A great amount of obsolete equipment has been written off, requiring the whole of the depreciation reserves and utilising part of the year's balance. The outlook for the current year is said to be good, both in the heavy machinery and small supplies departments.

Electric Supply Corporation, Ltd.

The gross earnings for 1926 were £103,966 and the net profit was £42,357 (against £46,977). The ordinary dividend and bonus is maintained at 11 per cent., £3,000 is transferred to general reserve, and £10,110 to depreciation fund, £1,000 is written off underwriting commission on preference share issue, and a balance of £5,101 is carried forward. At the meeting on April 25th a resolution providing for the raising of the capital from £350,000 to £500,000 will be submitted.

Foundation Co., Ltd.

Last week this company issued, for information only, particulars of £150,000 of 6½ per cent. secured bearer notes redeemable at par on December 31st, 1929, the issue of which was sanctioned on April 11th. The notes will be secured as a floating charge on the undertaking and property of the company present and future, and the proceeds will be utilised for meeting capital expenditure incurred in the general expansion of the business.

Direct Spanish Telegraph Co., Ltd.

The balance of profit for the past year, including £1,213 brought forward, was £10,366. After paying the preference dividend and one of 10 per cent., free of tax, on the ordinary shares, £900 remains to be carried forward. The traffic receipts show a decrease of £446 as compared with the previous year. The company's cables worked without interruption during 1926. Meeting: May 3rd.

Electrical Distribution of Yorkshire, Ltd.

The directors announce that the issue of 300,000 £1 ordinary shares to existing shareholders in proportion to their holdings has been very successful. The applications for additional shares (apparently those not taken up by shareholders) represent double the amount available.

Wycombe (Borough) Electric Light and Power Co., Ltd.

After providing for all expenses, including debenture interest, preference dividends, &c., and crediting the balance brought forward, the net profit for 1926 was £13,222. An interim ordinary dividend of 4 per cent., free of tax, was paid, and it is proposed to distribute a further 6 per cent., free of tax, to transfer £4,000 to general reserve, and £500 to superannuation provision account, leaving £1,222 to be carried forward. To meet the increasing demand, additional generating plant, cables, &c., have been installed, and since the end of the year 3,000 ordinary shares have been issued. The original plant has been removed. Mr. F. E. Gripper has resigned the position of chairman through ill-health, and his place has been taken by Mr. A. N. Rye, while Mr. C. H. Jones has been elected a director.

Madras Electric Tramways (1904), Ltd.

The gross profit for the past year was £21,628 and the net profit £5,650 (against £14,392). To this is added £7,516 brought forward, making £13,166. The preference dividends are paid, and a balance of £7,166 is carried forward. For 1925 the ordinary dividend was 6 per cent. The decline in the profit is attributed to competition.

Chelsea Electricity Supply Co., Ltd.

The directors' report for the past year records a net profit of £41,997, after providing for debenture interest and the statutory amounts for the sinking and contingency funds. The preference and standard ordinary dividends are paid, and a balance of £5,097 is carried forward. The connected load rose from 12,159 kW to 12,747 kW, and the sales of energy from 7,092,550 kWh to 7,746,878 kWh. The meeting is to be held on April 28th.

The Great Northern Telegraph Co., Ltd., of Denmark.

The directors propose to distribute a total dividend and bonus of 20 per cent., including the 5 per cent. already paid, for the year 1926, and to transfer £20,000 to the reserve and renewal fund, while £37,500 has been allotted to the pension fund. £192,624 is carried forward.

Anglo-American Telegraph Co., Ltd.

A dividend of 15s. per cent. has been declared on the ordinary stock and one of £1 10s. per cent. on the preferred stock for the quarter ended March 31st. The rates are the same as a year ago.

Lisbon Electric Tramways Co., Ltd.

The balance of arrears of preference dividend is being paid and at the same time an interim dividend of 3 per cent. net has been declared on the ordinary shares. The last payment of ordinary dividend was 4½ per cent. in respect of 1915.

Simms Motor Units, Ltd.

Out of a net profit of £30,565 for 1926 the company is paying a dividend of 12½ per cent. (against 10 per cent.), of which 4½ per cent. has been paid, transferring £10,000 to reserve (against *nil* last year), and carrying forward £33,173.

Dutch Company.

The Amsterdam correspondent of the *Financial Times* reports that the *Netherlands Cable Factories* has declared a dividend of 24 per cent. for 1926, as against 21 per cent. for the previous year.

Herbert Morris, Ltd.

A dividend at the rate of 7½ per cent. per annum has been declared on the ordinary shares for the six months ended January 31st last.

Marconi International Marine Communication Co., Ltd.

The directors recommend a final dividend of 5 per cent., making 8¾ per cent. for the year, as against 7½ per cent. for 1925.

Joseph Lucas, Ltd.

An interim dividend of 5 per cent. has been declared on the ordinary shares.

Erinoid, Ltd.

It is proposed to pay an interim dividend of 3 per cent., as compared with 4 per cent. last year.

Brazilian Traction, Light and Power Co., Ltd.

A quarterly dividend of 1½ per cent. has been declared on the ordinary stock, as against 1½ per cent. last year.

Stocks and Shares.

Tuesday Evening.

Easter holidays and the Budget being comfortably out of the way, Stock Exchange markets have no valid excuse, save that of China, for being otherwise than animated and cheerful. The Budget, so far from being a drag upon prices, is a bull point. No increase in income-tax, no raid upon the Sinking Fund, no oppressive taxes upon industry—these are

three negative consolations of active interest. They make for confidence amongst investors. They encourage a feeling of hopefulness in regard to the trade outlook: a general rise in iron and steel shares is testimony to the cheery prospect which speculators consider to open in front of the heavy trades of the country.

Babcock & Wilcox rose another 1/16th to 55s. on the figures in the report, which is considered very satisfactory in view of the trade conditions that prevailed during the period covered by the accounts. There is a greater disposition, shown in various directions, to regard with favour the shares in manufacturing companies. Siemens, for example, are better than the nominal price suggests, there being buyers about at the middle figure. British Aluminium ordinary regained the 9d. lost in the previous week. A fall of 10s. in Telegraph Constructions draws attention to the low yield afforded by the shares. The only reason why proprietors accept so slender a return is the hope of the Board declaring a bonus, which hope has buoyed the price for years past, but which seems as far off as ever from fulfilment.

Eastern Extensions are ½ up at 17½, this being the only change in their group. Marconis are fluctuating between 17s. 6d. and 18s. Although the opposition to the reorganisation plan is stilled for the time being, the objectors are but waiting for the resolutions to come before the Court, when the protests are to be raised again. In the Stock Exchange the assumption is general that the scheme will go through, and that the capital reduction, &c., will be duly carried out. Burndept preferred are flat at half-a-crown.

Reference was made here three weeks ago to the statement on the subject of Beam developments by the president of the important American concern known as Mackay Companies. In that statement, naturally, not wholly unbiased, he defined the Beam radio as a system using low power and short waves which, by means of suitable reflectors, are more or less concentrated into a converging beam directed towards the receiving apparatus. The older trans-ocean wireless systems use high power and long waves which are much less susceptible to efficient directional sending. The superiority of short waves over long waves, he declared, remains to be proved, and he quoted Dr. W. H. Eccles, president of the Institution of Electrical Engineers, as saying that a commercial (radio) firm competing with cables would find long waves generally more trustworthy. The development of the high inductance, or so-called "loaded" cable, is a long forward step; general progress and improvement in recent years have been marked and important, even if lacking in spectacular appeal. A good deal is made, of course, of the ease with which "beam" radio can be picked up by anyone possessing the necessary equipment.

Technical testimony to the composure with which radio and wireless achievements can be regarded by holders of cable securities is of solid value. A dozen times during the past 25 years scares of greater or of less intensity have disturbed the cable companies' proprietors. Yet, in spite of the wonderful advance made by the newer systems, and the marvels which these can now accomplish, nothing has so far arisen to shake the so oft-repeated conviction that there is plenty of room for them all; that one is complementary, rather than antagonistic to the other, and that the Senior Service keeps abreast of modern requirements by linking wireless interests to those of the submarine cable. Marconi Marine proposes a dividend making 8¾ per cent. for last year, against 7½ per cent. for 1925.

Automatic Telephones remain dull, but Internationals rallied a trifle to 41s. 9d., and the deferred to 40s. 9d. Telephone Manufacturing are 7s. 3d.

Mexican Light and Power preferred are conspicuous with a rise of 7½ points, at 107, on the assumption that the scheme for dealing with dividend arrears stands upon the point of publication. According to market talk, the details of the plan are settled, but require one formal assent before the plan can be placed in front of the proprietors. Other Mexican issues are unchanged. Brazilian Tractions have gained 1½ points. The Anglo-Argentine Tramways group is steady. British Columbia Electric Railway preferred has put on 1, at 116½. The London railway and tramway descriptions are quiet, Underground £1 shares being 6d. up, at 16s. 6d., on the expectation that bumper traffics were secured at Easter.

Electric Supply shares are uninteresting, a decline to 59s. 6d. in Bournemouth and Poole being offset by a slight improvement in Metropolitan ordinary shares. Hope deferred possibly maketh sick the hearts of speculative investors who bought Bournemouth and Poole shares many months ago, believing that the company would be acquired by one of the corporations—Bournemouth being the more obvious. Alternatively, it was hinted that the company might make some kind of a bonus issue to its shareholders. But nothing more than gossip has resulted from these rumours.

India Rubber shares are a harder market at 20s. The readier disposition on the part of the public to buy iron and steel shares has already been noted. Rubber, as regards shares and produce, is tame, offering no interest or excitement. Business generally in the Stock Exchange is of the retail order. It is expected, and with good reason, that the Bank rate will be reduced in the near future. This, with the cheery effect produced by the Budget, is responsible for a strong tone in most of those Stock Exchange departments that look for their price-movements to the inspiration of money market considerations.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Apr. 19 1927.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	59/6	—⅛	4 14 1
Brompton Ordinary	1	10	8⅜	25/6	—	7 5 3
Charing Cross Ordinary	1	15	8½	25/-	—	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	12	8⅜	25/-	—	5 12 0
City of London	1	15	10	1⅜	—	5 1 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	31/-	—	5 3 3
County of London	1	15	7½	27/6	—	5 1 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	26/3	—	6 2 0
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	31/3	—	6 8 0
Kensington Ordinary	1	15	8	25/-	—	5 12 0
Lancs. Light and Power	1	7½	7½	26/-	—	5 15 5
London Electric	1	10	8½	24/-	—	5 16 8
do. do. 6% Pref.	5	6	6	5⅞	—	5 10 4
Metropolitan	1	11	8	28/6	+6d.	4 18 3
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary	1	7	5	22/6	—	4 9 0
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	—	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	25/6	—	5 9 10
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1¼	—	6 3 0
Urban Ordinary	1	4	7	25/6	—	5 9 10
do. 6% Pref.	1	6	6	1⅛	—	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/8	—	7 8 2
Yorkshire Elec.	1	8	8	29/6	—	5 8 4
Home Rails.						
Central London Ord. Assented	Stock	4	4	70	—	5 14 4
Metropolitan	,,	5	3	62½	—	4 16 0
do. District	,,	3½	3½	59	—	5 18 8
Underground Electric	£1	Nil	1½	16/6	+6d.	1 16 4
do. do. Income	Bonds	6	6	102	—	*5 17 8
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	100	—	6 0 0
do. Def.	,,	1½	1½	23⅞	—	6 6 0
Automatic Telephone	1	8	10	48/9	—	4 2 4
Chili Telephone	5	5	6	6⅞	+⅛	4 13 2
Cuba Sub. Ord.	10	5	5	7	—	7 2 10
Eastern Extension	10	10	10	17½	+½	*5 14 3
Eastern Tel. Ord.	Stock	10	10	172½	—	*5 15 10
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 8 1
do. do. Pref.	10	6	6	10⅞	—	5 10 0
Great Northern Tel.	10	20	20	27½	+½	7 6 10
Indo-European	25	8½	10	46½	—	*5 7 6
Marconi	1	Nil	Nil	17/6	—	.. ..
Marconi-Marine	1	7½	8½	23/9	—	7 7 4
Oriental Telephone Ord.	1	12	12	52/-	—	*4 12 4
United R. Plate Tel.	5	8	8	8½	—	*4 11 5
Western Telegraph	10	10	10	17	—	*5 17 8
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3⅜	—	8 2 6
do. do. 2nd Pref.	5	6	6	3⅞	—	9 1 2
do. do. 5% Deb.	Stock	5	5	71½	—	7 0 0
British Electric Traction Ord.	,,	8	—	142½	—	5 13 8
do. do. 6% Pref.	,,	6	6	109	—	5 10 1
Brazil Traction	100	5	6	137½	+1½	4 7 3
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	6¾	6¼	116½	+1	*5 7 4
do. do. Deferred	,,	8	—	156	—	*5 2 9
do. do. Deb.	,,	4¼	4¼	79½	—	5 7 0
London & Sub. Trac. 5% Pref.	1	Nil	Nil	7/9	—	Nil
London United Tram. Deb.	Stock	4	4	51	—	7 16 10
Mexico Trams, 5% Bonds	—	5	5	73½	—	6 16 1
Mexican Light Common	100	Nil	Nil	45	—1	Nil
do. Pref.	100	Nil	Nil	107	+7½	Nil
do. 1st Bonds	—	5	5	68½	—	7 6 0
Yorkshire (West Riding)	1	5	—	8/9	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	1	13	13	55/-	+1/3	*4 16 6
British Aluminium Ord.	1	12½	10	44/6	+9d.	4 10 0
British Elec. Transformer Pref.	1	Nil	7	18/-	—9d.	7 9 0
British Insulated Ord.	1	15	—	70/-	—	4 5 9
Brush Ord.	1	10	—	28/3	—	7 1 7
Callenders	1	15	—	3½	—	4 5 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	—	30/-	—	6 13 4
Enfield Cable Pref.	1	7½	7½	1½	—	6 6 4
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	8	—	12/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	1	20	—	90/-	—	4 8 11
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1	+1/16	*5 0 0
Johnson & Phillips	1	17½	—	2⅜	—	7 7 4
Met.-Vickers Ord.	1	8	8	27/6	—	5 11 4
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	7½	—	26/9	—	5 12 2
Telegraph Construction	12	10	10	28½	—½	*4 4 2

* Dividends paid free of Income Tax.

The Electrical Industry and Market.

The Influence of Other Trades and Industries.

THE second quarterly trade survey published by the British Electrical and Allied Manufacturers' Association (5s. net) is a study of the economic situation in the leading industrial countries, and an attempt to forecast future developments in which the electrical industry is not treated separately but as a section of the economic framework. The familiar broad aspects are restated, *e.g.*, the growth of productive power as a consequence of the war, increased protective tariffs, the reduction of national wealth in European countries, &c. To the coal dispute of last year is mainly attributed the fact that Germany is at the moment the only country which can point to improvement in industrial production. There are factors at work which will induce still greater reductions in the price of finished German goods to enable them to compete, but the competitive situation is not so favourable now, and trade will react at once. There are few indications of any growth of demand in the more important markets upon which the prosperity of Europe depends.

Dealing with the basic industries, the report urges the importance of coal, iron and steel to the electrical industry; over 40 per cent. of the industrial motors in Great Britain have been installed in these industries, and they may be the decisive factor in the expansion of the industrial branch of the electrical industry for a considerable time to come. With regard to the coal industry, it is pointed out that prices have not yet regained the pre-dispute level, and this is an important point in favour of electric power in industry; dear coal affects the price of electricity less than it affects the cost of production in non-electrified works. Complaint is made that the home industries are being unfairly treated to expand the exports of coal. The British iron and steel industry, when compared with the German industry, is said to be 700,000 h.p. of electric motors behind.

The official indices of the state of industrial production upon the 1913 basis are shown to be open to amendment; it is alleged that they have not taken full account of the changes in direction which have been made since then. It is stated, for instance, that while our exports of textile and agricultural machinery and machine tools outweighed all other branches of the industry until a few years ago, electrical machinery and apparatus, with steam turbines, boilers and condensing plant now come easily first, with automobiles second; agricultural machinery is near the bottom of the list. In many industries, of which electrical engineering is one, Germany has definitely lost ground as company with Great Britain. A study of the state of industrial activity leads to the conclusion that recovery from the effects of the coal stoppage has not been rapid enough. Coming to the electrical industry, the report deals with the effects of last year's troubles, but it is stated that the rate of expansion of electricity supply is now greater in this country than in the United States, Canada or Germany. Amalgamations in the coal and chemical industries are expected to lead to the wider adoption of electrical machinery, and the fact that only improved equipment can make the iron and steel industry able to compete is expected to lead to orders from this direction. Only financial difficulties, coupled with a certain amount of prejudice, have retarded electrification in the cotton industry. After remarking upon the high degree of industrial electrification in Germany, which is now greater than in the United States, the survey deals with the deficiencies of British industries. A table of estimated arrears for seven industries gives a total of 2,032,000 h.p. (including coal mining, &c., 800,000 h.p.; iron and steel, 700,000 h.p.; and cotton textiles, 500,000 h.p.). These industries are said to represent only 50 per cent. of the total, and it is therefore computed that the aggregate shortage is in the neighbourhood of 4,000,000 h.p., or about 70 per cent. of all the electric motors at present in operation. These statistics aim at illustrating the immensity of the field waiting to be cultivated by the electrical manufacturer, and at the same time the serious handicap under which he labours in his struggle against German and American competitors. The American manufacturer, with American industry employing 24,000,000 h.p. of electric motors, has four times the market, and the German manufacturer more than twice the market, open to the British manufacturer, who must suffer, in addition from the effects of unrestricted competition at home. The real disadvantage *vis-à-vis* the United States and Germany is about 6 : 1 and 3 : 1 respectively. While the Americans and Germans can embark upon large-scale production, the British manufacturer, forced to discover 30 per cent. of his market overseas, cannot standardise or specialise, and therefore mass production cannot be widely adopted.

The position in British industry itself, through its inability to adopt electrical machinery, threatens a crisis in production which can only be avoided through a policy of renewals and replacements and extensions of manufacturing plant of the most far-sighted and thorough nature. A national electrification policy is necessary to the realisation of sounder competitive conditions and the restoration of trade activity. In 1926 the electrical industry reported a record flow of orders; there are indications that a similar result will accrue this year, provided that progress is begun on the national power scheme. In the small industrial motor section, however, conditions were unsatisfactory through the inability of industry and transport to earn sufficient profits to justify the installation of electrical plant. The financial reconstruction undergone by a number of large industrial undertakings, with a resultant difficulty in raising new capital, is thought to be an adverse influence so far as the electrical industry is concerned. On the generating side the orders already received will give continuous employment for the rest of the year; on the heavy industrial side, coal-mining and steel orders are beginning to materialise, and may possibly reach a satisfactory total before the end of the year; but activity is less pronounced in the manufacture of cables. Great Britain maintained the position, gained in 1925, of chief supplier to the world's electrical market and held its ground in the first two months of 1927. A table shows that in the latter period exports amounted to £3,257,263, against £2,941,868 in January-February, 1926. Germany's exports increased from £2,778,500 to £2,781,050, and those of Switzerland from £299,130 to £338,290. The export position is satisfactory at the moment as a result of heavy orders placed by Australia, New Zealand, South Africa, India, Japan, Russia, and Argentina during 1926, while the restoration of normal exchange conditions in Europe has stimulated the demand for generating plant and switchgear. During the last three years Britain has held, and continues to hold, its own in generators, motors, convertors, and switchgear; in batteries and accumulators its position has improved; while in insulated wires and cables a fairly steady decline has taken place, Germany forcing out both Britain and the United States. In telegraph and telephone apparatus, excluding wire, a similar change in position has occurred. Germany and Switzerland supply the bulk of the world demand for meters, the share of Great Britain being less than 10 per cent.; and in lamps the competitive situation is equally unsatisfactory.

Since the beginning of the year a marked improvement has resulted in exports of insulated wire and cables, but a decline has occurred both in telegraph and telephone apparatus and lamps. In electrical machinery the upward movement in British exports continues, accompanied by a similar development in Switzerland, while a decline has occurred in the United States and Germany. As a part of its efforts to capture foreign trade, Germany has reduced the prices of its motors, and now with Switzerland and France is well below the British level. The difference in price is increasing presaging intensified competition. The cost of living in the competing countries tends to a common level, but it remains too high in Britain, and the gap between wholesale and retail prices must be reduced if labour troubles are to be avoided. The competitive position is full of uncertainty; stocks are low in the majority of industries, so that a lowering of prices can be operative at once, but there is a danger of destroying the real profit basis of production and seriously weakening the market. The position of the British electrical industry is fairly sound even at present price levels, since quality and efficiency of operation have decided the issues in almost every important contract, but the persistence of the downward movement in wholesale prices must react also on the British manufacturer and cause a narrowing in the available markets. The survey concludes with a general forecast of trade conditions. It is pointed out that while currency stability has been reached, this stability is due more to the deliberate policy of financiers than to a revival of international trade, which is still depressed. There has been over-production accompanied by restriction of credit. Although Germany has been active, there are indications of a downward movement. Uncertainty exists in international trade with a marked tendency towards depression. Britain and France have followed Germany in the "rationalisation" of industry, and are offering strong resistance to German penetration of foreign markets. The position of the British exporter is not reassuring, but conditions may improve later in the year. If the national reorganisation of electricity supply is proceeded with immediately, the electrical manufacturer may escape almost wholly from the trade depression. There is still a shortage of about 600,000 kW of generating plant to be made good. The export position is strong; for six years Britain has more than held her own, but this year will be the most difficult and most decisive of all. The growth of amalgamation and trustification continues in Britain as well as in Germany, with the result that already important orders have been secured for electrical equipment in the heavy industries.

Two appendices to the survey review the German electrical industry, and they are followed by a series of curves and diagrams dealing with many phases of industry.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Suspended Globe Fitting.

With a view to preventing the constant breakages of electric-fitting glassware which occur in large stores and similar establishments, due to insecure methods of fastening, the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has evolved a patent safety canopy fitting, which, it is claimed, entirely eliminates the possibility of dropping the globes, by means of a flexible incorrodible steel suspension wire which is securely attached to the supporting ring of the glass at two points and secured to a vertical winding drum in the crown of the fitting When it is desired to replace a lamp or clean the globe, the latter is released by means of a wing nut, when the drum will automatically unwind and lower the globe by means of the suspension wire, leaving both hands free to carry out the necessary work. To wind up, fig. 1, the canopy of the fitting, to which the drum is secured, is turned by one hand, the other being used to hold the gallery in position and act as a brake for the drum. The globe cannot, it is claimed, be left insecurely fixed, as unless the locking nut is screwed up, it will not stay in the closed position. The metal-work is of oxidised-copper finish, and the globe is of white low-absorption glass. The fitting is available in 14-in. and 16-in. diameter sizes, suitable for 100/150-W and 200-W lamps, respectively.

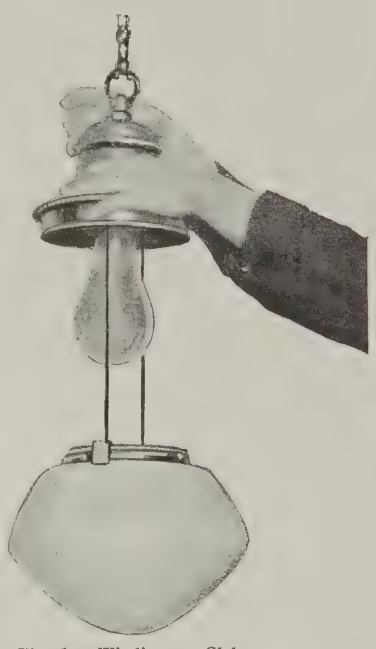


Fig. 1.—Winding-up Globe.

A Pole-Type Condenser.

The accompanying illustration, fig. 2, shows, in position, a l.p. pole-type condenser which is marketed by the Telegraph Condenser Co., Ltd., Southampton Street, High Holborn, London, W.C.1. The apparatus is intended for installation on the overhead transmission lines of distributing supply undertakings where bulk supplies are metered on kVA demand. In the case depicted the supply is distributed by 3,000-V lines, the pressure being transformed down by means of pole-type transformers. The condenser is connected direct to the transformer secondary, thus relieving the transformer itself of wattless current in addition to the overhead system generally. It is built into an outdoor type of tank with a specially constructed lid, and is provided with a water-shed terminal cover. The tank is fitted with pole-hanging straps. The apparatus illustrated has an output of 7 kVA when working at 400 V, and is one of a large number supplied to one undertaking. The voltage regulation of the system has been materially improved, quite apart from the decrease in kVA demand, which resulted in a very substantial reduction in the power bill. The l.p. 400-V supply in the case of this undertaking is distributed to farms where numbers of small motors are used and where individual power-factor correction would not be desirable, or, in fact, possible on commercial grounds.

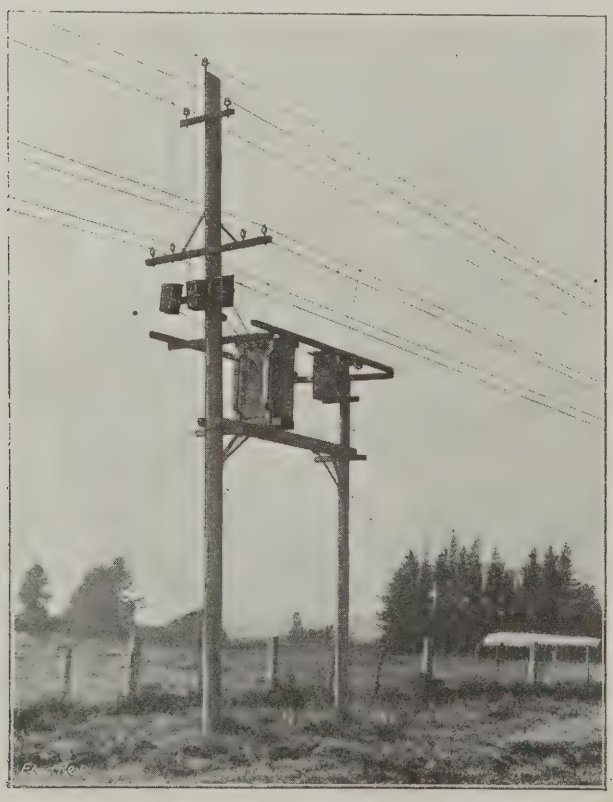


Fig. 2.—Pole Condenser and Transformer, in Position.

A Cable-Haulage Equipment.

A recent production of Messrs. F. T. Murdoch & Co., Ltd., Thompson Street Works, Belfast, is a new patent winch, fig. 3, specially designed for pulling cables through conduits. It is

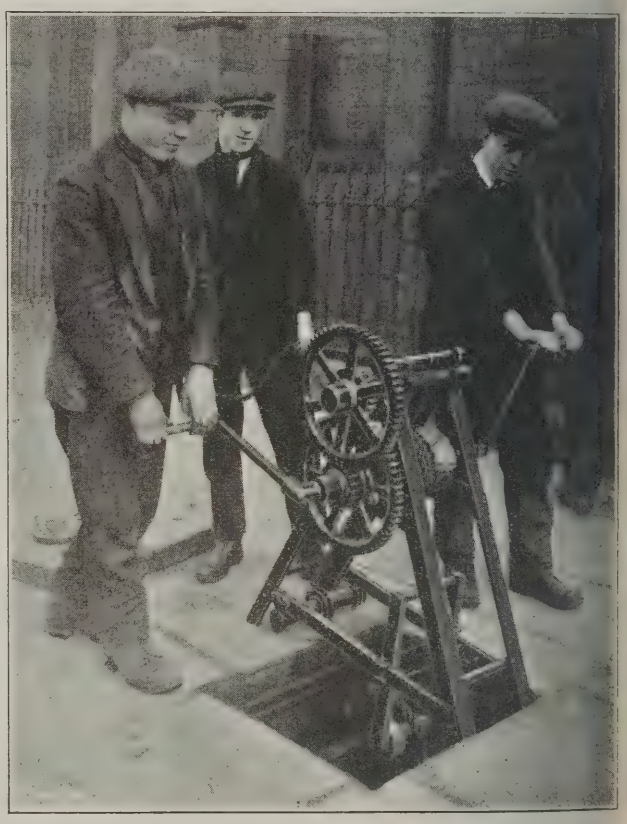


Fig. 3.—A Cable Winch.

claimed to be stable and to require no weights to hold it down. The hauling rope passes over a guide, which leads the rope directly from the centre of the conduit, and can be adjusted so as to eliminate all friction against the corner of the manhole, &c. The rope is next led over the sheave provided at the rear side of the winch, and goes thence to the winding drum. The apparatus can be placed over any part of the manhole so as to allow a workman clear passage into the hole, and central fixing over the particular cable which is being worked on. Three speeds are provided, giving ratios of 9 to 1, 3 to 1, and 1 to 1. Only two axles are employed, and none of the usual clutches or drop bars.

A Radio Valve Testing Machine.

A machine which tests thermionic valves more rapidly than the most expert human operator is in use at the factory of the Westinghouse Lamp Company at Bloomfield, N.J., U.S.A. The capacity of the machine is 30,000 tubes a day, and for the period of several months during which it has been in service its record for accuracy stands at 99.9 per cent., the 0.1 per cent. error being chargeable to the accidental introduction of defective valves into the good stock. The machine was invented by Mr. Allen B. Dumont, of the Westinghouse

Company, and its operation is simple. It consists essentially of a revolving disk, about 3 ft. in diameter, which carries sockets for valves on one of its faces; as the disk revolves, the valves are connected successively, a defective one being knocked out of its socket by an electromagnetically acting plunger located at the rear of the machine. Valves that are hopelessly bad are unceremoniously shot on to the scrap heap; but those which can be reclaimed are gently laid on to moving belts which convey them to operators for further treatment; good ones are also placed on a belt and carried to the wrapping department. The valves are tested for short circuits, broken filaments, emission, gassiness, and high and low plate current; some of the tests involve the use of extremely small currents, and special sensitive relays are employed to operate the ejecting mechanism. Each test is a positive one, and each testing mechanism will eject a valve if it should be damaged during the process of testing. The machine is arranged to be fed by two girls seated side by side, one of whom must be left-handed and the other right-handed, but it will soon be re-arranged to be fed automatically in order to bring it up to its full productive capacity.

The Electrical Imports of Ceylon.

THE following table shows the value of Ceylon's imports of electrical and allied materials during the past year. The figures have been taken from the recently published official returns. The corresponding statistics for 1925 have been added and notes of decrease or increase are also given :—

	1925. Rupees.	1926. Rupees.	Inc. or dec. Rupees.
Control and switchgear—			
Total, all from United Kingdom	8,000	36,000	+ 28,000
Generators, alternators and dynamos—			
Total	175,000	192,000	+ 17,000
From United Kingdom ...	166,000	183,000	+ 17,000
,, Germany	2,000	4,700	+ 2,700
,, United States	3,600	2,600	− 1,000
Motors—			
Total	20,000	47,000	+ 27,000
From United Kingdom ...	17,000	43,000	+ 26,000
,, United States ...	2,000	4,000	+ 2,000
Transformers and convertors—			
Total	500	5,000	+ 4,500
From United Kingdom ...	500	3,500	+ 3,000
,, United States	—	1,500	+ 1,500
Magnetos, ignition—			
Total, all from United Kingdom	120	1,400	+ 1,280
Magnetos, road—			
Total	16,000	11,000	− 5,000
From United Kingdom ...	11,000	7,000	− 4,000
,, Germany	4,000	3,000	− 1,000
Electric wires and cables (insulated)—			
Total	272,000	289,000	+ 17,000
From United Kingdom ...	262,000	273,000	+ 11,000
,, Germany	1,000	1,600	+ 600
,, United States	2,400	500	− 1,900
,, Holland	1,600	3,600	+ 2,000
Electrical machinery not elsewhere specified—			
Total	139,000	354,000	+215,000
From United Kingdom ...	100,000	252,000	+152,000
,, Germany	3,000	5,400	+ 2,400
,, United States	33,000	48,000	+ 15,000
,, Italy	3,000	9,500	+ 6,500
Telegraph and telephone instruments and apparatus—			
Total	213,000	285,000	+ 72,000
From United Kingdom ...	181,000	257,000	+ 76,000
,, United States	16,000	8,600	− 7,400
,, Sweden	8,000	3,400	− 4,600
Electric lighting accessories and fittings, including switches—			
Total	305,000	354,000	+ 49,000
From United Kingdom ...	209,000	248,000	+ 39,000
,, Germany	38,000	42,000	+ 4,000
,, United States	29,000	23,000	− 6,000
,, Holland	18,000	29,000	+ 11,000
Electrical goods and apparatus not elsewhere specified—			
Total	581,000	426,000	−155,000
From United Kingdom ...	518,000	332,000	−186,000
,, India	13,000	17,000	+ 4,000
,, France	3,000	6,400	+ 3,400
,, United States	38,000	48,000	+ 10,000
,, Germany	5,000	12,000	+ 7,000

Turbo-Generator Construction in Russia.

AS we recently reported, an attempt is being made greatly to extend the construction of steam turbo-generators in Russia. At the works of the Electroforce (Elektrosil) in Leningrad the construction of 5,000-kW sets has been begun for the first time in Soviet Russia. At the same time preparations have been completed for the turning out of similar sets of 10,000 kW, the patterns and drawings having already been finished. These machines are intended for the stations at Kieff, Novorossisk, Kizel, &c. The works, which belongs to the State Electrical Trust, claims to have orders on hand for 44 turbo-generators of a total of 240,000 kW. In connection with the development of this branch large orders for milling and other machines were placed abroad and this plant is now beginning to arrive in Leningrad.

Still further expansion is proposed by the Metallurgical Works in Leningrad in the matter of steam turbines. This undertaking has started the erection of a new large turbine shop which with a full load, it is claimed, will be able to turn out turbines of a total of 325,000 kW per annum, or nine times more than the existing shop is able to construct at the present time. According to the scheme, the costs of production will at the same time be reduced by not less than 20 per cent. The new works will be equipped with foreign machines which will permit of a very considerable extension of the production while only involving the doubling of the number of men employed.

The general work of electrification and industrialisation is bringing about an increasing demand for steam turbines. Prior to the war the construction of turbines was carried on only to an inconsiderable extent; the maximum power was only 1,250 kW. Altogether between 1905 and 1914 the Metallurgical Works, above mentioned, only turned out 44 turbines of a total of 50,000 kW. After the war, work on turbines was only recommenced at this particular works in 1921, when works of repair were executed. New turbines were begun in 1924, and now the works is building machines up to 10,000 kW, these being for the Southern Steel Trust. This size has not exhausted the capabilities of the works as, at the request of the Electric Current Undertaking (Elektrotok), a scheme is being worked out for the construction of two 20,000-kW steam turbines. In this connection it is mentioned that turbines are being made not only for normal pressure but also for higher pressures, and this year a turbine for about 440 lb. per. sq. in. will be turned out for the Vladimir-Alexandroff Textile Trust. At the same time turbines for 580 lb. per sq. in. with a capacity of 5,500 kW are to be made for the Krasny Treugolnik works. The technical possibilities of the existing turbine works was limited because it was only able to turn out machines of a total of 35,000 kW per annum, but the demand has exceeded this capacity many times over, so that it was decided to erect an entirely new and large works. A beginning was made last year and the completion of the first portion is expected to take place next year, the total expenditure being 5,800,000 roubles. The works will consist of 18 bays and will be, it is claimed, one of the largest in Europe intended for the construction of steam turbines. Last year three bays were finished, nine are to be completed this year, and the remaining six next year. In the current year a start will be made with the erection of the machinery, part of which has been ordered abroad, and thus the possibility exists that work on machine construction will begin next year. The final equipment of the works will be effected in 1930-31, when the demand for turbines, according to the General Metal Trust, will represent 450,000 kW per annum, which output the new works will be able to cover entirely.

Leningrad does not stand alone in the work of the development of the construction of turbines, as the Moscow Machine Trust is also working in the same direction, particularly with hydraulic turbines. Three such turbines of 3,600 h.p. are being built for the Swiran hydro-electric works, and it is stated that the works will now be able to construct similar turbines of up to 10,000 kW.

The Elimination of Waste.

The Report of the U.S.A. National Committee on Metals Utilisation ("Simplified Practice Recommendation, No. 57"; Government Printing Office, Washington, price 5 cents) gives the sizes of wrought iron and steel pipes, valves and fittings adopted at a general conference last year, which are said to fill over 80 per cent. of all normal requirements. Eighteen diameters are quoted between ⅛ and 12 inches (nominal), with three grades of thickness. It is stated that "the combined efforts of this general conference resulted in a reduction from a total of 62 sizes to 49 sizes of pipe, corresponding to an elimination of 20.96 per cent. and an elimination of 762 sizes of valves and fittings, or a 3.8 per cent. reduction in the current variety. . . . One concern has stated that their sale of the 4½-, 7-, and 9-in. sizes alone represents only one-third of the investment that is required to produce them, so heavily does the fabrication and stocking of the odd sizes drain their resources."

New Drum-Type Controllers and Motors.

The development by the British Thomson-Houston Co., Ltd., of Industrial Equipment with "Unbreakable" Resistances.

WITH the object of affording reliability and convenience from an installation and maintenance viewpoint, the British Thomson-Houston Co., Ltd., has developed a new line of reversing drum controllers for electric motors operating cranes, hoists, and such-like industrial equipment. They differ entirely in construction from those hitherto manufactured, and incorporate features based on experience of steel-works' auxiliaries and other plant, the operating conditions of which are arduous.

Drum-Type Controllers.

This range meets the requirements for a.c. slip-ring induction motors up to 75 h.p. and for d.c. motors up to 120 h.p., both at 550 volts: the same features are common to both types.



Fig. 1.—Pivoted Contact Finger.

The frame consists of separate top and bottom castings fixed together by steel bars and the sheet-iron back and front covers are both detachable so that the whole of the inside is accessible. The body of the drum consists of ribbed castings carrying the copper contact segments with their renewable arcing tips, and all the segments are of the same diameter. The starwheel is secured to the top of the cylinder, is designed to give positive notching at each starting point, and the pawl is fitted with a large roller and pin to obtain a maximum wearing surface.

All the contact fingers are built up of extruded sections: the fixed base is clamped on four sides of a mica-insulated square steel bar, and the moving part is attached to the fixed part by a pivot screw. The renewable tip is adjusted in relation to the segments on the cylinder by means of a screw which operates on an extension of the finger arm and is adjustable to one-sixth of a turn and automatically locked in position; the arrangements are shown in fig. 1. Pressure of the finger on the segment is maintained by means of a compression spring, which is free to function without friction on any part of the finger: the pivot is not used for carrying current, a flexible shunt being fitted between the moving

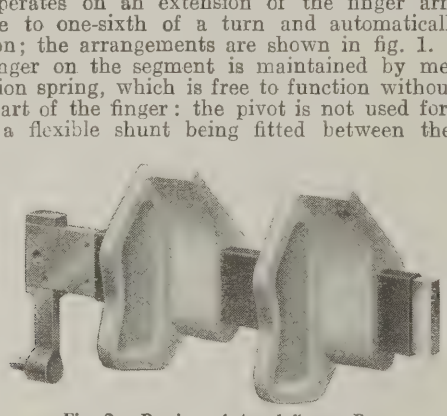


Fig. 2.—Portion of Arc-deflector Bar.

and the fixed parts, entirely enclosed, so that it cannot be accidentally damaged.

Any finger can be removed without disturbing the remainder, or taking out the whole bar, simply by taking out the cable and removing two screws. Interlocking fingers are provided, so that an electrical interlock exists between the controller and a protective circuit breaker, preventing the latter being reset unless the controller is in the "off" position.

Fire-proof arc deflectors between the contacts prevent cross arcing, the portion which acts as a barrier between each finger being moulded in one piece with the portion which is shaped to slip over and enclose the pole piece of the magnetic blow-out; screws are not used for fixing them, and to facilitate inspection the assembled deflector is hinged so as to swing clear of the fingers (figs. 2 and 3). A new type of crank handle has an automatic "off" position latch to prevent the handle being accidentally knocked into a running position, the latch mechanism being released from below the casting which forms the handle by the weight of the operator's hand on the top of the knob.

Controllers for a.c. duty are of similar design, as may be seen by reference to fig. 3, which shows that four arc deflectors only are required in this design, as cross arcing can only take place between the fingers in the stator circuits.

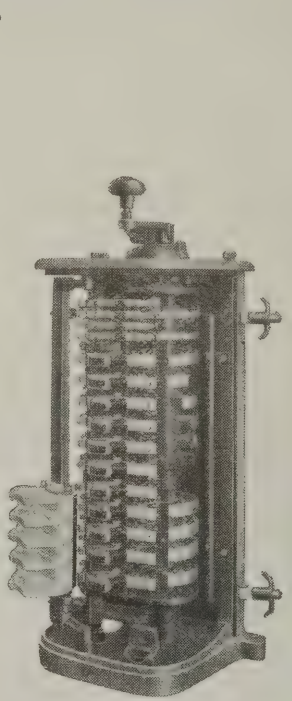


Fig. 3.—A.C. Drum Controller.

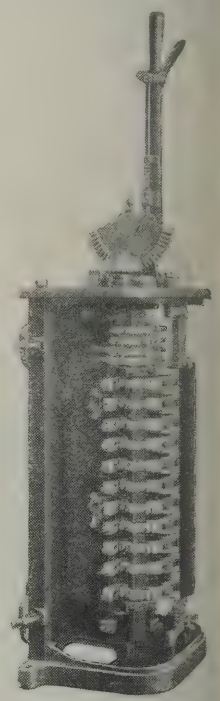


Fig. 4.—D.C. Drum Controller with Vertical Lever Gear.

All the controllers can be fitted, if desired, with lever mechanism having either a vertical or horizontal "off" position; alternatively, a rope-wheel can be used in the case of the smaller sizes, and spring return mechanism can also be employed.

"Unbreakable" Resistances.

The B.T.-H. Company has recently perfected manufacturing equipment for producing new light resistance grids so graded that the temperature-resistance co-efficient usually associated with the "unbreakable" type does not adversely affect the equipment with which it is used: if specially required, grids can be supplied with practically a zero temperature-resistance coefficient. The resistance

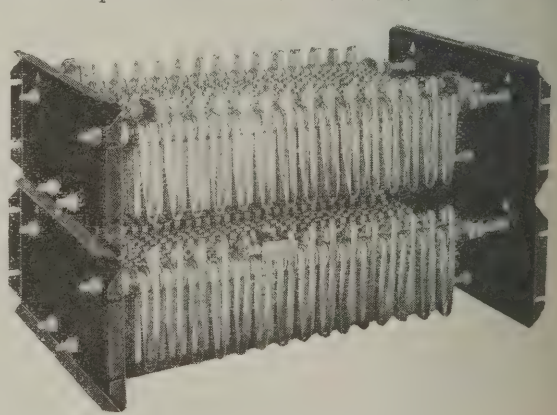


Fig. 5.—"Unbreakable" Resistance.

element is composed of a continuous strip, machine formed into grids, without joints between the two external terminals (fig. 5). High-resistance steel strip, heavily plated with zinc to render it rustless, is generally used, but in some cases another rustless material may be used for the smaller sizes.

Resistances can be supplied in any of the combinations already adopted for cast grids: for crane service each bank is mounted in a separate box, consisting of two pressed-steel end-frames so flanged that any number of boxes up to six

may be bolted together to form a self-contained unit. The grids are supported between the end-frames by four mica-insulated steel bolts, adjacent grids being insulated from one another by mica washers between steel washers. Another feature is the method of mounting the terminals so as to ensure good contact between terminal and resistance, and also rigid support for the incoming cable: the terminals are of extruded brass section and are bolted to a loop in the grid immediately above one of the insulated bolts for all units up to approximately 200 amperes at the 5-minute rating.

Motor Developments.

Some interesting features can be recorded in connection with a range of a.c. and d.c. motors, U-type, which has recently been put into production by the British Thomson-Houston Co., Ltd. The range covers sizes from ½ h.p. up to about 40 h.p. for squirrel-cage machines, up to 15 h.p. for slip-ring machines, and from ¼ h.p. up to 35 h.p. for d.c. machines; the latter are suitable for conversion as generators. The machines all comply with the B.E.S.A. requirements; they can be supplied with any of the usual types of enclosure and all of them incorporate end-shields spigoted into the cast-iron frames. The peripheries of the shields are machined, ensuring close-fitting joints between them and the enclosing sheet-steel covers; the latter are interchangeable. Fig. 6 shows a protected d.c. machine.

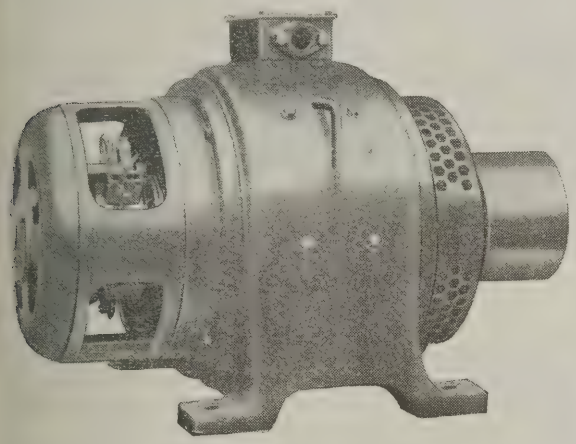


Fig. 6.—D.C. U-type Motor.

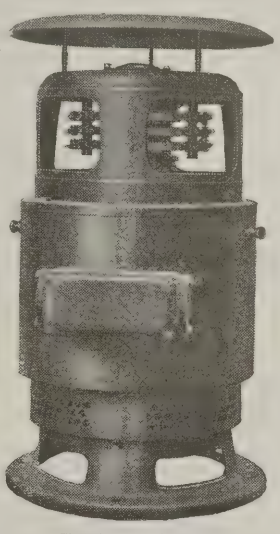


Fig. 7.—Vertical Induction Motor.

On each motor a roller bearing is fitted at the driving end and a ball bearing at the other end, whilst any of the motors can be used with its shafts at a given angle from the horizontal or vertical, as the case may be, and with the provision of special bearings, if necessary, the motor will run in any position between horizontal and vertical. Fig. 7 shows a vertical protected slip-ring induction motor. The skirt-base casting is separate from the end-shield casting, so that machine makers can readily fit their own adaptor rings to obtain the necessary drive. The construction of the stator is claimed to be such that the air gap will be correctly maintained.

The rotor construction of the squirrel-cage motor is interesting, in that there are no joints in the cage, and as only one metal, aluminium, is used for both the bars and end rings, the rotor is immune from fracture due to unequal expansion. The bars and end-rings are cast in one piece by a patented centrifugal process which, it is claimed, ensures both absolute uniformity of texture and absence of blow holes or air pockets.

The slip-ring rotors are fitted with bar-type windings on account of the simplicity and mechanical rigidity of the latter, and also because of the open spacing obtained at the end connections; this construction renders them particularly suitable for high speeds.

On the d.c. brush equipment the pressure fingers are designed to give uniform pressure on the brushes throughout their life, and the pressure can be readily adjusted without lifting the brushes. The brush holders are covered with moulded-on non-hygroscopic insulation, and their adjustment can be effected in an axial direction. The brush stud is directly attached to the yoke, and consequently the brush-gear is free from the possibility of the brush stud working loose and rotating due to shrinkage of the insulation. The brushes conform to the dimensions given in B.S.S. No. 96, and as the pig-tails are attached to the same terminals on the brush-holder as those for the machine leads, the brush current does not have to pass through any part of the brush-holder.

The a.c. brush-gear is insulated in a similar manner.

Mercury-Contact Motor Starters.

A New Multiple-contact Tilting Switch.

THE disadvantages with which the use of mercury-contact switches has been associated in the past are claimed to have been overcome in a new design of mercury multiple switch which has been embodied by Messrs. Isenthal & Co., Ltd., in a new range of motor starters which they have recently adopted.



Fig. 1. Mercury Container, Bottom.

The essential part is a specially designed mercury container which, by a tilting operation, makes or short-circuits the necessary step-resistance units of the starting apparatus. The container consists principally of two parts, box and lid,

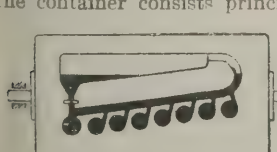


Fig. 2.—Mercury Disposition, "On."

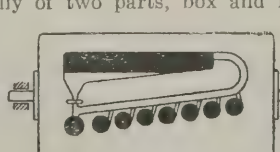


Fig. 3.—"Off" Position.

made of a moulded insulating material with perfectly machined contact faces, so that when screwed together they form a perfect seal for the mercury and an air-tight box. Fig. 1 shows the bottom section of the device in which are moulded the necessary mercury cups, channels, and reservoir. In the "off" position the mercury is contained in the last mentioned compartment, at the top, by virtue of the tilt of the box in the required direction, but when the opposite inclination is given to the device, the fluid runs through a calibrated aperture on the left, thus gaining access to the several cups. These are made of steel and at the back are provided with

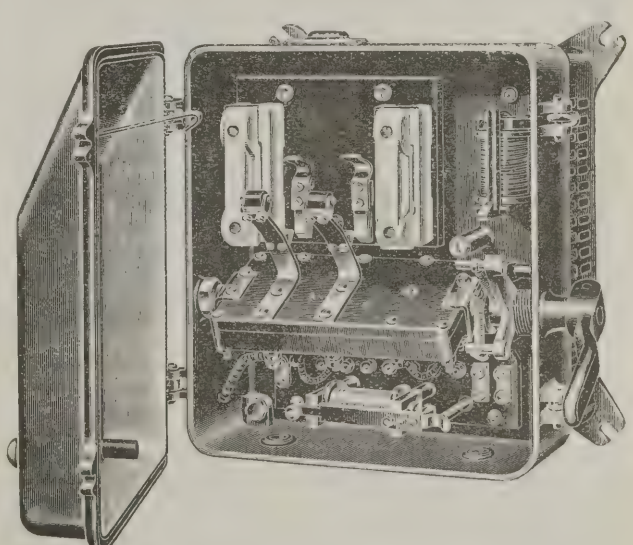


Fig. 4.—"Swichon" Hand-operated Starter.

screw studs and nuts for the resistance connections. The shape and grading of the channels and cups are such that the mercury stream carrying the current cannot break, except when required, at the point of contact, and that at each cup it immediately coalesces with the small amount of the substance which is retained therein. A small projection at the opening to each cup causes the mercury to collect there and then drop into the cup in bulk, so that full contact is made from the first.

The important feature of the apparatus is that the mercury functions in inert gas, eliminating the objection to sparking at the contacts. The chamber is air-tight and the small amount of air which is enclosed on assembly of the container is rendered inert after a few operations. It is obvious that once the box has been tilted into the "start" position the process of starting is quite automatic and independent of the operator. When the apparatus is tilted back again into the original position the mercury flows back into the reservoir through the channel at the opposite end to the entrance gate. Figs. 2 and 3 show the mercury disposition at the "on" and "off" positions of the container respectively.

The makers have incorporated this mercury-containing device in four types of "Swichon" starting apparatus, providing for hand, electrical, or mechanical operation, remotely or directly. Fig. 4 shows a simple starter of the first type for controlling small motors up to 5 h.p. For the control of larger motors it is intended to utilise the mercury tilting box as a master controller, operating a suitable set of contactors for the resistance stages or winding combinations. It should be mentioned that the actual breaking of the main circuit is performed outside the box, in order to totally eliminate any possibility of sparking on the mercury.

In conclusion, attention must be drawn to the one limitation of the mercury starter described above: it is not suitable for use on board ship or aeroplane for obvious reasons.

Some Recent "Metrovick" Contracts.

Examples of plant of large size and special features manufactured by the Metropolitan-Vickers Electrical Co., Ltd., for use both at home and abroad.

A FEW years ago an impression seemed to be prevalent that the construction of transformers of very large capacity, or for service at extra-high-voltage, was beyond the capability of British manufacturers. It is accordingly satisfactory to know that the ability of British firms to carry out such work has been amply demonstrated.

With regard to home contracts, what are described as the largest single-unit transformers yet made in Great Britain were built for extensions to the Barton power station of Manchester Corporation: they are three-phase, core-type units of 25,000 kVA each, with a voltage ratio of 6,600 to 33,000 volts, and are to be installed with the 41,000-kW steam turbo-alternator set recently ordered from the above-named company. The present British record for large capacity units is held by Metropolitan-Vickers main step-up transformers already in commission at Barton, *viz.*, six three-phase units, each of 19,500 kVA capacity, which have been in successful operation for about four years; one of these transformers, photographed recently while removed from its tank for inspection, is shown in fig. 1. In design, the new transformers will be similar to the original ones, arranged for forced cooling, and will be nearly 16 ft. long, 7 ft. broad, and 17 ft. in height to the top of the high-voltage terminal.

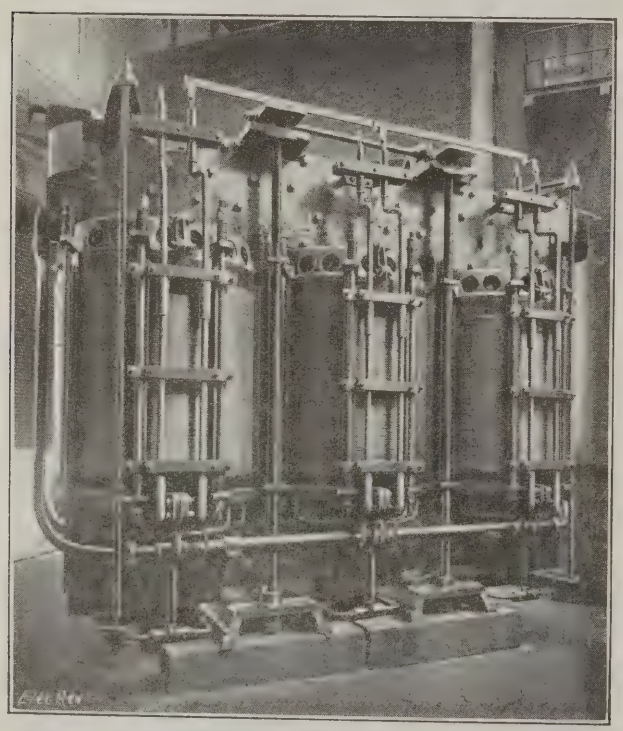


Fig. 1.—A 19,500-kVA, 3-phase, 50-period Transformer after 4 years' service in Barton Power Station.

Amongst transformers being supplied on foreign contracts are three-phase banks up to 54,400 kVA capacity per group: two banks of this capacity and one spare unit are being sent to South America, each bank consisting of three 18,113-kVA, single-phase, shell-type transformers for 13,650/28,500-volt operation at 50 periods; they will be fitted with oil conservators and breathers, two sets of cooling equipment per group being included in the contract, and the guaranteed maximum efficiency of these transformers is 99.34 per cent.

A 51,000-kVA bank of similar type, but designed for operation at 6,600/115,000 volts on outdoor service, is being built for a power station in Europe. The units of this group, as well as those of the 54,400-kVA groups above-mentioned, will be of greater capacity than any single-phase units hitherto manufactured in this country. Some idea of the size of the plant now being built may be obtained from fig. 2, which shows one of the single-phase units recently manufactured at the Metropolitan-Vickers works for the Victoria Falls and Transvaal Power Company, South Africa. The initial power plant which is being supplied by the company for the new Waikaremoana hydro-electric power station in New Zealand includes two 20,000-kVA, three-phase banks of single-phase transformers and one spare 6,666-kVA single-phase unit, water-cooled and arranged for outdoor service at 11,000/110,000 volts. The Great Indian Peninsula Railway has ordered 12 single-phase transformers, of the self-cooled outdoor type, to form four 11,000-kVA, three-phase banks for 6,600/110,000-volt



Fig. 2.—Single-phase Transformer of 11,000 kVA Effective Rating, one of many for service on a 132,000-volt system in South Africa.

peration in connection with the electrification of the main railway line north-west from Bombay.

Within the last few years Metropolitan-Vickers transformers aggregating over half-a-million kVA total capacity have been ordered and supplied for pressures of 110,000 volts and above, and the company is now completing extensions to its high-voltage laboratory, which will increase its capacity by over

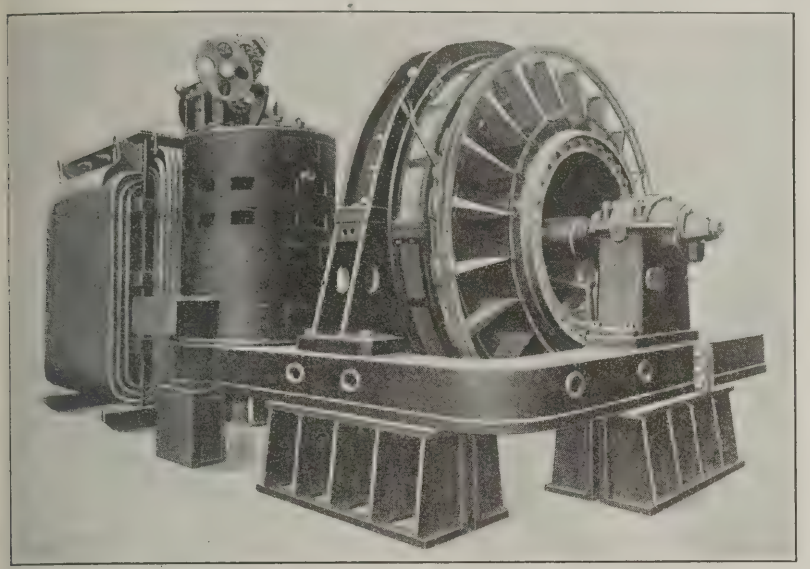


Fig. 3.—Rotary Convertor, with Induction Regulator and Transformer.

four times and include transformers for making commercial tests at one million volts.

Four rotary-convertor sets with special features have recently been completed by the company for sub-stations in Buenos Ayres; three are of 3,000-kW capacity each, and one is of 2,000 kW. Apart from size, the equipments are interesting in that they include induction regulators to provide wide voltage regulation, together with power-factor correction: moreover, the heavy control gear necessary for such large machines is electrically operated, and the motors for operating the induction regulators and the field rheostats are remotely controlled.

The incoming supply to the sub-station is at 27,500 volts, 3-phase, 50 periods. The transformers of the rotary sets are oil-immersed and self-cooled, three single-phase shell-type units in one tank for each of the 3,000-kW sets, and a 3-phase core-type unit for the 2,000-kW set. All four sets deal with either 3-wire 440-volt lighting, or 2-wire 580-volt traction load, this unusually wide range of d.c. pressure being obtained by means of the induction regulators. Fig. 3 shows one of the convertors, with its transformer and induction regulator, in the makers' works. The output of each 3,000-kW convertor is 6,800 amps. at 440 volts and 5,200 amps. at 580 volts; provision is made to carry a mid-wire out-of-balance current of 1,700 amps., and the machines run with a leading kVA in order to improve the power factor of the system. At full load, 1,900 wattless kVA is supplied by each machine when operating at 580 volts and 0.85 leading power factor on the h.p. side, and 4,000 kVA when operating at 440 volts and 0.95 leading power factor. The larger rotaries are tap started, a small motor-driven high-pressure oil-pump being provided to force lubricate the bearings in order to reduce the power required for starting.

The 2,000-kW set is similar, but is provided with a directly-connected starting motor on the Metropolitan-Vickers self-synchronising system.

The induction regulators are vertical, air-cooled, motor-operated, and forced ventilated by a motor-driven fan. The rotor movement, by which the regulator boost is varied, is effected by means of a small motor with worm reducing gear mounted on the top of the regulator. The motor controller-type switch is on the operator's panel, and a magnetic brake on the shaft ensures that movement of the regulator ceases immediately the motor is switched off; limit switches and mechanical safety stops are also fitted.

The control gear for all four sets is remote electricity operated; fig. 4 shows the main contactor panel of one of the 3,000-kW sets, while fig. 5 shows the panel carrying the knife-switch push buttons and small contactors from which the massive main contactors are operated. The control gear is on a separate 180/230-volt d.c. circuit, and interlocks provide that the contactors can only be closed in their correct sequence. The two controller-type switches on the panel are for the induction-regulator and field-rheostat motors respectively; the three-pole knife-switch is for the oil-pump motor.

Control gear of this type, in some cases accompanied by synchronising apparatus, has been supplied by the Metropolitan-Vickers Electrical Co. for installations including rotary convertors up to sets of 4,500-kW capacity.

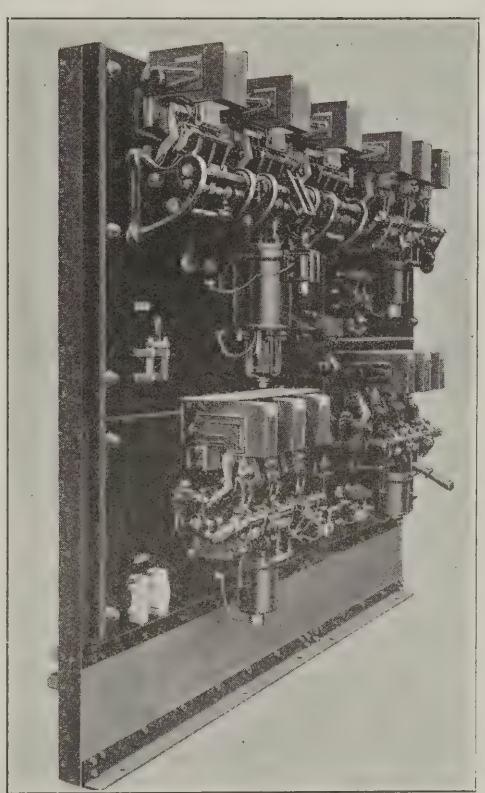


Fig. 4.—Main Contactor Panel for 3,000-kW Set.

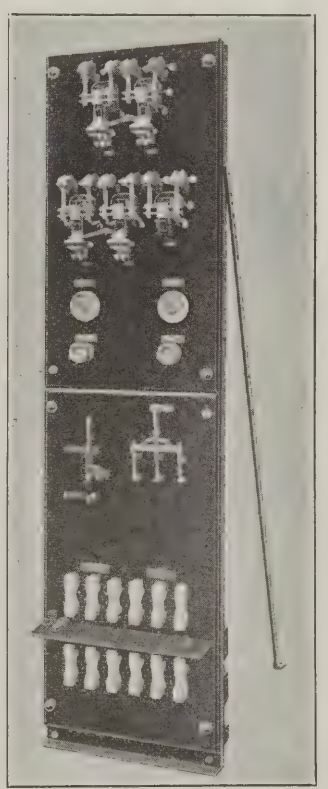


Fig. 5.—Control Panel for Large Machine.

Low-Loading Electric Vehicles.

For some time past commercial motor-vehicle practice has tended to lower the loading platform level, and builders of industrial electric vehicles are adapting their productions to the new order of things. Some time ago the Glasgow Corporation invited tenders for a fleet of thirty-six refuse-collecting vehicles, affording a large carrying capacity, low-loading line, small turning circle, and adequate sanitary protection for the contents. Many tenders were received, of which that of Messrs. Richard Garrett and Sons, Ltd., was accepted. The first vehicle has recently been delivered and is now on trial in Glasgow. The design enables a loading-line of 4 ft. 8 in. to be obtained, without reducing to any considerable extent the diameter of the road wheels. The driver's cab is well forward, the front axle being unusually far back, so that the vehicle has the large load-carrying capacity of from 4 to 5 tons on a comparatively short wheelbase. The Tudor battery is located above the front wheels and behind the driver's cab.

An electric vehicle recently supplied by the General Vehicle Co., Ltd., to the electricity department of the Manchester Corporation, took the form of a short-wheelbase tractor with a long low-platform two-wheel semi-trailer, the whole forming a flexible six-wheel vehicle specially designed for the transport of electric cable drums. The motor is so arranged that it drives a differential shaft by an enclosed silent chain, side roller chains transmitting the power to the rear wheels of the tractor. The battery consists of 44 Exide-Ironclad cells of 500 amp.-hour capacity, and is carried above the frame of the tractor behind the driver's cab; the cells are mounted on transverse rails, so that they can be readily removed through the sides. The trailer is designed to carry either a single 10-ton cable drum, or two smaller drums of 6 tons each. The tail board is hinged to the trailer platform, so that when lowered it forms a ramp up which the drums can be hauled by means of an electrically-driven winch on the vehicle.

Oil-Immersed Circuit Breakers.

A contribution to the study of the number of tests required to establish the rupturing capacity of an oil switch, in the form of a report (ref. G/T28) from the British Electrical and Allied Industries Research Association: startling conclusions are drawn.

By E. B. WEDMORE, M.I.E.E., W. B. WHITNEY, B.Sc.(Eng.), and C. E. R. BRUCE, M.A., B.Sc.

(*Abstract of Paper read before the* Institution of Electrical Engineers.)

WHAT number of tests is required to establish the rating of an oil circuit-breaker? The purpose of this paper is to examine the problem and state conclusions in language as free as possible from technicalities.

The simplest case of a single-break circuit breaker controlling the circuit between two poles of a machine was studied first, but investigation of the three-phase case is also in progress, and sufficient work has been done to show its extreme complexity; however, at least the same degree of reliability from the results can be obtained on three-phase work by two-thirds the number of tests required on single-phase, but it would probably be unsafe to take one-third the number as sufficient, because the *range* of variation already observed in the total energy of the three phases in the relatively small amount of test data available is greater than the *range* of variation of the total energy of groups composed of three separate single-break tests based on a much larger amount of data. It might be argued that the authors are too conservative in this and that, since there are six breaks, one-sixth the number of tests is sufficient. Though they cannot agree with such a view, they point out that, even if it were accepted, it would not materially alter the main conclusions of their paper.

An analysis of a large number of repeat tests on a given oil circuit-breaker shows that the energy liberated at a single break of a single-pole breaker varied from about 1 to 50 kW-seconds, and the variation is as large on commercial breakers of about the same capacity. Hence a large number of repeat tests is required before a rating can be checked even to within, say, 50 per cent. of its true value.

Although the B.E.S.A. specification uses the ability to continue carrying rated current after clearing maximum rated kVA as the criterion of rating, this criterion affords no quantitative measure of the condition of the auxiliary contacts (which are the ones involved in clearing the circuit), nor does it take account of the possible expulsion of smoke, oil, or flame, which may be sources of grave danger to operators in the vicinity. Since a *quantitative* measure of efficiency is required, the authors have based their conclusions on a study of the magnitude of the arc energy liberated between the contacts, which may usually be considered amongst the main causes of destruction of switchgear. This energy can be definitely measured by means of oscillographic records of the current through, and the voltage across, the arc.

The authors have chosen a somewhat arbitrary maximum of 50 kW-seconds, but they are satisfied that any modification (under the given conditions) would not alter the general conclusions. For instance, the chance of the occurrence of, say, 30 kW-seconds or over is 1 in 14, *i.e.*, on the average, about 14 tests would have to be done before one occurred that was 30 kW-seconds or over; this at once shows that two tests cannot be hoped to give any reliable information. Further, the chance of getting, say, 47 kW-seconds arc energy output or over is about 1 in 1,000, or, on the average, about 1,000 tests would have to be done before one could be reasonably sure that the circuit breaker had been subjected to within a few per cent. of its worst strain.

In the commercial testing of heavy circuit breakers it is obviously impossible to do 1,000 tests, and we therefore want to know how near the truth we could get if we only do, say, 5, 10, or 20 tests. This is a problem in probability and the results of the author's calculations are shown in a family of curves (in the original paper) which indicate the manner in which the maximum values vary. Consideration of the maximum of a group of tests is unsatisfactory as an indication of the maximum possible and mean values do not materially reduce the limits of uncertainty.

Put in a rough-and-ready way, the authors' investigations indicate that if a single-phase, single-break circuit breaker twice clears, without serious distress, a single-phase dead short-circuit on a supply circuit capable of giving a maximum of, say, 10,000 kVA, all that can be assumed is that the circuit breaker is safe for operation on about 1/24th the kVA, or, say, 400 kVA. If it clears:—

5 tests at 10,000 kVA it is safe for operation on about 1/8th, or 1,200 kVA;

10 tests at 10,000 kVA it is safe for operation on about 1/5th, or 2,000 kVA;

50 tests at 10,000 kVA it is safe for operation on about 1/2, or 5,000 kVA.

This striking result indicates that there is little hope of being able to check the rating of an oil circuit-breaker by the methods usually accepted in commercial testing, even on three-phase work, without doing a prohibitively expensive number of tests. Moreover, the necessary number of tests would have to be greatly increased unless the arc energy output that will just cause a given criterion of distress is accurately found by some other means. Such means must allow of the stress-producing forces being rigidly controlled and increased little by little in suitably graded steps, but this is a problem still awaiting solution. The two tests specified by the B.E.S.A. specification are thus totaly inadequate. These results are quite contrary to commonly accepted opinion and have only been possible owing to the large number of tests available.

So far we have only dealt with the *checking* of a rating, but the difficulties multiply when a manufacturer is faced with the problem of determining the rating of a new design of breaker. Two distinct problems are involved, namely:—

(i) What arc energy output and rate of output a given breaker will stand *between its contacts.*

(ii) Determining the kVA and other *external* conditions which, when associated with the operation of the circuit breaker, will never result in a greater energy output *within* the breaker than the safe limit determined under (i).

In the absence of any other aids, such as the B.E.A.I.R.A. is gradually securing, the manufacturer must start by making an intelligent guess at the rating before checking it by the process of repeat tests. A series of small steps may have to be taken, each requiring 50 tests, and even then, when the distress limit is reached, he cannot be sure that the energy released in the switch in any test has been appreciably more than half the possible maximum.

Unfortunately, we have not sufficient data to be certain that when the externally applied load, or kVA, is increased or reduced, the maximum release of energy inside the circuit breaker in a given number of tests is increased or reduced proportionately, so that it might be necessary to carry out even longer series of tests to determine the shape and limits of the distribution curves at various values of applied kVA.

The only solution of the problem appears to be the systematic discovery and study of every variable entering into the production of arc energy and the discovery of the laws governing the magnitude of these variables and their inter-relationship and the crystallising of this information in the form of a general formula. Such a formula would contain constants, some of which would undoubtedly have to be determined by a few tests on each new type of breaker at a current in the neighbourhood of its current rating, but once these tests have been carried out it should be possible to determine by calculation the limits of variation in arc energy that would occur in a given breaker operating under given circuit conditions.

The British Electrical and Allied Industries Research Association has been engaged for several years on a careful analysis of variables with this end in view and is now within measureable reach of success so far as the range up to 20,000 kVA (single-phase) at 6,600 volts is concerned, but, in regard to certain causes of variation, research at higher ranges may be necessary before the safety of applying the formula to such higher ranges is established.

In conclusion, the authors point out that their observations regarding the probability of occurrence of high values of arc energy after a certain number of operations give strong grounds for belief that unexplained failures of circuit breakers may not be due to mysterious over-voltages, or other bogies, but may simply have been the result of the circuit breaker operating at the bad end of its energy distribution curve, the rupturing capacity having been overestimated due to inadequate previous tests.

[The paper was illustrated with a kinematograph film. The research work was carried out at the Carville power station of the Newcastle-upon-Tyne Electric Supply Co.—Eds., Elec. Rev.]

Discussion.

Mr. G. W. Partridge, in opening the discussion, said he was disappointed in the paper in that he thought the authors should have arrived at something more definite. At Deptford many severe "shorts" were experienced—in one day as many as 50 occurred—and they all happened with a power factor varying from 50 to 75 per cent. Years ago he installed a new oil switch which normally carried only 1 or 2 A. It blew up the first time it was operated; also the second time after it had been carefully reinstated. It was discovered that, owing to static effect, the switch broke at the top of the wave at five times the normal pressure, or about 35,000 V. Experimental work was necessary to see if operation could not be ensured on the zero line. He thought that horizontal operation would prove better than vertical. It would be better to increase the number of breaks and so reduce the liberated energy at each break. One of the difficulties of the manufacturer was the chemical separation of the oil, the gas from which often got mixed with copper vapour which "shorted" all the live metal near. A switch which was designed to open at a certain loading often had to close on similar conditions. With the increasing size of generating stations, the cost and size of the oil switch would have to be increased unless some quick-operating apparatus could be evolved to reduce the generating pressure at the time of short-circuit.

Mr. H. W. Clothier said he received the general impression from the paper that the extent of variation of the liberated arc energy was greater than was generally realised. But the authors did not take the electrical industry into their confidence. They did not tell enough of the explanation of the variables, and he did not think that the conditions given were sufficient to account for such wide variation. What was the oil doing? It was exposed—and the atmosphere around Newcastle was often damp. The tests were made on apparatus of abnormal construction, open, and with a single break. Most commercial equipment had two breaks, and was closed in with a strong cover. Most failures were due to the bursting of tanks; but the test tank provided no equivalent. What was wanted was a knowledge of the maximum arc energies—could the authors correlate those energies with the static energies on the tank? He preferred the strong-type tanks to those that were made to yield. The easement might give out; then the weak tank would have to go. He asked if the authors could say what was the reduction in arc energy liberated where two breaks in series were employed. Were the authors justified in assuming that the variations were as large on the commercial breaker? The Association had tested commercial breakers at Carville, and the tendency was to increase the capacity of oil switches as the result of those tests. He criticised the authors' comments on the B.E.S.A. specification. The important factor of the stress on closing was not covered in the paper, but it was by the B.E.S.A. It frequently happened that research apparatus struck a zone of instability which was not met with in commercial equipment. He emphasised the need for testing plant of larger capacity in this country, where we had to submit to the humiliating position of having to take breakers abroad for testing. He suggested that a meeting of manufacturers of this country should be convened to obtain the reason why we were not equipped with testing plant equivalent to that possessed by competing nations.

Mr. R. W. Gregory did not feel sure that the inconsistency of the test results was not due to bad conditions. If the generator had been of only one-tenth the size, would the same inconsistency have obtained? He calculated that on the authors' results the chances of a switch breaking at the worst conditions in actual practice on 6,000 V would be a million to one, and on 30,000 V 2,000 to one. It was necessary to find out how much money could be expended to take care of these chances.

Mr. P. R. Boulton pointed out that the apparatus in question was not an oil switch at the actual time of break. If the oil could be made to be present at the actual time of break, the temperature could be kept down. He had arranged apparatus which broke at 10,000 ft. per second at 0 points instantaneously. The oil was not only present at the commencement of the rupture, but was under very high pressure and actually moving in the direction of flow caused by the break. The apparatus made millions of breaks on a.c. with no sign of consequent deterioration of the contacts. It did not matter what metal the contacts consisted of; steel would do as well as copper.

Dr. C. C. Garrard said that the experimental switchgear had only a remote resemblance to commercial apparatus. The variation was not a true criterion, as switch failures were due to gas explosions. The explosion energy was greater than that of the arc, and it was therefore necessary to take a more practical view of the operations. There was no difficulty in designing a switch to break 10,000 kVA. Information was wanted concerning operation at 1,000,000 kVA. He had calculated that in the largest generating station the cost of the switchgear was 1s. per kW installed.

Mr. E. B. Wedmore replied to the discussion, and said that the real research of the Association was concerned with the intensive study of the variations. Certain patents had been applied for, and the position would be explained later. Tests under heavier power and higher pressures had established the main contentions of the paper, and the same distribution had been obtained. Since the paper was written, a number of tests had been carried out at Carville which confirmed the results given in the paper. The problem was associated more with arc energy than with any other quantity.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Duty on Bakelised Paper.

On April 12th, Mr. A. Alexander asked the Secretary to the Treasury whether the wrapping paper duty was being charged on bakelised paper used exclusively for electrical insulation purposes; and, if so, whether the duty was levied on the value of the body-paper or on the manufactured value.

Mr. R. McNeill said he understood that bakelised paper consisted of paper with a coating of varnish or other material, and that the body paper was usually of a dutiable description. In such cases, duty was chargeable on the value of the coated paper, as a whole, if within the limits of dutiable weight.

Interference with Broadcasting.

On April 12th, Mr. Montague asked the Postmaster-General whether his attention had been called to the effect of spark signals sent out constantly by the Lloyd's station at Niton, Isle of Wight, which made the wireless receiving sets for which licence fees had been paid in Sandown, Shanklin, Blackgang, and district, practically valueless; and whether he would make representations to the company concerned as to the advisability of substituting continuous-wave messages for spark signals to ships entering the Channel.

Viscount Wolmer, who replied, said that the wireless station at Niton was a Post Office station used for communication with ships and in the interests of safety of life at sea. Although some interference with the reception of the Bournemouth broadcast programmes was unavoidable in the immediate vicinity of the Niton station, there should be no serious interference at Sandown, Shanklin, and the district when reasonably selective receiving apparatus was used. The Daventry programmes could be received without difficulty even 200 yards only from the Niton aerial. An International Radiotelegraph Conference was to be held at Washington in the autumn of this year, at which the question of spark transmission from ships would be considered. In the meantime it was not practicable to take any steps to restrict the use of spark apparatus on ships.

Beam Service to Australia.

On April 12th, Viscount Wolmer informed Lieut.-Commdr. Kenworthy that the Anglo-Australian beam wireless service was opened for public traffic on April 8th. No public ceremony took place, but a Press demonstration was given on April 7th, when complimentary messages were exchanged between the Secretary of State for Dominion affairs and the High Commissioner for Australia in London and the Governor-General and the Prime Minister of the Commonwealth.

Replying to Sir H. Brittain, Viscount Wolmer said that the service was being operated successfully. It was too early at present to express an opinion upon the volume of traffic.

The Budget.

During the Budget discussions certain members took strong exception to the Government's proposal to abolish the Ministry of Transport.

Mr. Townend, a Labour member, said that the Ministry of Transport was empowered to give effect to the Electricity Acts of 1919 and 1926. The latter Act involved an expenditure of £33,500,000 of public money. By 1940, in the opinion of certain authorities, the Ministry of Transport would have had control over the expenditure of no less than £200,000,000 of the taxpayers' money. And yet without a word of explanation they were told that that Ministry was once again to be divided into more than one department, and huge combinations and groups would find that questions would be dealt with in different ways. It was important that all these matters should be under one head.

Mr. J. Hudson, another Labour member, pointed out that although the country had entered on an enormous electricity scheme, to be supervised by a special department, the Government had decided to scrap that particular department.

Housing Enterprise.

In a recent *Evening News* advertisement a housing estate company announced a number of attractive features which distinguished its houses, stating that "among the standard fittings are electric radiators, cooker, and a 2-valve wireless set with a loud speaker."

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Machine Tools in the Power Plant.

The problem of equipment for the workshop connected with the power plant is one of long standing. Some folk seem to muddle along without tools of any sort; when anything goes wrong, rush tactics predominate, accompanied by rush prices, and much unnecessary loss is incurred.

The power plant of any size can never be an ideal one without machine tools at hand for emergencies; the real live engineer realises that the extra cost of all repairs would in itself soon pay the cost of tools, and uses every effort to get them installed. One of the best equipments of this sort known to the writer was obtained by the engineer-in-charge in an interesting manner, which he usually describes as "free of charge," and is well worth the attention of others. On his taking charge of this plant, his only equipment consisted of an old lathe and an older drilling machine; pointing out their uselessness to the powers-that-be, he suggested that he should be allowed the disposal of all scrap machinery and metal about the place, and that the money so received be put aside as a tool and equipment fund.

To this proposal the firm agreed, and he very soon got busy; within two years he not only purchased his machine tools, consisting of lathe, shaper, two drilling machines, large and small, and a small planing machine, but many other appliances, some of them for testing purposes. Everything he wants is on hand, and all was obtained in this way.

The firm being an old one, a good deal of old machinery, far more than anyone but the engineer realised, was lying about. This was all dismantled and most of it was broken up; the various metals were sorted, brass, bronze, copper, tin, lead, and white metal, were all carefully graded, and soon mounted up to a considerable weight. Tenders were then invited from those having a market for metals, and no machinery or junk of any sort was sold in bulk, but as metal of various kinds, all of which commanded market prices; this entailed very little cost, the necessary sorting being mostly a spare-time occupation, but it increased the returns considerably. With this equipment the engineer is saved a good deal of worry and is to a large extent independent of others. All running repairs and renewals can be put in hand in good time and in the easiest manner, and many little things are got ready in advance for the next overhaul. It is also a wonderful help when getting in estimates for various alterations and the like; the fact that he has plant of his own has without doubt brought about much keener prices all round, It is also possible to carry out many experiments of various kinds that would be unthought of if every little stud or pin had to be purchased outside.

This engineer also puts discarded plant, not completely worn out, in a more saleable condition when it is thought that better prices will result, thus making his own pathway to better plant easier. In every plant there is some use for machine tools, and once they are installed more and more jobs are found for them; everything is kept in a better state of efficiency throughout the plant. Many slight leaks can be stopped that without tools are apt to be neglected, and it is soon apparent that it pays, and often handsomely, to have them as part of the engineer's outfit.

Belfast, *April 13th*, 1927. W. S.

Legal.

"Electric Hare" Dispute.

In the Chancery Division on April 12th, Mr. Justice Tomlin had before him two motions by the Liverpool Greyhound Club, Ltd., and the Leeds Greyhound Association, Ltd., asking for injunctions against the Greyhound Racing Association, Ltd., restraining the latter from claiming that it was the sole licensee for Great Britain in respect of a patent for electrically-operated "hares." For the first plaintiff it was stated that, with the apparatus in question, the "hare" could be made to travel at 60 miles per hour. Counsel for the defendant company offered to give an undertaking in the terms of the notice of motion, without making any admission as to any question at the trial. That undertaking being accepted by the plaintiffs, Mr. Justice Tomlin said that he would make no order except that the costs of the motion would be costs in the action.

Fraudulent Conversion Charge.

The Times reports that on April 12th, before Alderman Sir Harold Moore, at the Guildhall, Elie Stacey Charlier, a company promoter, was charged with the fraudulent conversion of money entrusted to him by various persons for the preliminary expenses of forming an electric railway compa in Canada. The prosecution stated that the accused was American citizen who was adjudged bankrupt in July la The main allegation against him was that he only remitt to Canada small portions of the sums entrusted to him a appropriated the remainder for his own use. Mention w made of three sums amounting to £5,450 which had be handed to the accused. The case was adjourned.

La Radiotechnique v. Norton Wireless Co., Ltd.

Mr. Justice Romer, in the Chancery Division on April 12t heard a motion by La Radiotechnique, a French compar for an injunction restraining the Norton Wireless Co., Ltd., 17, Norton Folgate, E.C., from passing off radio valves n of the plaintiff company's manufacture as and for th goods, and in particular from selling or offering for s valves marked with the words "Radio Micro" and "Rad Micro Special" in cartons similar in appearance to those the plaintiff company.

Mr. Courtney Terrell, for the plaintiffs, said that h clients' goods were well known in the trade, and it w obvious that the defendant company's cartons were a co of theirs.

His Lordship granted the plaintiffs an injunction *ex par* over the first Friday next sittings.

Reviews.

Heat-Power Engineering. Part I, Thermodynamics a Prime Movers. By William N. Barnard, Frank Ellenwood, and Clarence F. Hirshfeld. New York John Wiley & Sons, Inc. London: Chapman & Hall, Lt Pp. xii+493; 251 diagrams and numerous charts. Pri 22s. 6d. net.

To those of our readers who may be familiar with "Hirs feld and Barnard's Elements of Heat-Power Engineering it may be mentioned that the volume under review co stitutes the third edition of that well-known American tex book. Owing, however, to the new ideas which have bee developed during recent years in connection with the conve sion of heat into mechanical work and the improvement i the methods of treating the theories underlying this conve sion, it has been found necessary to rewrite many of th chapters in their entirety, while in the others an attempt h been made to bring them up to date. The result is a boo which may be regarded as covering the whole field of th various theories underlying what in this country is know as modern heat engine practice.

For the benefit of those who are not acquainted with th work it may be mentioned that it covers what the autho call the full year's course in heat-power engineering of th American technical colleges and universities, and since knowledge of mathematics up to and including the differenti and integral calculus is assumed, as well as a knowledge mechanics and physics, it might be suggested that it woul prove suitable for a second or even a third year's course i our own engineering colleges. At the same time it is n to the student alone that this book should make an appea To the power-station engineer and the engineer who is in an way connected with the design and manufacture of moder power-station equipment a knowledge of fundamental principle underlying the working of such equipment is absolutely esse tial, particularly if he is to appreciate the value of the variou developments which are being continually brought to hi notice. Thus, much is being said at the present time abou the advantage of using high-pressure steam superheated t a high temperature. The question at once arises as to th extent to which either or both of these can be employe to increase the thermal efficiency of the steam plant. Again the question of re-heating the steam between the variou expansion stages in the turbine and the bleeding of steam a various pressures for regenerative feed-water heating, is on which is becoming of increasing importance as the capacit of our turbo-alternator units is increased. Similarly, th theory underlying the various problems in internal combustio engine practice are also fully investigated. Other question which are less prominent at the present time, but which nevertheless, may assume great importance in the near future are also discussed in their theoretical aspects, such as, fo example, the binary cycle engine, and the engineer who ha a knowledge of the fundamental principles underlying these questions is well equipped to understand the full value of such developments as he may read of from time to time in the proceedings of our technical institutions and in the engineering Press.

With regard to the general scope of the book, it will be sufficient to mention that it proceeds along more or less accepted lines, the alternation of theory and practice being skilfully maintained to retain the interest of the student throughout, but we feel that as regards the references to

actual engines and plant the value of the book might have been enhanced—particularly from the point of view of the technical college student—by the inclusion of the reproduction of a few well-chosen photographs. Here, also, we cannot fail to notice the fact that the volume before us is the third edition of an earlier work. This is particularly noticeable in the chapter on steam turbines, which, in view of their supreme importance in the development of power from heat, are very inadequately dealt with, only 11 pages being given to the description of the various types of turbine and their method of operation as compared with 50 pages devoted to the description of reciprocating engine types. At the end of the book there is a very useful collection of problems classified according to the chapters, the answers being appended to enable the student to check the accuracy of his work. Various steam tables and charts are also appended, and in this connection it is noteworthy that the properties of steam for pressures up to 1,200 lb. per sq. in. and superheat temperatures 400 deg. F. above saturation temperature are given, together with complete data for very high vacua. We cordially recommend this book to all engineers who are anxious to study the theories underlying the conversion of heat into power.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

10,717. "Manufacture of electroionic discharge tubes." Edison Swan Electric Co., Ltd. (Radio-Rohren Laboratorium Dr. G. Nickel Ges.). December 29th, 1925. (Convention date not granted.) (239,979.)

27,407. "Radio-frequency amplifier." S. Cohen. October 31st, 1925. (267,993.)

31,371. "Wireless and like signalling installations." M. J. Goldberg and Ohne Ges. December 11th, 1924. (244,486.)

31,894. "Inductance coils." M. E. Elliott. December 17th, 1925 (268,007.)

31,894. "Electric circuit breakers, relays, and the like." A. Reyrolle and Co., Ltd., and N. Cooke. December 17th, 1925. (268,008.)

32,096. "X-ray apparatus." W. Moppett. December 18th, 1925. (268,012.)

32,220. "Filter diaphragms for electrolytic purposes." Dr. J. Billiter and Siemens & Halske Akt.-Ges. December 23rd, 1924. (245,127.)

32,316. "Terminals or connectors for electrical apparatus or appliances." J. Rowe. December 22nd, 1925. (268,023.)

32,480. "Electrically-driven timepieces." M. A. Juillerat. March 16th, 1925. (249,078.)

32,481. "Vacuum-tube generators for high-frequency alternating currents." J. Brown and Metropolitan-Vickers Electrical Co., Ltd. December 23rd, 1925. (268,028.)

32,482. "High-frequency electrical apparatus of the type employing thermionic valves." W. J. Brown, C. R. Burch, E. Y. Robinson, and Metropolitan-Vickers Electrical Co., Ltd. December 23rd, 1925. (268,029.)

32,495. "Telegraph receivers." Morkrum-Kleinschmidt Corporation. December 28th, 1924. (245,149.)

32,497. "Electrical wave filters." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). December 23rd, 1925. (268,030.)

32,505. "Signalling devices for use in connection with telephone or like systems." Automatic Telephone Manufacturing Co., Ltd., and C. R. Woodland. December 23rd, 1925. (Addition to 164,313.) (268,031.)

32,622. "Electrical inductances." B. Hesketh. December 24th, 1925. (268,038.)

32,629. "Electric transformers regulatable by varying the active number of coils." E. Hering. December 24th, 1925 (268,039.)

32,636. "Variable inductances and the like." W. S. Smith, H. C. Chantin, and E. W. Smith. December 24th, 1925. (268,040.)

32,642. "Submarine sound signalling." W. Gardner. December 24th, 1925. (268,042.)

32,690. "Fog penetrating lamps or lights for illuminating or signalling purposes." E. V. Hayes-Gratze. December 28th, 1925. (268,046.)

32,718. "Galvanic batteries." Count De Micres. December 28th, 1925. (268,047.)

32,732. "Space discharge tube systems for electric wave signalling." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). December 28th, 1925. (268,048.)

32,806. "Electric water heater of the storage type." A. E. Lewis. January 14th, 1925. (246,120.)

32,831. "Carrier-wave signalling systems." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). December 29th, 1925. (268,054.)

32,837. "Secret signalling." M. Trouton. December 29th, 1925. (268,055.)

32,842. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. December 29th, 1925. (268,058.)

32,951. "Electrical fuses." Midland Electric Manufacturing Co., Ltd., and W. L. Barber. December 31st, 1925. (268,060.)

1926.

15. "Charging of electric accumulators." R. J. Middleton. January 1926. (268,063.)

57. "Apparatus for automatically charging electric storage batteries." A. Wilde. January 6th, 1926. (268,064.)

18. "Cases for portable secondary batteries." A. E. Frost and A. E. Powers. January 11th, 1926. (268,066.)

29. "Multi-layer inductance coil for use on wireless receiving apparatus." A. Tester. January 12th, 1926. (268,067.)

45. "Miners' safety and like lamps." E. A. Hailwood. January 12th, 1926. (268,068.)

69. "Electric lamp holders." Sun Electrical Co., Ltd., and W. Otis. January 12th, 1926. (268,069.)

373. "Electric heating elements." C. H. Roddis. January 27th, 1926. (268,079.)

500. "Terminals for wireless apparatus and like purposes." W. Okines. January 28th, 1926. (268,081.)

977. "Variable electric condensers." P. Blok. February 2nd, 1926. (268,089.)

273. "Switchboards for controlling electric circuits." British Lighting & Ignition Co., Ltd., and J. C. Hutton. February 24th, 1926. (268,106.)

557. "Holders for thermionic valves and the like." India Rubber, Gutta Percha & Telegraph Works Co., Ltd., and J. Haseltine. March 9th, 1926. (268,116.)

6,612. "Thermionic valve holders." C. J. Payne. March 9th, 1926. (268,118).

6,806. "Rectifying devices." British Thomson-Houston Co., Ltd. March 11th, 1925. (249,135.)

7,817. "Electrical terminals or connections." J. H. Tucker & Co., Ltd., and T. R. Martin. March 22nd, 1926. (268,128.)

7,904. "Electric heaters." British Thomson-Houston Co., Ltd. March 21st, 1925. (249,562.)

8,286. "Alternating-current measuring instruments." B. Dunglinson (Republic Flow Meters Co.). March 26th, 1926. (268,130.)

8,309. "Apparatus for carrying or holding together a number of galvanic batteries." Oldham & Son, Ltd., and M. Smith. March 26th, 1926. (268,131.)

8,374. "Dry batteries." Lissen, Ltd., and R. P. Richardson. March 27th, 1926. (268,132.)

8,861. "Directional wireless signalling." Marconi's Wireless Telegraph Co., Ltd. April 2nd, 1925. (250,256.)

8,880. "Adjustable short-circuit device for electrical measuring instruments of the induction type." Landis & Gyr Soc. Anon. August 3rd, 1925. (256,180.)

9,371. "Electric lighting devices." R. J. Heaton. April 9th, 1926. (268,140).

9,609. "Means for protecting electric transmission lines." J. P. Gil. April 12th, 1926. (268,143.)

9,766. "Electric percolators." Metropolitan-Vickers Electrical Co., Ltd. April 24th, 1925. (251,262.)

10,384. "Electric condensers." International General Electric Co., Inc. April 22nd, 1925. (251,274.)

10,399. "Private automatic branch telephone exchanges." Relay Automatic Telephone Co., Ltd., and B. B. Johnson. April 20th, 1926. (268,150.)

11,346. "Sound-reproducing diaphragms." R. Custerson. April 29th, 1926. (268,160.)

12,094. "Devices for the insertion of the electrolyte and for the evacuation of gases in electric accumulators." Accumulateurs Tudor Soc. Anon. May 8th, 1925. (252,024.)

12,728. "Automatic telephone systems." Deutsche Telephonwerke und Kabelindustrie Akt.-Ges. September 17th, 1925. (258,547.)

13,522. "Manufacture of accumulators or electrical storage batteries." S. J. Williams. May 28th, 1926. (268,179.)

14,277. "Loud speakers." American Bosch Magneto Corporation. February 5th, 1926. (265,538.)

16,204. "Electric cables." Macintosh Cable Co., Ltd., and A. W. Williams. December 23rd, 1925. (Divided application on 32,414/25.) (268,194.)

16,221. "Fault-indicating devices for transformers." Allmanna Svenska Elektriska Aktiebolaget. November 9th, 1925. (Addition to 255,836.) (260,944.)

16,736. "Television systems." Westinghouse Electric & Manufacturing Co. July 13th, 1925. (255,057.)

16,843. "Electrical plug boxes." E. Maté. July 4th, 1925. (254,754.)

18,545. "Contact device for electrical switchgear." Maschinenfabrik Oerlikon. September 16th, 1925. (258,557.)

18,598. "Time-lag electro-responsive devices." British Thomson-Houston Co., Ltd. August 5th, 1925. (256,603.)

18,864. "Electric welding machines." J. F. Lawson. August 27th, 1925. (257,581.)

20,091. "Variable electric condensers." C. Zwicker. June 28th, 1926. (268,211.)

20,687. "Dry cells and method of making same." General Dry Batteries, Inc. August 24th, 1925. (Addition to 244,494.) (257,288.)

22,942. "Electrically-heated sterilisers, egg-cookers, and the like." E. Shrubsole. September 17th, 1926. (268,222.)

23,310. "Coupling units for use in wireless circuits." A. E. Watkins. December 21st, 1925. (Divided application on 267,619.) (268,224.)

24,215. "Apparatus for producing high-frequency oscillations for medical purposes." Reiniger, Gebbert & Schall Akt. Ges. December 16th, 1925. (263,093.)

25,652. "Means for selectively cutting out a rectifier on a back-ignition taking place in the same." Akt.-Ges. Brown, Boveri et Cie. November 27th, 1925. (Addition to 251,539.) (262,062.)

26,366. "Calculator for readily determining the relationship between wavelength, inductance, and capacity in electrical circuits." F. H. Haynes. October 22nd, 1926. (268,243.)

29,734. "Means for registering faults of insulation in insulated electric conductors." Allgemeine Elektricitats-Ges. November 24th, 1925. (262,113.)

30,635. "Electric arc welding or coating with material." International General Electric Co., Inc. December 3rd, 1925. (262,453.)

30,795. "Filter diaphragms for electrolytic purposes." Dr. J. Billiter and Siemens and Halske Akt.-Ges. December 23rd, 1924. (Divided application on 245,127.) (262,470.)

31,324. "Amplifying valves for wireless telephony." Schweiz Gluhlampenfabriken Akt.-Ges. and K. Burk. December 11th, 1925. (262,806.)

1927.

2,871. "Joints for high tension electric cables." Pirelli & Co. June 12th, 1926. (Divided application on 255,033.) (Addition to 255,033.) (268,271.)

3,238 "Electric oscillation generators." British Thomson-Houston Co., Ltd. February 26th, 1926. (266,690.)

6,117. "Thermionic electrodes." British Thomson-Houston Co., Ltd. March 6th, 1926. (267,142.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 13th:—

Wizard. No. 478,601. Class 6. Domestic clothes washing machines.—General Electric Co., Ltd.

Unitone (lettering and design). No. 472,329. Class 8. Electrical inductances.—Igranic Electric Co., Ltd.

Ace. No. 477,001. Class 8. Dry batteries (electrical) not for medical purposes.—E. Kohn, 115, Dulwich Road, S.E.24.

Van Raden. No. 477,248. Class 8. Electrical storage batteries.—Van Raden & Co., Ltd., 567, Foleshill Road, Coventry.

Bluebell (design only). No. 478,001. Class 8. Radio-telephonic and telegraphic apparatus and parts thereof.—Lissen, Ltd.

Varsola (lettering and design). No. 478,407. Class 8. Radio-telephonic and telegraphic apparatus and parts.—R. R. Thompson, Ltd., 38-42, Chestnut Grove, New Malden.

Jonphilite. No. 478,410. Class 8. Electric cables.—Johnson & Phillips, Ltd.

Splendor (lettering and design). No. 476,164. Class 13. Electric incandescent lamps.—M.S.L., Ltd., 50, Holborn Viaduct, E.C.1.

Zelco. No. 477,350. Class 13. Electric lamps (ordinary).—I. Weiner, trading as the Zenith Lamp Co., 5, Dyers' Buildings, Holborn, E.C.1.

Tenax No. 478,434. Class 13. Wall plugs or sockets.—Hommade, Ltd., 150, Great Titchfield Street, W.1.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AINSDALE (Southport).—Cinema; Messrs. Sutton, builders.

BARNSLEY.—Artificial light installation, Market Street centre; medical officer of health.

BEIGHTON.—School (300 places), for Derbyshire E.C.; H. W. Skinner, clerk, County Offices, Derby.

BLACKBURN.—Improvements to Emmanuel School (£2,000); Rev. J. E. Samuel, vicar.

BLACKPOOL.—Additional housing scheme (78), Bispham, for the T.C.; borough surveyor.

BRADFORD.—Reinstatement, after fire (£100,000 damage), wool warehouses and offices, Manor Row; J. Riddiough and Co. Garages for motors and railless-cars, Thornton Road; city architect.

BREDBURY AND ROMILEY (Cheshire).—Additional 50 houses, for the U.D.C.; surveyor.

BRIERLEY HILL.—Additional housing scheme (68), for the U.D.C.; surveyor.

BROMLEY (Kent).—Premises for mental defectives (£16,000), for the B.G.; Burnand, Pickett, Ltd., builders, Wallington, Surrey. Additional 40 houses, for the T.C.; Percy A. Coad, architect, 90, Nightingale Road.

BROMSGROVE.—Additional 56 houses, Rubery, for the R.D.C.; surveyor.

BURPHAM (near Guildford).—50 houses, Paddocks estate; Hodgson, Lunn & Co.

COCKERMOUTH (Cumberland).—Bank, Main Street, for the National Provincial Bank, Ltd.

CROYDON.—Arcade additions, North End; S. Burmseter. Additions, The Picture House, North End; Clayton and Black, Prince Albert Street, Brighton. Housing scheme (336), Mitcham Road, for borough engineer.

(Addiscombe).—Cinema, Lower Addiscombe Road; Addiscombe Cinema Co., Ltd., 46, High Street.

DUDLEY.—Rehousing scheme (180 houses to be replaced), for the T.C.; borough engineer.

DUNDEE.—Linoleum factory; Gray, Robertson & Co., solicitors. Shopping centre at Craigiebank housing scheme; city architect.

ECCLES (Lancs.).—Post office and telephone exchange, for H.M. Office of Works, King Charles Street, London, S.W. Development of estate (70 houses), Bridgewater Estates, Ltd.

EXETER.—Three blocks of almshouses, for the Municipal General Charities; Wright & Jerman, 21, Cathedral Yard, architects.

FAREHAM.—96 houses, for the U.D.C.; district surveyor.

GILLINGHAM (Kent).—Boot repairing factory, Canterbury Street, for the Co-operative Society; L. G. Ekins, architect.

GODALMING.—Engine and generator houses, workshop, &c., Borough Road pumping station, for the T.C.; H. C. Head, consulting engineer, 90, High Street, Winchester.

GOLDTHORPE.—Office and stores at sub-station for Dearne District Electricity Board.

HASTINGS.—Alterations, Palace Hotel, White Rock; H. Ward & Son, architects.

HOYLAKE.—Extensions to children's home, for Wirral B.G.; Finchett, Lancaster & Archer, architects, 13, Hoghton Street, Southport.

IRISH FREE STATE (Dublin).—Jam factory, Poplar Row and Annesley Place, for R. & W. Scott.

KIDDERMINSTER.—Extensions to sugar beet factory (£90,000), Foley Park, for the West Midlands Sugar Beet Co.

LANARKSHIRE.—Infant department at Bishopbriggs School (£7,000); clerk, County Education Authority, Hamilton.

LANCASTER.—Extension of the Royal Grammar School; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

LEEDS.—Housing scheme (118), Meanwood and York and Selby Road estates. Pavilions and conveniences and rebuilding of garages, &c.; W. T. Lancashire, city engineer, Municipal Buildings.

LEICESTER.—1,200 houses, Braunstone estate; Lanchester, Lucas & Lodge, for Corporation.

LEITH.—Shed at Harbour (£16,400); harbour engineer.

LIMEHURST.—Rating offices, with electric lighting and heating, Waterloo, for the R.D.C.; J. W. Carey Titterington, clerk, 113, Old Street, Ashton-under-Lyne.

LINCOLN.—Showrooms and offices (£10,000), Silver Street, for the T.C.; city surveyor.

LONDON (Barking, E.).—Headquarters, for the Essex Territorial Army Association; secretary, Market Road, Chelmsford.

(Camden Town, N.).—Alterations, fire station, for L.C.C.; J. & C. Bowyer, Ltd., Norwood.

(Catford, S.E.).—Bazaar premises, 130, Rushey Green, for F. W. Woolworth & Co., Ltd., Kingsway, W.C.

(Fulham, S.W.).—Buildings, Fulham Palace Road, Silverton Road, and Crabtree Lane; Wallis, Gilbert & Partners, 29, Roland Gardens, S.W.

(Ilford, E.).—Garage, showrooms, shops, &c., Eastern Avenue (£45,000); Super Mobile, Ltd.

(Kensington, S.W.).—Alterations, Sussex Place and Onslow Gardens; Westminster Bank, Ltd. Extensions, Town Hall and central library; borough engineer. Rebuilding Kensington, Fulham and Chelsea Hospital, Finborough Road; Sir Aston Webb & Son.

(Kentish Town, N.W.).—Polytechnic buildings, Kentish Town Road; L.C.C. Education Committee.

(St. Pancras, N.W.).—Workshops, 12-20, Fitzroy Place; Association for Promoting the Welfare of the Blind. Extensions, Grafton Street; Maple & Co., Ltd.

(Streatham, S.W.).—32 houses, Sherwood Park Road; Wates, Ltd. 30 houses, Pendennis Road; Chapple and Utting. 37 houses, Southcroft Road; Thomas and Westcott. 80 houses, Southcroft and other roads; E. Clarke & Sons.

(Tooting, S.W.).—Kitchen reorganisation, South Western Hospital; Metropolitan Asylums Board.

MACCLESFIELD.—Pooster station, waterworks, for the T.C.; borough engineer. Additional 103 houses, for the T.C.; borough surveyor.

MILNGAVIE.—Cinema, Mrs. Patrick Breckenridge, Milngavie.

MITCHAM.—Extensions to maternity home, Devonshire Road, for the U.D.C.; Chart, Son & Reading, architects, Union Bank Chambers, Croydon.

NELSON (Lancs.).—Cabinet works, Scotland Road, for W. Blades (£8,000).

NEWPORT (I. of W.).—Joinery works, Leverton Row; H. W. Morey & Sons, Ltd. Municipal offices, Town Lane; borough engineer.

NEWTON ABBOT.—Electricity supply, new factory, Kingsteignton Road; Webmetals, Ltd.

ORMSKIRK.—Housing scheme (50), for the West Lancashire R.D.C.; A. Dickenson, surveyor, Derby Street, Southport.

PAISLEY.—Wing at Museum; the curator.

POOLE.—Bathing pavilion (£10,000), for the T.C.; borough surveyor.

SALISBURY.—Bazaar premises, Silver Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.

SHEFFIELD.—South-Western District Sorting Office for H.M.O.W.; Contracts Branch, King Charles Street, London, S.W.1.

SOUTH SHIELDS.—School of art; Education Committee. Amusement and dancing pavilions, South Foreshore; H. Hill, architect for Mr. C. J. Daniels.

STAMFORD (Lincs.).—Re-erection of Palace Theatre, Blackfriars Street, for R. R. & E. D. Edinborough (£6,000).

STOCKPORT.—Additional 100 houses, for the T.C.; borough surveyor.

STRETFORD.—Elementary school, King's Road, for Education Committee; P. Hodgkinson.

TORQUAY.—Additions, Natural History Museum, Babbacombe Road; trustees. 128 houses, Westhill estate, for Corporation; Universal Housing Co., Ltd.

WADDON.—23 houses and 24 flats, Stafford Road; Southern Foundries, Ltd.

WINCHESTER.—Out-patients' department (£12,000), Royal Hampshire County Hospital; secretary.

WORCESTER.—Nurses' home (£12,000), for the B.G.; the clerk.

The

Electrical Review

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Contents:

	PAGE
The Southern Railway Contract	665
"The Electrical Retailer and Dealer"	666
Belgian Foreign Trade	666
Swiss Railway Electrification	666
The Poplar Electricity Undertaking *(illus.)*	667
The Ideal Wiring System, by H. R. Taunton	670
The Landlord and Tenant Bill, by W. Eric Jackson	672
Reducing Selling Costs, by A. J. Smith	674
Wireless Telegraph Communication, by Lieut.-Col. Chetwode Crawley	675
Correspondence—	
Power Transformer Operation	676
Cheap Electricity	676
Electric Water Heating	677
Salaries of Engineers	677
Electroculture	677
Business and Industrial Notes	677
Lighting and Power Notes	681
Tramway and Railway Notes	682
Telegraph and Telephone Notes	683
Radio Notes	683
Contract Information	683
Forthcoming Events	685
Notes	686
Institution Notes	687
Our Personal Column	687
Financial Section—	
New Companies Registered	688
Official Returns of Electrical Companies	689
City Notes	689
Stocks and Shares	691
Our Foreign Electrical Trade	693
The Situation in Belgium	694
Heat for Factory Processes *(illus.)*	695
A New Current Limiter *(illus.)*	696
Economic Value of Increased Steam Pressure, by H. C. Guy *(illus.)*	697
Kiosk Sub-Stations *(illus.)*	699
Selected Radio-Telephone Apparatus *(illus.)*	700
The Southern Railway Contract	701
The Venner Time-Switch Anniversary	702
Published Specifications	703
Trade-Mark Applications	703
New Work for Contractors	704

The Southern Railway Contract.

THE decision of the directors of the Southern Railway Company to place a substantial order for the supply of twenty rotary convertors and sixty transformers with a Swedish concern because of its disapproval of the arrangements existing between certain British electrical manufacturers, has occasioned widespread discussion in the newspapers. The manner in which publicity was given to the decision may be in some measure responsible for the unusual extent of it, and for the wrong impression which may easily have been left upon the mind of some sections of the community unfamiliar with the necessities of the modern industrial situation. It is said that some small blame rests elsewhere for what may be individual mishandling of the matter, a circumstance which might be quoted, if it were necessary, in demonstration of the individual freedom which exists however complete the compact between members of a group may be.

The official versions of the matter, as prepared by some of the various interests concerned, are set forth in detail in later pages, and they need not be repeated here. So much has been published by us lately regarding the present industrial situation, both from our own collected information and from the annual statements made by the B.E.A.M.A. Council and its chairman, and the speeches delivered at meetings of electrical manufacturers, that readers of the ELECTRICAL REVIEW, whether as purchasers or producers of electrical machinery and plant, may be regarded as familiar with the arguments showing the need for co-operative action if we are to be assured security and efficiency for these departments of the industry.

It has become fairly generally recognised that combinations or amalgamations of, and agreements between, different producers in the same industries, also inter-industrial connections, have become an essential factor of life in British, American and Continental industrial communities because they conduce to efficiency of product and of production, more satisfactory wages and employment, and a fairer return on

capital. This is subject to the qualification that such arrangements do not operate harshly against the common interest or stifle reasonable and legitimate competition or savour of a policy of "dictation" likely to irritate and antagonise purchasers, however large or small. Those of our readers who can recall the cut-throat competition of pre-cooperative days, with the resultant small return on capital, will not need to think twice regarding the desirability for employing measures to avoid a return to such a state of affairs.

It is in respect of the nature of these measures that the Southern Railway controversy has arisen. The record of that railway was so consistently satisfactory in support of British electrical industry previous to the present incident that one is driven to regret still more than ordinarily the departure from its patriotic utilisation of the services of British manufacturers and British workpeople. That departure would appear to have been made somewhat hastily—we will not say petulantly—and seemingly some injustice has been done to British concerns. The manufacturers who were invited to tender indicated the best that they could do individually, as we understand it, and it was open to the Railway Company to approach others who are considered to be well able to meet the specification. The statement of the Railway Company, which we print elsewhere, was issued in London at a date when the invited firms had submitted further modifications to meet its wishes and criticisms, so that the statement itself was at the time it was published not a correct representation of the position. To the criticism that one manufacturer was willing to abandon certain stipulations on condition that he received another part of the contract, there is the very pertinent reply that conditions regarding part of the contract were also made by the Swedish Company and accepted by the Railway Company. And the unwillingness of the latter to open the tendering to firms other than the invited three because it desired to standardise on a type of machine already installed seems unjustifiable when one remembers that in the final event the company has actually made that change by introducing a fourth from abroad. It is difficult to imagine that it was seriously believed that the three uninvited concerns could not meet the specification.

We have dealt in the foregoing, and in our report of the details, with the principal points in the affair as we understand them, while admitting that there may be some considerations affecting the original tendering with which we are unfamiliar, and in conclusion can only repeat our regret that the Southern Railway should have felt it necessary in this case to depart from its excellent practice of using British equipment. Railways as such can hardly with consistency reproach others for appreciating and availing themselves of pooling arrangements, and we believe that if they can anyhow find it possible to come into closer conference with British electrical manufacturers and appreciate a little better the conditions of competitive production, they will find that from grouped operations they can probably secure more efficient results than from unrestricted competition. The principle of co-operation in connection with railways, mines, the chemical industry, and other departments of activity, involves all kinds of understandings and arrangements, and the application of railway principles in the electrical industry is by no means new. It is far from being the desire of British electrical manufacturers, whether grouped or operating individually, to antagonise the railway or any other public authorities. What all need to do at the present time is to operate unitedly, reconciling conflicting interests, as far as practicable, for the well-being of the nation as an industrial one.

Possibly there has been fault on both sides in the present case, and we may hope that somehow or other the features that have occasioned the breach of good relations may be removed so that the railway companies and corporations of the kingdom will utilise the services of British industry rather than go abroad for their requirements.

"The Electrical Retailer and Dealer."

The April issue of this publication is being distributed along with this number of the Electrical Review, and it is also being circulated widespread separately amongst the large class of electrical retailers from end to end of the United Kingdom. Evidence is reaching us that it is fast establishing its position; its value to those for whom it is produced is well recognised, and it is bringing orders to manufacturers and traders. In addition to its usual section particularising suitable selling lines for across-the-counter trade, it deals editorially with various matters of topical and news interest, and contains signed articles on "The Electrical Retailer's Banking Account," "Price Tickets," "Practical Advertising," and "Selling on Deferred Payment Terms."

Belgian Foreign Trade.

The statistics of Belgium's foreign trade in electrical goods, which we publish on another page, show that the imports of dynamo-electric machinery, though dwindling, are still larger than the exports, which at the same time showed an advance in 1926 of about 75 per cent. over 1925.

Of cables, submarine and underground, Belgium imported last year only a little less than she exported, but it is disconcerting to notice that, whereas her imports from Great Britain were negligible, her exports to Great Britain amounted to 1,650,000 kg., as compared with 415,000 kg. in 1925. Belgium is advancing strikingly as an exporter of insulated wire and cable, as an examination of the figures will show. She still purchases large quantities of porcelain insulators from abroad, but France and Germany do the bulk of the trade. Last year she nearly trebled her exports of telegraph and telephone apparatus. Looking at the record of electrical exports as a whole, it is noteworthy that Belgium is extending her sales not only with her own Congo colony, but also with South America, Australia, and China.

Swiss Railway Electrification.

Recent criticisms on the financial situation of the Swiss Federal Railways have resulted in some very interesting articles in the Swiss daily papers. From more than one of these articles details can be gleaned which go to prove that, far from the electrification of the State Railways being an error of judgment, it is incontestably an advantage from every point of view.

For instance, the development of hydro-electric works in Switzerland is in close correlation with the increasing needs of the Federal Railways. Ever since 1904 the latter have been studying the scheme of electrification now in process of completion, and in 1913 they voted a sum of 38 million francs for the first line electrified. In 1920 the first electric locomotive passed through the St. Gothard, and in 1925 the power produced by Swiss hydro-electric works had leaped from the 800,000 h.p. of 1912 to 1,850,000 h.p.

Again, it has been represented to the Federal Railways that by the time the present electrification is finished in 1929, their debt will be augmented by over 550 million francs. But the interest on this sum will be easily covered, according to the most stringent calculations, by the annual economy in combustible, rolling stock and staff; at least 26 millions a year will be saved on coal, 5 millions on rolling stock, and 12 millions on staff, making a total of 43 million francs.

Up to the present the Federal Railways remain obstinately impenitent, and rightly so, on the subject of their electrification, and appreciation of the improvement increases daily.

The Poplar Electricity Undertaking.

A brief record of the undertaking and descriptive features of the "Lopulco" pulverised coal-fired boilers, 12,500-kVA turbo-generator, and 6,600-volt switchgear installed in the new generating station.

NOTABLE as a ship-building centre 300 years ago, Poplar became a metropolitan borough in November, 1900. To-day its area of 2,327 acres, which supports a population of 162,618, has a rateable value of £996,400.

When Mr. J. Horace Bowden, M.I.E.E., M.I.Mech.E., became engineer and manager of the electricity undertaking in 1904, he commenced the replacement of the original d.c. generating plant, which was commissioned in 1900, by 3-phase, 6,600-V turbo-generators, which were added to from time to time until the generating capacity had reached a total of 16,000 kW in 1922. Then, following visits to the Continent of Europe and the United States of America, Mr. Bowden commenced to plan a new station, the inaugural ceremony of which was performed on Monday last by Sir Andrew Duncan, M.A., LL.B., chairman of the Central Electricity Board.

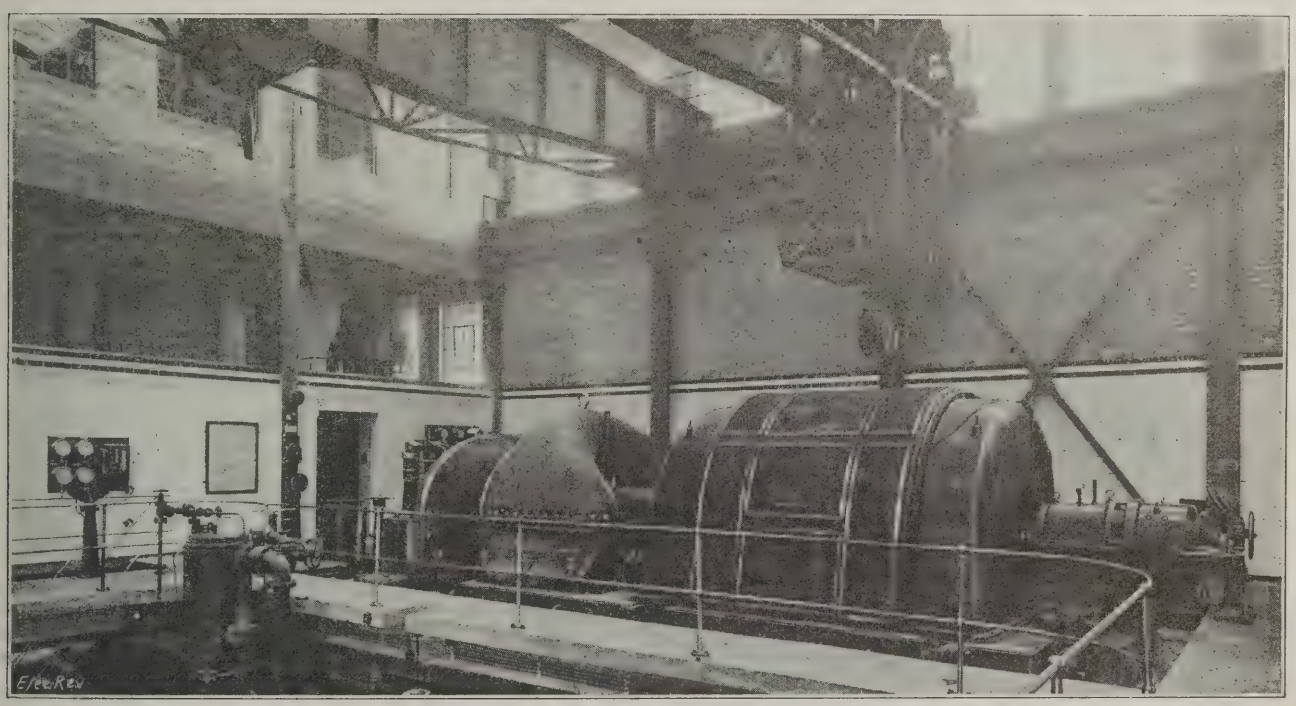


Fig. 1.—The 12,500-kVA Steam Turbo-generator Set in the New Poplar Power Station.

The present capacity of the two stations is 26,000 kW, the new one consisting of one 10,000-kW set with three pulverised-coal-fired boilers, and provision has been made for a further extension of 15,000 kW. The estimated capital commitment of the undertaking at March, 1927, was £684,760, or £26.3 per kW installed. The load factor of the supply generated is approximately 31 per cent., and it is estimated that 34,250,000 kWh will be sold during the year 1926-27, excluding reciprocal supplies, at an average charge of 1.62d. per kWh; the fuel consumption is approximately 33,000 B.th.u. per kWh delivered to the feeders, or 3.5 lb. per kWh sold, at an average cost of 39s. 3¼d. per ton delivered.

The whole of the generating plant installed between 1899 and 1908, excepting three 20,000-lb. boilers, has been scrapped to make room for subsequent extensions. The site of the new station is in proximity to the older one in Glaucus Street, and a canal facilitates the delivery of water-borne coal and also provides condensing water; all the work was carried out to the specification of the main contractors, International Combustion, Ltd., in conjunction with Mr. J. H. Bowden. Two grab cranes on the wharf, one steam and one electric, unload the barges and deliver coal to hoppers for storage or for feeding through a Simon or alternatively a motor-driven Avery scale, a motor-driven magnetic separator, the elevator and conveyor systems to the two main bunkers. The gravity bucket elevator, supplied by the Mitchell Conveyor and Transporter Co., lifts the coal through a vertical distance of 70 ft. and discharges it into the raw fuel bunkers. The pulveriser house contains plant made by International Combustion, Ltd., and also the East Ferry Road Engineering Co. The two "Lopulco" dryers are of the rotary steam-heated type, driven by totally-enclosed variable-speed d.c. motors through reduction and bevel gear. The two Raymond mills are each capable of pulverising 12,000 lb. per hour, so that 85 per cent. of the ground product passes through 100-mesh and all passes 40-mesh screens; each mill is fitted with an exhauster fan with an air duct system, by means of which the mixture is conveyed to the cyclone separators.

The Bradley pulverising installation was constructed by the East Ferry Road Engineering Co. The raw coal from the bunkers is passed through an automatic feed arrangement on top of the dryer, which is of the rotary type, containing a vertical series of trays, over which the coal is distributed during its passage; drying is effected by means of waste gases from the boiler flue, which are passed through the dryer by a fan and escape to the stack. The gases are cooled

before entering the dryer to prevent ignition of the coal and an auxiliary inlet prevents recondensation of the moisture driven off by the coal; the dryer has a capacity of 4 tons per hour. The dried coal then passes to a belt-driven three-roll mill capable of pulverising 3½ tons of coal per hour to such a fineness that 75 per cent. will pass a 200-mesh sieve and 95 per cent. a 100-mesh sieve. The pulverised coal is passed by a short screw conveyor through a dust separator to a cross screw conveyor having a capacity of 10 tons per hour, which discharges to the vertical bucket-type elevator which delivers the coal to the main screw conveyor that carries it to the three storage bins situated at the top of the boiler house, one over each boiler. There are five burners to each combustion chamber, and the five corresponding feeders are arranged in one group, driven by a variable-speed motor, which enables the feeder to be run at any speed between 35 and 140 r.p.m.; each feeder screw is operated through a clutch and may be isolated from the group. A primary fan is provided for each group, having an output of 3,500 cu. ft. of air per minute against a static load of 16 in. w.g., the temperature of the air being 300 deg. F. The fans are located on the feeder floor and air is drawn from the air-heater duct.

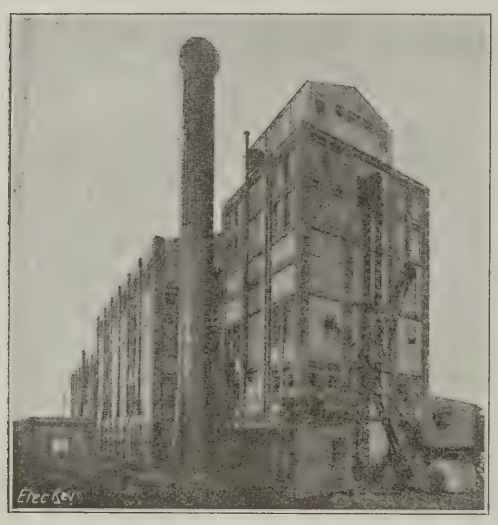


Fig. 2.—Pulveriser House and Thomson Chimney.

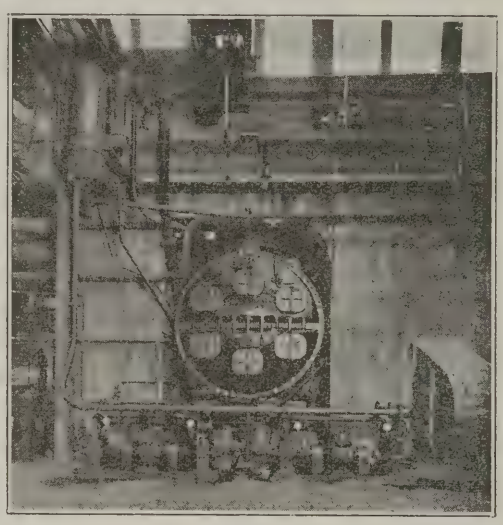


Fig. 3.—Condensing Plant.

The boiler-room equipment at present consists of three units by the Vickers Boiler Co., each designed for a normal evaporation of 50,000 lb. per hour and an overload evaporative capacity of 70,000 lb. per hour, these figures being actual evaporations. The working pressure is 325 lb. per sq. in. and the final temperature of the steam 700 to 714 deg. F.; two boilers are of the standard cross-drum steel-cased design and one of the double-circulation type; the heating surface of each is 6,200 sq. ft.

Feed water is supplied to the boilers through Foster economisers supplied by the Power Specialty Co., Ltd., each having a heating surface of 2,196 sq. ft., raising the temperature of the water to 240 deg. F. and reducing the flue-gas temperature to about 540 deg. F. Each boiler is equipped with a superheater of 3,950 sq. ft., supplied by the Ferguson Superheater Co., Ltd. The air for combustion is preheated by "Usco" plate-type heaters manufactured by the Underfeed Stoker Co., Ltd.; each consists of 80 elements 11 in. long, giving a heating surface of 6,950 sq. ft., and under normal conditions raises the temperature of the air from 60 deg. F. to 260 deg. F. whilst reducing the flue-gas temperature from 540 deg. F. to 340 deg. F.

The combustion chambers follow standard "Lopulco" practice, being provided with the usual water screen and water-cooled rear-wall elements. The secondary air from the preheater is admitted to the side walls, which are hollow, and the air is still further preheated before entering the combustion chamber. Air for combustion is supplied by a forced-draught fan in the basement, capable of delivering 30,000 cu. ft. per minute at normal temperature against a static head of about one inch water gauge; the air is discharged through the preheater to the primary fan suction at the feeder level and to the secondary air-ports in the combustion chamber. The products of combustion, after passing through the economiser and air preheater, are discharged by the induced-draught fan to a main flue at basement level which is common to all three boilers and connects with a steel chimney outside the boiler house. Each induced-draught fan is driven by a two-speed motor and is capable of dealing with 45,000 cu. ft. of flue gas per minute at a temperature of 380 deg. F. against a static head of 3-in. water gauge. The fans were supplied by Musgrave & Co.

A sluicing trough in the basement floor transports

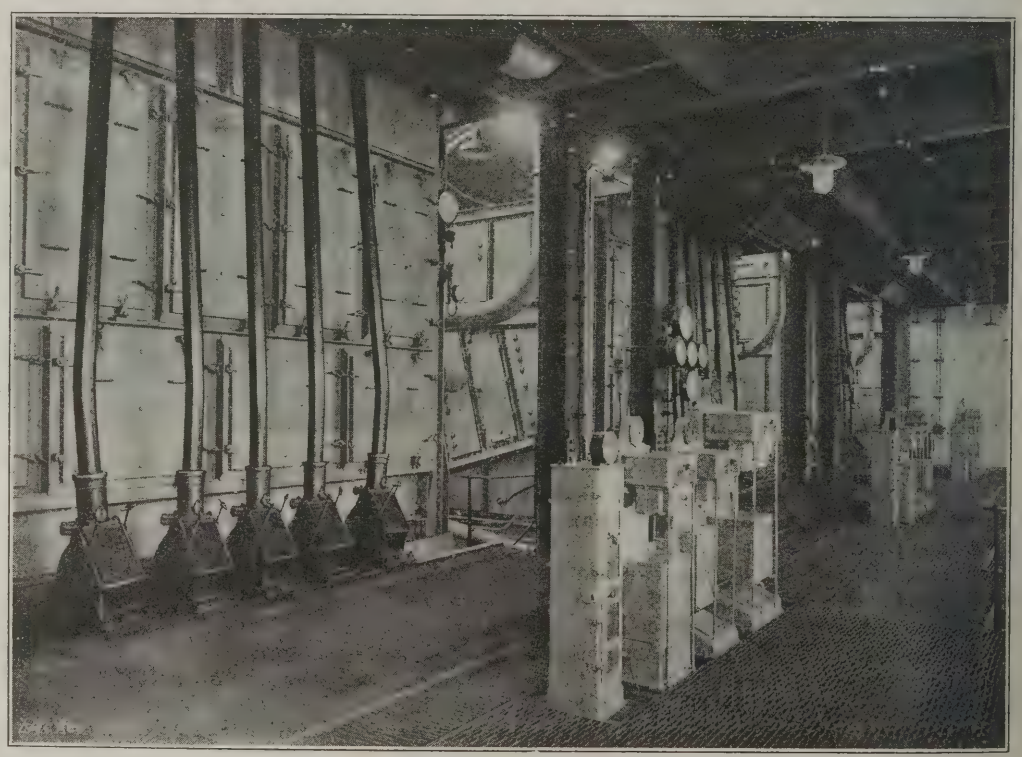


Fig. 4.—New Boiler House: Burner and Operating Floor.

the ashes to a pit outside the boiler house, where they can be handled by a grab crane and loaded into wagons. The water-circulating system is self-contained, the

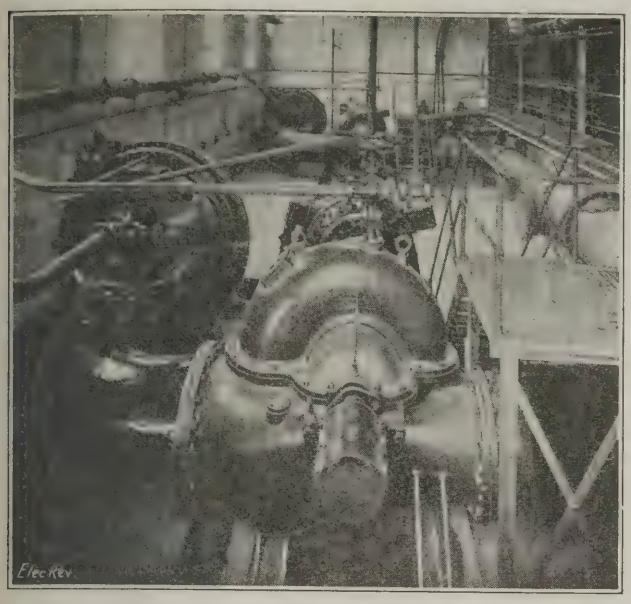


Fig. 5.—Condenser Circulating Water Pumps.

motor-driven pump being in a pump house adjacent to the ash pit and drawing its supply from a culvert fed through a metal screen from the ash pit. The ash system was supplied by the Underfeed Stoker Co., Ltd.

A pure feed-water supply has been provided for by the installation of a Vickers flash evaporator for breaking the raw water, and a "Contraflo" de-aerator for the treatment of all water passing to the boilers. The evaporator obtains its steam supply at a pressure of 30 lb. per sq. in. absolute through an 8-in. bore bleeder connection from an intermediate stage of the main turbine, and under normal working conditions vaporises 3,500 lb. of water per hour. The vapour is condensed in the low-pressure feed-water heater and enters the condensate system as make-up feed water by being discharged through a steam trap to the condenser. The de-aerator is between the surge tank and the feed pump suction, the steam for the heating element being provided by the feed pump exhaust at a pressure of 10 lb. per sq. in. gauge; under normal full-load conditions it treats 109,100 lb. of feed water per hour.

Provision has been made for utilising the steam generated in a destructor plant, situated on an adjacent site, in the new station; it is intended to connect this steam to an auxiliary heater between the feed-pump discharge and the economiser inlet connection; the condensed steam will be taken through a steam trap to the l.p. heater and thence to the condenser, so that in addition to supplying feed-water make-up, it will also be used for feed-water heating. It is anticipated that when this steam becomes available it will be unnecessary to have the evaporator in service, and an alternative source of steam for the l.p. feed heater will be bled from the main turbine at a pressure of 9.6 lb. per sq. in. absolute, when the evaporator is not in use. The feed system is entirely closed; the two pumps, by J. & G. Weir & Co., Ltd., are turbine-driven, and each is capable of supplying the whole of the feed required under normal conditions; the pump turbines exhaust to atmosphere when the de-aerator is not in use, and excessive back pressure is guarded against by an atmospheric relief valve. When the auxiliary heater is in service, the feed water will be further pre-heated to a temperature of about 220 deg. F. before entering the economisers. Automatic feed regulators of the Crosby type are fitted; the feed heaters are of the floating head type, by Caird & Rayner, Ltd.

The turbine room was designed to house two sets ultimately; one set has been installed by the General

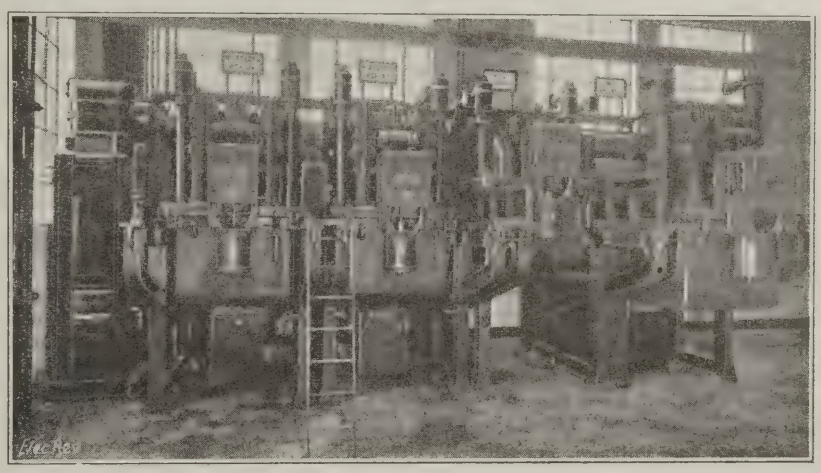


Fig. 6.—The 6,600-Volt Switchgear.

Electric Co., Ltd. Its output is 10,000 kW at a power factor of 0.8 (or 12,500 kVA), 6,600 volts, three-phase, 50 cycles. The turbine is of Fraser & Chalmers' standard high-pressure 3,000-r.p.m. design, and it

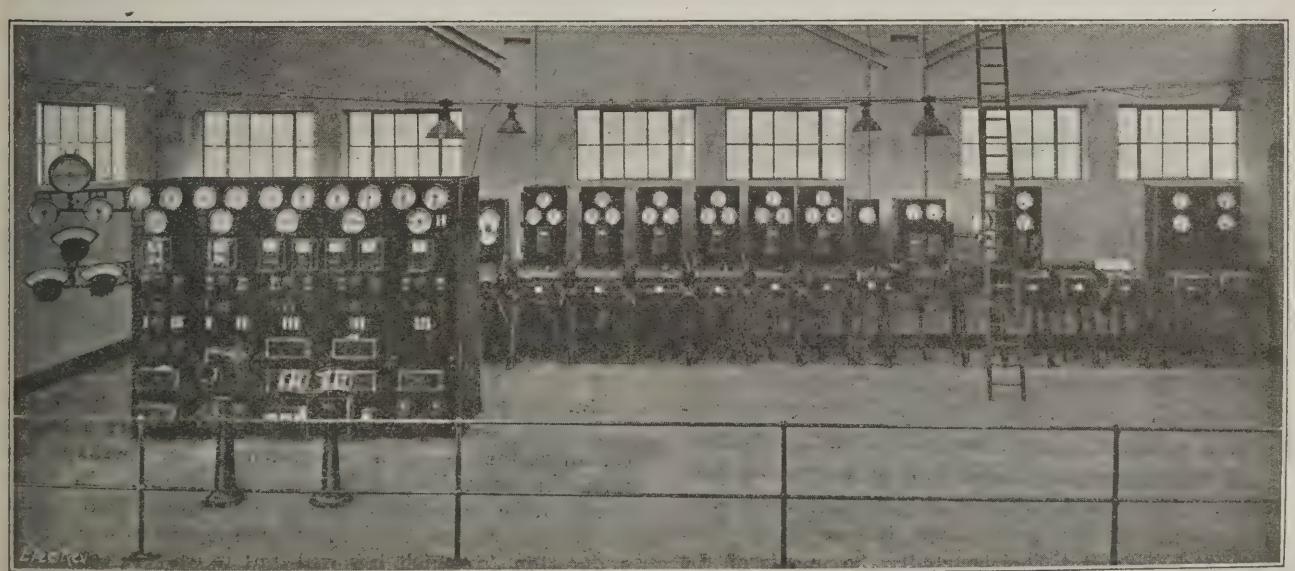


Fig. 7.—Station Control Gallery: E.H.P. Board on Left, House-service Board in Background.

operates at a steam pressure of 300 lb. per sq. in. and a total temperature of 700 deg. F.

The generator is capable of carrying a 25 per cent. overload for two hours; its stator, weighing 40 tons, was cast in the foundry at the G.E.C. Witton works; mica insulation is used throughout the stator, and a totally-enclosed system of ventilation has been adopted, the air being circulated by means of external fans driven by a G.E.C. motor of 110 h.p. in the basement, with a surface cooler through the tubes of which the condensate and make-up feed water is passed.

The surface condensing plant was manufactured by Vickers, Ltd.; of the "Contraflo" type, it has a cooling surface of 14,500 sq. ft. and maintains a vacuum of 28 in. at normal load. The circulating water pumps were supplied by the Mirrlees Watson Co., Ltd., and have a capacity of 9,000 gallons per minute, with water at an inlet temperature of 75 deg. F.; the motors are each of 150 h.p., 415 r.p.m., squirrel-cage type, and the auto-transformer control gear is mounted at one end of the pump house in the form of an industrial panel, provided with busbars and isolators, by Brookhirst, Ltd. The smaller pump motors in this section are of the "Metrovick" squirrel-cage type with auto-transformer starters.

The main 6,600-volt switchgear in the new station comprises six "Metrovick" electrically-operated oil circuit breakers of the metal-clad type with duplicate busbars. A field control pedestal and a neutral earthing cubicle are provided for the alternator; no earthing resistance is provided, and the neutral is connected solid to the earth plate outside the station.

The breakers are of the K4 type, and each has a disruptive capacity of 500,000 kVA; Merz-Price balanced-current protective gear has been provided for the alternator and the station auxillary transformers, and balanced-voltage protective gear for the feeders, with a three-pole overload relay on each of the two feeder groups, having an inverse time characteristic with an adjustable definite minimum time of operation for discriminating. The telegraph equipment is of the Chadburn type, and the loud-speaking telephones by Graham & Co.

Each of the two "Metrovick" transformers is capable of dealing with the total auxiliary plant load; each has an output of 750 kVA at a power factor of 0.8, and the low voltage is 450 V three-phase, with 3 and 6 per cent. tappings up and down on the high-tension side; they have been erected outside the station.

The l.p. switchboard was supplied by George Ellison, and is divided into three groups: all switches are of the draw-out type with single busbars. One group of ten panels is for the a.c. equipment and lighting, the second group is a three-panel equipment for the three-wire d.c. supply, and the third group is a two-panel equipment for the battery supply.

For the pulverised-fuel plant and boiler house the motors were supplied throughout by Veritys, Ltd., and range from 1½ to 80 h.p.; both slip-ring and squirrel-cage types are represented for use on the three-phase system, as well as d.c. machines for use where variable speed requirements are necessary. For the forced- and induced-draught fans and Bailey water screens, the motors were supplied by G.E.C. Brookhirst switchgear is employed. The electrical equipment for the Babcock and Stothert & Pitt cranes is of "Metrovick" make. The lighting of the turbine and boiler houses has been effected by means of Benjamin dispersive fittings carrying high-candle-power gasfilled lamps; various alleyways and passages have been illuminated by smaller lamps in water-tight fittings.

All motors with their control gear exceeding 45 h.p. are connected up with paper-insulated, lead-covered, single-wire-armoured cables supplied by Glover and Co., Ltd. For motors below 45 h.p. and for the whole of the lighting circuits, the "Maconite" system has been employed, single-core cables for lighting and four-core cables for motors having been supplied by the Macintosh Cable Co., Ltd.; the fourth core has been utilised for earthing the frames to the earthing bus which encircles the station on every floor, and is thence connected to the earth plate. The wiring has been carried out by the Alliance Electrical Co. The distribution boards controlling the sub-circuits were supplied by Parmiter, Hope & Sugden, Ltd., and a lift is being installed between the basement and the bunker levels by Waygood Otis, Ltd.

The main interconnecting cables between the old and new stations are of the paper-insulated, lead-covered and served type supplied and laid by Glovers, Ltd.: there are four, each having a cross sectional area of .35 sq. in., laid in Sykes earthenware ducting supplied by the Albion Clay Co., Ltd. A pilot cable is provided with each main feeder for protective purposes and connects with the Merz-Price gear at both ends.

In conclusion, it may be noted that in 1908 an arrangement was entered into with the neighbouring borough of Stepney for linking the e.h.p. systems of both undertakings. Subsequently the boroughs of Hackney and Shoreditch joined the link, with the result that for many years this interconnected group of undertakings has sold energy at average prices which are amongst the lowest in London.

The Ideal Wiring System.

A comparison of the several wiring systems that are available, with a view to deciding which, in the author's opinion, approaches nearest to his ideal for ordinary domestic wiring.

By H. R. TAUNTON.

IN a recent issue of the Electrical Review a layman voiced his bewilderment at the multiplicity of wiring systems offered him by competing contractors. He echoed what was probably the secret bewilderment of the contractors themselves. Each would naturally extol wholeheartedly the merits of the particular system he put forward—put forward largely for the sake of a "different" talking point—but while his praise might be temporarily sincere, it would inevitably be biased by the underlying consideration of competitive cost.

But suppose he were considering the wiring of his *own* house, and, further, suppose expense were a minor consideration—a wild supposition, but perhaps an uncle in Australia has left him a fortune. In other words, if he were unfettered by conditions, what would be his own choice, his ideal wiring specification? It is a question on which few will find it easy to come to a definite decision; and the eventual decisions would make an interesting symposium—if one could ensure a symposium of contractors only, uninfluenced, directly or indirectly, by the contributions of makers' representatives, each with his little axe to grind.

My own ruminations on the question have been clarified into the present article, and in their course have probably reflected the general trend of the more or less indefinite ideas of most contractors of any experience, however few may be found to agree with my personal conclusion.

When I was first introduced to a "married joint"—almost unknown to the modern wireman—a quarter of a century ago, the one popular system of house wiring was casing and capping, with compo. bends. Conduit was in its infancy, and for heavy work screwed gas-barrel with special cast-iron boxes was commonly employed, a clumsy, expensive, but quite efficient forerunner of heavy-gauge conduit. Concentric systems were known, and various forms of armoured cable were already on the market; and there were, of course, any number of freak systems used by individual contractors, which have died a natural and unregretted death.

One of these, which I often came across in Scottish country houses, had certain merits. It was the speciality of the late Mr. R. F. Yorke, and consisted of a single v.i.r. wire run in compo. tubing with a bare-wire earthed return. We were less critical in those days, and its obvious merits of simplicity and economy appealed to me—until I happened carelessly to handle a terminal while standing on the damp floor of a battery room.

The present legion of "surface" systems were, I think I am right in saying, unknown twenty-five years ago. Ordinary single and twin lead-covered wire was, of course, in use—usually without any attempt at bonding—but the first special house-wiring system of that kind which I can remember, I came across in Dublin in 1902 or 1903. It was made, I think, by the B.I.W., and consisted of flat conductors, paper-insulated and lead-sheathed. In such installations as I saw, no attempt had been made to seal the ends; and in the humid Irish atmosphere some of the later tests must have been interesting!

The next landmark in my wiring experience, apart from the gradual popularisation of simplex and similar conduit systems, was the introduction of Stannos. I think it must have been one of the earliest of the practical surface systems. In pre-war years I wired a number of London police courts in Stannos, to the specification of the Scotland Yard architect, and it certainly made a neat and workmanlike job, provided the work was done by men with some experience in its handling.

Since the war, surface systems galore have been marketed. Every cable maker—almost every electrical manufacturer—has managed to extract from his advertising man something novel in the way of nomenclature, and then produced something not quite so novel in the way of wire to back it up. (A contractor, with a little jointing, could almost wire a six-room house with his accumulated samples.) It is as impossible as it would be invidious to name all the various makes from which the modern contractor can make his embarrassed choice; and equally is it impossible to discuss them all in detail—and quite unnecessary: they are all much of a muchness, with a few exceptions which, in striving after originality, hardly escape a certain freakishness. The difference between the best and the worst of them is the difference between Tweedledum and Tweedledee. And from one point of view the same can be said of any wiring system, from the flex-and-button system favoured on the Continent to the massive ironclad system on which the Admiralty lavishes the taxpayers' money.

That is not the paradox it may at first sight seem. For electricity is so safe, wiring for safety is so simple, that almost any conductor, insulated and protected in almost any way, will, *if properly installed*, give a margin of safety infinitely higher than is attainable with gas or any other illuminant. I should doubt if electrical fires are markedly more common in France than they are here, though French wiring methods would give spasms to the meticulous gentlemen who draft the I.E.E. wiring rules. The truth is that our rather fussy regulations still too much reflect the ignorant awe with which the novelty of electric lighting was regarded by our Victorian ancestors. They are conceived too much in the spirit of the red flag which so long handicapped the progress of the motor-car.

A careful workman can make a wiring installation safe with any system; just as a slovenly man with the most gilt-edged one can contrive a potential volcano. All the twelve dozen rules of the Institution can never take the place of care and commonsense; nor can the mere multiplication of regulations close every loophole against the unregulated whims of Fate. Their only tangible result is a needless handicap to the popular extension of the uses of electricity.

In short, one system is as good as another, once it is properly erected, within reasonable limits, of course, and under normal conditions. I am not trying to maintain, for instance, that bare-wire on insulators, excellent under the high roof of a workshed, would be equally so along the skirting of a bathroom. I am only looking at the question now from the point of view of safety—safety from fire, shock, or breakdown—and disregarding for the moment the less important points of permanency, flexibility, convenience, appearance, and so on. From that point of view, the one superlatively important point of view, the true criterion by which any system should be compared with its rivals is the degree to which it reduces the possibility of poor workmanship producing dangerous results.

A system which can be made safe by the ordinary skill and care of the average wireman is therefore to be preferred to one which needs the handling of a master craftsman; and by the same reasoning, one which only gross clumsiness and negligence could make dangerous would be better still, and so on, towards the unattainable ideal of "foolproof." Despite the optimism of switchgear makers, "foolproof" is an absurd interloper in the electrical dictionary. There is nothing foolproof in this world. You might think a common brickbat was—until somebody dropped it on your head!

If, then, we examine the more popular systems of wiring from this standpoint—the scope they give to faulty workmanship—and at the same time glance at their merits and demerits on minor points, we shall, I think, be able to come to something like a definite conclusion. Undue weight given to these minor points—appearance, adaptability, &c.—might lead to widely differing conclusions; but if "safety first" (the average expectation of safety when erected by ordinary workmanship in normal conditions) be made the acid test whereby to judge competing systems, the issue will be greatly simplified.

To analyse all the possible systems that are in use to-day would be an impossible task. Many of them differ only in their trade name; eliminating these and the freaks, and the systems designed for special conditions, the remainder can be grouped in half-a-dozen classes:—

a. Heavy-gauge screwed conduit, more or less completely ironclad from main switch to fitting—generally "less"—it is rare to meet an installation in which the logic of the system does not lapse at a wooden fuseboard or a ceiling block or the like.

b. Light-gauge slip conduit, with or without continuity fittings of all degrees of complexity and inefficiency.

c. Casing and capping, wood or metal—often with the addition of metal or rubber bends.

d. Twin or single wires, metal-sheathed—usually some form of lead alloy. This includes the bulk of the "surface" systems, in which wires are clipped directly to surfaces without other mechanical support or protection.

e. Cab-tire, similar to the above, but with a sheathing of hard rubber instead of metal.

f. V.i.r., enamelled, or bare wire run on insulators or cleats.

It is safe to say that 99 per cent. of to-day's buildings are being wired on one or other of these six main systems. As, however, we are here concerned only

with domestic wiring, we can eliminate *f*, which, though often the best possible system for factories and similar buildings, where it can be run out of reach, is hardly suitable for a drawing-room. It is true that many a house has been, and is still being, wired on the "threaded-joist" principle, with unprotected v.i.r. wires under the floors. No doubt consulting engineers will shudder at the thought of it, but there is really no reason why such wiring should not be safe and satisfactory if carefully done. Logically, v.i.r. wires touching wood only where they pass through joists should be even safer from fire risk than similar wires touching wood throughout the length of a wood casing system. There is here at least a suggestion of a possible approach to the problem of house wiring for the masses. However, it is not a system which a contractor, regardless of expense, is likely to choose for his own house, so we can dismiss it with the rest of *f*.

We can also dismiss system *b*—light conduit. Any merit it has except cost, which is not here in question, is obviously possessed in greater measure by *a*—heavy gauge—for which it is admittedly no more than a cheap substitute, although it probably rivals *d*—"lead-covered"—as the most popular of wiring systems.

I think, too, we can dismiss without much discussion *c*—casing and capping. Metal—usually sherardised steel—casing is little heard of to-day; nor is the more common wood casing used much by up-to-date contractors, except in special situations. Its neat erection needs a joiner's skill, which the modern wireman rarely aspires to. Its bulk makes it unsuitable for concealed work and often unsightly for surface work. In dry situations it has certain electrical advantages, and its fire risks are probably less than those of a poorly-earthed metal system. On the score of mechanical protection it is at a certain disadvantage; though in a private house that is a minor consideration. Its expectation of safety, given average skill in erection, is largely dependent on the care taken to keep wires apart at bridges, tees and angles, and on the avoidance of joints, to which it is rather a temptation. It is indeed a method best associated with the old tree system, where joints were a commonplace. The average wireman of to-day cannot be relied upon to make the sound soldered joints of his predecessor.

Despite its many good points, therefore, casing and capping cannot, in ordinary circumstances, be considered as in the running for to-day's ideal-system stakes. We are now left with three claimants only: *a*, heavy gauge; *d*, "lead-covered"; and *e*, cab-tire; and it will probably be conceded that most of the best domestic work of to-day is carried out on one or other of these three systems. In our search for the ideal, then, they require examination in closer detail.

Heavy-gauge conduit is the pet of the consulting engineers and, without question, it is the best system for most factories, public buildings, offices, and the like, where mechanical protection against accidental or malicious damage is an important consideration. It is, however, too often specified for factories where the less pretentious and very much less expensive system *f*—open wiring on insulators—would be really preferable; and it is, of course, unsuitable for very damp or corrosive atmospheres. In this article, however, we are only discussing domestic installations, and in them, as I have suggested above, mechanical protection becomes a question of quite secondary importance. I think, personally, too much stress is laid in wiring rules, specifications and practice on the necessity of protecting wiring—in private houses—from possible injury.

Consider the average domestic installation. If the wires are run on the surface, how are they in the least likely to be damaged, accidentally or wilfully, unless perhaps in an ill-regulated nursery? If the wires are concealed, how is a nail—the only probable cause of disaster—likely to reach the bulk of them, run below floor-boards? The wiring to plugs is usually protected by the skirting, and that to switches is usually run in an angle or by the architrave of a door, where nobody but a lunatic would want to drive a nail. There only remains the wiring to rare bracket points, in rooms so old-fashioned as to lack a picture rail. Certainly the aberrations of human intelligence call for some protection here—but not for armour-plating. To encase the whole wiring of a house in thick steel for the sake of protecting a few feet of wire against one chance in a million is like wearing a "tin hat" against the chance of the "foolproof" brick mentioned in an earlier column; or like a native of the Sahara living perpetually in a diving suit lest he be caught in the rain!

For domestic wiring, then, the mechanical advantages of heavy-gauge conduit are beside the point. Another great claim for the system is that it is "flexible"—that new wires can be pulled in and out when necessary for repairs or extensions. But how often is it necessary in a private house? And how seldom is it possible in practice! It presupposes a reasonable margin in the sizes of the pipes and an adequate number of accessible inspection boxes, ignoring the hazards of bad judgment in erection—to say nothing of the influence of competition. It also ignores the difference between handling old wires in old conduit and new wires in new conduit, and the possibilities, in repair work, of broken wires, stripped insulation and jamming. In short, so far as house wiring is concerned, the whole claim is a weak one. Actual disadvantages of conduit for domestic work are its unsightliness on the surface and its bulk if concealed, entailing heavy cutting away if rusting through the covering plaster is to be avoided.

(To be concluded.)

The Landlord and Tenant Bill.

New Rights for Traders.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

THERE seems little doubt that a certain amount of disappointment will arise over the terms of the new Landlord and Tenant Bill now before Parliament. Such disappointment is inevitable, not because the legislature does not desire to satisfy the reasonable demands of traders who are lessees, and whose misfortune on being ejected from their premises at the expiration of their leases is apparent, but because in many cases legislation cannot cover or avoid all the difficulties of the question.

It has long been felt that the iniquitous system whereby landlords, on the expiry of a lease, have been able to hold tenants to ransom by forcing them to pay extortionate sums for a renewal of a lease, ought to be abolished. But on the other hand, if every tenant is to become his own freeholder or, what is almost the same thing, be able to demand perpetual renewal of his lease, development and reconstruction of property will become impossible unless local authorities are given further powers to regulate building and town planning.

The root causes of the contention over leasehold reform seem to be (*a*) the increased values of land at the end of the lease, and (*b*) the covenant to hand over to the landlord the premises in a good state of repair.

The Landlord and Tenant Bill deals with both these points in a limited way. In so far as the increase in the value of the premises is due to the tenant's business activities, whereby a goodwill has attached to the property, the landlord ought not to make any capital out of it. But increases in land values arise from numerous other causes—for example, change in the character of the district—and if the value increases from such a cause and not from the tenant's business, the landlord is surely entitled to this rather than the tenant, just as the owner of any movable property of value is entitled to any increase in its market value.

In order to see how the Bill proposes to deal with these questions, a review of its terms is of interest. The Bill was not debated as was intended on April 4th, and doubtless the impending Budget discussions will cause the Bill to be postponed in its second reading for some time. Traders have therefore a useful opportunity meanwhile of acquainting themselves with its proposals, and of making any criticism they think fit.

The principal part of the Bill deals only with premises used for trade or business in England and Wales. In the case of premises used partly for business and partly for other purposes, the provisions in question apply only so far as the business part of the premises is concerned.

The rights of a tenant under the Bill are divided into two classes: (*a*) in respect of improvements to the property executed by the tenant, and which have increased its value, and (*b*) as regards loss of goodwill on quitting the tenancy.

Take class (*a*) first. The Bill only covers those improvements done after the Bill becomes law. The suggested date is September 30th, 1927, but will very probably be later than that. Accordingly, tenants who up till now have spent money on improving their premises will get nothing for their expenditure when their leases expire. To many persons this may appear a defect in the Bill.

After the Bill becomes law, any tenant who desires to make an improvement for which he may afterwards obtain compensation, must either get the consent of his landlord or, if the landlord objects to the proposed improvement, obtain a certificate from the appointed tribunal. The tribunal will only grant a certificate if it is satisfied that the improvement is reasonable. The landlord can avoid a certificate by undertaking to do the improvement himself in consideration of a reasonable increase of rent.

So far, then, tenants will have the power to prevent landlords from refusing reasonable improvements and to safeguard themselves from providing improvements entirely at their own expense for which the landlord will benefit.

The amount of compensation will be assessed at the expiry of the lease, and will in no case exceed the capitalised value of the increased letting value due to the improvement, or the cost of executing the improvement at the date when the lease expires.

A point of difficulty is created in the case of premises which are to be demolished or rebuilt in an altered form after the lease has expired. Obviously, if a tenant executes structural improvements, these will be of no value when the premises are demolished. Such cases will have to be carefully considered, and Section 1 (3) of the Bill goes so far as to provide that if the improvement will have no effect on the value of the property after demolition no compensation shall be payable to the tenant.

Somewhat similar provision is made later on in the Bill with regard to loss of goodwill. Where premises are to be demolished or altered, the tenant will be in the same position as now, and will have to leave his premises with no compensation. Of course, there are cases in which an improvement or goodwill will not be affected by rebuilding or only affected in a limited way. For example, a tenant may incur paving or drainage expenses. Such expenses will enure to the landlord's benefit after rebuilding. And if a shop is pulled down and rebuilt as a shop, goodwill may attach to the new premises by reason of the old business, but not if the new premises are converted into offices or a kinema. The Bill provides for the taking into consideration of all cases of this kind, but the whole basis of compensation is to be found in the answer to the question: What benefit does the landlord get by reason of the tenant's acts or business? If no benefit (as in the case of demolition), no compensation.

As regards goodwill, the problem is dealt with on the same basis as above, but the tenant's rights and the landlord's rights are a little more complex. The tenant, on claiming for loss of goodwill, may take the case before the tribunal. He will only be compensated for the increase in value of the premises due to his goodwill, and then only so far as that value enures to the landlord's benefit.

The landlord may meet the claim by offering a renewal of the lease on reasonable terms or a sale of the freehold at a fair valuation. Such terms or valuation will include any increase in value not due to the tenant's goodwill, as where the value has gone up owing to changes in the district.

The tenant can, as an alternative to claiming compensation, demand a renewal of the lease on reasonable terms. He can only make this demand if he shows that he is a suitable tenant and that no money compensation would adequately compensate him for loss of goodwill.

The landlord, in reply to the demand for a renewal, can avoid a new lease by showing that he wants the place for occupation by himself or a son or daughter, or that he wants to develop or reconstruct the property, or that a new lease would retard development of other property and be contrary to good estate management. In such cases the tenant will not get a new lease, but will be thrown back on his claim for compensation. It is somewhat unfortunate that the foregoing provisions are all applicable to business premises, but are not applicable to premises occupied by professional men.

The remaining part of the Bill deals with all tenancies and attempts to tackle the "covenant to repair" problem by enabling all disputes over the amount claimable for non-repair to be referred to the tribunal.

The exaction of money payments by landlords for granting a licence to assign, sublet, alter the user of the premises or execute improvements is expressly forbidden by the Bill. Consent to an assignment or subletting or improvement is not to be unreasonably withheld. The landlord may, however, claim, in the case of improvements or alteration in user, for any diminution in value caused.

It should be mentioned that the Bill is one of three dealing with similar matters. Two have been presented by the Liberal party, and although similar in some respects do not entirely agree with the Government proposals (No. 2 Bill). The fate of the Liberal Bills is doubtless assured in view of the Government Bill, but the existence of these opposition proposals makes it evident that by no means are all minds agreed on this rather involved question, and much dissension is bound to arise.

Electric Vehicles in New Zealand.

The annual report of the Christchurch (New Zealand) Corporation states that the electric-vehicle depôt offers charging and garaging facilities for all sizes of electric vehicles, from runabout cars to 5-ton lorries. Rates are quoted covering charging, watering, and general care of the batteries, and, in addition, the garage staff is able to carry out any repairs required to the vehicles. The number of vehicles at present in the garage is 43. The flat nature of the city and surrounding districts promises well for the future development of the electric vehicle in Christchurch.

Reducing Selling Costs.

Some examples of modern practice in the pursuit of economy and efficiency.

By A. J. SMITH.

THE travelling representative or salesman at one time was regarded in many trades as something between an unavoidable expense (like the rates) and a highly speculative investment which might possibly pay handsomely. The task of selection was frankly admitted to be in the nature of a gamble, in spite of the most careful precautions and preliminary investigations. From all accounts, however, salesmanship is now becoming something in the nature of an exact science, whose principles and practice can be taught, whose exponents work upon lines hardly capable of failure; and it is claimed that the gambling element is consequently entirely removed from this necessary branch of modern industry. Though the writer is not prepared to vouch for the accuracy of the contention, it will be fairly evident from the most casual perusal of the "Situations Vacant" columns during the past few years that a vast change has taken place in manufacturing opinion of what may reasonably be expected of a salesman and what he may expect in return.

Years ago, remuneration of this section of the staff was very usually upon an outright salary basis. It was perhaps a feature of the system that the weeding-out process had to be both drastic and continuous, but not the least of its merits was that it enabled outside staff to be controlled and directed by headquarters exactly the same as the rest of the establishment.

The increasing efficiency of salesmanship, and a growing appreciation of what the trained man could perform, however, brought a modification in the shape of a general change-over to a part-salary part-commission basis, by which the salesman drew merely a nominal fixed salary, depending upon his unaided efforts for the commission necessary to make the post a remunerative one. While increasing the stimulus to exertion, the system lessened to a certain extent the power of direction and control from headquarters.

The next step in increased selling efficiency is very well indicated by the following class of advertisement:—

> "Representative wanted, possessing powerful personality, to market high-grade product made by nationally-known manufacturers. None need apply but thoroughly experienced men who will not be satisfied with less than £2,000 per annum minimum."

It might be explained for the benefit of readers possessing the powerful personality and the wide experience that this is not quite what it seems. Even a sworn affidavit from an applicant that he will on no account accept one penny less than two thousand pounds per annum will hardly help him; nor, if the truth must be told, is the successful applicant at all likely to take home a cheque for £166 at the end of his first month's service. Put into plain English, this class of advertisement is usually a plea from a small manufacturer who on account of a banker's reluctance to increase the overdraft without tangible security is unable to add to his staff on the usual basis, and has perforce to look for a man who will be content to rely for his prospect of remuneration upon a small commission upon sales; "such commission," to quote the legal phraseology of the agreement, "not to become payable until the manufacturer shall have received payment in full." What basis there is for the amount named to be £2,000 per annum is in such cases difficult to discover, for it certainly does not represent the average earnings of half a dozen typical salesmen taken over the last three years according to Income Tax Returns (Schedule "D"), but is a purely imaginary figure which for all the evidence there is behind it might equally well have been stated as £20,000 or £200,000.

Another method of keeping down selling costs which has become increasingly popular of late years is the simple plan of allowing the salesman to pay his own salary out of his own pocket! This is euphemistically described as giving a worker "a stake in the business" or "a share in industry," and is usually presented in the following manner:—

> "District Sales Managers wanted to develop sales of speciality without competition. Salary £500 per annum; investment required, £600."

This plan, to judge by appearances, is a far surer method of raising additional much-needed capital than any financial appeal to the investing public through the usual channels. The drawback from the manufacturing point of view is that it is usually confined to comparatively small sums; £600 is a very common figure, though larger sums up to about £2,000 are occasionally raised in the same way. Regarded from another point of view, the plan has the merit that in addition to obtaining the greatly-desired "stake in the business," the successful candidate can usually obtain a nominal "security of tenure," for a simple calculation will show that even under a definite service contract for a full year the proposition is still a profitable one for the advertiser, who remains £100 to the good at the end of that period, assuming the transaction takes no untoward turn before that time. A study of a few dozen such transactions, however, leads to the conclusion that the remuneration will cease for some reason or another at the end of the second month!

For those who may wish to study the possibilities of this method of making (and losing) money, it might be useful to add that it is not the best or the most business-like application which is most likely to receive attention.

The very latest examples of all make no pretence that remuneration depends upon anything but the unaided work, the financial resources, and the organising abilities of the salesman himself. In this respect, some of the more up-to-date advertisers appear to have profited from a careful perusal of recent reports upon industrial conditions in the United States, where the worker is considered to be entitled to all he can earn. In fact, there are signs that in the Midland manufacturing districts of this country even American selling methods can be improved upon, and the following recent advertisement is quoted to show how a profitable new department may be added to an existing business, or an entirely new undertaking started without financial risk to the owner:—

> "High-class and thoroughly experienced Sales Organiser for new concern selling both to trade and public. Must be prepared to finance his own department, pay his own staff, and make business show a profit. Capital required, £ . . ."

It will be evident from this that our Midland industrialists have nothing to learn from America in selling methods, though one is left with a feeling of slight bewilderment why a modern salesman who is expected to possess the power to launch, sell, and make a profit upon a new product as well as the capital necessary for financing the undertaking should not also be assumed to possess sufficient business acumen to start the new business himself, and take over the profits as well as the risks of the venture.

Wireless Telegraph Communication.

A review of the present position of maritime safety services, commercial communication, and point-to-point telegraphy in view of the proposed modified requirements and regulations to be discussed at the forthcoming International Conference in the United States next Autumn.

By Lieut.-Col. CHETWODE CRAWLEY, M.I.E.E.

(*Continued from page* 594).

(II) Ships' Commercial Services.

THE International Radiotelegraph Convention of 1912 laid down regulations for dealing with ships' commercial services, as well as with the safety services which we have already considered. Safety and commercial services have developed extensively since 1912, the former because all but the smallest ships are now fitted with wireless telegraph plant, and the latter because, in addition, all the larger ships are now capable of working on continuous waves over great distances.

Spark Waves.—By the 1912 Convention all ships fitted had to be able to signal for commercial purposes on the 600-metre and the 300-metre spark waves, the former being used also for distress communications. In addition, an 1,800-metre wave was detailed for long-range working, but this wave has never been used to any great extent. It was intended that a good deal of traffic should be conducted on the 300-metre wave, but, except in the case of small ships, where owing to the smallness of the aerials available the 300-metre wave is suitable technically, it has never been used to any appreciable extent as with larger ships' aerials it is not so good for range; and besides, all ships and coast stations normally stand by on the 600-metre wave for distress purposes. As the 300-metre wave is now within the broadcasting band of all countries, it has been nearly universally abandoned as a ships' wave, and so far as this country is concerned a 220-metre wave is used instead for communicating with small ships, such as fishing vessels, &c., but compared with the rest of ships' traffic the work done on this 220-metre wave is negligible. In this country we are using an 800-metre spark wave to reduce the congestion on the 600-metre wave, but the 800-metre traffic, so far, is small. In other countries use is also being made of waves between 600 and 800 metres, but such waves tend to interfere with both the 600-metre and the 800-metre waves. Waves above 800 metres interfere with waves used for aircraft communication, and waves between 600 and 250 metres interfere with the broadcast services. The allocation of spark waves for ships' traffic, in addition to the 600-metre wave, will be an important question for consideration at the International Conference. In this country the 800-metre wave as an alternative to the 600-metre one is available at the stations at Lands End, North Foreland, Fishguard, Wick and Seaforth, and the 220-metre wave is available at the Humber station and will be employed at other stations in due course.

It is generally recognised that the real solution to the congestion on the 600-metre wave is to transfer the bulk of ships' traffic to continuous waves so as to leave the 600-metre wave free for safety signalling and, possibly, messages on the service of ships. This is a solution which will no doubt be brought about somewhat gradually owing to the expense of fitting continuous-wave sets in ships already fitted with spark sets, and the first step is likely to be the gradual supersession of spark sets by interrupted-continuous-wave sets which will pave the way for the use of continuous waves for traffic purposes.

About 65 per cent. of the traffic between ships and the shore in this country is conducted with the Post Office coast stations on spark waves, the remaining 35 per cent. being conducted on continuous waves with the Post Office station at Devizes. A very small amount of spark traffic is also conducted by the railway companies between their cross-Channel boats and their stations at Parkeston Quay, Heysham, Newhaven, and Folkestone Harbour, the two former using an 800-metre wave and the two latter a 700-metre wave.

Continuous Waves.—At present about 320 British ships, or 10 per cent. of those compulsorily fitted with wireless telegraphy, carry continuous-wave installations, and communicate with Devizes up to a range of about 1,500 miles. In addition, 50 per cent. of the British ships compulsorily equipped can receive continuous-wave signals, though they are not fitted with continuous-wave transmitters, and the number of these ships is rapidly increasing. These two classes of ships can receive messages from the Post Office station at Rugby, which broadcasts news and sends ordinary traffic to ships all over the world at scheduled times on an 18,740-metre wave.

The Devizes station transmits on 2,100 and 2,400-metre waves, and receives on 2,100, 2,300, and 2,600-metre waves. Devizes is operated from a station at Burnham-on-Sea, where the reception is carried out, and from which there is direct land-line connection with the General Post Office in London.

Trials have been carried out with high-speed signalling apparatus, but very few ships are fitted for high-speed operation, and, so far, hand working only is carried out here, though on the other side of the Atlantic the few ships which are fitted sometimes resort to high-speed operation when clearing large batches of telegrams.

The Burnham station is fitted with directional receiving aerials in order to reduce interference, and similar arrangements are now being made at such of our spark coast stations as are not already fitted.

Experiments in short continuous-wave communication between ships and the shore are being carried out here and in other countries, but no commercial services are yet in operation. The Devizes station is being fitted with a short-wave set. A new Post Office station to replace Devizes is being erected at Portishead. This station will also be equipped for short-wave, in addition to long-wave, working.

Continuous-wave services were not of course considered in the 1912 Convention, and the wave bands to be allocated to these services will be considered at the forthcoming Conference.

Charges.—The normal charge for radio-telegrams to and from Devizes, or to and from any of our 11 spark stations situated round the coast, is 11d. a word, made up of 6d. for the land station, 4d. for the ship, and 1d. for the inland telegraph service. There is also a special rate of 5½d. a word for Press telegrams. The normal

range of Devizes is about 1,500 miles, and that of the spark stations about 250 miles, much greater ranges are frequently obtained. Short-voyage ships, about 450 in number, are given reduced rates of 3½d. or 5½d. a word according to the service on which the ship is engaged. About 3,200 British ships, in addition of course to many foreign ships, make use of all these services for commercial traffic, and this traffic has just about doubled since 1920, when it was laid down that for safety purposes passenger ships and ships of 1,600 tons gross tonnage or over, registered in Great Britain, must be fitted with wireless telegraphy. About two-thirds of this traffic is conducted by the spark stations and one-third by Devizes on continuous waves.

Last year a broadcast service to ships twice daily was opened from the Rugby station at 1s. 6d. a word, including 4d. for the ship charge. This service is available for some 2,000 ships fitted with continuous-wave receivers in any part of the world; the ships cannot of course reply to Rugby direct, but can do so through coast stations abroad, whence the replies can be forwarded to this country by the ordinary telegraph and cable. Rugby also broadcasts Government news messages free of charge three times a day to ships and stations all over the world. Messages can also be sent by the ordinary telegraph route to coast stations abroad and thence by wireless to ships. Radiotelegrams for ships in plain language, code or cipher can be handed in at any postal telegraph office in the country.

The station must be specified in the address of telegrams for Rugby or for stations abroad or for short-voyage ships at the reduced rates. In other cases where the sender is not sure of the station the word "wireless" may be used on the message form in place of the station's name, and the appropriate station will then be selected by the Post Office.

It was laid down in the 1912 Convention that as a general rule a ship should call up the nearest coast station and indicate its position and the next port of call so as to facilitate the disposal of traffic. This however is not always done, so that our coast stations invariably endeavour to get into touch at once with any ships for which they have traffic. The 1912 Convention provides for the retention of a message at a coast station for a period of eight days, or advice of undelivery earlier if it is known that the ship has passed out of the station's radius of action. In practice it is very seldom necessary to retain a message for such a lengthy period, as the object aimed at is early disposal or alternatively early advice of non-delivery.

Operators.—The qualifications required by ships' operators were laid down in the 1912 Convention, and the classes of operators to be employed on the different classes of British ships were laid down in the Rules of the Merchant Shipping Act of 1920. Amendments in the qualifications and classification of operators will, no doubt, be discussed at the forthcoming Conference. There are some 4,000 operators on British ships and about 85 per cent. of these are in ships which carry only one operator. The large British passenger ships must carry at least three operators for safety purposes, but more are carried voluntarily in the great liners which deal with a considerable volume of wireless traffic. The position of operators on board British ships up to December last was somewhat anomalous, but has now been brought into line with that of the rest of the ships' officers. The rates of pay of operators with more than three years' service vary from £13 to £20 a month, according to the class and tonnage of the ship on which the operator is serving.

(To be continued.)

Illuminating Engineering Society, U.S.A.

The twenty-first annual convention of the Illuminating Engineering Society is to be held in Chicago from October 11th to 14th, inclusive, with headquarters at the Edgewater Beach Hotel.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Power Transformer Operation.

In your issue of the 15th inst. there is an article under the above heading dealing with transformer protection. The author, although he rightly recommends the earthing of the neutral on the l.p. side, gives fig. 2 as the correct diagram of connections for M.P. gear on a star-star transformer. The arrangement shown in that diagram will **not** balance on "straight-through" earth faults; as the current in such cases returns by the neutral on the l.p. side and by the other phases on the h.p. side (the neutral being insulated), it is obvious that balance cannot be obtained with star-star connected current transformers. The secondaries of the latter should, of course, be connected in delta; in fact, the standard rule for all M.P. circulating-current transformer protection is to have star-connected secondaries with delta transformer windings and *vice versa.*

Manchester, *April 20th*, 1927. **G. L. Porter.**

Cheap Electricity.

I duly noted your review of Messrs. Ruston & Hornsby's pamphlet entitled "Cheapest Electricity—How to obtain it," on page 605 of your issue of April 15th. This is, of course, a condensed version of a pamphlet by Mr. W. C. Mountain entitled "A Word in Favour of the Independent Power Plant." Mr. Mountain specialises in advising on small power plants—and hence is not quite as disinterested as the publishers would apparently wish one to think. When the original booklet first appeared, a marked copy was sent to me by one of the leading engineers of the country, who was highly amused at its speciousness. I have a high respect for the author and his honest belief in his own views, which are shared by others, as is indicated by several papers that have been read lately before various institutions and associations.

The object of this letter is not to attack any of these gentlemen, but rather to draw attention to the great difficulty there is in refuting the arguments put forward in favour of the small independent plant. I agree that there are bound to be special cases where the conditions are such that the small independent plant has advantages over the central undertaking, but they are very few. I may say that I have been an advocate for some years of plants of this nature, for use by power companies, as a temporary measure for the purpose of building up loads, until such a time as it is worth running a distribution line to a new district. Mr. C. Bell Walker has refined this idea, and full-automatic heavy-oil engines, three-phase, storage-battery plants operating at 50 cycles, 400/230 volts (*i.e.*, the same kind of current as the future central-station supply) are now available for the purpose. As a matter of fact, the advocates of small plants could make their case even better, if they made them automatic, as then much of the very costly attendance would be eliminated.

In this particular pamphlet (and also in the various papers that have appeared on the same subject) it will be noted that in no case are *all* the costs included. In other words, the acid test is that current could not be profitably supplied to another independent party at anything like the figures quoted. After all, taxes, rates, rent, repairs, and other out-of-pocket expenses have to be paid by someone. Then there is the question of the stand-by required to ensure uninterrupted service. The manufacturing business that only looks for 5 per cent. on its capital outlay cannot be considered to be in a healthy state. As a matter of fact, nearly every such business can make a far better return by investing all its available capital in its own line. The power cost is almost always but a trivial proportion of the whole of the manufacturing expenditure. Again, in busy times, there is a shortage of power. In slack times the overhead charges of the small power plant mount up excessively per unit generated. It is no use the factory owner persuading himself that his home-generated power is cheap, if a number of what should be generating charges are borne by the works generally. It is natural perhaps that the factory engineer should prefer to have his own generating plant. It is an added technical interest which he thinks also adds to his prestige (incidentally, it increases his worries). Truly, however, the time he expends on this plant could be far better employed in improving factory operations. The adoption of modern quick-costing systems in factories would do much to convince the owner on the point as to the best source of power. It is strange that the independent plant is getting a better run for its money in Great Britain than in almost any other country. Possibly this is largely due to the independent attitude of our race, which seems antagonistic to much co-operative work.

It would do a great deal of good to all branches of the electrical industry if an independent authoritative body such as the Electricity Commissioners could make arrangements to state what are fair rates for charging for current under various conditions in various localities, and so remove much distrust on the part of the user. The latter rarely appreciates that a public utility undertaking, from the very nature of its

business and the publicity to which it is exposed, can never make an extravagant profit. Hence, why should the factory owner extend into another business which cannot be described as lucrative?

I meet many electrical engineers who say that they consider the oil engine good enough for the farmer, and do not see the necessity or advisability of recommending electric motors for his purposes. Still, they would not invest much of their own capital in a company whose object it was to replace the electric motors of the city factory, by oil engines dotted all over the place.

There is much to be said for both sides, yet if factory owners put in their own generating plants, it is very advisable that they should generate the same form of current as the local electricity supply undertaking—as it facilitates getting extra power and, one day, that eventual change-over.

R. Borlase Matthews.

East Grinstead, *April 16th*, 1927.

Electric Water Heating.

Mr. Ross's article in your issue of April 22nd appears to bear out the contentions in my own contribution in that issue. Assuming that his curve is a good approximation, it is clear that there are three periods of peak, namely, from 7 to 9 in the morning, from 11 to 1 midday, and from 5 to 7 in the evening. If the water heater were automatically switched off at all these times it would not affect the maximum load; and with proper thermal storage it would not seriously affect the hot-water supply. Furthermore, if Mr. Ross's 2 kW were increased a little, so as to give a higher temperature in the tank (or, alternatively, if larger tanks were used) a geyser would surely be unnecessary.

J. W. Meares.

Guildford, *April 23rd*, 1927.

I am very interested in the subject of electric water heating, and was therefore glad to see the article by Mr. J. W. Meares in your current issue, although there are several things in it with which I must disagree.

For one thing, he rather underestimates the cost of a time switch, but as he has over-estimated the annual charge for a *good* time switch, the net result is about correct.

I know it is not unusual for the kick about first cost to be given to the time switch, but I cannot see why this should be. The water heater itself is very much more expensive, and these things really cannot be judged by size or we should expect to pay more for a dustbin than for a decent watch. The fact is that the annual charge for the time switch is less than that of any of the other items, and therefore it is the latter which offer the most scope for reductions.

If Mr. Meares's idea of using a meter element were carried out, I do not know that he would find it much cheaper by the time the necessary gearing and switch had been fitted to it, but the point that he overlooks, and I am afraid you also have overlooked in your footnote, is that any temporary stoppage of supply would put the motor out of operation and subsequently cause the switching on and off to be done at the wrong time; this quite bars that type of mechanism where work has to be performed at stated periods.

With the Warren clock, provided the supply station has installed the proper apparatus, it is possible to get correct average time over the 24 hours, but I can see no prospect of this under Mr. Meares's scheme, as the voltage and periodicity certainly do not average out in the course of a day.

I can answer his question as to whether this has been tried out; I know definitely of its having been tried in New York, and I seem to remember its having been tried out in England, but I cannot say where.

We must bear in mind that even a 1 per cent. error means practically 15 minutes in the course of a day.

I think before very long schemes will be started which will meet Mr. Meares's desires and in which the cost of a time switch will not be too serious.

I should like to ask Mr. Meares if he has not allowed for quite twice as much hot water as a small house would require.

Ernest E. Sharp.

London, *April 25th*, 1927.

The Salaries of Engineers.

Referring to your interesting article, "The Ordinary Engineer and his Remuneration," by P.B.E., his reference to the Society of Technical Engineers is not quite correct when he states that the declared object of the Society was to raise the status of the engineer. I distinctly remember the chairman of the first Executive Committee at a public meeting in Manchester saying that we must secure "our shares in the wealth of the industry to which we belong and which we have helped to build up." I feel sure this object enrolled more members than any other, and greater progress might have been made with the Society if the chairman had added: "And with our share in wealth we will undertake our share of the burden of responsibility of control, but we must have a voice in determining that responsibility."

My experience when enrolling members was that the average engineer was more interested in his salary than in his status.

April 23rd, 1927. **S. W. G.**

Electroculture.

We would be very much interested to hear if any of your readers have had experience in the culture of tomatoes by means of electricity. If there are any books available on this subject we would be glad to know where these can be obtained.

Paisley.

April 14th, 1927.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

British Industrialists to Visit America.

At the invitation of the Virginia State Chamber of Commerce a party of delegates representing the Federation of British Industries, Chambers of Commerce, and the Chamber of Shipping are sailing to-morrow (Saturday) for the United States. The principal object of the visit is the strengthening of direct trade relations between this country and the Middle-Western States.

Improvement in the Engineering Industry.

At the London conference of the Amalgamated Engineering Union held a few days ago, Mr. J. T. Brownlie, president, commented on the satisfactory reports on the condition of the industry which had been received. Orders of considerable aggregate value had been obtained, and the records of the Union showed a recent decrease in unemployment, the percentage falling from 12.8 in December last to 8.06 at the end of March. It is generally expected that the employers will make an offer representing an improvement upon the 2s. 6d. bonus, with modifications in the overtime and night-shift conditions.

G.E.C. Lighting in South Africa.

Several installations of G.E.C. lighting fittings and "Osram" lamps have recently been completed in South Africa. One of the principal instances is the new town hall at Boksburg. In Johannesburg the new Chamber of Mines building has been equipped with these fittings, and the new Prince's Cinema, Durban, has been similarly provided, almost exclusively, with G.E.C. equipment.

New Belgian Companies.

Under the auspices of the Société de l'Union Minière, a company is being formed in Brussels, with a capital of 60 million fr. and the title La Société des Produits Chimiques au Katanga, to establish works in the Belgian Congo for the electrolytic treatment of copper and the production of sulphuric acid.

La Société Belge-Polonaise de Force et de Traction Electriques is the name of a company which has been formed in Brussels with a capital of 26 million fr., to organise and finance electric power and traction undertakings in Poland.

New French Company.

A new company has been formed at Dax with a capital of 250,000 fr. and the title La Société d'Electricité des Landes, to establish electricity distribution undertakings in the Pyrenees.

Meter Approved.

The Electricity Commissioners have approved of the construction and pattern of the meter known as the Hookham 1907 type, d.c., 2-wire Ah meter, rated from and including 2.5 amps. to 150 amps.

The Anglo-Spanish Commercial Convention.

The *Board of Trade Journal* announces that a supplementary convention revising certain provisions of the Anglo-Spanish Commercial Treaty of 1922 came into force at midnight, April 23rd-24th. This applies reciprocal most-favoured-nation treatment to certain classes of goods which are scheduled. Special allowance is made for British coal, and among other things the 20 per cent. increase in the Spanish tariff imposed in July last year is removed in respect of some goods and reduced as regards others.

Unemployment.

The Employment Exchange returns dated April 11th gave the number of registered unemployed as 1,078,300. This represented an increase of 4,540 during the week, and was 53,910 more than on April 12th, 1926.

Harcourt Lighting Fittings.

We have received from METRO-VICK SUPPLIES, LTD., a series of photographs illustrating examples of installations employing "Harcourt" lighting fittings. They show that these types of fittings are suitable for all kinds of commercial applications



Harcourt Fittings at Barker's.

such as banks, offices, and stores. The one reproduced herewith is a view inside Messrs. John Barker's new building, in which a vast array of small articles is excellently illuminated.

Electric Power in Industry.

The eighth of the preliminary reports upon the 1924 Census of Industry was published as a supplement to the *Board of Trade Journal* dated April 21st; it deals with the paper-making, printing and allied trades. In the paper-making industry the amount of generating plant installed rose from 14,914 kW in 1907 to 32,075 kW in 1912, and 79,032 kW in 1924. The aggregate capacity of electric motors installed was 146,715 h.p. in 1924, as compared with 38,130 h.p. in 1912; power for 38,341 h.p. of the motors was purchased in 1924. The printing and bookbinding trades reported 6,593 kW of electrical generating plant, as against 7,645 kW in 1907. The installed motor-power aggregated 81,514 h.p., power for 70,593 h.p. of which was purchased. In the trades covering the printing and publication of newspapers and periodicals 3,911 kW of generating plant was in use in 1924, as against 2,220 kW in 1907. Electric motors with a total capacity of 56,337 h.p. were installed, power for 55,724 h.p. of which was purchased.

Czecho-Slovakian Tariff Reductions.

Under the recently-signed Commercial Treaty between Czecho-Slovakia and France, which comes into force 15 days after ratification, the duties upon several classes of goods upon importation into Czecho-Slovakia are reduced. As Great Britain is on a "most-favoured-nation" basis with Czecho-Slovakia, the reductions apply equally to goods from this country. The classes affected include steam turbines, electric generators, motors, telephone and telegraph apparatus, electrical measuring apparatus, ignition apparatus, and other, unspecified, electrical goods (except mounted carbon brushes, cooking and heating apparatus, and dry batteries). A full list of the classes involved, with the reduced rates of duty, appears in the *Board of Trade Journal* dated April 21st.

Local Exhibitions.

HAMMERSMITH.—The Electricity Department of the Hammersmith Borough Council has arranged a special electrical display to form part of the exhibition at the Town Hall in connection with the Health Week campaign, which commences on May 8th. The General Electric Co., Ltd., has arranged to erect two stands on which a complete range of "Magnet" household electric appliances will be shown. There are to be frequent demonstrations with such appliances of electric cooking, washing, &c.

CLITHEROE.—The Electricity Committee is arranging an exhibition of electrical apparatus at the Castle, and representatives of neighbouring local authorities have been invited to attend.

MANCHESTER.—At the Better Housing and Housekeeping Exhibition organised by the *Daily Dispatch* at the City Hall, Manchester, an "all-electric" house has been completed adjoining the Main Hall. The electrical installation has been carried out by Messrs. E. O. Walker & Co., Manchester, and the furnishings by Messrs. Waring & Gillow. Vacuum cleaners are exhibited by the C.C.A. (Vacuum Cleaners), Ltd.; the Gem Labour-Saving Device Co., Ltd.; Hoover, Ltd.; Vac-tric, Ltd.; and Thorwash, Ltd. The last company also exhibits electric washers and wringers. Electrolux, Ltd., shows its cleaner and refrigerator, and Frigidaire, Ltd., displays its automatic electric refrigerator. The exhibition will remain open for one month.

MORECAMBE.—An "all-electric" bungalow is a feature of a Spring Trades Exhibition, opened at the Winter Gardens, Morecambe, on April 27th, and which continues until May 4th, under the auspices of the Morecambe Chamber of Trade. Mr. Francis, of the British Electrical Development Association, is giving lectures on the domestic uses of electricity.

Recent Contracts.

The ENGLISH ELECTRIC CO., LTD., has received an order from the Measham Collieries, Ltd., for an electric winder for the Minorca Pit. The winding motor, which is of the 3-phase induction type, will drive the drums through single-reduction, treble-helical gearing, the motor output being 160/325 b.h.p. at 363 r.p.m. Power is being obtained from the Warwickshire and Leicestershire Power Company at 11,000 V, and a transformer with the necessary h.p. switchgear is being installed. The winder will be designed to deal with an output of 122 tons per hour from a depth of 540 ft., the net weight per lift being 48 cwt. Normally, however, coal will be drawn from the 270 ft. level and, in view of there being two working levels, it has been decided to install a double drum winder, one drum being fixed to the shaft, and the other loose, but fitted with a multi-tooth clutch, so that the rope can be adjusted easily and quickly to permit winding from either level. The mechanical parts are being supplied by Messrs. Fullerton, Hodgart & Barclay, Ltd. In addition to the winder a 250-kW motor-generator set has also been ordered from the English Electric Co., together with the necessary a.c. and d.c. switchgear, to provide an alternative source of d.c. power for the plant at Measham Colliery, which at present is being supplied from the colliery power station.

We learn that within the last few days the ELECTRIC FURNACE CO., LTD., has received orders for six Ajax-Wyatt brass melting furnaces, each of 600-lb. capacity, for a French firm, and also a 100-kW resistance furnace for annealing aluminium sheet in Scotland.

Chinese Electrical Imports.

Commerce Reports states that certain sections of China appear to be much alive to the advantages accruing from the use of electrical power. Not only were electric railroads and electric lighting facilities extended during the first nine months of 1926, but considerable business was transacted in motor-driven machinery for buildings and for grinding cereals. As a result, China's imports of electrical equipment, including general supplies and telegraph, telephone, and power-station materials, advanced 17 per cent., while imports of machinery were reduced about 2.5 per cent. During the period January-September, 1926, electrical materials and equipment to the value of 9,044,502 taels was imported through 45 maritime Customs ports, as compared with 7,731,728 taels in the corresponding period of 1925. The Haikwan tael averaged 3s. 6d. in 1925 and 3s. 2d. in 1926.

British Goods in South America.

Speaking at the recent annual meeting of the British Bank of South America, Mr. F. R. S. Balfour said that while there existed in South America a distinct preference for British goods, even at higher prices, there were several factors operating to the detriment of British export trade. One of those was the tendency for the trade to develop between a borrowing nation and the centre affording accommodation. That had happened between the United States and South America, in spite of the former country's tariffs, which had acted in her favour. Again, confidence in British manufacturers was being undermined by the continual industrial disturbances in this country; there was uncertainty regarding delivery. Our prices and freight charges were too high, and placed us at a considerable disadvantage in respect of our competitors. Local manufacturers also had to be contended with. If our connection with South America was to be maintained, the needs of the market must be thoroughly studied by reliable representatives, and suitable, effective propaganda must be pursued.

For Sale.

The County Mental Hospital, Rainhill, Lancashire, has for disposal one 115-kW, 230-V steam-driven, direct-coupled d.c. generating set. Crittall Manufacturing Co., Ltd., has for disposal two Garrett direct-coupled generating sets, condensers and auxiliaries. (See our advertisement pages to-day.)

Trade Announcements.

The Nantwich Electrical Co. has opened premises at 4, Church Lane, Nantwich.

A new company has been formed with the title Canadian Porcelain Co. (British), Ltd.—its registration is detailed in our "New Companies" column this week—to act as exclusive representative here of the Canadian Porcelain Co., Ltd., of Hamilton, Canada, muanufacturers of extra-high-pressure insulators, transmission line equipment, &c. Its office is at 343, Abbey House, Victoria Street, London, S.W.1, and the branch will be in charge of Mr. Geo. M. Duncan, manager of sales for the Canadian Co. and managing director of the new company, and of Mr. Chas. A. Burnier, secretary and sales engineer of the new company.

Messrs. Weight & Bradley, wireless engineers, have opened premises at 14, Cross Street, Reading.

A company known as Lectro Linx, Ltd., has been formed with offices at 1, 2 & 3, Ashley Mansions, Vauxhall Bridge Road, S.W.1, to undertake the exploitation of the "Clix" specialities. Notice of registration appears in our "Financial Section" to-day.

Mr. W. E. Beaver has commenced business as an electrical engineer at 176, Park Road, Peterborough.

The General Radio Co., Ltd., has purchased Radiobats, Ltd., and has thus secured control of an English high-tension radio battery factory producing 7,500 cells per week.

Messrs. Poynter, Griffiths & Co., Ltd., of the Maxim Lamp Works, have increased their capital. Sir James W. Paton, J.P., of Paton, Calvert & Co., Ltd., Liverpool, and Mr. John Baird Walker, of the Fine Cotton Spinners' & Doublers' Association, Ltd., have joined the board—which now consists of these gentlemen, Mr. Thos. Crosby (chairman), Mr. T. H. Griffiths and Mr. J. F. Poynter (managing). The registered offices remain at Canonbury Road, N.1.

Mr. A. W. Saulter has granted a sole licence to Messrs. Hugh Stevenson & Co., Ltd., Manchester, for the manufacture of his patent coiling device.

New Catalogues and Lists.

Power Contracts, Ltd., 138-140, Southwark Street, S.E.1.—An illustrated folder advertising "Batwin" electric motors for many purposes.

The Yorkshire Electric Transformer Co., Ltd., Dewsbury.—A leaflet illustrating an example of the company's pole-type transformers for rural distribution.

Messrs. William Geipel & Co., Vulcan Works, St. Thomas Street, S.E.1.—Two leaflets, describing Ward Leonard "Vitrohm" resistors, for which the company is sole agent for the United Kingdom and the British Colonies, and Ward Leonard theatre-lighting dimmers.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—The "Osram-G.E.C. Bulletin" for April, containing illumination notes, descriptions of "Magnet" domestic appliances, and articles upon "Osram" valves and radio apparatus.

The Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, E.15.—A purse folder containing an attractive pamphlet giving prices and details of "Hart" radio batteries.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.—A photogravure poster (20 in. by 30 in.) illustrating and advertising in a pleasing manner "Exide" high- and low-tension wireless batteries.

Societe des Etablissements A. Foucher, 62, Boulevard Jourdan, Paris, XIVe.—A booklet containing illustrations of machine tools for the book-making and box-making industries.

Messrs. Houghton-Butcher (Great Britain), Ltd., 88-89, High Holborn, W.C.1.—"Houghton's Radio News" for April, containing illustrated descriptions of radio apparatus and accessories and articles on various phases of the radio business.

The Fuller Accumulator Co. (1926), Ltd., Chadwell Heath, Essex.—A showcard, in colours (18 in. by 12 in.) depicting "Fuller" batteries as "The Power Behind the Valve."

The British B.A.G., Ltd., 23, Farringdon Avenue, E.C.4.—Two illustrated and priced catalogues dealing with lighting, heating, and cooking appliances, &c., and a folder advertising the "Lomax" lampholder.

Messrs. Watson & Sons (Electro-Medical), Ltd., Sunic House, Parker Street, Kingsway, W.C.2.—Bulletin No. 81, dealing with the new "Sunic" flat Potter-Bucky diaphragm.

The Drayton Regulator & Instrument Co., Ltd., West Drayton, Middlesex.—An illustrated leaflet describing the "Drayton" pressure recorder.

Ransome & Marles Bearing Co., Ltd., Newark-on-Trent.—A comprehensive catalogue of the company's roller and ball bearings for all purposes. The list is illustrated and priced, and provided with a thumb index to the various sections.

The Atlas Diesel Co., Ltd., 35, Surrey Street, Strand, London, W.C.2.—A well-illustrated booklet describing the company's air compressors and pneumatic tools.

Messrs. A. F. Bulgin & Co., 9-11, Cursitor Street, Chancery Lane, E.C.4.—List 111, illustrating various "Competa" radio products; list 112, "Competa" measuring instruments; lists 114 and 115, "Deckorem" radio products; and list T.2, illustrating "Taka" radio terminals. The whole are contained in a convenient folder carrying the company's name and address, &c.

The Walker Electrical Service, Annandale Street, Edinburgh.—A folding card advertising the firm's repairing and overhauling business.

Higgs Motors, Witton, Birmingham.—A comprehensive catalogue of the firm's industrial a.c. and d.c. motors, containing full specifications, details and prices, as well as particulars of control gear.

The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.1.—A coloured poster (38 in. by 29 in.) setting out in minute detail the arrangement and wiring of the K-1 three-valve receiving set operating direct from a.c. mains.

Messrs. S. Davis & Co., Aldwych House, Aldwych, W.C.2.—A brochure illustrating many examples of the firm's publicity work in widely-differing fields.

Bankruptcy Proceedings.

T. F. Collier, Union Street West, Oldham, electrician.—The public examination of this debtor was held recently at the Court House, Oldham. The statement of affairs showed liabilities of £77, and there were no assets. Debtor stated that in February, 1919, he commenced business as an electrical engineer at Olive Street, Werneth, with £500 left by his father. He was successful at first, but later there was a decline in trade owing to general depression. In August, 1922, he sold the business to a limited company for 430 £1 fully-paid shares. These debtor later sold to his mother for 10s. a share in consideration of a loan of £500 received in 1921. In July, 1926, debtor started as an electrical engineer again, but owing to lack of capital was not successful, and in January last his trade effects were realised under an execution. The examination was adjourned.

W. J. Broome (Stockport Electrical Co.), electrical engineer, Garrick Place, Daw Bank, Stockport.—First meeting to be held to-day (Friday), at the Official Receiver's offices, Manchester; public examination, May 3rd, at the Court House, Stockport.

H. Busfield and J. J. Whittaker (Busfield & Co.), electrical engineers, 6, Wilfield Street, and 215, Padiham Road, Burnley.—Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Square, Preston, released April 6th.

Company Liquidations.

Service Radio Co., Ltd., 67, Church Street, Stoke Newington, N.16.—A meeting of creditors was held on April 19th at the Institute of Chartered Accountants, E.C., when the chair was occupied by the liquidator, Mr. I. Levy, 27, Chancery Lane, W.C. The statement of affairs presented disclosed liabilities of £1,409, of which £1,320 was due to the trade, and assets of £308, leaving a deficiency of £1,101. The liquidator reported that the company was registered on February 15th, 1924, with a nominal capital of £1,000, to carry on the business of manufacturers of wireless components and parts. The subscribed capital was £150, fifty £1 shares being held by Mr. W. Grossman and 100 £1 shares by Mrs. L. Grossman, his sister-in-law. The management of the business had been under the control of Mr. Grossman. For the 17 months to July 31st, 1925, there was a net profit of £89. The turnover for that period was £14,645, on which there was a gross profit of approximately 20 per cent. For the 12 months to July 31st, 1926, there was a turnover of £4,331 and a loss of £74. In that period £1,012 was spent on advertising. Accounts for the eight months to March 31st, 1927, showed a turnover of £2,532 and a loss of £529. Endeavours had been made to obtain fresh capital without success; creditors began to press, and it was decided to go into voluntary liquidation. One creditor had levied execution, and over £100 worth of stock had been sold to satisfy the claim. A resolution was passed providing that application should be made to the Court for the appointment of Mr. W. A. J. Osborne, of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C., as liquidator in the place of Mr. Levy. The following are creditors:—

	£		£
Albion Mfg. Co. ...	69	Igranic Electric Co., Ltd.	43
Birkbys, Ltd.	27	Jewel Pen Co.	75
Benjamin Electric, Ltd.	79	Odham's Press	47
Clackson, A. H., Ltd. ...	186	Petruskin, —	49
Chloride Electrical Storage Co., Ltd.	166	Radio Communication Co., Ltd.	20
Climax Radio Co. ...	27	Recorder Press	41
Clayton Rubber Co. ...	21	Robertson, —	20
Graham, Enoch, Mfg. Co.	34	Trauberman, —	79
Grossman, L.	44	Telegraph Condenser Co., Ltd.	99
Grossman, W.	45	*Wireless Trader* ...	100
Thorpe & Butcher ...	29		

Sherborne Trust, Ltd., 65, London Wall, E.C.—Under the compulsory liquidation of this company Mr. G. Digby Penys, Official Receiver and Liquidator, reports that it was formed in June, 1926, with a nominal capital of £2,500, and entered

into various underwriting contracts for shares and debentures, some of which it was unable to fulfil. The promoters were Messrs. Frederick Seyffert and J. A. H. Chaproniere. In respect of one sub-underwriting contract for £100,000 debenture stock of the Perak River Hydro-Electric Co., Ltd., the company had to take up and was allotted £7,800 of the stock. A cheque for the application money of £500 is stated to have been given by Mr. Chaproniere, but was dishonoured, and the amount had to be paid by the underwriters. The company received £250 and 500 ordinary shares of £1 each in the Perak River Hydro-Electric Co., Ltd., as commission. The underwriters obtained judgment against the company for the £500 paid by them, and obtained a charging order absolute on the debenture stock and the 500 ordinary shares. The company was unable to carry out its contract. The allotment was cancelled and the £500 paid by the underwriters forfeited. The accounts filed under the liquidation show liabilities £2,249, against assets £7; whilst the only issued capital of the company are two signatories' shares, which do not appear to have been paid for.

Deed of Arrangement.

MRS. NINA RAYNER, trading as D. D. Rayner & Co., electrical engineers, 26a, Curzon Street, Derby.—The trustee, Mr. J. M. Sibbald, 21, Corn Market Derby, reports that the winding-up of the business has been delayed by a disputed account. A statement shows a balance of £95, and it is said that as soon as the account mentioned is settled, the surety will be called upon for the balance due in order to make up the composition of 6s. 8d. in the £.

Dissolution of Partnership.

FALGATE ELECTRICAL CO., 9, Merchants' Place, Reading.—Messrs. A. E. Falgate and A. S. Sayer have dissolved partnership. Mr. Sayer will continue the business at the old address. Mr. Falgate will carry on business at 21a, King's Road.

Employment During March.

The April *Ministry of Labour Gazette* states that while employment in a number of important industries remained bad during March, there was, nevertheless, a pronounced improvement in industry generally. There was a further, almost general, improvement in the engineering industry, and the overall percentage of unemployed fell from 11.6 in February to 10.3 in March. The unemployment percentage of the electrical engineering branch fell from 6.5 to 6.2. In the electric cable, wire and lamp manufacturing group the proportion of unemployed remained at 8.6 per cent, but there was a fall in the case of the electrical wiring and contracting industry from 8.9 to 7.9 per cent. The actual numbers of unemployed at March 21st were as follows:—Total, 1,187,782; engineering (including electrical), 103,262; electrical engineering, 4,790; electrical wiring and contracting, 1,093; and cable, wire and lamp manufacturing, 7,567.

Irish Free State Wireless Duty.

In the course of his recent Budget statement in Dail Eireann, Mr. E. Blythe, Minister for Finance, said that the import duty on wireless apparatus was calculated to produce £20,000 during the financial year 1926-27, and the actual yield had been just over £19,000 in that period. The policy of the Government was to expend on additional stations and provide better programmes, all the revenue got out of broadcasting, whether in the way of Customs duties, licence fees, or fines recovered from defaulters.

Scientific Production.

The *Financial Times* quotes the following statement by Mr. J. C. Goff at last week's annual meeting of Crosse & Blackwell, Ltd., upon the subject of the installation of up-to-date efficient plant:—"We now work 47 hours per week. On the same turnover, with the introduction of modern machinery and scientific methods, we are getting more goods made, we are paying better wages, we are getting shorter hours, and we are earning bigger profits."

Australian Wireless Litigation.

The Melbourne *Age* reports that recently the action of the Amalgamated Wireless (Australasia), Ltd., Sydney, and the Associated Radio Co., of Australia, Ltd., Melbourne, was before the Chief Justice in the Practice Court on an application for a stay of proceedings in the action pending appeal to the State Full Court. The action relates to an agreement under which the Amalgamated Wireless granted a licence to the Associated Co. to use certain patents, in return for which the latter company agreed to pay 25 per cent. of its revenue as a broadcasting authority, with a minimum of 10s. per subscriber. At the date of the agreement the regulations provided for the broadcasting company to charge a fee to all listeners-in, but later this arrangement was replaced by a State licensing system whereby part of the receipts were paid to the company by the Government. The defendant company thereupon contended that the agreement terminated as the basis was destroyed, but Mr. Justice McFarlan gave judgment for the plaintiff company for £5,502. Counsel for the latter offered to repay the money within 48 hours if Mr. Justice McFarlan's decision was set aside. This undertaking was accepted, and the application was dismissed.

Book Notices.

"Principes de L'Electro-Chimie," by J. Ponsinet. Pp. 211. Paris: Armand Colin. Price 9 fr.

"Electrical Horology," by H. R. Langman and A. Ball. Pp. xi+170; figs. 68. London: Crosby, Lockwood & Son. Price 7s. 6d. net.

"The *Electrician* Annual Tables of Electricity Undertakings for 1927." London: Ernest Benn, Ltd. Price 10s. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVI, No. 4. April, 1927. New York: The Institute. Price $1.

"*Journal* of the Institution of Electrical Engineers." Vol. LXV. April, 1927. No. 364. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

Scientific Papers of the U.S.A. Bureau of Standards. Vol. 21, No. 546, "Magnetic Reluctivity Relationship." (5 cents.)

"Carbon Brushes and Brush Shunts. Simplified Practice Recommendation." No. 56. Issued by the U.S.A. Bureau of Standards. (5 cents.)

American Exports to New Zealand.

In a recent article upon the New Zealand electrical market, *Commerce Reports* shows that United States electrical goods to the value of $1,404,363 were imported into the Dominion during 1925. The chief item was storage batteries ($171,042), while other notable classes were domestic heating and cooking devices ($130,431), electro-medical apparatus ($98,265), flashlight batteries ($72,420), and switches and circuit breakers over 10 A ($70,394). Our contemporary claims that for sizes up to 5 h.p. American motors predominate.

The Department of Overseas Trade.

The following resolution was to be moved on behalf of the Executive Council at the annual meeting in London this week of the Association of British Chambers of Commerce:—

"The Association of British Chambers of Commerce regards with dismay the proposal of His Majesty's Government to discontinue as a separate department the Department of Overseas Trade. The Association is of opinion that the department has proved itself to be of great value in the assistance which it has rendered to the overseas trade of the country, and that so far from its discontinuance as a separate department being likely to benefit the finances of the country, such a change will tend to retard the extension of our commerce overseas, and the loss to the Treasury will cancel any saving in expenditure. The Association believes, moreover, that only a small part of the expenditure of £328,000 a year will be saved because many of the functions performed by the department are pre-war duties which were previously undertaken by the Board of Trade or the Foreign Office, and must be continued and paid for. The Association therefore urges His Majesty's Government to allow the work of the department in the furtherance of British trade to continue separately on its present lines, and to be extended."

New Artificial Silk Company.

The position with regard to the contract openings of Scottish Artificial Silks, Ltd., has been somewhat clarified by the registration of the company with a capital of £250,000 and offices at 145, St. Vincent Street, Glasgow. The company is to erect a weaving factory at Kirkcudbright, in the old Galloway motor works, and a yarn-producing plant at Hyde, in the old Providence Mill. Negotiations are almost completed for the purchase of the old Argyll Motor Works at Alexandria, near Dumbarton.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, April 26th:—Copper (electrolytic) bars, £62 5s., 15s. dec.; ditto ditto sheets, no change; ditto ditto wire rods, £72 5s., 15s. dec.; ditto ditto h.c. wire, 9¼d., ¼d. dec.; Silicium bronze wire, 10¼d., ¼d. dec.

Messrs. James & Shakespeare report, April 26th:—No change in the prices of copper bars (best selected), sheet and rod; English pig lead, £27 5s., 20s. dec.

Messrs. Edward Till & Co. report, April 26th:—No change in the price of India-rubber, Para fine.

Messrs. C. Clifford & Son report, April 26th:—Babbitt's metal and anti-friction metal, Grade I, £258, £14 dec.; Grade II, £180, £9 dec.; Grade III. £94, £3 dec.

Messrs. James Forster & Co., in their letter dated April 23rd, state:—"Closing prices yesterday were £26 1s. 3d. for April, and £26 10s. for July. . . . Before the Easter holidays consumers showed some interest, and purchases were made by cable makers and the home trade. This week demand has been very quiet, which is not surprising in view of the fresh fall in prices. . . . The future is obscure, but there are certainly more grounds for optimism than pessimism. The position on the Continent is improving, while in this country, the reduction in the Bank rate is bound to stimulate industry and increase demand. Moreover, the metal is getting to a figure which may result in trouble in the mines, particularly in Australia, and thereby hamper production. The Board of Trade returns for March show imports of 22,504 tons and exports of 1,317 tons, leaving 21,187 tons for home absorption."

Lighting and Power Notes.

Bangor.—Loans.—The Town Council is applying for sanction to borrow £1,000 for transformers and switchgear, £1,000 for meters, and £6,000 for mains and services.

Barking.—Loans Sanctioned.—The Electricity Committee has received sanction to the borrowing of £4,000 for buildings, £4,000 for mains, and £3,280 for plant.

Barnsley.—Change-over.—The borough electrical engineer has submitted a report to the Electricity Committee upon the necessity of a further change-over from d.c. to a.c. in certain areas in order to meet the winter load of 1927, and also the provision of a sub-station and a ring h.p. main between Harboro' Hill Road and Hall Baulk Lane, at a total estimated cost of £5,336. Application is to be made for sanction to a loan for this purpose.

Birkenhead.—Electrical Development.—That the Corporation electricity showrooms have well justified their expense is demonstrated by statistics which have just become available. During the past year, since the opening of the showroom, the following increases in the use of electrical devices have been registered:—Cooking appliances, 285 per cent.; electric fires, 86 per cent.; other domestic appliances, 75 per cent. The value of apparatus sold by the showrooms was £5,700. During the year ending March 31st last 2,820,000 kWh was sold for domestic consumption, an increase of 112 per cent. The showrooms are to be extended.

Bridge of Allan.—Electricity Supply.—In the event of the Electricity Commissioners sanctioning the transfer of the Town Council's Special Order to the Scottish Midland Electricity Supply, Ltd., the company is prepared to undertake the laying of an underground distribution network in the burgh at an estimated cost of £4,500. Pending the transfer of the Order the company will act as the duly authorised agents of the Council.

Buckingham.—Electricity Supply.—The Town Council and the Rural District Council have consented to an application by the Northampton Electric Light and Power Co., Ltd., to extend its area of electricity supply to include the borough and rural area. Underground mains will be laid in certain streets in the borough, and overhead cables erected in the rural area, and the maximum prices will be 10d. per kWh in the borough and 1s. in the rural district.

Canada.—Electrical Development.—The Dominion Water Power and Reclamation Service of the Department of the Interior of Canada has recently issued the annual review of the water-power resources of Canada, developed and undeveloped, as at March 1st, 1927, according to the most recent information available. This bulletin includes sections dealing with current progress and development, the use of water-power in the central electricity stations and for the pulp and paper and other leading industries, the coal equivalent of developed water-power, and estimates of the developed and undeveloped water-power in each province. By the end of the year 1926 Canada's hydro-electric installation reached a total of 4,556,266 h.p., of which 265,838 h.p. was installed during that year. While the addition for 1926 was substantial, it falls far short of indicating actual constructional activities, as projects under way, a number of which are nearing completion, will ultimately add to the Dominion's total more than 1,700,000 h.p., while others in active prospect indicate a further addition of 1,000,000 h.p. The capital investment due to these developments under construction and in prospect is estimated at approximately $270,000,000, regardless of the extra capital required in the application of their power output.

Clayton (Yorks.).—Loan.—The Urban District Council is applying for sanction to the borrowing of £7,000 for mains, &c.

Supervising Engineer Appointed.—Alderman J. W. Longley, deputy chairman of the Bradford Corporation Electricity Committee, was consulting engineer to the Urban District Council during the negotiations which recently resulted in the Council securing an Order to supply electricity in the district, and has now accepted the position of supervising engineer in connection with the laying of cables and services. It is expected that an electricity supply will be available next winter.

Continental.—Portugal.—A new company called the Confederacao Hidrografica do Douro, a subsidiary of the Espano-Portuguesa de Transportes Electricos, has been formed for the purpose of utilising the waters of the Douro for industrial and irrigation purposes. By the use of turbines the river is expected to yield a total of 800,000 h.p.—*Reuter* (Lisbon).

Belgium.—The Société d'Electricité de l'Escaut, Antwerp, in its report for last year, states that the number of consumers increased from 24,147 to 30,800, while the sale of power advanced by 16 per cent. At the Merxem power station three new boilers and two additional 12,500-kW turbo-generator sets were installed and put in operation. A 50,000-V transmission line was also completed to supply power to the northern and eastern portions of the province of Antwerp, and the line is now being extended in order to link up the Merxem power station with one at Moll-Donck which is being erected by the Société d'Electricité de la Campine.

Italy.—As a result of the difference in the conditions between the water supply for the hydro-electric power stations in the Alps and in the Appennines, it has been found desirable to connect the plants in the two areas by means of h.p. transmission lines so that in times of low output and high demand one can supply the other. A 130,000-V line has recently been erected by the Società Interregionale Cisalpina to connect the plants of the Società Edison in the Southern Alps with the stations of the Società Emiliana d'Esercizi ed Idroelettrica in the Northern Appennines. The line is about 94 miles in length, and extends from a transformer station at Brughiero, near Milan, to Reggio Emilia. The Società Edison has two stations, one at Paderno, with an annual output of 300 million kWh, and the other at Oresca capable of an output of 200 million kWh per year. The Società Emiliana has plants in operation and in course of construction with a capacity of 133,000 kW. The Brughiero transformer station will later be connected to new plants with a total capacity of 275,000 kW, which the Società Cisalpina is erecting on the Livo at Chiavenna and on the Mera near Sondrio.

Switzerland.—Application has recently been made for a concession to establish a plant near Klingnau to utilise the water power of the lower falls on the Beznau-Koblenz, where it is estimated that from 18,000 to 30,000 h.p. is available. The power produced would be "exported" to Wurtemburg, but if the concession is granted a Swiss company is to be formed to exploit it.

Croydon.—New Cables.—The Corporation Electricity Committee is to replace cables from Crown Hill and Gloucester Road to the power house, at a cost of £1,900.

Douglas (I. of M.).—Loan.—The Electricity Committee is applying for sanction to the borrowing of £11,000 for mains, services, meters, cookers, &c.

Farnham.—Electricity Charges.—The Electricity Charges Committee of the Urban District Council reports that in May last the Council approached the Farnham Gas and Electricity Co. with a request for the voluntary reduction of the present lighting charges from 10d. to 6d. per kWh, and for a reduction in power charges, upon the ground that the company was now purchasing its supply in bulk from the War Department. The consideration of this request has been held in abeyance until the completion of the company's accounts for the year 1926. The Committee has had an interview with representatives of the company, who have intimated that it is not prepared at the present time to make any reduction. The Committee is of opinion that application should be made to the appropriate Government department for an Order reducing the maximum prices, in the hope that the Department will hold an inquiry into the circumstances of the case.

Grantown-on-Spey.—Electricity Supply.—The town has been supplied with electricity since 1912, under an agreement with a local contractor, and the Council has now decided to renew the agreement, which was due to expire this year, as an alternative to purchasing the undertaking. The new agreement is made subject to the contractor installing additional plant and modifying and extending the distribution system to meet the demands of the burgh. Mr. Frank Anslow, M.I.E.E., of Messrs. Walter Dixon & Co., Glasgow, who has been advising the Council in its negotiations with the contractor, has been retained for a period of three years to supervise the installation on its behalf.

Gravesend.—Loan Sanction.—The Corporation Electricity Committee has received sanction to a loan of £20,000 for mains and services.

Grimsby.—Loan.—The Corporation Electricity Committee is applying for sanction to the borrowing of £20,000 for mains and services.

Halifax-Huddersfield.—Interconnecting Scheme.—Speaking at Halifax Rotary Club, on April 20th, Alderman Thos. Hey, chairman of the Tramways and Electricity Committee, stated that the linking between the Halifax and Huddersfield Corporation electricity undertakings was now complete and had already been working. From midnight on the Saturday preceding Easter to the morning of Wednesday following Easter the Halifax station had been supplying the whole of Huddersfield, as well as Halifax, whilst much-needed repairs were undertaken at Huddersfield station. The repairs at Huddersfield not being yet completed, the Halifax station was still supplying Huddersfield with 2,000 kW to complete the Huddersfield load.

Harrogate.—Electricity Agreements.—The Council has ratified agreements for the purchase of the Knaresborough electricity undertaking and a bulk supply of electricity to Ripon.

Hastings.—Electricity Extensions.—The Town Council is commencing forthwith the laying of mains and the erection of overhead cables for a supply of electricity to Rye, Battle, and to places in the rural districts of Hastings, Rye, Battle, and Hailsham. The estimated cost of the work is over £70,000, and the proposed charges are 8d. per kWh for lighting and 1½d. per kWh for power.

Hull.—Electricity in Bulk.—Provided sanction is obtained from the Electricity Commissioners, the Corporation will supply electricity in bulk to Driffield. According to the *Manchester Guardian*, in a letter from the Driffield Urban

Council it was suggested that future extensions of the electricity undertaking might link up outlying districts between Hull and Bridlington so that intervening local authorities might take supplies in bulk for local consumption. The Corporation has already decided to seek sanction for an extension of its supply to Beverley at the request of the latter town.

London.—Islington.—The Electricity Committee is applying for sanction to the following loans:—Meters, £8,000; transformers, £20,000; mains, £27,000; services, £17,000. The Committee proposes to proceed with the erection of cooling towers at the power station at a cost of £33,000.

Milton (Hants.).—Electricity Supply.—At a recent meeting of the Urban District Council it was reported that a meeting with the representative of the Milton and Barton-on-Sea Electricity Supply Co. had been held, who pointed out that if underground cables were laid the cost of electricity would be 2d. per kWh more than if overhead cables were erected. It was suggested that there should be no overhead lines from the railway station to the corner of Barton Court Road and Avenue and the Marine Drives. After some discussion it was decided to approve the suggestion, and the overhead system of wiring, subject to certain safeguards, was agreed to.

Newport (I. of W.).—New Cables.—The Town Council has given permission to the Isle of Wight Electric Light and Power Co. for the laying of armoured service cables under the bed of the river Medina, in Hillside Road, and along the railway line from Newport to Cowes. The borough surveyor states that the railway line cable will be placed on concrete posts about 4 feet high.

Northern Ireland.—Portadown (Co. Armagh).—The Urban District Council has passed plans for the reconstruction of the local company's power station, which was recently destroyed by fire.

Palestine.—The Rutenberg Concession.—According to a correspondent at Jerusalem, the concession granted to the Palestine Electric Corporation (the "Rutenberg" concession) for the electrification of Palestine and the irrigation of the country has now been put into force by an order of the Government of Palestine. With regard to the extension of the scheme to Transjordania, there is still some opposition. Another scheme concerns the utilisation of water power for purposes of electrification in Southern Lebanon. A commission, under the presidency of the Minister of Public Works, has been appointed to examine the question of the use of the power of the Nahrel Awali, the preliminary works being still in an initial stage.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Whitehaven.—Lighting, heating and power: A reduction of ¼d. per kWh.

Luton.—The increase of 66⅔ per cent. made owing to the coal dispute has been removed.

Radcliffe.—The temporary increase due to the coal strike has been withdrawn.

South Africa.—Bloemfontein (O.F.S.).—The new power station was formally inaugurated by the Administrator of the Orange Free State on March 24th. The erection of the station was commenced in March, 1925, and has cost £180,000. The plant includes two 3,000-kW sets, and the work was carried out by Messrs. Clarke & Partner, of Johannesburg.

South-East Lancashire Electricity Advisory Board.—The Board has decided that a committee be appointed to consider various methods by which some measure of district control could be secured, either by means of the delegation of powers by the Central Electricity Board, or otherwise, with a view to reporting when the scheme for this district is formulated by the Central Board as to any change which might then be possible or desirable in the organisation of the district.

Southend-on-Sea.—New Cable.—The Electricity Committee has informed the Highways and Works Committee that it proposes to lay a main past Belfairs and Kent Elms Corner, and thence to Southbourne Grove, at an estimated cost of £3,060. Application has been made for a Special Order authorising the supply of electricity to premises which are situated outside the borough boundary, and it is anticipated that the work of laying the cable will commence as soon as such powers are obtained.

Special Orders.—Application has been made to the Electricity Commissioners for a Special Order by the Tonbridge Urban District Council authorising it to extend its area of electricity supply so as to include the parish of Hildenborough and part of the parish of Leigh.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Porlock and District Electric Supply Co., Ltd., to supply electricity in part of the rural district of Williton, and the Electrical Distribution of Yorkshire, Ltd., to supply in the urban districts of Altofts, Ardsley East and West, and Methley, the rural district of Wakefield, and part of the rural district of Tadcaster.

Swansea.—School Lighting.—At a recent meeting of the Education Committee it was reported that at a joint conference between representatives of committees, together with the borough treasurer, the borough electrical engineer and the borough architect had decided to make the following recommendations with regard to the wiring of schools for electric lighting:—That the director of education and the borough treasurer be authorised to explain to the Board of Education the authority's scheme for the electric wiring of all its schools during the present year instead of spreading the work over a period of about 15 years; that on securing the approval of the Board of Education, application be made to the Ministry of Health for sanction to a loan to cover the cost of the work; that the borough electrical engineer be authorised to arrange that Sketty, Cwmbwrla Boys' and Morriston Boys' Council schools be wired forthwith.

Tramway and Railway Notes.

Argentina.—Buenos Aires.—Lord Ampthill has arrived at Buenos Aires. It is understood that the main object of his visit is in connection with plans for the construction of an underground railway and new tramways, the award of the contract for which has been held up for a long time owing to the inability of the local authorities to agree as to the apportionment of the cost.—*Reuter* (Buenos Aires).

Brazil.—Railway Electrification.—The Companhia Paulista has decided to electrify a further 93 km. of its railway, from Rio Claro to Sao Carlos-de-Pinhal. Contracts for materials for the electrification of this section, as well as that to Rincon, a further 82 km., have been placed. The company has under consideration the electrification of the section Campiñas-Casa Branca section of the Magyana railway (172 km.).—*Reuter's Trade Service* (Sao Paulo).

Burnley.—New Route.—The Corporation tramway extension past the Turf Moor football ground was inaugurated on April 14th. For the present single-deck cars will be run.

Continental.—Austria.—It is reported from Vienna that the new National Council will be occupied with a scheme prepared by the large electrical companies and the Vienna banks for the conversion to electric traction of further railways, including those between Vienna and Salzburg, Vienna and Graz, and the Tauern line. The total expenditure is estimated at 310,000,000 schillings, and the execution of the scheme would lead to an economy of 540,000 tons of coal per annum.

Switzerland.—The Geneva correspondent of *The Times Trade and Engineering Supplement* reports that electrification is steadily progressing on the Lausanne-Berne line (61 miles), and electrically-driven trains are now running on the Lausanne-Romont section (25½ miles). It is expected that the conversion will be completed between Lausanne and Berne by May 15th, when about 20 minutes will be saved on the journey, which now takes two hours. Between Lausanne and Romont the line rises 853 ft., and in spite of steep gradients an electric locomotive was able during recent trials to haul a 200-ton train at a speed of 40 miles an hour on the steepest section and at a speed of 50 miles an hour on the Palezieux-Romont section. The conversion of the Lausanne-Berne section will mean the complete electrification of the Geneva-Berne-St. Margarethen line, linking France with Austria across Switzerland.

Holland.—The municipal authorities of Rotterdam have decided to take over the tramway undertaking owned by the Rotterdam Electric Tramways Co.

Glasgow.—Tramcar Improvements.—A report by the tramway manager on the rolling stock of his department states, with regard to lighting, that owing to the cheap rate, the cost of lighting is not great, and he recommends that four circuits, instead of three, should be the standard in future. For some time the department has been experimenting with 100-V, 40-watt internally-frosted lamps. These have given good results so far as improved illumination is concerned, but the "mortality" has been very high. Further experiments are still being conducted with a view to ascertaining the best type of lamp for cars. Experiments in heating are also being made, and firms have asked to be allowed to demonstrate their ideas on two cars.

Preston.—Permanent-way Renewals.—The Tramways Committee has recommended permanent-way renewals amounting to £10,020 during the current year. The amount includes £4,000 for permanent-way renewal from the borough boundary to Moor Park Avenue, £900 for permanent-way between the Beech Grove Co-operative and Ashton terminus, and £800 for permanent-way between Fulwood Hall Lane and barracks. Four cars are to be reconstructed at a cost of £2,400.

Pontypridd.—Inquiry.—On behalf of the Minister of Transport, Mr. A. D. Erskine recently held an inquiry at the Municipal Buildings into the application for sanction to extend the tramway to Rhydyfelin. According to the *Western Mail*, Mr. H. L. Porcher, clerk to the Council, referred to the houses which had been built at Rhydyfelin, and to the fact

that in this particular part of the district there were many residents who worked at collieries long distances away. The extension would be a great convenience, and there would be a corresponding benefit to the town generally and to the tramway undertaking. Mr. J. E. Teasdel, chief electrical engineer to the Council, said no additional plant or supplementation of the staff would be required if the Council's application were granted, and the running of the tramway would be made simpler. The Ministry will give its decision in due course.

Sheffield.—New Cars.—The Corporation is to build 25 double-deck tramcars in the Corporation works, and another 25 are to be bought under contract. The total cost will be £117,500.

Telegraph and Telephone Notes.

India.—Automatic Satellite Telephones.—With a view to extending telephony in India, by providing exchanges in outlying towns and villages, the Indian Telegraph Department has been experimenting with a 10-line automatic exchange, the switchboard of which is connected by a short trunk line to the nearest telephone centre, all the calls both to and from subscribers on the outlying "satellite" exchange being dealt with by the operator in the central exchange. One such switchboard was installed on trial in Kalka last December, and was so successful that four more are now being installed in the same district; they will be watched with much interest, for the system, if successful under service conditions, will open up possibilities for development in an untapped field. The installation of a set in Bombay recently also gave satisfaction.

New Zealand.—Automatic Telephony.—A new automatic telephone exchange at Stratford, New Zealand, has been completed by Siemens Bros. & Co., Ltd., Woolwich, and was opened on the 8th instant. The exchange has an initial equipment for 600 ordinary lines and 50 rural and party lines, with an ultimate capacity of 900 and 100 respectively. The exchange equipment includes a two-position manual board and a one-position test deck. The automatic equipment is the No. 16 type with several novel and interesting features, which include revertive calling on 4-party lines and special signalling arrangements for the rural lines.

Radio Notes.

Irish Free State.—Cork Station.—The new State broadcasting station at Cork, which is intended to serve the south and west of the country, was officially inaugurated on April 25th by Mr. J. J. Walsh, Minister for Posts and Telegraphs. Equipped with "Standard" plant, the Geneva rating of the station is 1.5 kW, which means that 4-kW "peak" power can be handled without distortion. It will operate on a wave-length of 400 metres and its call sign is 6CK.

Licence Revenue.—In Dail Eireann, Mr. Ernest Blythe, Minister for Finance, said that the yield from the duty on wireless-telegraphy apparatus in the Irish Free State from April 22nd, 1926, the date of the imposition of the duty, up to and including March 31st, 1927, was £19,008. The total amount received from licences on wireless receiving sets for the first three months of the present year was £8,315, *viz.*, for January last, £2,432; for February, £4.527; and for March, £1,356. The number of receiving licences issued in the Free State during the financial year ended March 31st, 1927, was 21,795. The figure for Northern Ireland was 28,455 up to February 28th, 1927.

Long-wave Stations.—Interference Tests.—Capt. P. P. Eckersley, chief engineer of the B.B.C., and M. Braillard, the Belgian president of the Technical Committee of the Union Internationale de Radiophonie, have co-operated in carrying out tests recently to ascertain the amount of wave-length separation needed between long-wave high-power stations in order to avoid interference between them. At its meeting at Geneva next month the Union will consider the results of the investigation. A 10-kilocycle interval between stations is apparently as essential in the case of long-wave stations as it is in that of the shorter band, while it seems to be not really sufficient between two powerful stations geographically "near" to each other.

U.S.A.—Fewer Stations Advocated.—A plan for the reduction of the number of broadcasting stations in the United States from 733 to 364 has been submitted by the American Engineering Council to the Federal Radio Commission, says *World Radio*. Under the scheme there would be 64 national stations and 300 local stations; the former would operate in the band between 550 and 1,250 kilocycles, that is to say, from 240 metres to 545 metres: the local stations would be confined to the range of from 1,250 to 1,500 kilocycles, or from 240 down to 200 metres. The proposal has the support of many radio engineers and was worked out by the Radio Broadcasting Committee of the Engineering Council.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—June 1st. Victorian Government Railways. Electric time-releasing mechanisms. (B.X. 3431.)*
July 5th. State Electricity Commission. One 15,000-kW steam turbo-generator and accessories. (B.X. 3369.)*
Tensioning and suspension-type insulators. (B.X. 3455.)*
Sydney.—June 22nd. New South Wales Government Railways. Remote-control switchgear. (B.X. 3442.)*
June 20th. Municipal Council. Turbo-alternators for Bunnerong power station. (B.X. 3443.)*
Brisbane.—May 18th. City Electric Light Co., Ltd. Outdoor switchgear. (B.X. 3456.)*

Barking.—May 9th. County of London Electric Supply Co., Ltd. Cables and accessories for the Barking power station. (April 1st.)

Belgium.—May 3rd. Department des Ponts et Chaussées, 15, Rue de la Charité, Brussels. Electrical and mechanical equipment for the Kruisschans Dock, Antwerp. Particulars (Cahier des Charges et Plans) for 52 fr., from 15, Rue des Augustins, Brussels.

Darton.—May 17th. West Riding Education Committee. Electric lighting installation at Darton Kexborough new school. Specifications from Education Department, County Hall, Wakefield.

Durrington (Wilts.).—April 30th. Wiring 30 houses, for the Durrington Electric Light Co., Ltd., Mr. S. N. Bigwood, secretary, Midland Bank Chambers, Salisbury.

Edinburgh.—May 2nd. District Board of Control. Electricians' work at new buildings at Gogarburn Institution. Mr. Stewart Kaye, architect, 14, Hill Street, Edinburgh.

May 16th. East Lothian Education Authority. Works, including electric lighting installation, for the extensions, &c., at Macmerry Public School. Schedules from the surveyors, Messrs. R. & A. K. Smith, 44, Queen Street, Edinburgh.

Egypt.—Cairo.—May 24th. Director-General of Prisons. Twelve months' supply of electric lamps, &c. (C.X. 2268.)*

Grimsby.—May 2nd. Electricity Department. E.h.p. and pilot cables; l.p. feeder cables. (April 15th.)

London.—St. Marylebone.—May 18th. Electricity Department. L.p. and e.h.p. cables for 12 months. (April 15th.)
Islington.—June 1st. Electricity Department. Steel-tube lamp columns, 2,200-V feeder switchgear, rotary and/or static power factor correctors. (April 22nd.)
Metropolitan Asylums Board.—May 18th. Installation of a multiple roller ironing machine; new steam boiler, &c.; steam main; electric power in laundry, &c., at Darenth Tramway Colony; conversion of mechanical stokers to hand firing at North-Eastern Fever Hospital. (See this issue.)

Manchester.—May 5th. Electricity Committee. Twelve months' supply of electric kettles, potential and current transformers, electricity meters, and cable supplies. (April 22nd.)
May 3rd. Stores required during the 12 months ending June 30th, 1928. Mr. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall.

May 10th. Tramways Committee. Trucks, motors, and controllers for electric tramcars; tramway poles, span-wire brackets, trolley wire, and copper bonds. Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly, Manchester.

New Zealand.—Wellington.—June 21st. Public Works Department. Sub-station switchgear and metering equipment for Arapuni. (B.X. 3398.)*

June 7th. Railway sub-station equipment, Lake Coleridge electric power scheme. (B.X. 3295.)*

June 13th. New Zealand Railways. Machine tools, workshop equipment and overhead electric travelling cranes. (A.X. 4344.)*

June 6th. Six electric locomotives. (A.X. 4355.)* Overhead equipment for the Christchurch-Lyttelton electrification scheme. (B.X. 3301.)*

Invercargill.—May 31st. Southland Electric Power Board. Transformers. (B.X. 3379.)*

June 15th. 66,000-V oil circuit-breakers. (B.X. 3378.)*

Lyttelton.—July 20th. Harbour Board. Four 5-ton electrically-operated portal cranes, and ten electrically-operated capstans. (A.X. 4532.)*

Sleaford.—May 17th. Electricity Department. Cables, boxes, &c. (See this issue.)

South Africa.—Cape Town.—June 1st. The University. Electric cooking utensils for the new residences at Groote Schuur. (B.X. 3393.)*

Scarborough.—June 3rd. Corporation. Installation of electrical pumping plant in duplicate for the new Irton water scheme No. 2. Specifications (£5) from Dr. H. Lapworth, engineer, 25, Victoria Street, S.W.

Thorne.—May 17th. West Riding Education Committee. Electric lighting installation at new boys' school. Specifications, &c., from Education Department, County Hall, Wakefield.

Uruguay.—Montevideo.—June 15th. State Electricity Supply Works. 15 transformer sub-station equipments (6,600/220 V, 50 cycles). (B.X. 3371.)* Five overhead transformer sub-stations mounted on tubular or section iron columns. (B.X. 3430.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—Sydney.—Electricity Supply Committee. Recommended:—

Bare copper cable (Spec. 1095), £6,552; double-braided weatherproof cable (Spec. 1090), £5,351.—Enfield Cable Works (Aust.), Ltd. —*Tenders.*

Barnsley.—Board of Guardians. Accepted:—

Electrical work at the Institution.—Brown & Roberts.

Bury St. Edmunds.—Board of Guardians. Accepted:—

Installing electric lighting at the Institution (£345).—Wood & Co.

Chesterfield.—Rural Council. Accepted:—

Electrical installation in connection with the sewage disposal works (£1,457).—British Thomson-Houston Co., Ltd.

Electric travelling crane and railway (£511).—Thomas Smith & Sons (Rodley), Ltd.

Government Contracts.—The following contracts were placed by various Government departments during March, 1927:—

Admiralty, Contract and Purchase Department.

Motor alternators.—Small Electric Motors, Ltd.

Alternators and spare armatures.—Newton Bros. (Derby), Ltd.

W./t. amplifiers.—The Plessey Co., Ltd.

Turbine blading materials.—J. Wilkes, Sons & Mapplebeck, Ltd.

W./t. boards.—Park Royal Engineering Co., Ltd.; Veritys, Ltd.; W. McGeoch & Co., Ltd.

W./t. coils.—H. W. Sullivan, Ltd.; Gambrell Bros., Ltd.; Radio Instruments, Ltd.

Motor convertors.—Brush Electrical Engineering Co., Ltd.

Electric crane.—T. Broadbent & Sons, Ltd.

Ventilating fans.—Newton's Dynamo Works; James Keith & Blackman Co., Ltd.; Veritys, Ltd.

Electric fires.—Berry's Electric, Ltd.

W./t. fittings.—W. McGeoch & Co., Ltd.; J. Stone and Co., Ltd.; Highton & Son, Ltd.; Park Royal Engineering Co., Ltd.

Motor generators and panels.—W. H. Allen, Sons and Co., Ltd.

Cable installation.—G. E. Taylor & Co.

Electric lighting installation.—G. E. Taylor & Co.

600-h.p. motor.—Brush Electrical Engineering Co., Ltd.

Main and auxiliary propelling motors.—Metropolitan-Vickers Electrical Co., Ltd.

Motor-driven submersible pump.—W. H. Allen, Sons and Co., Ltd.

Electric radiators.—Edison Swan Electric Co., Ltd.

Automatic starters, resistances and switches.—Watford Electric & Mfg. Co., Ltd.

W./t. switches and circuit breakers.—General Electric Co., Ltd.; Park Royal Engineering Co., Ltd.; Whipp and Bourne, Ltd.; Veritys, Ltd.

Telephone leads.—Ward & Goldstone, Ltd.

Terminal blocks.—Edison Swan Electric Co., Ltd.

W./t. valve holders.—H. W. Sullivan, Ltd.

W./t. valves.—General Electric Co., Ltd.; Mullard Radio Valve Co., Ltd.; Edison Swan Electric Co., Ltd.

War Office.

W./t. valves.—General Electric Co., Ltd.; British Thomson Houston Co., Ltd.

Electric lighting installations (Cameron Barracks, Inverness).—Watson & Dundas.

Air Ministry.

Battery (North Weald).—Premier Accumulator Co. (1921), Ltd.

Engines and generators (Bicester).—Tangyes, Ltd.

Internal wiring (Upper Heyford).—Read & Partners.

Underground mains (Sutton's Farm).—Watshams, Ltd.

Air-driven generators and spares.—W. Mackie & Co., Ltd.; G. E. Mortley, Sprague & Co., Ltd.

Magnetos and spares.—British Thomson-Houston Co., Ltd.

Receivers.—The Plessy Co. (1925), Ltd.

Syntonisers.—Radio Instruments, Ltd.

Transmitters.—C. A. Carter & Co.

Post Office.

Telegraph apparatus.—Creed & Co., Ltd.

Telephone apparatus.—Ericsson Telephones, Ltd.; International Electric Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Sterling Telephone & Electric Co., Ltd.

Testing, protective and miscellaneous apparatus.—Automatic Telephone Mfg. Co., Ltd.; British Thomson-Houston Co., Ltd.; Power Equipment Co., Ltd.

Battery stores.—General Electric Co., Ltd.; C. A. Vandervell & Co., Ltd.

Service boxes.—Horstmann Gear Co., Ltd.

Cable (various).—British Insulated Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; Connollys (Blackley), Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Pirelli-General Cable Works, Ltd.; Standard Telephones & Cables, Ltd.

Compound.—W. H. Keys, Ltd.

Cords for telephones.—British Insulated Cables, Ltd.; Reliance Electrical Wire Co., Ltd.; Standard Telephones & Cables, Ltd.

Cable drums.—Eames Bros.; Hackbridge Cable Co., Ltd.; Siemens Bros. & Co., Ltd.

Ducts.—Albion Clay Co., Ltd.; Donington Sanitary Pipe and Fire Brick Co., Ltd.; Hepworth Iron Co., Ltd.; J. Oakes & Co. (Riddings Collieries), Ltd.; Oates and Green, Ltd.; J. Place & Sons, Ltd.; Standard Brick & Terra Cotta Co., Ltd.

Generating set.—W. Beardmore & Co., Ltd.

Lamps.—General Electric Co., Ltd.

Cable distribution plugs.—Siemens Bros. & Co., Ltd.

H.d. copper wire.—Nevill, Druce & Co., Ltd.; Enfield Cable Works, Ltd.; R. Johnson, Clapham & Morris, Ltd.; Pirelli-General Cable Works, Ltd.; Whitecross Co., Ltd.

Replacing batteries (Blackpool telephone exchange).—Chloride Electrical Storage Co., Ltd.

Manufacture, supply, drawing-in and jointing cable.—London-Purley-Redhill-Reigate: Standard Telephones and Cables, Ltd. Hitchin-Letchworth: Johnson and Phillips, Ltd.

Lift (Manchester H.P.O.).—W. Wadsworth & Sons, Ltd.

Telephone exchange equipment.—Garston (Liverpool): Automatic Telephone Mfg. Co., Ltd. Sub-contractors: Alton Battery Co., Ltd., for batteries; Newton Bros. (Derby), Ltd., for machines. Metropolitan: Automatic Telephone Mfg. Co., Ltd. Sub-contractors: D.P. Battery Co., Ltd., for batteries; Newton Bros. (Derby), Ltd., for charging machines; Crompton & Co., Ltd., for ringing machines. Chancery, Ambassador, Cosham (Portsmouth multi office area), Bishop's Stortford, Roundhay (Leeds), and Synthetic

Ammonia & Nitrates, Ltd. (Norton, near Middlesbrough): Automatic Telephone Mfg. Co., Ltd. Rainham (Essex): Ericsson Telephones, Ltd. Subcontractors: D.P. Battery Co., Ltd., for batteries; Crompton & Co., Ltd., for machines. Lee Green, and E. & F. Beattie, Ltd. (Manchester): Standard Telephones & Cables, Ltd. Horsham: General Electric Co., Ltd. Ecclesfield (Sheffield multi exchange area): Siemens Bros. & Co., Ltd. Royal Berkshire Hospital (Reading), Bristowes Tarvia, Ltd. (S.W.1), Trades Union Congress and Labour Party (S.W.1), and Liptons, Ltd. (E.C.1): Automatic Telephone Co., Ltd.

Two- and four-wire repeater station equipment.—Halesworth: Standard Telephones & Cables, Ltd. Taunton: General Electric Co., Ltd.

Spark transmitter (Seaforth wireless station).—Radio Communication Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Cables.—St. Helens Cable & Rubber Co., Ltd.; British Insulated Cables, Ltd.

Electrical material.—General Electric Co., Ltd.

Switching equipment.—Metropolitan-Vickers Electrical Export Co., Ltd.

Telegraph materials.—Siemens Bros. & Co., Ltd. Bullers, Ltd.

Telephone material.—Standard Telephones & Cables, Ltd.; Peel-Conner Telephone Works, Ltd.

Train-lighting spares.—Pritchett & Gold & E.P.S. Co., Ltd.; Chloride Electrical Storage Co., Ltd.; J. Stone and Co.

Transformers.—British Electric Transformer Co., Ltd.

Turbine, &c.—Sir W. G. Armstrong, Whitworth & Co., Ltd.

H.M. OFFICE OF WORKS.

Wiring Marlborough House, S.W.—H. J. Cash & Co., Ltd.

Wiring Princes Risborough Laboratory.—Electrical Installations, Ltd.

Transformers, National Physical Laboratory.—British Electric Transformer Co., Ltd.

Grimsby.—Electricity Committee. Recommended:—

Balancer, switchgear, and cable work in connection with Deansgate sub-station (£505).—J. H. Holmes & Co., Ltd.

Irish Free State.—Department of Posts and Telegraphs.

Telephone cabinets.—Siemens Brothers & Co., Ltd.

Cable racks, various.—Standard Telephones & Cables, Ltd.

Dials (for automatic telephones).—Peel-Conner Telephone Works, Ltd.

Electric lamps.—Cossor, Ltd.; Sphinx Electric Supplies, Ltd.

Electric motors.—General Electric Co., Ltd.

Stay-rods.—Bayliss, Jones & Bayliss, Ltd.

Telephone wire.—Fernand Espir.

Kettering.—Electricity Department. Accepted:—

E.h.p. and l.p. armoured cables.—Union Cable Co., Ltd.

1,000-kVA transformer.—British Electric Transformer Co., Ltd.

300- and 250-kVA transformers.—Brush Electrical Engineering Co., Ltd.

King's Lynn.—

Electrification of the new sugar-beet factory. The installation will include some 84 electric motors (approx. 2,138 h.p.), with the necessary control gear, main switchboard, and the complete electric lighting installation of the factory.—Mann, Egerton & Co., Ltd.

London.—STEPNEY.—Electricity Supply Committee.

Centrifugal oil purifier (£116).—Empson Centrifugals, Ltd. (Recommended.)

2 tons plumber's solder (£284).—H. B. Barnard & Sons. (Accepted.)

2 tons sheet lead (£71).—Page, Calnan & Co., Ltd.

Works Committee.

Electric ash hoist, with steel supporting structure (£268).—London Hoist & Machinery Co. (Recommended.)

The EDISON SWAN ELECTRIC CO., LTD., has received contracts for accumulators from the London County Council, and for No. 2 E.C.C. dry cells from the Metropolitan Railway Co.

LAMP CONTRACTS.—The contract for "Cosmos" lamps received recently by Metro-Vick Supplies, Ltd. (see ELEC. REV., April 15th, p. 604), was placed by the London & North-Eastern Railway Co., and not the L. & N.W.R. Co.

Mansfield.—CORPORATION.—The Corporation last week decided to accept the tender of the Netherlands Cable Works, Ltd., for the supply of low-pressure cables. It is stated that the quotation was 20 per cent. below those of British firms.

Portsmouth.—Electricity Committee. Recommended:—

Installation of coal-handling plant at power station (£13,460).—Babcock & Wilcox, Ltd.

Reigate.—Corporation. Accepted:—

One 6-cylinder 1,715 b.h.p. Mirrlees-Diesel engine.—Mirrlees, Bickerton & Day, Ltd.

It is stated this will be the largest oil engine supplied to any electricity undertaking in this country.

Southend-on-Sea.—Town Council. Accepted:—

E.h.p. cables for the linking-up of the Leigh, London Road, and Thorpe Bay sub-stations (£31,752).—International Combustion, Ltd.

Five police and fire-alarm posts (£237).—Standard Telephones & Cables, Ltd.

De Laval centrifugal oil purifier for Diesel engine (£157).—Alfa De Laval Co., Ltd.

Swinton and Pendlebury.—Urban District Council. Accepted:—

H.p. cubicle (£182); a.c. l.p. switchboard (£450).—General Electric Co., Ltd.

Tynemouth.—Electricity Committee. Accepted:—

Meter boards.—J. Pelton.

Three 250-kVA transformers (£597); one 500-kVA transformer (£335).—Bruce Peebles & Co., Ltd.

ELECTRICITY COMMITTEE.—The electrical engineer reported at a meeting of the Committee that a tender for cable from a Dutch firm was £483, as compared with £587, the lowest British quotation. The Committee decided that when small supplies of cable are required, foreign tenders shall be invited.

Weymouth.—Housing Committee. Accepted:—

Wiring 94 houses on the Westham estate (£5 10s. per parlour house and £5 per non-parlour house) (screwed steel-tube system).—H. V. Bennett & Co.

Forthcoming Events.

Institution of Engineering Inspection.—Friday, April 29th. Royal Society of Arts. 7.30 p.m. "The Stress-strain Diagram and its Application to the Testing of Rolling Stock Drawgear." Mr. L. H. Evans.

Royal Institution of Great Britain.—Friday, April 29th. 9 p.m. "Wireless Transmission and the Upper Atmosphere." Dr. E. V. Appleton.

Junior Institution of Engineers.—Friday, April 29th. 39, Victoria Street, S.W. 7.30 p.m. "The Design and Balancing of Three-phase Low-tension Distribution Systems." Mr. W. F. Cooper.

Friday, May 6th. 7.30 p.m. Question and discussion evening.

Society of Engineers.—Monday, May 2nd. Burlington House, W. 5.30 p.m. "The Internal Combustion Boiler." Mr. O. Brunler.

Royal Society of Arts.—Monday, May 2nd. 8 p.m. Cantor Lecture. "The Measurement of Light." Mr. J. W. T. Walsh. (Lecture II.)

Röntgen Society.—Tuesday, May 3rd. 32, Welbeck Street, W.1. Ordinary meeting.

Institution of Civil Engineers.—Tuesday, May 3rd. London, S.W. 6 p.m. James Forrest Lecture. "Some Recent Services of Metallurgy to Engineering." Prof. H. C. H. Carpenter, F.R.S.

Association of Supervising Electrical Engineers.—Tuesday, May 3rd. 39, Victoria Street, S.W. 7.15 p.m. "Items of Practical Importance in Mining Electrical Engineering." Mr. E. J. Davies.

Institution of Electrical Engineers.—Thursday, May 5th. London. 6 p.m. Annual general meeting.

(Wireless Section).—Wednesday, May 4th. London. 6 p.m. Ordinary meeting.

(South-Midland Students' Section).—Tuesday, May 3rd. Annual general meeting.

Chemical Engineering Group.—Friday, May 6th. Imperial College of Science, South Kensington, S.W. 6 p.m. Annual general meeting. 8 p.m. "Chemical Fire Extinguishers." Dr. W. R. Ormandy.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

U.L.A. portable electric tools.

"D" type conduit clips as originally handled by Massey and Rothschild, of Birmingham.

ALUMEL wires (aluminium alloys, known also as Hoskins' alloy).

LANGWELL electric light fittings.

PERKINS YANKEE switches.

CLIMAX vacuum cleaners.

We also wish to know:—

The present address of the Continental Automatic Telephone & Electric Co. (spare parts are wanted).

Whether any agency exists in this country for the Estate Stove Co., U.S.A.

Notes.

The Southern Railway Contract.

In the House of Commons on Tuesday last, in reply to a question by Mr. R. Morrison (Lab.), Sir B. Chadwick, Parliamentary Secretary to the Board of Trade, said that he had no information regarding the Southern Railway contract beyond what had appeared in the statements of the Railway Company and the General Electric Co., Ltd. They appeared to set out all the essential facts, and he did not think a special inquiry would be likely to serve any useful purpose.

Accident.

An explosion occurred in an underground electric chamber in Falcon Square, Aldersgate Street, E.C., just before noon on April 25th, and the electricity supply in the surrounding area failed. Three electricians employed by the City of London Electric Lighting Co., Ltd., were in the chamber, and one of them, who was seriously burned about the face, was conveyed to St. Bartholomew's Hospital. The electricity supply was resumed shortly before 1 p.m.

Poplar Electricity Undertaking.

The new generating station of the Metropolitan Borough of Poplar, which is described elsewhere in this issue, was thrown open for inspection on Monday morning last, April 25th, when Sir Andrew Duncan, chairman of the Central Electricity Board, performed the opening ceremony; the speeches were amplified by means of Graham "Amplion" loud-speakers, and an exhibit of domestic electrical apparatus was arranged by the G.E.C., which also demonstrated a 10-kW incandescent lamp. A very large company subsequently assembled at the Hotel Cecil for luncheon, the speakers being Sir Andrew Duncan, Councillor C. W. Key, chairman of the Electricity Committee, Alderman George Lansbury, Mr. J. H. Bowden, engineer and manager of the undertaking, Alderman Samuel March, Sir Duncan Watson, Mr. Frank Hodges, Councillor R. Bond, vice-chairman of the Electricity Committee, Sir Hugo Hirst, and Mr. Geo. C. Usher. With coal of 11,000 B.th.u. thermal value, suitable for mechanical stoking, costing 20s. per ton (which is equivalent to the purchase of 102,700 B.th.u. per one penny), the existing plant's fuel consumption per kWh delivered to the feeders is at the rate of 33,000 B.th.u., the cost being 0.323d. per kWh. With coal of a similar thermal value, but costing 16s. per ton and fired in the pulverised form (which is equivalent to the purchase of 128,000 B.th.u. per one penny), the new plant will, it is estimated, be capable of delivering energy to the feeders at a cost of 0.143d. per kWh. Thus, a reduction of fuel cost of 0.18d. per kWh is anticipated. A condition of the contract having been that a proportion of the cost should be expended locally, it was decided to install one Bradley pulverising equipment, which is of American origin, but was made locally by the East Ferry Road Engineering Co.

Educational.

The Polytechnic, Regent Street, Electrical Engineering Department.—A special course of six lectures on the "Thermionic Valve and its Uses in Wireless Circuits," will be delivered by Mr. W. H. Date, on Wednesdays, commencing May 11th, from 6.30 to 8.30 p.m. On Thursdays, commencing May 12th, at 6.30 p.m., Mr. W. J. Bolton will deliver a special course of lectures on "Electrical Engineering Economics." Particulars and syllabus can be obtained from the Director of Education.

Irish Free State Electricity Supply.

The Irish Free State Government's proposal to take over the control of the municipal and other electrical undertakings in the State under the new Electricity Supply Bill, absorbing them as part of the Shannon hydro-electric scheme, and to refuse compensation to the present owners, continues to excite keen indignation in Dublin and other cities and towns, chiefly because of the confiscatory character of the plan. It is held that if the undertakings are to be taken over, full compensation should be paid for the important developments that have been made, largely at the expense of the ratepayers, but in many instances through heavy outlay by public or private companies or private individuals. Mr. McGilligan, the Minister for Industry and Commerce, in a recent speech, contended that there was little danger of contractors being put out of business through the operation of the Government measure, and estimated that in the wiring of houses there would be sufficient work to keep 5,000 men employed for two and a-half years. Assurance has been given that the cost of the Shannon scheme will not exceed the original estimate of £5,210,000. The Minister has sanctioned the raising of a loan of £90,000 for the provision of boiler plant and accessories, this being part of a loan of £475,150 applied for by the Dublin City Commissioners.

In the Dublin Chamber of Commerce recently it was made clear that before the Shannon scheme could pay, the consumption would have to reach 110,000,000 units per annum; Dublin's share of this will be about 50 per cent. The consumption now is calculated at 75,000,000 units, with a possible increase to 80,000,000 in 1929. Extraordinary efforts, the Minister urged, must be made to stimulate demand. He denied that the Dublin power station was to be "seized" with the object of giving cheap power to consumers elsewhere. A clause which he had undertaken to insert in the Bill would provide that the cost of distribution would be proportionate to the liability taken over from the particular area.

At a meeting of the Emergency Committee of the Municipal Authorities' Association of Ireland, a resolution was passed claiming for municipalities that have established electricity undertakings in the Free State the status outlined in the original report of the Government's expert advisers, under which such municipalities were to have the option of taking current from the Shannon or generating it themselves, and were in either event to act as the local distributing authorities.

A new sub-section has been put down providing that where an undertaking to be taken over has received money from the rates, the money still owing shall be repaid by the new undertaker in a number of years.

The Minister also proposes amendments to meet the objections taken by electrical contractors in the Free State to the Bill's provisions as to the purchase and sale of electrical apparatus and appliances. It would appear that the Board of Control is not, as at first supposed, to sell apparatus and appliances under cost, but it is contended that sale at cost would kill the ordinary contractor.

Association of Supervising Electrical Engineers.

The recognised standing of this Association (until lately the National Association of Supervising Electricians) has resulted in many cases of misuse by unauthorised persons of the Association's abbreviation and claims to membership, by persons who either have not been members or have been struck off the roll. In several cases it has been necessary to institute legal proceedings to safeguard the interests of the Association. With a view to avoiding a recurrence of such happenings, it has been decided to issue yearly membership cards, the colour of the cards varying each year and the date of currency being plainly printed thereon. The colour for the year ending December 31st, 1927, is turquoise blue, and persons claiming membership of the Association should be asked to produce their current membership cards. Cases of misrepresentation should be reported to the Association.

Fires.

A fire occurred on April 23rd, at the premises of Messrs. Wigglesworth & Crossley, electricians, Keighley Road, Frizinghall, Bradford. It is believed the fire was due to overheating of a heating appliance, setting fire to the floor and extending to the basement.

A fire occurred on April 14th at the premises of Messrs. H. White & Co., wireless engineers, of Siddals Road, Derby. The building was gutted, and a large quantity of wireless and electrical material was destroyed.

The Batti-Wallahs' Society.

At a well-attended luncheon at the Hotel Cecil, on Tuesday last, Sir Arnold B. Gridley unfolded an original scheme intended to reconcile relations between the consumer, the producer, and the wage-earner—rather to stimulate thought on new lines, than as a completely developed plan. Success, he held, would come if they curbed the spirit of gain and expanded the spirit of service. Mr. A. W. Blake presided, in the absence, through ill-health, of the new president, Mr. G. W. Partridge, who sent a cordial message of apology and good wishes.

Legal.

Wareham Electric Supply Co., Ltd.—In the Chancery Division on April 26th, the petition of Mr. W. E. Weston for the compulsory winding up of this company again came before Mr. Justice Eve. Mr. Galbraith, K.C., appeared for Mr. Edwards, who was the liquidator in the voluntary liquidation of the company commenced in 1923, but stayed. Mr. Edwards knew nothing of the subsequent proceedings, and asked for his costs. Mr. Willis, for the petitioner, said that it had been hoped that the case, which was a serious one, would be investigated fully before his Lordship.

Mr. Justice Eve granted the usual compulsory winding-up order, and directed that Mr. Edwards's costs should be reserved if not paid out of the assets.

International Conference on High-Pressure Systems.

The fourth session of the International Conference on Large Electric High-pressure Systems will be held in Paris from June 23rd to July 2nd next. The Conference is divided into three sections, namely, power production, construction of lines, and working of systems, and thus offers to all its members a rare opportunity of acquiring detailed information on matters of professional interest and to benefit by each other's experience in a much more effective manner than through the medium of books and periodical literature; it also enables them to meet personally and maintain friendly relations of the greatest value. Some 28 countries are represented in the membership. In 1925 a total of 530 members attended the Conference, of whom 242 were manufacturers of electrical material, 251 power distributors, and 37 professors or consulting engineers. Two languages are used at the meetings of the Conference, *viz.*, English and French, and all papers and discussions are translated from the one to the other. Full particulars will be supplied on request by the General Secretary, Mr. Tribot Laspière, 25, Boulevard Malesherbes, Paris, France.

Cables in Mines.

Important evidence relating to electric cables in mines was given recently at the inquest on the victims of the accident at Wharncliffe Woodmoor colliery, near Barnsley. A ripper stated that the electric cable was laid on the ground for about six yards to protect it during the work of ripping. A stone fell and brought down the cable at a point from which it was hung up. The cable fell on the rails and he saw some sparks. The men went to the pit bottom, a walk of about fifteen minutes, to turn off the power. They had been told by the overman to watch the cable, but they were not told how to watch and protect it. They were not told where the switches were to cut the power off. He was satisfied that the cable was cut on the rails. The overman said that at the time of the accident there were no switches between the scene of the fire and the pit bottom. He had given a warning always to have the cable sufficiently and properly covered. The inquiry was adjourned.

Appointments Vacant.

Meter assistant for the Worcester Corporation Electricity Department. Motors and hiring superintendent (£312) for the Borough of Birkenhead Electricity Department. Clerk for the Bingley U.D.C. Electricity Department. Mechanical superintendent (£364) for the Sheffield Corporation Tramways. Junior scientific officer (£279) for the Air Ministry Scientific Research Staff. Sub-station switchboard attendant for the Ilkley Urban District Council Electricity Department. Visiting lecturer of electrical engineering for the London County Council Paddington Technical Institute. Charge shift engineer for the Yorkshire Electric Power Co. Junior technical officers for the Wireless Experimental Depôt of the Royal Aircraft Establishment. Mains engineer for the Calcutta Electric Supply Corporation, Ltd. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.

South Midland Centre.—The report of the Committee for the 1926-27 session shows that interest in the activities of the Centre has been fully sustained during the session. The Faraday lecture was made the occasion of a joint meeting between the Institutions of Civil, Mechanical and Electrical Engineers, when some 1,150 members and visitors were present, and approximately 100 were unable to obtain admission. The meeting was followed by a conversazione at Birmingham, where the attendance was 360. In co-operation with the Institutions of Civil and Mechanical Engineers, the Committee is progressing as regards establishing a suitable meeting place, and efforts at the moment are being concentrated on obtaining a site in what will be known as a "Civic Centre" of Birmingham. The attendance at ordinary meetings averaged 25; the membership was 1,032, an increase of 50. The new session officers are as follows:—*Chairman*: W. Wilson; *vice-chairmen*: S. H. Holden, G. R. J. Parkinson; *ordinary members of the committee*: G. W. Billingham, W. Burton, R. A. Chattock, Capt. J. Coxon, Prof. W. Cramp, G. M. Harvey, R. G. Jakeman, J. D. Morgan, J. Morton, A. D. Phillips, F. C. Platt, G. Rogers, Dr. A. H. Railing, J. J. Swarsbrick. Wireless Section.—*Chairman*: J. D. Morgan.

Wireless Section.—Four meetings were held, the attendance at which was 28, 120, 41, and 28.

Students' Section.—The meetings numbered 8, and six visits to works, &c., took place.

East Midland Sub-Centre.—Eight meetings were held, and the average attendance was 100. During the winter four visits to works were organised.

Kelvin Lecture.—On April 21st Dr. E. W. Marchant delivered the 18th Kelvin Lecture, on "High-frequency Currents," showing how Kelvin laid the foundations of much of the work on oscillatory currents that was now commonplace, and developing the theory in its application to modern problems. A vote of thanks, moved by Mr. W. B. Woodhouse, and seconded by Mr. Ll. B. Atkinson, was passed by acclamation.

Informal Meeting.—At the meeting held on April 11th, Mr. A. H. Allen was in the chair, when Mr. T. Hodge opened a discussion on "The Maintenance of Small Electric Power Plants." Mr. Hodge's remarks were mainly confined to factory and works installations, but the discussion extended to machine and line troubles in a variety of services. An interesting case of breakdown was described by Mr. Hodge where a 20-h.p. enclosed ventilated motor was set at work to drive several high-speed dry grindstones. After a few weeks the sparking at the brushes became so excessive that there was an occasional flash-over. Tests were made for insulation, and overload, the mica was undercut, the brush position was verified, and apparently everything was in order. Still the trouble remained, until on one occasion whilst the shunt field was excited separately, it was noticed that the gap between the pole faces and the iron of the armature was bridged over by small particles of iron and steel, which in floating about in the air, had been attracted by the magnetic field of the motor, although it was situated some 20 ft. away from the nearest grindstone, and not in any direct line with the dust given off.

In the course of the discussion, Mr. Burnand said that maintenance was not always intelligent. He knew of a case where an engineer regularly took down and cleaned his motors, and there were always many breakdowns, but when he was persuaded to be less zealous the breakdowns ceased. Mr. W. L. Wreford said that starter troubles varied inversely with the cost of the starter. Engineers often would pay for a good motor but would buy the cheapest starter obtainable.

Association of Mining Electrical Engineers.

London Branch.—At the annual general meeting of the London Branch of the Association on April 12th, it was stated that Mr. Humphrey M. Morgans would be the Branch-President for the year 1927-28.

Royal Society of Arts.

The competition of industrial designs this year will be held at the Imperial Institute, South Kensington, S.W. Particulars of the scholarships and prizes offered in connection with it can be obtained from the Secretary; applications for forms of entry, &c., must be sent in between May 2nd and May 15th, and the designs entered are to be forwarded between June 20th and June 22nd.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Councillor J. A. Forde, engineer and manager of the Isle of Thanet Electric Supply Co., has been elected vice-chairman of the Broadstairs and St. Peter's Urban Council.

On April 16th Mr. A. M. Dallen, assistant secretary of the Woking Electric Supply Co., Ltd., was married to Miss Kathleen Jose, of Woking.

Mr. S. H. Penning, deputy borough electrical engineer at Woolwich, who has completed 25 years' service with the Corporation, has been presented by the staff with an armchair and a nest of tables.

The Heckmondwike Urban Council has increased the salary of the electrical engineer, Mr. William Parrett, from £330 to £350 per annum.

At the annual spring meeting of the Executive Committee, Mr. Clyde L. Chamblin, of San Francisco, was elected president of the Association of Electragists, International, for a two-year term.

The Marlborough Town Council has decided to pay an inclusive salary of £60 a year to Mr. R. J. Rance for his services as electrical engineer. Mr. Rance is in charge of the installation at the College, from which electricity is supplied.

At a recent meeting of the South-East Lancashire Electricity Advisory Board, Alderman W. T. Dagnall (Manchester) was appointed chairman for the ensuing year in the place of Alderman W. Walker, who has joined the Central Electricity Board. Mr. C. D. Taite (Lancashire Electric Power Co.) was appointed vice-chairman.

Mr. J. Christie, of Brighton, sailed for New York on Saturday last by the *Mauretania*.

Mr. G. H. Lock, of the electrical engineering department of Plymouth Technical College, has been married to Miss Winifred Russell.

According to a South African contemporary, Mr. W. B. Phelp, managing director of the British General Electric Co., Ltd., in South Africa, left Cape Town a few weeks ago on a visit to England.

Obituary.—Captain Reginald John Wallis-Jones, O.B.E., T.D.—It was with deep regret that we announced last week the death of Capt. R. J. Wallis-Jones, which took place on April 16th at the Hospital of St. John and St. Elizabeth, London, after a long illness. Capt. Wallis-Jones, who was 64 years old, was educated at Finsbury, at the Central Technical College, and at King's College, London, and commenced his career with the American Brush Corporation and the Brush Electric Light Co. Subsequently he became an installation engineer with Woodhouse & Rawson, and later, as chief electrical assistant to Kincaid, Waller and Manville, he supervised the erection of several electricity works and the construction of the Birmingham-Bournbrook electric tramway.

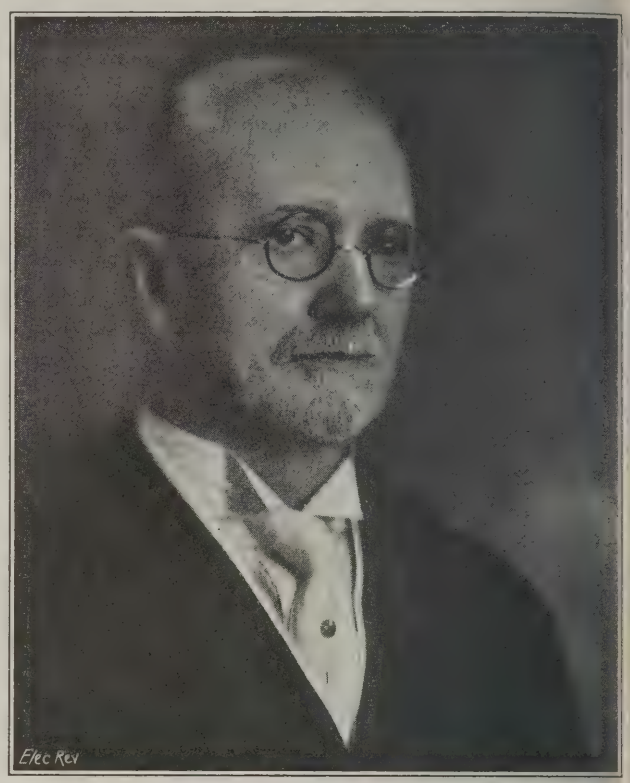
In 1900, in partnership with Mr. M. C. Dent, he commenced practice as consulting engineer and carried out a number of important installations in London and the provinces. As engineer and manager of the Electric Welding Co., Capt. Wallis-Jones did much to promote the develop-

ment of the Thomson system, and lectured on electric welding at Faraday House for some years.

An ardent supporter of the Territorial Force, Capt. Wallis-Jones was awarded the Territorial Decoration, and he served with the 1/4th Welsh Brigade R.A. in France until he was invalided home; afterwards he became the Controller of Foreign Iron and Steel at the Ministry of Munitions, receiving the C.B.E. His amiable disposition and attractive personality endeared him to a wide circle of friends, and he devoted much time to the work of social and charitable organisations; he was a Member of the Institutions of Civil and Electrical Engineers. He leaves a widow and one daughter.

The funeral took place at Hampstead Parish Church on Wednesday, April 20th. In addition to the members of the family, we noticed amongst those present Sir Edward Manville, M.P., Mr. Ll. B. Atkinson, Mr. Frank Gill, Col. C. B. Clay, Mr. J. E. Kingsbury, Mr. Moss, Mr. G. Scott Ram, Mr. P. F. Rowell (secretary, I.E.E.), Mr. H. M. Sayers, Mr. H. W. Couzens, and Mr. W. J. Tennant.

Mr. T. D. Lockwood.—We learn with very deep regret of the death, on the 5th inst., of that pioneer of telephone pioneers, Mr. Thomas Dixon Lockwood. He was born at Birmingham on December 30th, 1848. His schooldays ended with his eighth year; his education only ended with his death. At eleven years of age he began to work for a living, and he has described himself as "a fairly good machinist by 1865," when his father and family emigrated to Canada. From there T. D. Lockwood went to the United States, taking up any employment which offered. He was successively engaged in making paper in Massachusetts, plate glass in Indiana, and teaching school in Arkansas. By 1871 he had become connected with railway service as telegrapher, ticket clerk, signal operator and engineer on trains. In 1875 his connection with telegraphy became rather more stabilised, first in a private fire alarm system, and later with the Gold and Stock and American District Telegraph Companies. The telephone naturally came within his ken. He began to study and experiment with the telephone in 1878, and in 1879 sought for and obtained a position in the Bell Company with the title of assistant general inspector. In that capacity he undertook much technical work and opened a number of exchanges, but in those early days of the telephone's life the establishment on a firm basis of the Bell patent was of vital importance, and it is easy to realise how the commercial managers turned for assistance to the one man on the staff who had the necessary technical knowledge. Mr. Lockwood's adaptability and practical common sense enabled him to translate scientific definitions into everyday language and convey to Counsel and Court the real meanings of obscure phrases. His success in the company's patent work in these early days led to his being called upon to organise and take charge of a bureau of patents and technical information. This he undertook, though he had no previous knowledge of patent practice or patent law. In 1911 he was appointed general patent attorney to the American Telephone & Telegraph Company, retiring from active work in 1918, when he became their consulting patent attorney. Though mainly engaged in patent work and historical investigations, Mr. Lockwood continued for many years to take an active part in the practical features of telephony and has left his mark upon most of the developments of the earlier years. He was a frequent contributor to the electrical Press of the United States and the author of a number of technical works, including "Practical Information for Telephonists" (1882) and "Hand Book of Electric Telegraphy" (1883). His writings are characterised by clearness, vigour, and precision. His retentive memory and his first-hand knowledge of the telephone from its very first commercial beginnings, ensured a prompt and accurate reply to any question which might be put to him. His loss will be felt amongst a wide circle, and most keenly amongst his personal friends. Mr. Lockwood was a Charter member of the American Institute of Electrical Engineers, and



The late Mr. T. D. Lockwood.

had served as vice-president and one of the Board of Management of that body. He had been a member of our own Institution of Electrical Engineers since 1880.

Mr. C. Canham.—The death has taken place, at the age of 77 years, of Mr. Charles Canham, who for 40 years was engaged at the works of Crompton & Co., of Chelmsford, and for most of that period in the lamp shop.

Alderman W. Walker.—Alderman William Walker, chairman of Messrs. H. A. Davie, Ltd., electrical engineers, Sunderland, died on Saturday last at the age of 62 years. He was an ex-Mayor of the Wearside borough.

Mr. A. N. Dickson.—*World-Radio* records the death of Mr A. N. Dickson, formerly of Nottingham, director of the Capetown Broadcasting Station.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies. Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Johnson & Tanner, Ltd.—Private company. Registered April 16th. Capital, £2,000 in 20,000 ordinary shares of 1s. and 1,000 preference shares of £1 each. To acquire the business of electrical and mechanical engineers carried on by F. Johnson and J. J. Tanner, at 2, Park Terrace, Worcester Park, Surrey. The first directors are:—F. Johnson, "Acadia," Donnington Road, Worcester Park, Surrey, electrical engineer; J. J. Tanner, 207, Hampton Road, Twickenham, electrical engineer (who shall be joint managing directors for 10 years). Remuneration as fixed by the company. Registered office, 2, Park Terrace, Worcester Park, Surrey.

Gorford Bros., Ltd.—Private company. Registered April 14th. Capital, £4,500 in 10,000 founders' shares of 1s. each and 1,000 7½ per cent. cumulative preference and 3,000 ordinary shares of £1 each. Objects:—To acquire the business of engineers and contractors carried on by L. G. Davies and D. A. Davies at Station Buildings, Wealdstone, Middlesex, and to carry on the business of an electric light company in all its branches. The directors are:—L. G. Davies and D. A. Davies, Station Buildings, Wealdstone. Qualification (except permanent directors), 50 shares. Solicitor: H. E. Robertson, Oakfield Corner, Amersham, Bucks. Registered office; Station Buildings, Wealdstone.

Porn & Dunwoody, Ltd.—Private company. Registered April 14th. Capital, £10,000 in 6,000 8 per cent. cumulative preference shares of £1 each and 40,000 ordinary shares of 2s. each. Objects:—To adopt an agreement with Marcel Porn and to carry on the business of mechanical, electrical and

consulting engineers as formerly carried on by him at 72, Fleet Street, E.C. The permanent directors are:—M. Porn, 31, Lancaster Road, N.W.3, engineer (managing director and chairman); T. A. Dunwoody, 103, Foxley Lane, Purley, merchant. Solicitors: Woodbridge & Sons, 5, Serjeant's Inn, E.C.4. Registered office: 72-78, Fleet Street, E.C.4.

Canadian Porcelain Co. (British), Ltd.—Private company. Registered April 22nd. Capital, £500 in £1 shares. Objects: To acquire the sole agency in the United Kingdom for the sale of products of the Canadian Porcelain Co., Ltd. (registered and carrying on business in Canada) and to carry on the business of manufacturers, importers and exporters of porcelain, glass, metals, and similar substances; electrical and mechanical engineers, &c. The provisional directors are:—G. M. Duncan, Embassy Court, 91, Jermyn Street, S.W.1, sales manager; H. J. Wallis, 17, Victoria Street, S.W.1, solicitor's clerk.

Lectro Linx, Ltd.—Private company. Registered April 22nd. Capital, £5,000 in £1 shares. Objects: To acquire from A. E. Chapman, C. R. Cook, and Mrs. E. A. M. Cook, or any of such persons, the benefit of certain existing inventions relating to electrical contact terminals, couplings, wire attachments, and the like, &c. The directors are:—Mrs. E. A. M. Cook (chairman), address not stated; C. R. Cook, 61, Acacia Road, St. John's Wood, N.W.; I. B. Felton, 11F, Hogarth Road, S.W.5. Qualification, 50 shares. Secretary (*pro tem.*): J. G. Martin, 7, Philpot Lane, E.C. Solicitors: Martin & Haslett, 7, Philpot Lane, E.C.

Langs (Wimbledon), Ltd.—Private company. Registered April 22nd. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical engineers, manufacturers, factors, and vendors of and dealers in all kinds of wireless and electrical apparatus and goods, &c. The subscribers (each with one share) are:—A. E. Bonner, 65, Weston Park, Crouch End, N.8, clerk; H. R. Fisher, 42, Foxham Road, Tufnell Park, N.19, clerk. Qualification, £25. Remuneration, £50 each per annum (chairman £75). Solicitors: Tucker & Co., 40, Finsbury Square, E.C. Registered office: 15, Kingston Road, Wimbledon, S.W.

Official Returns of Electrical Companies.

Central Electric Development Co., Ltd.—Return dated January 14th, 1927. Capital at date of return, £1,500 in ordinary shares of £1 (increased February 3rd, 1927, to £2,000 in 500 preference and 1,500 ordinary shares of £1 each). 1,500 ordinary shares taken up. £1,400 paid. £100 considered as paid. Mortgages and charges, nil. Return of allotments, made up to February 28th, 1927, shows a further 160 preference shares allotted for cash and fully called up.

Horley and District Electricity Supply Co., Ltd.—Capital, £20,000 in £1 shares. Return dated December 31st, 1926 (filed March 7th, 1927). All shares taken up. £10,262 paid. £2,000 considered as paid. £7,738 in arrears. Mortgages and charges at date of return, nil. Since registered: Series of £2,500 debentures (part of £5,000 authorised) issued January 28th, 1927.

Issue on April 9th, 1927, of £2,500 debentures, part of a series already registered.

Kingsmill Art Metal and Electrical Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 7th, 1926. 4,502 shares taken up. £2 paid. £4,500 considered as paid. Mortgages and charges, £515.

Strange & Sons Electrical Engineering Co., Ltd.—Capital, £200 in £1 shares. Return dated December 31st, 1926 (filed February 3rd, 1927). 32 shares taken up. £32 paid. Mortgages and charges, nil.

Permac, Ltd.—Capital, £100 in 1s. shares. Return dated December 31st, 1926 (filed March 22nd, 1927). All shares taken up. £100 paid. Mortgages and charges, nil.

Norton Wireless Co., Ltd.—Debenture dated March 14th, 1927, to secure £1,000, charged on the company's property, present and future, including uncalled capital. Holder: Matilda Parks, 65, Douglas Street, Deptford, S.E.

Charles White Electrical Co., Ltd.—Capital, £3,000 in 1,000 "A" and 1,000 "B" shares of £1 each. Return dated December 17th, 1926. 1,550 "A" and 1,000 "B" shares taken up. £1,050 paid, £1,500 considered as paid. Mortgages and charges, nil.

Belshaw & Co., Ltd.—Capital, £3,000 in 2,500 7 per cent. preference and 500 ordinary shares of £1 each. Return dated July 30th, 1926 (filed March 15th, 1927). 2,000 preference and 500 ordinary shares taken up. £2,500 considered as paid. Mortgages and charges, nil.

Wireless Lights Syndicate, Ltd.—Capital, £10,500 in 10,000 ordinary shares of £1 each and 10,000 deferred shares of 1s. each. Return dated December 30th, 1926. 10,000 ordinary and 5,000 deferred shares taken up. £10,000 paid on the ordinary shares. £250 considered as paid on the deferred shares. Mortgages and charges, nil.

Ernest F. Moy, Ltd.—Particulars filed of £7,500 debentures authorised by resolutions of December 8th and 21st, 1926, and covered by trust deed dated April 5th, 1927, charged on certain leasehold properties in Camden Town and St. Pancras and on the company's other assets, present and future, including uncalled capital, the amount of the present issue being £6,000. Trustees: C. G. Fox, 76, West Hill, Highgate, and P. H. Bastie, 7, Coniston Road, Muswell Hill, N.

West Wilts Electric Light and Power Co., Ltd.—Capital, £35,000 in 2,000 preference shares of £5 each and 25,000 ordinary shares of £1 each. Return dated December 7th, 1926 (filed March 17th, 1927). 1,700 preference and 21,821 ordinary shares taken up. £30,321 paid. Mortgages and charges, nil.

Correcta Light Co., Ltd.—Capital, £7,000 in 6,500 preference shares of £1 each and 10,000 ordinary shares of 1s. each. Return dated February 25th, 1927. 3,450 preference and 10,000 ordinary shares taken up. £2,453 paid on 2,453 preference shares. £1,497 considered as paid on 997 preference and 10,000 ordinary shares. Mortgages and charges, nil.

Mawdsleys, Ltd.—Capital, £20,000 in 13s. 4d. shares. Return dated November 15th, 1926. 26,500 shares taken up. £9,666 13s. 4d. paid, £8,000 considered as paid. Mortgages and charges, £7,000.

Brecknell, Munro & Rogers, Ltd.—Capital, £150,000 in 2,200 preference shares of £5 each, and 278,000 ordinary shares of 10s. each. Return dated January 27th, 1927. 2,058 preference and 174,829 ordinary shares taken up. £90,673 10s. paid (being £5 per share on 2,058 preference and 10s. per share on 160,767 ordinary shares), £7,031 considered as paid on 14,062 ordinary shares. Mortgages and charges, nil.

Robert W. Blackwell & Co., Ltd.—Capital, £50,000 in £1 shares. Return dated January 12th, 1927. All shares taken up. £18,338 paid, £31,662 considered as paid. Mortgages and charges: £14,000.

Wardle Engineering Co., Ltd.—Capital, £25,000 in 10,000 preference and 15,000 ordinary shares of £1 each. Return dated December 21st, 1926. 5,765 preference and 7,306 ordinary shares taken up. £12,971 paid, £200 considered as paid. Mortgages and charges: £4,000.

C. F. Elwell, Ltd.—A. C. Lucas, of 167, Strand, W.C., ceased to act as receiver and manager on April 1st, 1927.

Woking Electric Supply Co., Ltd.—Issue on April 11th, 1927, of £40,000 debentures, part of a series already registered.

City Notes.

Prospectus.

Baird Television Development Co., Ltd.—This company came before the public on Monday last with an issue of 100,000 10 per cent. preferred participating ordinary shares of £1 each and 100,000 deferred ordinary shares of 1s. each, each of the former shares carrying the right to take one of the latter. The full particulars of the company were given in our "New Companies Registered" column, April 8th, p. 568, to which we refer our readers. The list of applications was to close on or before Wednesday last, April 27th, so that any comment here will have less influence than might otherwise have been the case. It may be stated, however, that the company, which has been formed particularly "to develop commercially" the Baird Television and other inventions, acquires the sole right to "exploit" the Baird inventions for Television, invisible ray, speaking films, and other purposes in the United Kingdom of Great Britain and Northern Ireland, the English Channel Islands, the Isle of Man, and the Irish Free State, and a 66⅔ per cent. interest in the net proceeds arising from and payable to Television, Ltd., in respect of the sale and exploitation of the Foreign and Colonial rights. The prospectus refers to the demonstrations that have been given of the invention, its possible uses, and a statement of estimated revenue and profits. Mr. J. L. Baird, the inventor, will be chief technical consultant and a joint managing director for a period of five years, and Mr. O. G. Hutchinson, who has been associated with him in his work, will be a joint managing director for a like period. The purchase price is £20,000 payable to Television, Ltd., by the allotment of the remaining 400,000 deferred shares (1s.) in the new company. After paying all preliminary expenses, the net proceeds of the issue will be approximately £89,500. The vendor company is taking no cash payment, and it has underwritten 32,000 of the ordinary shares. We need say little about the issue itself owing to the closing date, and it is obvious to every reader of the REVIEW that it is an investment of the most speculative and uncertain kind and one which, in our opinion, is made quite prematurely. Whilst, as our pages have shown, progress has been made towards attaining ultimate success, the work is still in the experimental stage, and no particulars have yet been published with regard to the construction of the light-sensitive cell which is the essential feature of the system.

Since the above was written, it has been announced that the list of applications was closed on Monday.

Shropshire, Worcestershire and Staffordshire Electric Power Co.

The net receipts for the past year amounted to £232,170, as compared with £218,066 for 1925. After deducting expenses, debenture interest, &c., and adding £50,615 brought forward, there is a sum of £144,969 available (against £140,286). It is proposed to distribute this as follows:—To reserve, £50,000; 6 per cent. preference dividend, £21,000; dividend of 8 per cent. on the "A" ordinary shares, £4,000; dividend of 7 per cent. on the "B" ordinary shares, £24,500; carried forward, £45,469. The Bill providing for the merger of the separate and general undertakings of the company has received the Royal Assent, and the report includes an amalgamated balance sheet. The reserve now totals £341,948, and the aggregate capital expenditure amounts to £2,368,148, the expenditure during the past year being £398,483. Investments in allied companies at cost stand at £114,805, and Government securities at £71,145. To provide capital for the development of the business issues of 50,000 6 per cent. cumulative preference shares, 10,685 "A" ordinary shares, and 192,137 "B" ordinary shares, all of £1 each, were made, at a net premium of £3,774, which has been written off the commission, &c., on capital issues. Supplies by overhead lines have now been made available in Evesham, Droitwich, Astwood Bank, and many smaller towns and villages. The Avon Valley Special Order, authorising the company to supply electricity in parts of Gloucestershire and Warwickshire, has been confirmed. The company has acquired the share capital of the Ludlow Electric Light Co., Ltd., and is applying for an order enabling it to supply electricity in the borough. The chief local offices are being moved from Smethwick to Halesowen. Meeting: May 3rd.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the register, and such companies are thereby dissolved:—

Atmospheric Nitrates (Kilburn Scott Patents), Ltd.
Blackpool and Garstang Electric Light Railway Co., Ltd.
Bovey Light & Power Co., Ltd.
Clar-O-Phon Radio Co., Ltd.
Electric Lamp & Bulb Co., Ltd.
Electroscopes, Ltd.
High Temperature Generators (1918), Ltd.
Horsa Electrical Contracting Co., Ltd.
Ivor Electrical Co., Ltd.
Mayfair Light & Power Co., Ltd.
National Conduit & Cable Co., Ltd.
Phillips' Commutator Grinder Co., Ltd.
Pneumatic & Electric Syndicate, Ltd.
Sceando Lamp Co., Ltd.
Searchlight Projectors, Ltd.
Southport Electrical Supply Co., Ltd.
Tubeless Rapid Steam Generator Co., Ltd.

Companies to be Struck off the Register.

At the expiration of three months the names of the undermentioned companies will be struck off the register, unless cause is shown to the contrary:—

Britannic Electrical Co., Ltd.
Enamelled Wires, Ltd.
Froggatt's Electric Lighting Co., Ltd.
Goodall Electric, Ltd.
Grasse & Cannes Electric Syndicate, Ltd.
New Process Electric Lamp Co., Ltd.

Northern General Transport Co., Ltd.

Mr. R. J. Howley, C.B.E., presided at the annual meeting on April 21st, and in presenting the report (*vide* our last issue, p. 650) said that the past year had been the most difficult one in the history of the company. Although, when the mines were reopened, traffic receipts had begun to improve, they were still far from normal. The receipts from investments were lower owing to the passing of the ordinary dividend by the Jarrow Company and the reduction of the Tynemouth Company's dividend from 10 to 5 per cent. An issue of £118,750 ordinary shares was made during the year; the proceeds were devoted to loan repayment, improvements, and working capital. Owing to the opposition of the shareholders of the Sunderland District Transport Co., the proposal to take over that company's omnibus assets and goodwill had not gone through. Competition was still acute, and the company had to bear heavy licence fees; the chairman deprecated the raiding of the Road Fund to balance the Budget.

National Electric Construction Co., Ltd.

The directors report a profit of £22,467 for the past year, and the balance, after providing for debenture interest, depreciation, &c., is £16,991; to this is added £5,390 brought forward, making £22,381. It is proposed to transfer £1,000 to reserve and renewals account (Dewsbury and Ossett tramways), £3,000 to dividend-equalisation reserve, and £6,000 to general reserve. After paying a dividend of 10 per cent., as for 1925, a balance of £5,581 is carried forward. The tramways in mining and industrial districts in which the company is interested suffered severely during the past year, and this will affect the dividends received on investments in the current year.

City Electric Light Co., Ltd. (Brisbane).

The report and balance-sheet for the year ended January 31st, 1927, shows that after making addition to the franchise and purchase sinking fund, renewal, replacement and contingencies account, and the employés' provident fund, there remains a credit balance of £115,712, which, with the balance brought forward from last year, makes a sum of £115,764. Out of this sum was paid an interim dividend in September last, amounting to £57,069, and a final dividend of 5 per cent. on the ordinary shares in proportion to the amount paid thereon, free of State income tax, was recommended, leaving a balance of £50 to be carried forward. The report records the death of Mr. William John Young, a pioneer of the company, and a director since its inception.

Marconi International Marine Communication Co., Ltd.

The accounts for the year ended December 31st last show total receipts of £890,865, as compared with £995,522 in 1925. The net profit, however, increased from £118,979 to £126,132, in spite of the fact that 1925 was an abnormal year owing to the compulsory fitting of ships' lifeboats with wireless, practically all of which was done in that year. The result is therefore considered gratifying. The company suffered loss of revenue on account of strikes, but now that normal conditions have returned orders for equipment show an increase. The shipowners agreed to pay increased amounts to the company on account of the award of higher wages to wireless operators by the Industrial Court. During the past year working arrangements were entered into with the Radio Communication Co., Ltd., and working costs have thereby been substantially reduced. The directors have set aside £20,000 from the profits to meet obsolescence of plant, and propose to pay a final dividend of 5 per cent., making 8¾ per cent. for the year, as against 7½ per cent.for 1925; £18,038 is carried forward. Mr. J. F. O'Malley has been appointed to the board. Meeting: May 5th.

Indo-European Telegraph Co., Ltd.

The report for 1926 states that only two serious interruptions, caused by severe weather, occurred during the year, apart from a stoppage due to a strike of Russian employés. The revenue from all sources increased from £310,345 to £314,007. The profit, after meeting income tax, was £103,125, and a net balance of £16,288 brought forward makes available £119,413. £45,000 is devoted to writing down expenditure upon line reconstruction in Russia and Poland, and £5,244 in writing down the cost of the Persian section, and £15,000 is handed over to the retirement trust fund. A final dividend of £1 2s. 6d. per share is to be paid (making 7 per cent. for the year), together with a bonus of 15s. per share, all free of tax, leaving a balance of £11,669 to be carried forward. The meeting was to be held yesterday (Thursday).

Llandudno and Colwyn Bay Electric Railway, Ltd.

The accounts just published cover the thirteen months to December 31st last, and show a loss of £1,427, against which is placed a surplus of £362 brought forward, leaving a net loss of £1,065. The report states that the results were seriously affected by the permanent-way expenses, high power costs, and legal expenses. Complaint is also made of the adverse effects of motor-omnibus competition. The company secured modification of the Colwyn Bay Council's Bill which sought powers to run motor-omnibuses in the district. Negotiations are in hand with regard to power supply. The company has not yet issued any of the new £100,000 6 per cent. prior lien debenture stock; the more pressing requirements were met by means of a loan of £10,000. The overhead equipment is being completely renewed from Llandudno to Colwyn Bay, and other improvements are under consideration.

Barcelona Traction, Light and Power Co.

Further progress is recorded by this company in the accounts for the past year. The gross revenue was over $4,000,000, and, after meeting all expenses, the net result is a profit of $1,783,882, as compared with $1,248,095 for the previous year. The balance has been applied in paying four quarterly dividends at the rate of 1¾ per cent. on the preference shares, making 7 per cent., and absorbing $1,729,509, leaving a surplus of $54,372, which, together with the amount brought forward, gives a balance of $214,695 to be carried forward.

Vickers, Ltd.

The profit for the past year was £562,284, and a balance of £190,775 is added, making £753,059. After meeting the preference dividends and transferring £200,000 to reserve, it is proposed to carry forward a balance of £134 868; no ordinary dividend is recommended. The result, in view of the dislocation of trade, is considered satisfactory; if conditions had been normal it would have been possible to pay an ordinary dividend. During the year the business was reorganised, and considerable economies were effected. Mr. G. G. Sim, C.S.I. C.I.E., has been appointed secretary, and Mr. F. C. Yapp a member of the Armaments and Shipbuilding Management Board and Messrs. A. Williamson and G. Vickers have been elected special directors. Mr. V. C. Vickers has resigned from the board.

Johnson & Phillips, Ltd.

The directors' report for the past year shows that after charging £15,454 for maintenance, providing for bad debts, &c., the balance at the credit of the profit and loss account is £115,114, as compared with £209,897 in 1925 (after allocating £21,000 to maintenance). To this is added £152,133 brought forward, less £60,000 paid in dividends in May last, making £207,247. From this are deducted directors' fees, &c., debenture interest, debenture sinking fund reserve, income tax, and depreciation of machinery and plant, and an interim dividend of 5 per cent., leaving £127,475. It is proposed to pay a final dividend of 7½ per cent. on the ordinary shares, making 12½ per cent. for the year, as compared with 17½ per cent. for 1925, leaving £82,475 (against £92,133) to be carried forward. The 100,000 new ordinary shares receive their first full year's dividend. The balance sheet shows a capital expenditure of £94,089 during the year, and also includes among the investments a £50,000 8 per cent. debenture in Burndept Wireless, Ltd. Meeting: May 5th.

Calcutta Tramways Co., Ltd.

The total revenue for the past year was £132,723, as against £219,044 for 1925. The addition of £37,703 brought forward makes available £170,426. It is proposed to place £70,000 to depreciation reserve and £2,164 to staff provident fund, and, after paying a dividend of 5 per cent., free of tax (against 7½ per cent.) on the ordinary shares, to carry forward £12,410. The decrease in revenue is attributed to the recurrent communal riots in Calcutta and to the growing competition of independent omnibus owners. To meet the competition the company lowered its fares and the increased traffic is expected to compensate for the reduction. Meeting: May 3rd.

Rangoon Electric Tramway and Supply Co., Ltd.

From the profits of the past year £50,000 is transferred to renewals reserve, £30,000 to cables reserve, £5,000 to fire-insurance reserve, and £10,000 to the low-pressure conversion reserve, leaving a net balance of £60,824, as compared with £47,983 for 1925. An interim dividend of 8 annas per share was paid on the old ordinary shares, and it is proposed to pay a further Rs.1.4 annas per share on these and 14 annas per share on the new ordinary shares, leaving £25,573. The 100,000 new £1 ordinary shares were issued in August last at Rs.16 per share.

International General Electric Co.

The company's report for 1926 shows a net income from sales of $806,753, and a net "sundry" income of $731,554, totalling $1,538,307. The dividends—7 per cent. on the preferred stock and 8 per cent. on the common stock—absorb $1,500,000, and the balance is transferred to surplus, making $11,898,577. The value of orders received fell from $25,710,000 in 1925 to $20,824,000 in 1926, and the value of orders in hand at the end of the year from $9,645,000 to $8,112,000.

Thames Valley Traction Co., Ltd.

The profit for 1926, after providing for all charges, including depreciation and reserve, is £11,120 (against £5.049), to which is added £3,088 brought forward, making £14,208. It is proposed to pay a dividend of 10 per cent. on the ordinary shares (against 6 per cent.), leaving £6,399 to be carried forward. During the year the authorised capital was raised from £75,000 to £100,000, and 5,000 new shares were issued.

Electrical Finance and Securities Co., Ltd.

After meeting debenture interest, fees and expenses, the credit balance for 1926 is £6,647, and the addition of £2,408 brought forward makes available £9,055. A dividend of 10 per cent. is recommended, leaving £2,962 to be carried forward.

Mexborough and Swinton Tramways Co.

After providing for taxation, depreciation, loss on motor-buses, &c., there is a deficit of £353 on the 1926 net revenue account. Against this is placed £1,460 brought forward, and the balance is carried to the next account. No dividend can be paid on the ordinary shares; in the preceding year they received 2 per cent., free of tax.

Howard & Bullough, Ltd.

The recently-issued accounts cover the ten months to March 31st last, and show a profit of £41,927, plus £159,947 brought forward, making £201,874. The final ordinary dividend is at the rate of 10 per cent. per annum for four months, making 8⅓ per cent. for the period, as against 10 per cent. for 1925-26, *i.e.*, the same rate.

Philips Lamps.

According to the *Financial Times*, Philips Incandescent Lamp Factories has issued a dividend of 16 per cent. on the ordinary shares for 1926 and one of 8 per cent. on the preferred shares.

Montevideo Telephone Co.

The directors of the Montevideo Telephone Co. have declared an interim dividend on the ordinary shares at the rate of 6 per cent. per annum, free of tax, payable on May 2nd.

Hopkinsons, Ltd.

The report for the year ended January 31st last is the first since the company's incorporation. A net profit of £72,283 is shown, and of this £11,547 representing profit earned prior to incorporation is transferred to capital account. A final dividend of 5 per cent. (making 10 per cent. for the year) is to be paid on the ordinary shares and £12,224 is carried forward.

At the first ordinary general meeting, Mr. Robert A. Hopkinson, chairman, commented on the strong financial position of the company. He said that the payments of the dividends had been arranged to fall at three-month intervals, *viz.*, preference, January 31st; final ordinary, April 30th; preference, July 31st; and interim ordinary (if any), October 31st. During the past year £25,058 had been spent on new buildings and plant. Included in the extensive development work which had been carried out by the company were the experiments made in connection with the electrical operation of valves from a distance. Considerable attention had also been given to the development of thermostatic valves for controlling the temperature of liquids. The manufacture of feed-water regulators was a new activity of the firm. At the end of 1926 arrangements had been made for the transfer of the business to the new company, and in nearly every case where shares of the old company were held by employés, they were converted to shares in the new company. The report and accounts were unanimously adopted.

Calcutta Electric Supply Corporation, Ltd.

The directors recommend a final dividend of 7 per cent. actual, making a total of 12 per cent. for the year. They also recommend a distribution of bonus shares in the ratio of one new ordinary share for every 10 of the existing ordinary shares. Meeting: May 4th.

Stock Exchange Notice.

Application has been made to the Committee to allow the following to be officially quoted:—

American Telephone and Telegraph Company.—$13,639,500 capital stock.

Western Union Telegraph Co.

The gross revenues for the quarter ended March 31st last amounted to $32,241,077, as compared with $32,705,184 in January-March, 1925. The net income fell from $3,415,646 to $3,236,223.

Associated Gas and Electric System.

The earnings during the year ended February 28th increased by $7,500,115 to $30,131,629. The net earnings rose from $9,135,820 to $13,617,033.

Consolidated Gas, Electric Light and Power of Baltimore.

A dividend of $⅝ per common share has been declared in respect of the quarter ending June 30th.

Stocks and Shares.

Monday Evening.

Thanks to the unexpected reduction to 4½ per cent. in the Bank rate, stock markets have taken on a very cheerful aspect. That monetary conditions would have to become easier in order to allow the Government to exercise substantial economies, was fairly obvious by a close reading of the Budget speech. City opinion regarded a change in the Bank rate as being dependent upon developments in China, and, these not being favourable, the fall last Thursday in the rate came as a surprise. A very pleasant surprise, too, and one that is hailed as the herald to a further decline to 4 per cent. in the fairly near future.

The immediate effect was to put up prices of all investment stocks and shares. Gilt-edged issues led the way, and were promptly followed by such sound industrials as those, for instance, in the cable group. The relief that will be afforded to trade and industry is reflected in the improved values for shares in iron, steel, and other "heavy" companies. Vickers' report, showing an increased profit—the ordinary shares still go dividendless—came at an opportune moment to fan the revival of hopefulness that is noticeable in regard to such industrials. Home Railway stocks were disposed at first to hang back in the advance which affected most of the other markets, but later on, they came into line with the rest.

The Underground Railway stocks and shares were taken in hand by their supporters, and Districts rose to 60½. Expectations of record crowds at the Cup Final last Saturday were supplemented by consideration of the fact that the time is close at hand when traffics will run against those of the General Strike fortnight. The strike started last year at midnight on Monday, May 3rd. The Metropolitan, true to its traditions, was the first line to re-open, which it did (with a very skeleton service) on the Wednesday in the same week. The District and the Tubes "got going" two days later. On Wednesday, May 12th, the strike was declared at an end, but this turned out to be premature, and not until Monday, the 17th, did con-

ditions approach normality. For many weeks afterwards, coal became worse in quality and dearer in price. The District, alone amongst the railway companies, earned the 3½ per cent. dividend which it paid for 1926, and this is the reason why the stock is chosen by the speculative investor of to-day. The Underground Electric Railways of London succeeded in entering the dividend-list with 1½ per cent. on the reorganised share capital, and, since then, the £1 shares have made steady upward progress week by week, standing now at 17s. 6d.

It is interesting to observe a gain of 7½ points in British Electric Traction stock. This brings the price to 150, comparing with 135 at the time, a few weeks ago, when attention was drawn to the "Trust" company character of the undertaking.

No little dust has been raised by the action of the Southern Railway in giving to a Swedish Company the contract for an important order whose execution will provide a good deal of work. The railway has laid especial stress upon the fact that its action was not dictated by considerations of price, although the English tenders were more expensive than the Swedish. The contract has gone abroad owing to the home firms' imposition of conditions that were not stipulated by the foreign manufacturers. In this column, we are concerned only with the financial aspect of the matter, and, in regard to that, it must be recorded that Stock Exchange opinion inclines to the view that the step taken by the Southern Railway has a good deal to be said in its favour, while regret is general at so substantial an order having been placed abroad. The effect upon share-prices is purely negative, in that no changes have occurred. Had the contract been given to British companies, the shares in the undertakings concerned would have strengthened, as a result. General Electrics and other shares in the manufacturing group are unaltered on the week.

Anglo-Argentine Trams are a good market, the second preference being 10s. higher at 76s. 3d. Rumours cluster thickly around the course of the negotiations that are said to be taking place. The 5 per cent. debenture stock has been in demand up to 73, and there is not much floating supply in the market. La Plata Trams are creeping up in price. The 6 per cent. preference, still cum 1s. 6d. dividend that will be deducted on Thursday in this week, stand at 21s. 3d., and the ordinary, in which a hand is being taken by speculators, are 4s. 6d. Mild gambling in the ordinary shares is encouraged by extremely nebulous reports as to the possibility of the company being taken over by a certain group.

Cable stocks and shares have responded to the Bank rate reduction with rises in Anglo-American preferred, Eastern ordinary, Eastern Extensions, and Western shares. Great Northerns advanced a further 5s., to 27½, on the dividend declaration. Globe preference are ⅛ up at 11 in sympathy with the improvement in the best-class stocks. Amongst the telephones, United River Plate are better at 8 13/16. Marconis mark time, and the Marine Company's shares remain at 23s. 9d., the dividend increase, to 8¾ per cent., having been expected, and discounted in advance. Weakness continues to characterise Automatic Telephones, in which the price has slipped back to 47s. 6d. India Rubber shares followed up last week's advance with a fresh rise to 20s. 7½d. Business in the equipment section is quiet.

A violent rise, of 4 points in one afternoon, lifted Brazilian Tractions to 141. Men in the market profess mystification at the current price of the shares, because there is little reason, on the surface, to justify the quotation. Consequently, guesses are made at what may be the explanation for this latest outburst of optimism inspired by Brussels buying. Another share to enjoy a dramatic rise is Barcelona Traction, but, in this case, the spurt from 46 to 52 has a foundation in the issue of an extremely satisfactory report. The directors go so far as to hint at the likelihood of a dividend on the common shares, and in the fairly near future. The Board seems to take a rosy view of prospects which, to the cautious eye, may still take time to materialise into dividends on the common shares. Mexican Utilities hold the gains of a week ago. Nothing has transpired, up to this (Monday) night, in the shape of news about the expected scheme for dealing with the dividend accumulation of arrears on Mexican Light & Power preferred. Meanwhile, private correspondence speaks none too comfortably concerning the state of the distressful country, where brigandage apparently still goes on in certain districts. The obvious reply is, of course, that in Mexico, there always was, and always will be, a measure of lawlessness in the outlying and mountainous parts.

Electricity supply shares are hard in tone, and a few advances have occurred. The Shropshire and Worcestershire report is a good one, the effect being to draw attention to shares in provincial companies that did poorly last year owing to the coal stoppage. It is contended that in the course of a year or two these undertakings will more than retrieve the damage inflicted upon them by the industrial conditions of 1926, and that the buyer of to-day is likely to see a handsome appreciation of prices in the future. Electric Constructions at 30s. are unaffected by repetition of last year's 10 per cent. dividend.

There is nothing much doing in the rubber share market, where only languid interest is taken in the suggestion that the Stevenson restriction scheme shall be abandoned, and that the producing companies shall revert to free selling. The exportable allowance of the rubber-producers that come under the voluntary restriction, will be reduced next week to 60 per cent., but this has led to no accession of business or of interest in the market for rubber shares.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Apr. 25 1927.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	59/6	—	4 14 1
Brompton Ordinary	£1	10	8⅜	25/6	—	7 5 3
Charing Cross Ordinary	£1	15	8½	25/-	—	5 12 0
do. do. 4½ Pref.	£1	4½	4½	17/-	—	5 6 0
Chelsea	£1	12	8⅝	25/-	—	5 12 0
City of London	£1	15	10	13⅜	—	5 1 10
do. do. 6% Pref.	£1	6	6	22/6	—	5 6 8
Clyde Valley	£1	8	8	31/-	—	5 3 3
County of London	£1	15	7½	28/-	+6d.	5 0 0
do. do. 6% Pref.	£1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	£1	7	8	26/3	—	6 2 0
do. 7% Pref.	£1	6	7	23/6	+6d.	5 19 2
Elec. Supply Corporation	£1	10	10	31/3	—	6 8 0
Kensington Ordinary	£1	15	8	25/-	—	5 12 0
Lancs. Light and Power	£1	7½	7½	26/6	+6d.	5 13 2
London Electric	£1	10	8½	24/-	—	5 16 8
do. do. 6% Pref.	£5	6	6	5½	+1/16	5 9 1
Metropolitan	£1	11	8	28/6	—	4 18 3
do. 4½% Pref.	£1	4½	4½	17/-	—	5 2 10
Midland Counties	£1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary	£1	7	5	22/6	—	4 9 0
do. 5% Pref.	£1	5	5	17/6	—	5 14 3
do. 7% Pref.	£1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	£10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	£1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	£5	17½	8	25/6	—	5 9 10
South London	£1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	£1	7	7	1½	—	6 3 0
Urban Ordinary	£1	4	7	25/6	—	5 9 10
do. 6% Pref.	£1	6	6	1⅛	—	5 13 0
Westminster Ordinary	£1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	£1	8	8	29/6	—	5 8 4
Home Rails.						
Central London Ord. Assented	Stock	4	4	70	—	5 14 4
Metropolitan	,,	5	3	62½	—	4 16 0
do. District	,,	3½	3½	60½	+1½	5 15 8
Underground Electric	£1	Nil	1½	17/6	+1/-	1 14 3
do. do. Income	Bonds	6	6	102	—	*5 17 8
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	101	+1	5 18 10
do. Def.	,,	1½	1½	23⅜	—	6 6 0
Automatic Telephone	£1	8	10	47/6	-1/3	4 4 2
Chili Telephone	£5	5	6	6 7/16	—	4 13 2
Cuba Sub. Ord.	£10	5	5	7	—	7 2 10
Eastern Extension	£10	10	10	17⅜	+⅛	*5 13 6
Eastern Tel. Ord.	Stock	10	10	174½	+2	*5 14 7
Globe Tel. and T. Ord.	£10	10	10	18½	—	*5 8 1
do. do. Pref.	£10	6	6	11	+⅛	5 9 1
Great Northern Tel.	£10	20	20	27½	+½	7 5 6
Indo-European	£25	8½	10	46½	—	*5 7 6
Marconi	£1	Nil	Nil	17/6	—	.. ...
Marconi-Marine	£1	7½	8¾	23/9	—	7 7 4
Oriental Telephone Ord.	£1	12	12	52/6	+6d.	*4 11 5
United R. Plate Tel.	£5	8	8	8 13/16	+1/16	*4 10 9
Western Telegraph	£10	10	10	17¼	+½	*5 16 0
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	3½	+⅛	7 17 2
do. do. 2nd Pref.	£5	6	6	3 13/14	+½	7 17 4
do. do. 5% Deb.	Stock	5	5	71½		7 0 0
British Electric Traction Ord.	,,	8	—	15	+7½	5 6 8
do. do. 6% Pref.	,,	6	6	109	—	5 10 1
Brazil Traction	£100	5	6	141	+3½	4 5 0
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	6¾	6¾	117½	+1	5 6 5
do. do. Deferred	,,	8	—	158	+2	*5 1 3
do. do. Deb.	,,	4¼	4¼	80½	+½	5 5 7
London & Sub. Trac. 5% Pref.	£1	Nil	Nil	7/9	—	Nil
London United Tram. Deb.	Stock	4	4	51	—	7 16 10
Mexico Trams, 5% Bonds	—	5	5	73½	—	6 16 1
Mexican Light Common	£100	Nil	Nil	45	—	Nil
do. Pref.	£100	Nil	Nil	107	—	Nil
do. 1st Bonds	—	5	5	68½	—	7 6 0
Yorkshire (West Riding)	£1	5	—	8/9	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	£1	13	13	55/-	—	*4 16 6
British Aluminium Ord.	£1	12½	10	44/6	—	4 10 0
British Elec. Transformer Pref.	£1	Nil	7	18/	—	7 9 0
British Insulated Ord.	£1	15	—	70/-	—	4 5 9
Brush Ord.	£1	10	—	28/3	—	7 1 7
Callenders	£1	15	—	3⅜	—	4 5 9
do. 6½% Pref.	£1	6½	6½	23/9	—	5 9 5
Crompton Ord.	£1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	£1	10	10	30/-	—	6 13 4
Enfield Cable Pref.	£1	7½	7½	1½	—	6 6 4
English Electric	£1	Nil	Nil	10/-	—	... ...
do. do. Pref.	£1	3	—	12/6	—	... ...
Gen. Elec. Pref.	£1	6½	6½	23/6	—	5 10 8
do. Ord.	£1	7½	—	30/6	—	4 18 4
Henley	£1	20	—	90/-	—	4 8 11
do. 4½% Pref.	£5	4½	4½	4½	—	5 6 0
India-Rubber	£1	5	5	1 5/32	+5/32	*4 16 10
Johnson & Phillips	£1	17½	—	2⅜	—	7 7 4
Met.-Vickers Ord.	£1	8	8	27/6	—	5 11 4
do. Pref.	£2	8	8	2⅜	—	6 14 9
Siemens Ord.	£1	7½	—	26/9	—	5 12 2
Telegraph Construction	£2	10	10	28½	—	*4 4 2

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during March, 1927.

THE Board of Trade returns of our foreign electrical trade during March record increased imports and smaller exports as compared with the preceding month. While, however, the rise in imports was substantial, the decrease in exports was only about 0.6 per cent. Looking at the export section, it will be observed that the increases predominated in number; most of them were small, but the rises in glow lamps, "other" motors and generators and submarine cable stand out. The second item nearly compensated for the decreases in the other two machinery sections. The increases in the exports of telegraph and telephone cables were more than offset by a drop of £46,594 in the case of insulated wires and cables. Telegraph and telephone apparatus continued the downward movement which commenced in December last. In comparison with March, 1926, the export total shows an increase of over £58,000; the individual items exhibit a number of wide variations. The machinery section improved to a satisfactory extent, but all three cable sections registered large decreases. Unenumerated electrical goods and batteries and accumulators were both well up. The figures for the first quarter show that last year's satisfactory export position is being improved upon.

The following table shows the distribution of our electrical machinery exports during March compared with the figures for the preceding March:—

Destination.	March, 1926. £	March, 1927. £	Inc. or dec. £
European countries	55,646	62,951	+ 7,305
Japan	7,467	23,872	+16,405
South American countries...	33,059	55,299	+22,240
South Africa	51,842	92,908	+41,066
British India	110,330	76,356	−33,974
Australia	111,347	153,280	+41,933
New Zealand	42,101	35,793	− 6,308
Canada	17,752	11,071	− 6,681
Other countries	54,869	66,074	+11,205
Totals	£484,413	£577,604	+£93,191

Turning to the imports, it will be noticed that only three items were lower in value than in February, and that the decreases were of a negligible size. On the other hand, there were some important increases, the chief of which occurred in the two unenumerated sections. Increases of over £10,000 also occurred in batteries and accumulators, insulated wires and cables, and meters and instruments. The comparison with the corresponding month of last year is a reflection of the preceding column, although the increases were generally smaller, and the two decreases larger; there was an increase in arc lamps and parts, where a decrease occurred in comparison with February. The first quarter's import total is well above that of the first quarter of 1926.

The dwindling tendency of re-exports continued.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Mar., 1927.	Inc. or dec. as compared with Feb., 1927.	Inc. or dec. as compared with Mar., 1926.	Electrical imports for Mar., 1927.	Inc. or dec. as compared with Feb., 1927.	Inc. or dec. as compared with Mar., 1926.	Electrical re-exports for Mar., 1927.	Inc. or dec. as compared with Feb., 1927.	Inc. or dec. as compared with Mar., 1926.
Electrical goods and apparatus (unenumerated)	£217,036	+ £6,386	+ £25,881	£118,002	+£31,144	+ £29,136	£4,419	−£1,231	−£2,887
Insulated wires and cables ...	260,725	− 46,594	− 32,144	63,575	+ 11,152	+ 1,054	517	+ 295	− 1,457
Glow lamps	52,455	+ 13,542	+ 11,420	27,624	+ 3,063	+ 5,545	3,593	+ 1,502	+ 2,486
Arc lamps and parts	3,984	+ 1,189	+ 3,090	2,476	− 321	+ 1,318	1,137	+ 1,081	− 267
Batteries and accumulators ...	102,869	+ 1,803	+ 35,272	44,376	+ 10,779	+ 7,397	237	− 174	− 1,965
Meters and instruments ...	30,984	− 4,890	− 5,212	26,445	+ 10,235	+ 2,859	328	− 86	− 1,344
Carbons	4,402	+ 3,589	− 3,131	3,993	− 1,678	− 4,888	27	+ 2	− 161
Electrical Machinery—									
Electrical machinery (unenumerated)	325,482	− 23,685	+ 52,842	138,728	+ 40,843	+ 21,573	8,785	+ 833	− 2,973
Railway and tramway motors	38,808	− 8,819	− 5,466	—	—	—	—	—	—
Other motors and generators ..	213,314	+ 27,825	+ 45,815	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	10,026	+ 2,355	+ 6,618	13	+ 4	+ 9	4	+ 4	− 14
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	55,724	+ 10,697	− 31,183	4,917	− 255	− 4,904	12	− 227	− 10
Submarine telegraph and telephone cable...	38,132	+ 13,641	− 11,469	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	183,450	− 16,793	− 40,471	36,567	+ 1,695	+ 2,477	3,220	− 2,135	− 1,447
Totals	£1,537,391	− £9,974	+ £58,124	£466,716	+£106,681	+ £61,606	£22,279	− £136	−£10,039
Increases and decreases for three months of 1927 ...		Exports: + £373,879			Imports: + £153,491			Re-Exports: − £10,614	

United States Electrical Exports.

The preliminary figures of the foreign electrical trade of the United States during February, published by *Commerce Reports*, give an export total of $7,009,482, as compared with $6,967,918 in February, 1926. The largest increases occurred in the lighter classes, such as telephone apparatus, electric lamps, batteries, portable tools, and motor-driven household devices. Although the shipments of heavy machinery declined upon the whole, there were increases in some classes, including transforming and converting apparatus, d.c. generators of 500 kW and over, self-contained lighting outfits, small motors, and industrial electric furnaces and ovens. The largest decline occurred in the case of electric railway locomotives, and among other classes which experienced falls were mining and industrial locomotives, a.c. generators, 2,000 kVA and over, switches and circuit breakers, railway motors and radio apparatus.

The Situation in Belgium.

Foreign Electrical Trade Statistics.

MR. J. PICTON BAGGE, Commercial Secretary at the British Embassy, Brussels, has forwarded to the Department of Overseas Trade a report upon the economic situation in Belgium in 1926. (Stationery Office, 4s. 6d. net.) In this a great deal of attention is paid to the financial and monetary problems with which the country was confronted. It is shown that by heroic measures the edifice of public finance was slowly but surely set up, making a firm basis for national economic life. It was recognised that a stable exchange, and therefore industrial and commercial well-being, rested on the basis of a balance of international payments, a balance which could only be secured by intensified production and a highly-developed organisation in all branches of the export trade. A national committee on industrial production was set up, and after examining numerous aspects it published a report dealing with the country's principal industries. Among the matters treated were the organisation of the supply and distribution of electrical power, the utilisation of the country's water power, the scientific organisation of factories, standardisation and specialisation, &c. Belgian industries have already made much progress in production methods since the war. The present position of industry in general is said to be good, and in spite of the difficult conditions the results for the past year were satisfactory.

Electric Light and Power.

The rapid development of the use of electricity continued during the past year. Hesitation upon the part of industry to proceed with the conversion of motive installations was caused by the instability of the currency, but this was compensated for by the demand from the rural districts, stimulated by a shortage of labour and the realisation of the necessity for improved methods of farming. In the province of Antwerp and in the Campine, excellent progress has been made with the electrification scheme. Of the 400 km. of cable to be laid 160 km. has already been completed, and 14 communes have been connected. Similar progress has been made in the provinces of Namur and Limburg. The report embodies a table showing the progress made by the principal electricity supply authorities. At December 31st, 1925, there were 28 power stations, with a total capacity of 630,000 kW, owned by private electric light and power companies; in addition to these the municipal plants in Brussels, Ghent and Liège had a total capacity of 45,000 kW, and a large quantity of power was produced by mining and metallurgical concerns for distribution. The supply companies' output rose from 630 million kWh in 1924 to 790 million kWh in 1925. The load dispatching system inaugurated in the Liège area is gradually extending.

Provincial administrations in provinces where no central power stations exist have decided to install h.p. circuits, with l.p. distribution, in the rural communes. In East Flanders only a few of the communes now remain without electricity, and official forecasts estimate that within five years every commune will be served. Directly electricity becomes available, local farmers install electric lighting apparatus and substitute electric motors for petrol-driven machines. Small-scale farmers are creating a demand for small motors (3 to 7 h.p.) which operate dairy and farm machinery of all descriptions. Oral and practical construction in the handling and repairing of machines is given by public authorities and agricultural associations. The increased use of electricity by the railways is also mentioned.

The Radio Industry.

While the iron and steel industry is dealt with at great length, no mention is made of the electrical manufacturing industries, with the sole exceptions of the porcelain and radio sections. Electrical porcelain is said to be produced in quantities more than sufficient for home requirements, and a good market is found in France. With regard to the radio industry it is stated that a stagnation has been caused in the supplies trade on account of the poor financial position of the broadcasting service, which is thus unable to develop. Negotiations are in progress which, if successful, will give the broadcasting company revenue from the licence fees which at present are retained by the Government. The fees will probably be increased. At present there are only 30,000 licences issued, and listeners are largely dependent upon the British and French services, for the reception of which expensive sets are required. If the arrangement with the State is negotiated the Belgian service will be improved, with a resultant increase in the sale of sets. The report states that at present British sets are too expensive for the Belgian market, which is mainly supplied by Belgian and French manufacturers. There is, however, a good demand for British component parts, the quality of which is superior to French and German makes. Holland practically monopolises the valve market.

Communications.

While but slight progress has been made in the internal telegraph system, cables are being laid for the international telegraph and telephone service between La Panne-Brussels and Herbesthal. Other international telephone lines under construction are those between Brussels and Roosendael and Lille. Between October 31st, 1925, and October 31st, 1926, the number of telephone exchanges rose from 367 to 382, and the number of subscribers from 119,153 and 130,398; new lines totalling 154 km. were erected. The 1927 Budget provides credits of 137 million francs for the development and improvement of the system. Amplifying stations for the Brussels-Luxemburg line are to be constructed at Jemelle and Aubange, and underground cables are to be laid in the Brussels, Antwerp and Liège areas in Flanders and in the provinces of Liège, Limburg and Luxemburg. Cables are also to be laid from Brussels to Charleroi with a branch to Mons. In August last contracts were signed between the Government and the Sociétés Radio Belgique and Goldschmidt for the use of the latter company's transmitting stations for a short-wave public radio-telegraph service which was inaugurated on August 30th. Powerful stations have been erected in the Congo. The 1927 Budget provides 145,000 fr. for the construction of the Ruysselede transmitting station, and 1,300,000 fr. for an electrical sub-station. Credits are also provided for the naval stations at Antwerp and Ostend.

Imports and Exports in 1925 and 1926.

The Belgian Government now publishes monthly statistics of the country's foreign trade in considerable detail, and with the publication of the December issue it is possible for the first time to survey the import and export trade in electrical machinery and apparatus during the past two years. Below are given the weights of such goods imported and exported in 1925 and 1926 with a note of any increase or decrease:—

	1925. Thous. kg.	1926. Thous. kg.	Inc. or dec. Thous. kg.
Imports.			
Dynamo-electric machines—			
Total	4,153	3,760	− 393
From France	1,449	1,317	− 132
,, Germany	826	865	+ 39
,, Sweden	700	465	− 235
,, United States	65	303	+ 238
,, Switzerland	395	228	− 167
Dry batteries—			
Total	303	221	− 82
From France	114	109	− 5
,, Denmark	117	66	− 51
Accumulators and plates—			
Total	610	539	− 71
From United States	432	270	− 162
,, Great Britain	48	108	+ 60
,, France	33	75	+ 42
,, Germany	14	31	+ 17
Cables, submarine and underground—			
Total	1,236	3,312	+2,076
From Germany	477	2,795	+2,318
,, Holland	166	241	+ 75
,, France	61	140	+ 89
Insulated wire and cable, other—			
Total	653	517	+ 136
From Germany	386	245	− 141
,, France	48	58	+ 10
,, Holland	66	96	+ 30
Carbons for electrical purposes—			
Total	239	369	+ 130
From Germany	115	140	+ 25
,, United States	70	152	+ 82
Insulators of porcelain, glass, &c.—			
Total	948	860	− 88
From Germany	70	190	+ 120
,, France	716	548	− 168
Insulating tubes, not metal covered—			
Total	19	36	+ 17
From Germany	11	87	+ 76
,, Switzerland	4	36	+ 32

	1925 Thous. kg.	1926. Thous. kg.	Inc. or dec. Thous. kg.
Insulating tubes, other, with junction boxes, &c.—			
Total	188	118	− 70
From Germany	128	95	− 33
Metallic filament lamps—			
Total	253	158	− 95
From Holland	185	106	− 79
Measuring instruments and parts—			
Total	260	265	+ 5
From Germany	70	98	+ 28
,, France	39	68	+ 29
,, Switzerland	119	74	− 45
Telegraph and telephone apparatus—			
Total	79	93	+ 14
From Germany	9	7	− 2
,, France	40	55	+ 15
,, Great Britain	21	19	− 2
Electrical and electro-technical apparatus and parts not elsewhere specified—			
Total	1,978	2,389	+ 411
From France	777	708	− 69
,, Germany	505	708	+ 203
,, United States	133	430	+ 297
,, Holland	153	179	+ 26
,, Great Britain	103	96	− 7
Exports.			
Dynamo-electric machines—			
Total	1,137	2,021	+ 884
To Belgian Congo	75	444	+ 369
,, Argentina	74	359	+ 285
,, Brazil	202	135	− 67
,, Great Britain	49	209	+ 160
,, Holland	98	121	+ 23
Dry batteries—			
Total	16	47	+ 31
To Greece	7	11	+ 4
,, Holland	1	20	+ 19
Accumulators and plates—			
Total	107	404	+ 265
To Belgian Congo	107	340	+ 233
,, Argentina	6	215	+ 209
,, Spain	11	40	+ 29
,, Holland	27	65	+ 38
Insulators of porcelain, glass, &c.—			
Total	197	164	− 33
To Belgian Congo	30	31	+ 1
,, France	107	74	− 33

	1925. Thous. kg.	1926. Thous. kg.	Inc. or dec. Thous. kg.
Cables, submarine and underground—			
Total	1,315	3,654	+2,339
To Belgian Congo	32	171	+ 139
,, Germany	287	516	+ 229
,, Argentina	130	66	− 64
,, Great Britain	415	1,650	+1,235
,, Holland	13	192	+ 179
,, Siam	—	520	+ 520
Insulated wire and cable—			
Total	2,736	2,517	− 219
To Germany	393	103	− 290
,, Belgian Congo	68	115	+ 47
,, Brazil	15	260	+ 245
,, Great Britain	848	1,017	+ 169
,, Holland	265	238	− 27
,, Argentina	345	79	− 266
Insulating tubes—			
Total	342	371	+ 29
To Germany	245	65	− 180
,, Egypt	19	150	+ 131
,, Greece	16	47	+ 31
Metallic filament lamps—			
Total	25	39	+ 14
Measuring instruments and parts: meters—			
Total	30	103	+ 73
To Argentina	1	25	+ 24
Telegraph and telephone apparatus—			
Total	622	1,732	+1,110
To China	2	121	+ 119
,, Spain	130	677	+ 547
,, Australia	16	95	+ 79
,, France	44	68	+ 24
,, Italy	10	72	+ 62
,, Norway	64	69	+ 5
,, Holland	22	88	+ 66
,, Switzerland	91	199	+ 108
Electrical and electro-technical apparatus and parts not elsewhere specified—			
Total	587	941	+ 354
To Belgian Congo	19	24	+ 5
,, Germany	2	26	+ 24
,, Egypt	10	77	+ 67
,, France	130	130	—
,, Holland	13	62	+ 49
,, Syria	3	135	+ 132
,, Siam	—	46	+ 46
,, Great Britain	239	18	− 221

Heat for Factory Processes.

A system of heat transmission with special reference to the cable industry.

THE generation and utilisation of heat in the most effective and economical manner is becoming more and more important as the necessity becomes evident of redu ing manufacturing costs. Except in special cases where favourable circumstances permit the use of electricity, the use of steam heating and direct firing, that is, the direct heating of vessels by means of coal or coke fires, or gas or oil burners, has been until comparatively recently almost universal in all industries. In many instances, however, steam heating and direct firing as a means of applying heat to material under treatment fall very far short of the ideal, and they have been adopted merely because better methods have not been available.

This is as true in cable making as in many other industries, all of which provide numerous instances where vast improvements in efficiency can be effected. Apart from special applications with which other defects become apparent, steam heating suffers from the general disadvantage that the temperatures which can be reached and maintained are dependent on the boiler pressure available and the pressures which the heating vessels can withstand. For instance, a steam pressure of 100 lb. corresponds to only 338 deg. F., and very much higher temperatures are frequently required. Similarly direct firing, although it is less limited in range of temperature, has disadvantages which more than offset its value as a means of obtaining a high temperature. For instance, it is extremely inefficient thermally, it is not conducive to accurate temperature control and often causes high local temperatures which spoil the product and burn the walls of the vessel.

The advantages of using oil for heat transmission, in preference to the above methods of heating, were realised many years ago, and several attempts were made to obtain in practice the obvious theoretical advantages, such as the ability to supply heat to any process at a high temperature without a high working pressure and with an improved thermal efficiency. For the most part these efforts were unsuccessful through a lack of appreciation of the fundamental principles involved, but a heating system believed to be quite satisfactory, embodying the principle of heat transmission by means of oil, has now been developed, and is available for general application in industrial processes. The system referred to is the Merrill patent oil circulation system, which is in the hands of the Kestner Evaporator & Engineering Co., Ltd. Apart from the very large number of installations which have been in continuous operation for several years in chemical works, roofing felt, oil hardening, and other industries in this country and abroad, a large proportion of the cable factories in America have adopted this system, and it is now attracting attention from English manufacturers of cables and insulated wire, for whom several successful installations have already been put down.

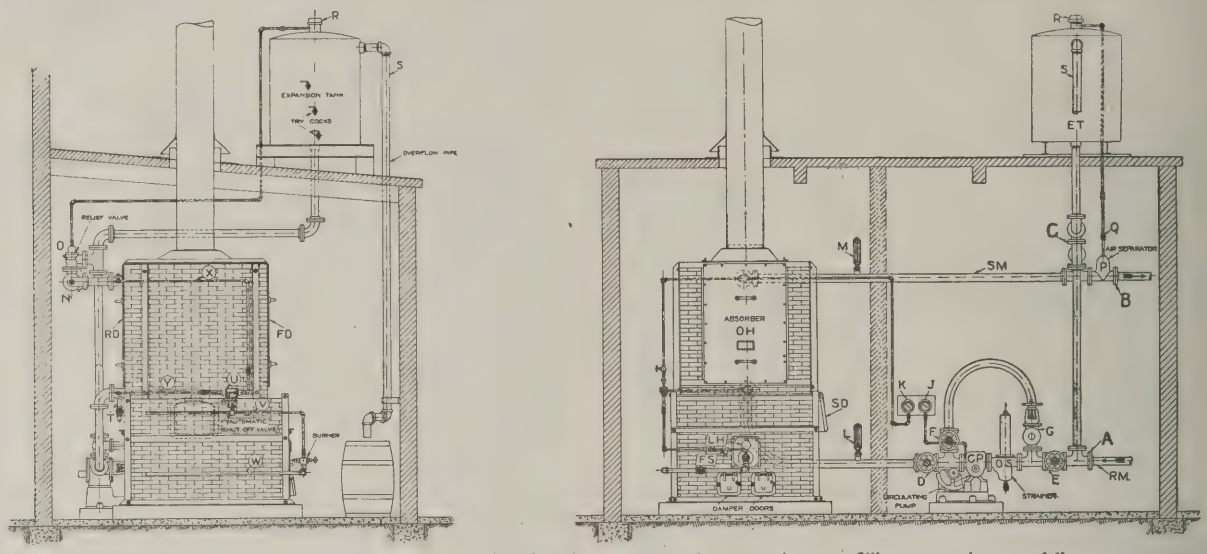
Essentially the plant consists of a central oil-heating unit from which the hot oil is distributed through the works, by suitably arranged pipe lines. Fig. 1 shows the arrangement of a typical heating unit, which consists of the furnace in which the oil heater or absorber is mounted, an oil-circulating pump, an expansion tank, and the necessary piping arrangements and fittings.

The design of the absorber is the result of many years of practical experience, and is such, it is claimed, that provided a suitable oil is used there is absolutely no danger of carbonising or burning out of the tubes. The pump ensures positive and rapid circulation of the oil through the system, the expansion tank providing for the change of volume in the oil as it is heated and cooled.

From the heating unit the hot oil is delivered at the point A, to which connection is made by suitable pipe lines to the plant to be heated, and the oil, after passing through the jackets or heating coils, returns to the point B. There is thus a complete circuit from which the only losses of heat are those due to radiation. The application of oil heating in cable and insulated-wire manufacture is largely in connection with the melting and heating of pitch, wax and high-melting-point compounds generally. The rate of heating with the oil-transmission system is claimed to be very much greater, while materials of higher melting points can be used. An existing steam plant, if converted to oil heating, would be capable of a much increased output, and at the same time could treat at a higher temperature, thus improving manufacturing conditions and enabling special compounds to be used.

Oil heating may also be applied with advantage to the heating of h.p. cable impregnators, and an important point in its favour in this connection is the impossibility of moisture finding its way into the cable from the jackets. As is well known, precautions are taken to dry the cable thoroughly before impregnation and to prevent the ingress of moisture at any stage of the process, and yet until quite recently h.p. steam had been employed universally for heating the impregnators. With steam there is always the danger of a slight leak from the jackets into the vessel, the detection of which is not always easy, and which may cause serious damage to the product, whereas with oil, not only is the danger of a leak developing very greatly reduced on account of the low working pressure, but if it did occur it could not do any great harm, and would be easily detected. The same heating unit may be connected to any number of impregnators, and may also be used to advantage for heating the compound storing and mixing tanks.

In conclusion it may be remarked that, apart from the cable industry, oil heating is also successful in use in a number of other industries, for instance, in the manufacture of dyes, roofing felt, synthetic chemicals, varnish, and accumulator cases.



A, B and C, connection points to external system; D and E, isolating valves; F, by-pass valve; G, filling connection; J, delivery pressure gauge; K, outlet pressure gauge; L, inlet thermometer; M, outlet thermometer; O, relief valve; P air separator; Q, air-drain valve; R, filler cap; S, overflow pipe; T, oil drum; U, fuel shut-off valve; V, fuel supply line; W, compressed-air line; X and Y, valve connections; LH, lighting hole; OH, oil heater; FS, oil filter; OS, oil strainer; CP, circulating pump; SM, supply main, RM, return main; ET, expansion tank; RD and FD, absorber inspection doors; SD, furnace inspection door.

Fig. 1.—Typical Oil-Transmission Heating System.

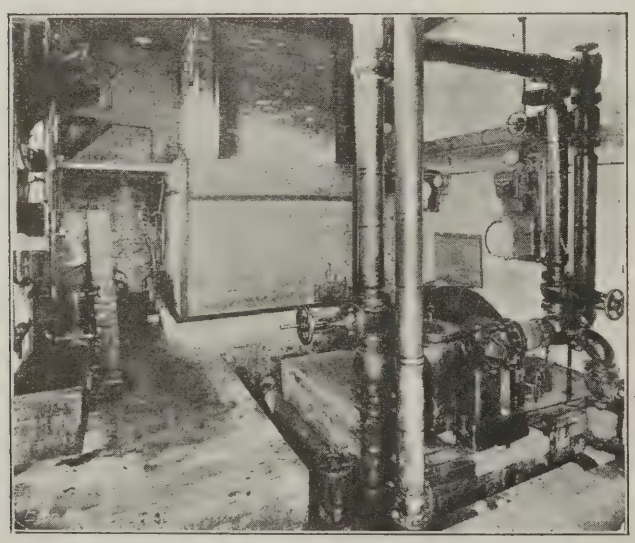


Fig. 2.—A 2,000,000-B.th.u. per hour Installation.

Fig. 2 shows the absorber, circulating pump, and other auxiliaris of an actual heating unit of two million B.th.u. per hour capacity installed in a factory in this country.

A New Current Limiter.

A Norwegian Development.

A POPULAR form of electricity tariff in Norway is the fixed charge per annum with no restriction on the period of consumption. This has resulted in the introduction of a current limiter, by Messrs. N. Jacobsen's Elektriske Verksted A/s., of Oslo, Norway, which is claimed to be immune from the disadvantages which are borne by other apparatus of its class, principally that the consumer might be able to derive an unjust advantage from the limiter in the case of heating apparatus, by using it on an intermittent circuit, and the inconvenience caused to the consumer, should his loading be slightly and accidentally increased, in not having sufficient light to see to the necessary reduction of his loading.

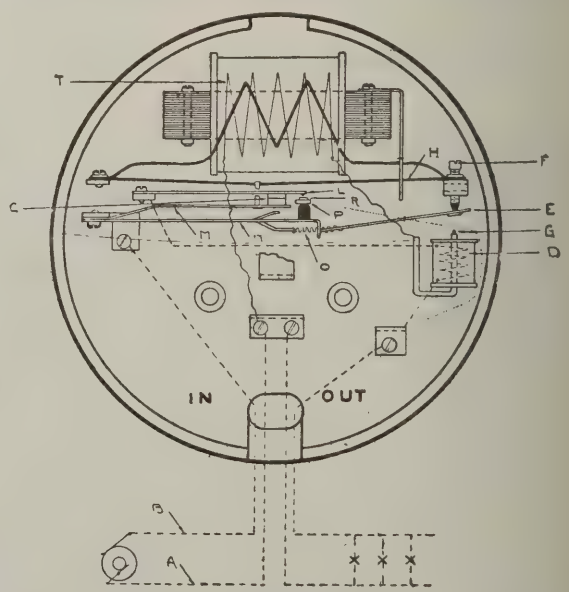


Fig. 1.—Jacobsen Current Limiter.

The instrument, which is designed exclusively for single-phase a.c., consists primarily of an overload relay, contact breaks, and a transformer, the secondary circuit of which embodies a heating wire used in regulating the periodical breaking of the circuit when the loading limit is exceeded. Fig. 1 illustrates the principle of the device. The two supply

eads are taken into the limiter, but A is only looped, and merely supplies the primary of the transformer T. The second wire B is led to the contact breakers, one of which is suspended by the heating wire H, and then passes on through the relay coil D to the consumer's circuit. This relay acts upon the anchor E, which normally is in contact with the screw F, and immediately the loading exceeds a predetermined value it strikes downwards on to the contact G and closes the transformer primary. The springs L and M are normally in contact at C by virtue of the heating wire, from which the lower spring is suspended, and which short-circuits the transformer secondary. The arm N acts upwards against the coupling P, and in its movable end carries an anchor E, which is held off the relay core at G by a spiral spring O. Immediately the loading limit is exceeded the anchor is drawn downwards on to G, and the transformer is coupled up and brought into action. The current induced in the secondary circuit of the transformer then causes the heating wire to become warm and expand, and it immediately sags downwards, allowing the springs L and M to fall. Spring L thereupon makes contact with R, while M moves still further, and first opens the contacts C, whereby the main circuit is broken, and finally strikes against the upper fork of arm N, which is lowered until the tension on spring O is such as to force the anchor E back against the regulating screw contact F, when the transformer is again deprived of current; the heating wire then cools, the spring M once more closes the main circuit, and the contact R puts in circuit a resistance wire (dotted line) laid parallel to the relay coil. The object of the last operation is to compensate for the "rush" current when the main circuit is closed, otherwise the apparatus would not come to rest until the load was reduced to a value far below that of the load limit. With this parallel connection, of course, the whole of the current does not act upon the relay coil at once, but with the load at 50 or 100 per cent. in excess of the limit the anchor E will be thrown over again immediately. This occurs so quickly that a metal filament lamp, for instance, is not given time to light up at each closing of the circuit, while the intervening periods of darkness are of constant duration. When the excess loading is great the limiter does not permit any energy to pass through the circuit at all, but acts as if the whole installation were uncoupled by means of an ordinary switch. Normally the entire load must pass through the relay coil, and in the case of small overloads the circuit will remain closed between the breaks for a sufficient time to allow the loading to be reduced. The current limit is regulated by means of the screw F. The device is enclosed in an iron cover, which is secured by a lead seal in front on the outer side of the screw nut. The limiter is stated to have been tested with approximately one million breaks at 30 A on a 220-V service, and to be capable of breaking 30 A for a very long period without sustaining any damage. The regulation is claimed to be absolutely constant, and the employment of this type of limiter has reduced the control and repairing expenses at the electricity works by quite an appreciable amount.

Messrs. Jacobsen's representative in this country is Mr. C. H. Smith, London.

Economic Value of Increased Steam Pressure.

Some results of investigations on the effects of steam-pressure increase on operation and plant efficiencies and costs, with considerations on the selection of particular pressures.

By H. L. GUY.

(*Abstract of a Paper read before the* North-Western Branch *of the* Institution of Mechanical Engineers.)

In the pursuit of increased efficiency of steam power plant in the last decade, the range of steam conditions with which it operates has been increased and the character of the cycle employed has been modified. The success attending these developments, coupled with the increase in size of the plant involved and the greater skill with which it is operated, is illustrated by the fact that in the last 10 years the thermal efficiency of the best power stations has been improved by some 50 per cent. Steam pressures have been materially increased, steam temperatures have shown some advance, and the vacua obtained with given water tempera-

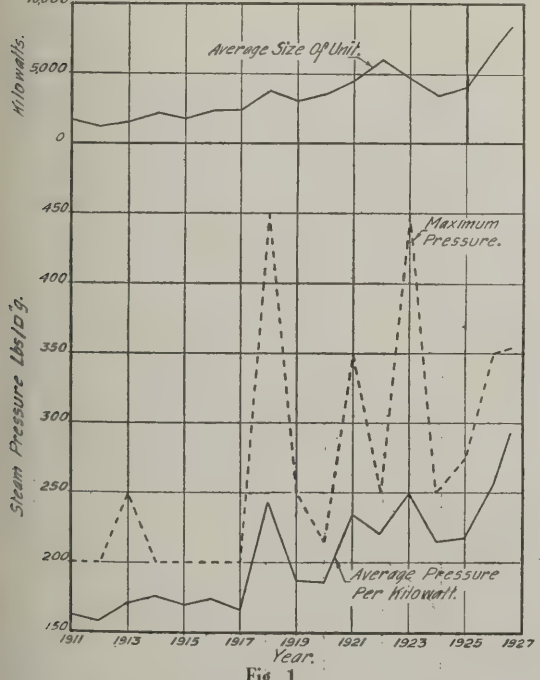


Fig. 1.

tures have been increased. Of these the change in steam pressure, still in a state of flux, is perhaps the most striking; the maximum steam temperature has in recent time shown a tendency to become stationary, and vacua, with given water temperatures, if anything, appear to be slightly reducing.

The steam cycle itself has changed as the result of the general adoption of regenerative feed heating, by the extraction of steam from the turbine at successive points in its expansion, and also, in some cases, by taking the steam out of the turbine after partial expansion and resuperheating it before returning it for expansion to be completed. The advantage to be derived from both these operations is a function of the initial steam pressure. The way in which the average steam pressure adopted has changed with time, based on the orders received by the firm with which the author is associated, is shown in fig. 1. The maximum pressure for which plant was ordered is also plotted. The first considerable peak shown is of historical significance, representing, as it does, the first commercial installation employing a considerably increased steam pressure, multiple-stage turbine or "regenerative" feed heating and resuperheating.

Table I.

Power Station	Output. Initial kW.	Output. Ultimate kW.	Output. Size of units kW.	Steam conditions before stop valve of turbine. Gauge pressure lbs./□"g.	Steam conditions before stop valve of turbine. Temp. °F.
North Tees (1)...	60,000	100,000	20,000	450-500	650
Barton (Manchester)	82,500	160,000	27,500	350	700
Trenton Channel (Detroit)	150,000	300,000	50,000	375	700
Philo (3) ...	80,000	240,000	40,000	550	725
Crawford Ave. (Chicago) (3)	160,000	750,000	50,000 60,000	550	725
Barking (London) (2)	120,000	500,000	20,000 40,000	350	700
Columbia (Miami Fort) (3)	90,000	360,000	45,000	550	725
Weymouth	82,900	400,000	3×3,150 32,000	1,200 350	700 700
Richmond ...	100,000	600,000	50,000	375	675
East River (N.Y.)	120,000	700,000	60,000	375	700
Hudson Avenue	150,000 240,000	400,000	50,000 90,000	265 375	614 700
Rummelsburg (Berlin)	240,000	600,000	70,000 10,000	462	752
Langerbrugge	26,400		1,600 6,600	710	822

(1). Reheating to 500 deg. F.
(2). " 709 "
(3). " 725 "

In Table I certain particulars are given of notable h.p. stations; this list is illustrative rather than exhaustive, and is inserted to emphasise the considerable extent to which

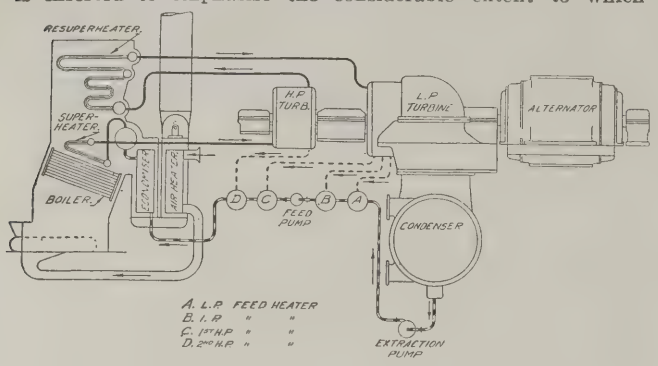
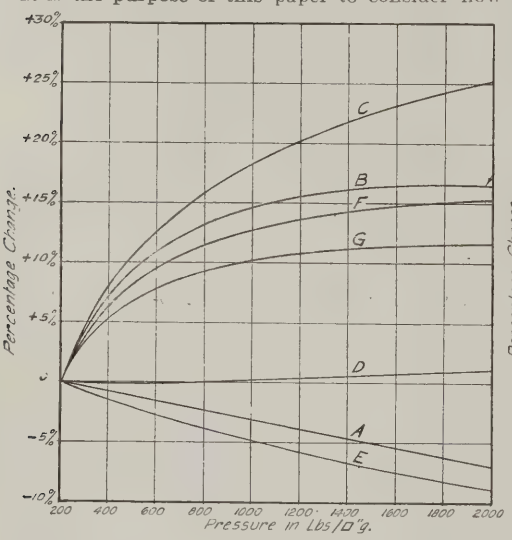


Fig. 2.

this movement has grown in all parts of the world and some of the mile-stones on the way.

It is the purpose of this paper to consider how far increase of steam pressure affects the efficiency of operation; some of its effects on the character and cost of the individual units comprising the whole plant, and what guidance can be obtained in the selection of the pressure appropriate to any particular case. Fig. 2 illustrates diagrammatically the type of complete installation considered.



700 deg. F., stop valve; 29-in. vac., exhaust.

Fig. 3.

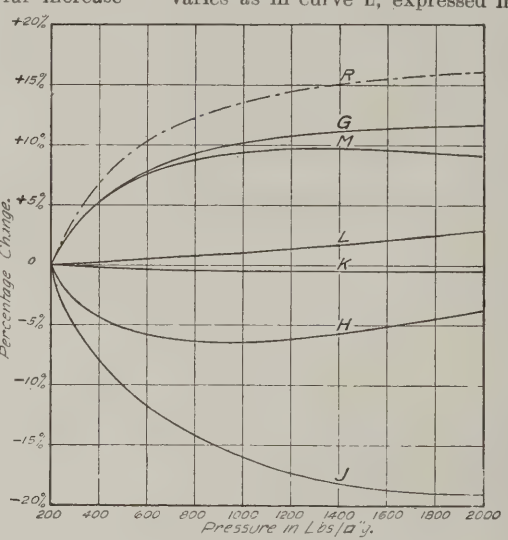
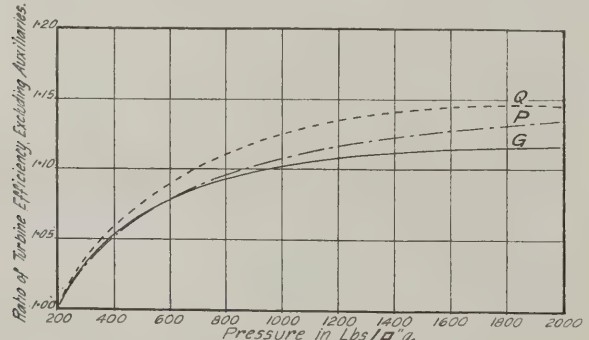


Fig. 4.

In order to consider the gains to be expected from the adoption of increased pressures in a simple condensing-turbine installation, steam will be assumed to be supplied to the machine stop valve at a normal total temperature of 700 deg. F. In commercial operation the possibility of the total temperature being 50 deg. F. above normal, necessitates plant suitable for a maximum total temperature of 750 deg. F.; operation with a moderate pressure for a given total temperature is rather more safe than at high pressure, for as the pressures increase so do the maximum stresses in certain parts of the plant. Maintaining the superheat constant and imagining the total temperature to increase with the pressure is inexcusable. A vacuum of 29 in. Hg. with 30 in. barometer has also been adopted. The calculations throughout are based on Callendar's enlarged steam tables.



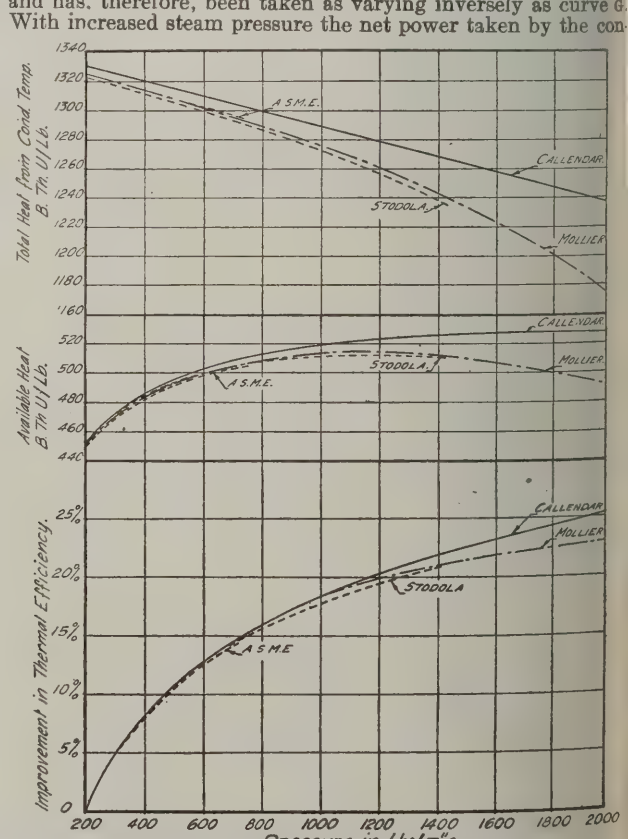
Q, 700 deg. F., 28-in. vac.; P, 900 deg. F., 29-in. vac.
G, 700 deg. F., 29-in. vac.

Fig. 5.

Steam at 200 lb./sq. in. g. pressure is taken as a basis, and an individual stage efficiency of 80 per cent. chosen for dry steam in the turbine designed for this condition. The variation with pressure of the total heat supplied to the steam, expressed as a ratio of that for 200 lb./sq. in. is plotted in curve A, fig. 3. Curve B gives the variation of availabl adiabatic heat drop; while C, the ratio of B and A, gives th first approximation to the variation in thermal efficiency The correction for the variation in the reheat factor is give in D; E shows the variation in efficiency due to the cor condensation which takes place as expansion proceeds, made a the rate of 1 per cent. loss in efficiency for each 1 per cent mean wetness in the stage considered, approximating the los in a straight condensing turbine; F is the corrected efficienc curve from D and E, and G gives the final efficiency, correcte for the remaining turbine losses at the rate of 1 per cent increased loss for each time the pressure is doubled.

This relatively small rate is obtainable only in plant o reasonable size for the speed at which it operates, which sug gests the expedient of gear driving the h.p. end of the tur bine, in order to keep such losses within the limits stated at lower outputs than would otherwise be possible. The pre sence of the gear introduces an additional loss of from 1½ t 2 per cent. of the power it transmits, or slightly lower wher a second generator is driven.

As the steam pressures are increased the power absorbe by various auxiliaries is affected, and, in turn, the heat con sumption of the plant at economic output. The steam con sumption per kW generated varies as in curve H, fig. 4. Th change in the power taken by the feed pump consequentl varies as in curve L, expressed in similar terms. Electricall driven feed pumps wer assumed, having a norma output corresponding t the steam quantity at th maximum continuous rat ing, and the discharg pressure was taken as 5 lb./sq. in. greater than th steam pressure at the tur bine stop valve. Th pump efficiency varie from 75 per cent. at 250 t 65 per cent. at 2,050 lb./sq in., and the motor effici ency was taken as 90 pe cent. for the normal pum duty throughout. As th pressure increases th amount of dry steam to b condensed decreases rapid ly, as shown in curve J The power taken by th condenser auxiliaries ha been assumed as varying directly with this. Th power taken by the boile stokers and fans decrease with the coal to be burnt and has, therefore, been taken as varying inversely as curve G. With increased steam pressure the net power taken by the con-



700 deg. F., 29-in. vac.

Fig. 6.

denser auxiliaries, stokers and fans decreases as in curve K. Curve G, corrected for the variation in the power of the

xiliaries affected by steam pressure, results in curve M, owing the net gain with increasing steam pressure. Curve gives the variation in thermal efficiency to be expected for installation employing four turbine feed heaters in a generative cycle, and having boilers fitted with economisers d air heaters, and from which Table II has been compiled. The last column gives the series of pressures at the turbine op valve, which correspond approximately to equal increents in the thermal efficiency. Undoubted advantages would sult if the standard pressures adopted were chosen on some ch basis as this, and also from fixing standard flanges to adopted for such pressures. It is regrettable that at present e B.E.S.A. tables do not extend beyond 325 lb./sq. in. Fig. 5 shows curves corresponding to curve G, fig. 3, for other eam conditions. It should be pointed out that the increased in at 28 in. vacuum would be reduced from 2.85 per cent. 2.05 per cent. if regenerative feed heating were adopted in th cases and the effect of auxiliary power taken into account. The variations in the total heat and the heat drop available adiabatic expansion with pressure which would be deduced om the work of some of the major authorities are plotted fig. 6. From the resulting thermal efficiency ratios it will e gathered that the three other authorities would suggest ins resulting from the use of the highest pressures sensibly ss than those arrived at on the basis of Callendar's tables. must be remembered that the data employed for such tables as been obtained from experiments covering a very limited nge, not nearly embracing that covered by current engineerg practice.

Table II.

Increments of Pressure for 3 per cent. Thermal Gain.

Accumulated thermal gain, per cent.	Corresponding increment in pressure, lbs./sq. in.	Change in pressure, lbs./sq. in.	Approximate corresponding pressure, lbs./sq. in.
3	65	200-265	250
6	95	265-360	350
9	140	360-500	500
12	255	500-755	750
15	570	755-1325	1300

(*To be continued.*)

Kiosk Sub-Stations.

English Electric Co. kiosk equipment, embodying alternative h.p. control apparatus and totally enclosed l.p. switchgear.

THE advantages of the kiosk type of substation have been fully discussed, and may be summarised briefly as cheapness, convenience, and efficiency, provided always, f course, that the design is sound. Among the firms which

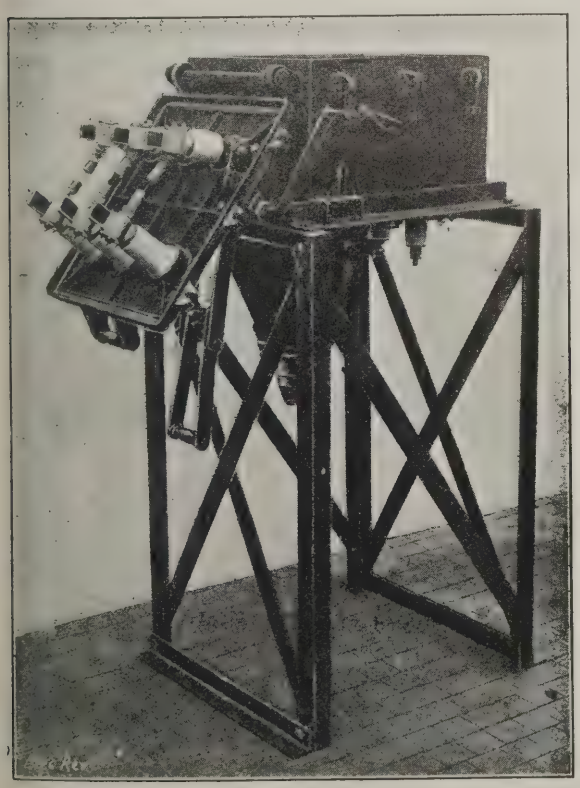


Fig. 1.—Oil-immersed Switch Fuse.

are giving attention to equipment of this description is the English Electric Co., Ltd., and we have received the following particulars of the products in question. Alternative control apparatus may be supplied with the kiosks, and may include on the h.p. side merely isolating switches or fuses, or oil-immersed circuit-breakers may be provided in addition. The fuses employed are of the " Zed " fuse family, and are claimed to have been found extremely successful on comparative tests and in service, no deterioration taking place at ordinary temperatures.

One of the latest productions of the company is the oil-immersed switch fuse, fig. 1, which may also be incorporated in the kiosk equipment in place of the cartridge fuse. The fuse portion, when closed, is immersed in oil contained in a strong

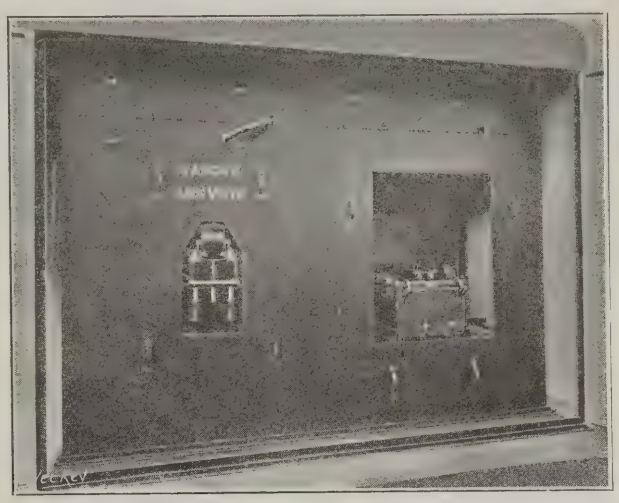


Fig. 2.—H.P. Kiosk Equipment.

welded steel-plate tank, to which is hinged and bolted a cast-steel top. The complete unit is very substantially constructed, and is rated for a rupturing capacity of 50,000 kVA. An interlocking device is incorporated to prevent the fuse being placed in circuit before the lid is properly down. Of course, oil-immersed circuit-breakers give the best protection, but they need only be included where the expense is justified. A particularly effective combination of oil-circuit-breaker and oil switch-fuse can be installed for use on ring-main feeders. The provision of an oil circuit-breaker in each kiosk, together with a suitable arrangement of isolating switches, makes it unnecessary to shut down the ring in the case of a cable fault

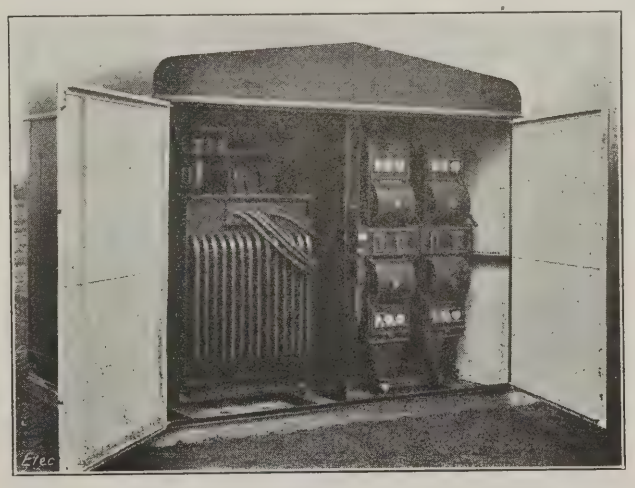


Fig. 3.—Kiosk Substation, L.P. Side.

in one section. A kiosk equipped in this manner and supplied recently for use on a large corporation network is shown in fig. 2. The transformer itself is supplied through an oil-immersed switch-fuse, and the illustration shows the thorough manner in which the h.p. connections are screened, so that no live metal is accessible on opening the kiosk doors. Fig. 3 is a view of the reverse side of this kiosk showing the totally enclosed l.p. switchgear employed, a feature which is strongly recommended by the makers. The transformers employed are of the double-wound, oil-immersed, self-cooled, delta-star type, with the neutral point brought out to a terminal. Tappings are provided in the h.p. windings, which can be connected either to an internal stud board or to a tapping switch. The latter is operated from outside the tank by means of a handwheel. It is standard practice with the English Electric Co. to provide a separate lock and key on the doors giving access to the power transformer, and to screen this chamber so that it is only accessible to an inspector or other person carrying the special key. In the ordinary course the transformer chamber would remain locked even when the doors to the h.p. and l.p. switchgear were open.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

M-L Wireless Generators.

As a result of its application of cobalt steel to the manufacture of magnetos, the M-L Magneto Syndicate, Ltd., has developed a range of machines fitted with permanent field systems, comprising motors, generators, and rotary transformers (*i.e.*, the armature carries two independent windings connected to two separate commutators), which are lighter and more compact than machines having wound field magnets, whilst special attention has been paid to quietness of running, balance of rotating parts, freedom from electrical ripple, and

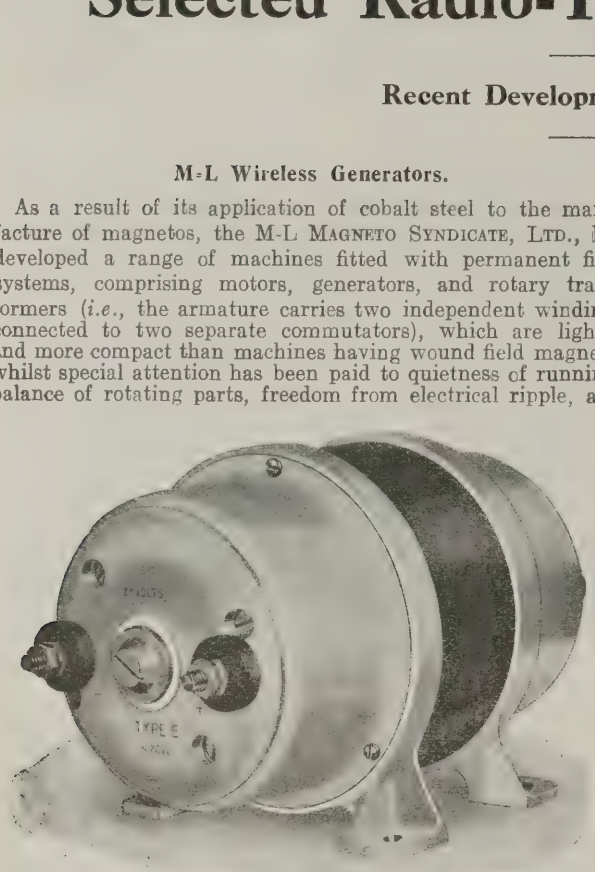


Fig. 1.—A Rotary Transformer.

sparkless commutation. While the machines are suitable for any service for which the orthodox type is normally employed, the employment of a permanent field renders them particularly adapted for certain classes of service. The voltage generated is a linear function of the speed, and the machines are eminently suitable for wireless transmission sets, having the important advantage of possessing better regulation and greater



Fig. 2.—M-L Anode Convertor.

inherent stability than a machine of orthodox type, where fluctuations in load, due to keying or modulation, will cause changes in the field current and strength. When d.c. is available a rotary transformer is preferable to two coupled machines, for charging batteries, for supply of power to small transmitting sets, large amplifiers, and public address systems. The machine is specially designed to reduce the amount of ripple, making the output comparatively easy to "smooth," and when used for reception purposes fine control of output can be obtained by inserting a rheostat in the l.p. circuit. In general laboratory work the machine has many uses, including insulation testing of dielectrics, flash testing of insulation, operation of cathode-ray oscillographs, and the supply of power to valve oscillators of all descriptions. As a generator the machine's output is 100 watts, if wound for a voltage not exceeding 600 V; and 80 watts if wound for between 600 and 1,000 V. As a rotary transformer (fig. 1) it is an excellent source of anode current for low-power transmission work, and is capable of delivering 60 watts up to 100 V, and 50 watts between 600 and 1,000 V. It can be wound for any d.c. input from 12 to 240 volts, and its overall efficiency is 55 per cent. at full load. Ball bearings are fitted, and the brush gear is protected by a cap which can be easily removed for inspection of the commutators. The addition of a motor would make the machine into a double-current generator for energising the anode and filament circuits simultaneously at two voltages.

The standard M-L anode convertor (fig. 2) is also of interest, for it has been designed to replace anode batteries in valve receiving sets and low-power transmitting sets. The machine, which is enclosed with accessories in an aluminium case, is a small permanent-magnet motor-generator, designed to take current from a low-voltage battery (generally the same as that which supplies the filaments) or country house plant, and to deliver current at two voltages simultaneously: a comparatively high one for the l.f. valve anodes and a lower one for the h.f. and detector valves. Provided with an l.p. control rheostat, whereby the convertor can be started and stopped and the output voltage regulated between wide limits, they are also fitted with an l.p. choke and with smoothing circuits on both the h.p. outputs. The convertor's overall dimensions are 17 in. in length and 5 in. in width and height, whilst the largest type weighs but 17.5 lb.

The "R.I." Battery Eliminator.

In order to enable the anodes of the receiver valves to be energised from the domestic a.c. mains and thus eliminate the high-voltage battery, an instrument has been placed on the market by Radio Instruments, Ltd., which comprises a power transformer wound for the voltage of the supply mains to operate a 5-volt double-electrode full-wave rectifying valve and a double-wound power choke having a total inductance of 40 henries for the smoothing circuit; a set of 3-wire wound resistances of 20,000 ohms each, a bank of fixed condensers having a total capacity of 11 μF, and a rheostat for regulating the filament of the valve, are also provided. The consumption of power from the mains is only 5 to 10 watts, whilst two output voltages are provided, one being fixed at approximately 130 V for low-frequency and power valves, while the variable one for the detector and high-frequency valves will give three values of 35, 45, and 65 volts. The set is both neat and compact, the

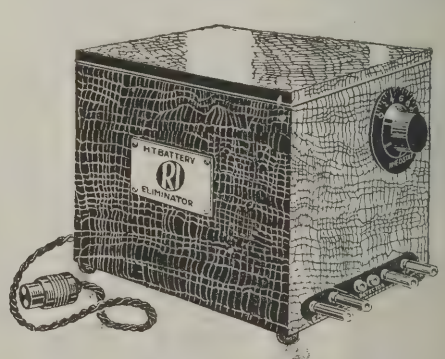


Fig. 3.—The "R.I." Anode Battery Eliminator.

whole of the parts being contained in a substantial metal case, finished to imitate the appearance of leather, as shown in fig. 3; its weight is 14 lb., and dimensions are 8½ in. long, 6⅜ in. wide, and 6¾ in. deep, being made for input pressures of 120 V or 250 V at from 40 to 100 cycles, but those who prefer to build their own eliminator may purchase a complete range of component parts for the purpose. The transformer and choke windings possess a very small d.c. resistance, so that the circuit loss is small; for instance, the resistance of the choke coils is only 190 ohms each: they will carry up to 80 milliamps. Should the domestic supply be d.c., the transformer and rectifying valve are replaced by a resistance, tapped at 2,800, 5,000, 7,000, and 9,000 ohms, suitable for carrying 50 milliamps. In both cases the earth connection of the receiving set should be made through a 1 μF fixed condenser.

The Southern Railway Contract.

Statements by the Various Parties.

WE give below either copies or abstracts of the statements that have been issued by the Southern Railway Company, by Mr. D. N. unlop, the Director of the B.E.A.M.A., by the board the General Electric Co., Ltd., and by others, re-ecting the £120,000 contract for rotary convertors d transformers required by the Railway Company, ich was placed with the Swedish General Electric, d., for its parent concern, Allmanna Svenska ektriska Aktiebolaget.

While we allow these statements to tell the story, we vote a leading article to some of the general con-lerations arising, and in addition we may quote here few impressions gained from Mr. Dunlop. It seems at the Railway Company would have acted with eater fairness to the British manufacturers inter-ted if they had included in their statement an acknow-lgment of the fact that these firms had advanced odifications in their proposals to meet the criticisms the Railway Company. The stipulation of the eneral Electric Co., Ltd., that there should also be aced with them an order for switchgear was regarded an objectionable condition, but it also appears that e Swedish company made it a condition that they ould receive the transformer contract, and the Rail-ay Company have thus penalised the British trans-rmer firms against whom they had no grievance. It understood that the Metropolitan-Vickers Electrical ., Ltd., and Messrs. Mather & Platt, Ltd., were per-ctly willing to undertake the contract, but the atti-de of the Railway Company was opposed to this course ecause they wished to standardise on a machine already stalled. By going out of the country and bringing another machine they have defeated their own end in is particular. There is little reason to doubt that ther the Metropolitan-Vickers Co. or Mather & Platt, td., or Bruce Peebles could have fulfilled the require-ents of the specification, and it is felt that this must ave been known. The statement that it was impos-ble for the Railway Company to avoid "rings" or pooling arrangements" by purchasing on the Con-nent has been traversed, and the Swedish General lectric, Ltd., has made its own declaration that its arent concern does not belong to the Continental ring, nd that its prices are not dictated by such a ring. uestions have been raised regarding the actual connec-ons of the A.S.E.A. with Continental companies, and would be interesting if the precise facts could be ated.

Statement Issued by the Southern Railway Company.

HE following statement appeared in the Press on April 9th:—The Southern Railway Company, as is generally nown, have for some years past been engaged in the ex-ensive electrification of their suburban area. They have already pent about £10,000,000 on this work, and their considered olicy has always been to place their orders for the necessary lant and equipment with British firms wherever possible. n occasion, the maintenance of this policy has been rendered ifficult by the existence between electrical manufacturers of greements which have enabled them to fix and quote iden-ical prices. Nevertheless, in connection with the electrifica-ion of the Eastern section (opened last year) the company laced the contracts for the supply of rotary convertors with hree British firms. On that occasion the plant was ulti-nately purchased, after weeks of negotiation, at prices con-iderably lower than those originally quoted. For the next tage of electrification now being undertaken, the company, n continuance of their policy of purchasing British-made lant, recently invited tenders for the supply of the requisite otary convertors from the same three British firms who had supplied the previous machines. The response to this invitation was an offer by two of the firms jointly to supply only fourteen machines out of the twenty-three required, one of the firms declining to quote without giving any reason. Of these fourteen machines, the supply of seven was made conditional upon the contractor receiving from the company an order for certain other electrical apparatus which had formed the subject of a separate inquiry, and for which, in fact, the company had received a more favourable tender from another firm. The offer of fourteen machines was subsequently increased to the full twenty-three, but only on the added condition that the contracts for the balance of nine machines should be post-dated to November next. This appeared to indicate the existence, not only of a price agreement, but also of some sort of quota arrangement restricting the output of individual firms—or, in effect, dictating to the company the source of supply. In these circumstances the company had no alternative but to find a contractor who was prepared to meet their full requirements on reasonable terms and conditions, and they were reluctantly compelled to turn to Continental manufacturers. As a result, the company have placed a contract with the Allmanna Svenska Elektriska Aktiebolaget of Sweden for the supply of the whole of the rotary convertors. The value of the contract is in the neighbourhood of £120,000. The price required by the Swedish firm is appreciably less than that quoted by the British firms, but the Southern Railway Company wish to emphasise that it is not the lower price which has led them to take this step. They feel that British enterprises should not be penalised by British manufacturers who seek to dictate terms and conditions. The Southern Railway Company have not only their shareholders, but their 70,000 British employés to consider, and in placing, for the first time, an order of this kind out of Britain, they feel that eventually it will not be to the disadvantage of British industry as a whole to draw attention to a state of affairs which causes the loss of wages such an order would ensure.

The B.E.A.M.A. Reply.

Upon the following day Mr. D. N. Dunlop, director of the British Electrical and Allied Manufacturers' Association, made a statement in reply to the railway company's contentions. Dealing with the latter's allegation of the existence of a "ring," Mr. Dunlop said that one of the necessities of modern industrial life was the arrangement of reasonable prices and the distribution of orders. The B.E.A.M.A. was justified in doing this by the enhanced prosperity of the industry; the policy had raised the average dividend paid on the capital of manufacturing firms from 1.67 per cent. to between 5 and 6 per cent., which was not an unreasonable figure. He pointed out that without co-operation in technical matters, in research and design, standardisation, &c., no industry could maintain itself in the face of foreign competition. Reasonable prices had to be obtained if proper wages were to be paid to the skilled workers. In other countries virtually all industries arranged prices and allocated business, and it was doubtful if any important orders for electrical machinery could be placed in any Continental country which would not be given to a member of a "ring." Our Free Trade system protected the home purchaser from being charged unreasonable prices. A railway company should be one of the last concerns to send an order abroad, for it depended to a greater extent than almost any other undertaking on the support of British trade. Mr. Dunlop said:—

"What happened in this case was that the Southern Railway invited tenders for these rotary convertors from three firms—the G.E.C., the English Electric Company, and the British Thomson-Houston Company. These three firms happened to be busy, and they could not carry out the order in exactly the manner which the railway company desired, whereupon, without giving other British firms the chance of taking on the contract, the company petulantly took their business to Sweden. There are at least three other firms in this country—the Metropolitan Vickers, Bruce Peebles, and Mather and Platt—which were not asked to tender, but which would certainly have executed the work within the time and supplied machines which would have filled the specifications of the railway, and that at competitive prices. It is quite untrue that there was any attempt to dictate to the railway company as to terms and conditions. The British firms frankly disclosed the fact that the arrangement existed for distributing business on an equitable basis among the manufacturers, and apparently this was objected to by the railway. Certainly, no attempt was made to charge excessive rates, for our prices are based as a rule on those which firms would quote in open competition. In the case of this contract the price quoted to the Southern was distinctly a 'cut' price."

He considered that the fact that the order had been placed abroad would do British manufacturers a great deal of harm in the foreign markets. He could not understand why the company should be irritated because the manufacturers combined and distributed business: combination had been the salvation of the railway companies, so far as they had been saved. He concluded:—"We know that they used their powers to dry up canals and generally snuff out all forms of competition of that sort. They now have to meet very keen competition in the way of road transport, and it may be that electrification will prove of enormous benefit to them in the struggle. Of course, we have no desire to irritate purchasers, and we shall certainly take this lesson to heart and try to make the application of our principles more attractive."

Statement by the G.E.C.

Subsequently, the General Electric Co., Ltd., expressed its views in a public statement in the following terms:—

The Southern Railway have sent a communication to the Press with the object of justifying their decision to place an important contract with a Continental firm. The reader will no doubt be impressed that the railway company have made out a good case; there is, however, another side to the question. The company, quite unmindful of the monopoly which they enjoy in an important part of the country, seem to resent the fact that electrical manufacturers have taken steps to protect their industry to some extent. For years the industry has lost hundreds of thousands of pounds through unrestricted competition and through the principle prevailing here of placing contracts with the lowest bidder, while demanding guarantees of the highest performance. Research and development have been carried out at great expense by dozens of firms. The industry did not develop on a normal progressive curve, but alternately by periods of rush and periods of stagnation. During the former, unjustifiable extensions of works occurred; during the latter, all were suffering. Wages had to be squeezed under such conditions, and periods of unemployment occurred all too frequently in different parts of the country. The conditions of the war forced us to collaborate for the good of the country, and some of the principles of co-ordination which were introduced then, still exist. They have proved for the good of the industry; they have helped to improve the conditions of labour; and they have not been unfair to the consumer. They have yielded a most modest return to the investor, they have enabled us to spread the work more equally amongst the factories existing and, above all, they have enabled us to build up a quality which puts British electrical products foremost in the markets of the world. Why the Southern Railway should be of opinion that it is wrong for the electrical industry to protect itself, more than it is wrong for a railway company, trade union, the Law Society, the Stock Exchange, or any other trade or profession to do so, we fail to understand. The contract is an unusually large one from one purchaser. The company itself is likely to place only one such contract in five or ten years. Realising the capacity of output of the whole industry, it seems to the common good that such a big contract should be divided amongst a few of us so as not to interfere with the regular service to regular clients. This is all we attempted in the first instance; there was no attempt at dictation. When the Southern Railway objected to place the contract with three firms, the General Electric Co., Ltd. (who, at the present moment, fortunately have a good order book) were anxious to accept 50 per cent. of the contract. We have previously supplied such machines to the Southern Railway, which have given satisfaction. Why the Southern have not accepted our offer, we do not know. The fact that we desired, at the same time, to obtain the contract for the switchgear required for the rotaries, was a mere expediency to balance our respective shops with the most suitable class of work. We withdrew that condition when the Southern were unwilling to grant us this favour; equally so, the condition dating the contract at the later period, was withdrawn. It was therefore open to the Southern to place one half of the contract with the General Electric Co., Ltd., who had given them satisfaction, and the other half with quite a number of British firms of first-class standing, who were anxious to secure the work. The fact that the Southern had no experience with some of them, surely applies also to the Swedish company to whom they preferred to give the order. The fact that a Swedish firm can make at a cheaper price than English firms, is easily accounted for, and needs no elaboration from us. We regret the loss of this contract to this company and to the country as a whole more than we can express. We trust this statement makes it clear that if there was any attempt at dictation, that attempt did not emanate from the side of the manufacturers.

A Non-B.E.A.M.A. View.

The *Manchester Guardian* quotes the opinion of a firm of electrical manufacturers which is not a member of the B.E.A.M.A. The view is taken that competition is far from eliminated by the Association's agreements, for there was very considerable competition between B.E.A.M.A. concerns and independent British companies, quite apart from competition with foreign concerns, such as the Swedish company to which the Southern Railway contract had been given. "Non-ring" firms were often able to quote more attractive terms on a better article, especially in the case of smaller machines or accessories. Of course, only the larger companies in the B.E.A.M.A. were able to produce exceptionally high-powered machinery, but there were only a few orders for such machines. Our contemporary's informant said that the B.E.A.M.A. fixed their prices by means of a "horse-power curve" which each firm adhered. This curve showed the rel between horse-power and price, so that in submitting a te for a machine of, say, 200 h.p., a manufacturer would to this particular point on the curve, which would show the agreed price to quote. He believed, however, that ac ence to the "horse-power curve" was not absolutely r and that in bidding for an order against a firm outside "ring" or against a foreign firm, members of the "ri frequently quoted "cut" prices to secure the contract.

Other Views.

A letter signed "Engineer" appeared in *The Times* of A 23rd. In this the writer says that the efforts of buyers to a "rings" by placing orders on the Continent would be ar ing if they were not so sad, for there the system of rings is more intense than in this country. "The judgment on c binations, rings, cartels, &c., should be based not on some s mental idea but the sound basis of the ultimate cost of pro ing and selling." An instance is quoted where combina would have actually reduced the price of a certain article, w giving a higher profit. With regard to the allocation of w "Engineer" says:—"Every manufacturer knows the ben obtained in the cost of production when the volume of w is kept at a steady level. A crowded workshop, entailing n shift and overtime, is uneconomical and unsatisfactory to workmen, and if there is a sudden drop in the volume of w necessitating the discharge of a number of workmen, the p tion becomes even less satisfactory. The general public been taught by the discussions on the Electricity Bill the v of a steady load, and the buyers of electrical plant should the last people to grumble at an endeavour to smooth out peaks of the load in the workshops by some method of s cating work. Practically everything one buys has a ring pr Our daily bread, and many of the other necessaries of life, c under this category, but we do not grumble so long as we kn that the price is a reasonable one. We recognise that unlim competition would be inadvisable and likely to increase rat than diminish the selling price. The manufacturer of e trical apparatus has to buy most of the material that con tutes the product at ring prices, and the Government municipalities insist, very properly, that labour is not to paid at less than standard agreed rates, and the employer no desire to lessen costs by forcing down wages which alre compare unfavourably with the wages paid in the shelte trades. If balance-sheets of the firms in a ring showed un profits one would think it necessary to call for some pu inquiry, but the dismal results shown by most of the engin ing firms hardly warrant a complaint of this nature."

Mr. Henry Edmunds, who had so much to do with initiation of the Cable-Makers' Association, writes to *Times* stating that the objects of that body were broad-min in nature, combining the protection of the industry fr price-cutting, improved labour conditions, standardisation quality of materials and workmanship, assuring to the c tomer stabilised prices and satisfactory product. The exp ment has, he says, been amply justified, and it is only natu that other branches of the industry should have followed "lead." Writing as a "spectator of the game," he a his regret that "a large order should have gone abroad account of a false feeling of pique occasioned by the appe ance of 'dictation' on the part of certain electrical firms w were carrying out an honourable understanding in the intere of the industry as a whole."

Another correspondent, an anonymous "Electrical En neer," thinks that the controversy will do nothing but g if it helps the public to realise the extent to which the nati is exploited by combinations of business concerns "and h much the advance of electricity in this country is hampe by these rings, which control . . . almost every other bran of the electrical industry." He proceeds to refer to the ope tions of the cable-makers, the accumulator makers, and t lamp manufacturers, and the arrangements existing betwe the last-named and the retailers. He concludes: "The sta ment that competition would be likely to increase pri rather than diminish them is astonishing. But why not gi competition a trial again?"

The Swedish Company's Denial.

Dealing with the implication that the Allmanna Svens Elektriska Aktiebolaget is in a Continental "ring," Mr. S. Busch, the managing director of the company's subsidiary, t Swedish General Electric, Ltd., says that his company and t parent concern are an entirely independent organisation and not belong to the Continental "ring." "The statemer therefore, that the Southern Railway have placed their ord with a firm whose prices are dictated by a Continental ri organisation, is completely without foundation."

Colour Photo-telegraphy.

The American Telephone and Telegraph Co. announces th pictures of three or more colours can now be transmitted b wireless across the Continent, and reproduced with delica shadings. Engineers have been experimenting for a year c coloured telephotos on the same principle as black-and-whi photos. Separate transmission is necessary for each colour.

The Venner Time-Switch Anniversary.

ON Friday last, at the Trocadero Restaurant, London, the directors of Venner Time Switches, Ltd., celebrated the 21st anniversary of the foundation of the company a dinner, to which many of their friends, representative of various branches of the electrical industry, were invited. A memorative brochure by Mr. W. L. Randell, of which ies were handed to the guests, told the story of the origin the firm, of which the late Robert F. S. Venner—an old adian, and one-time member of the staff of the Grosvenor lery works—was the head. The need for reliable time-tches made itself felt some 25 years ago, in connection h the two-rate system of charging for electricity; a solution he problem was furnished by Mr. R. C. Graseby, who has r since remained in charge of the technical work and has eloped 30 standard types of time-switches, in addition to cial types for special purposes, averaging one a week all year round. No mechanical problem comes amiss to him, his switches can do anything but talk. Mr. E. E. Sharp, co-director, deals with the commercial side of the business, has travelled in almost every country, invariably opening new fields and extending the company's circle of friends.

he policy of the company from the first has been to place lity before price; experience has shown that a time-switch, be of use, must be reliable and trustworthy above all gs, and no variation from that ideal has been permitted. de the works no less attention is given to securing the fort and satisfaction of the employés, with whom a close cordial relationship is maintained, and who are made feel—by practical participation in the profits—that they e a stake in the business.

t the dinner Mr. R. C. Graseby (managing director) pre-d, and, after the toast of "The King" had duly been oured, Mr. J. W. BEAUCHAMP (director, E.D.A.) proposed he Firm." He said the firm had applied modern commercial methods and modern scientific methods to what was, aps, the oldest mechanical contrivance in the world—clock—and they had done it with very great success. He w that the association between Mr. Graseby and Mr. dwell (the foreman) and the staff was a very happy one, he felt that they had managed to recapture the old Guild ng which was reflected in the very excellent quality of work turned out by the firm. Mr. Sharp was famous ughout the industry for his contact method of salesman-, and he particularly wished to thank him for the very lfish, far-sighted and whole-hearted sort of E.D.A. work ch he had been doing for a long time.

r. P. A. MAYDWELL, responding on behalf of the employés enner Time Switches, Ltd., said they had many privileges: e was a generous bonus system; they were paid for eek's holiday every year, and for all Bank Holidays, and e was an annual outing entirely at the expense of the . In case of sickness the men were paid up to two weeks ne year. The staff all felt that the firm's interests were r interests and *vice-versa*.

r. R. C. GRASEBY, who followed, said the firm started in nall way, but to-day it was making a range of time-ches from 1 ampere to 1,000 amperes and a voltage range 6 to 6,600 volts, having operating times ranging from 24 s to every few seconds. This apparatus had to be made od as it possibly could be. Quality had been the aim all time. The firm had not been satisfied with going out the home trade; it had gone out into the whole world markets, and had been able to meet competition com-bly and easily. The results of Mr. Sharp's visits over-were always very beneficial, not only to the firm but, he ved, also to the industry as a whole.

r. E. E. SHARP proposed "The Electrical Industry," re-ing that such a gathering meant that good craftsmanship generous dealing were still appreciated by those whose ions were worth having. Referring to the British Indus-Fair, he said it seemed to him an extraordinary thing old such an important Fair in February; they could not ct people who lived in sunny climates to come here at a period of the year. If they held the Fair in May or they would be so inundated with visitors that London d be the only place to hold it, because of the hotel accom-ation. They were gathering their forces together for one of greatest advances ever experienced; they could all be happy the working of the Electricity Act of 1926 had been placed ch thoroughly competent hands.

W. W. LACKIE, C.B.E. (an Electricity Commissioner), nding to the toast, said that the representatives of the rical industry present heartily congratulated the company. hoped that its prosperity would be maintained during the 21 years. They were a law-abiding nation, and he felt that, now the 1926 Act was on the Statute Book, they d all do everything in their power to help the work of Central Electricity Board, so that the electricity supply of country might be the success they all wished it to be.

J. R. BROOKE, C. B. (Secretary, Central Electricity Board), replying to the toast, congratulated the firm upon attain-s majority. The Board hoped in a very short time to win ght to recognition as part of the electrical industry of this try, by having rendered to it really valuable service.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

23,665. "Sound-recording and sound-reproducing instruments." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). May 29th, 1925. (252,637.)

24,371. "Sparking plugs for internal combustion engines." A. E. Macdonald. September 30th, 1925. (268,397.)

24,425. "Wireless direction-finding equipment." H. V. Flinn. October 1st, 1925. (268,398.)

24,672. "Thermionic discharge devices." Edison Swan Electric Co., Ltd. October 3rd, 1924. (240,862.)

24,673. "Metal mirrors within electroionic discharge tubes." Edison Swan Electric Co., Ltd. October 3rd, 1924. (240,863.)

30,497. "Rectifiers for alternating current." E. S. Rogers. February 23rd, 1925. (247,920.)

30,741. "Starting devices for alternating-current motors." W. A. Boulting and A. Williams. December 5th, 1925. (268,412.)

30,797. "Variable electric condensers." S. A. Lamplugh, Ltd., and J. S. Spittle. September 3rd, 1926. (268,413.)

32,414. "Electric cables." Macintosh Cable Co., Ltd., and A. W. Williams. December 23rd, 1925. (268,418.)

32,880. "Wireless cabinets and aerials." C. R. Williams. December 30th, 1925. (268,424.)

32,918. "High-pressure system for electrolytic processes, more especially for the production of hydrogen and oxygen." J. E. Noeggerath. December 30th, 1925. (268,426.)

32,939. "Thermionic vacuum tubes and like vacuum apparatus." J. K. Im Thurn and H. Morris-Airey. December 30th, 1925. (268,428.)

1926.

2. "Electric plugs." W. J. Line. January 1st, 1926. (268,433.)

192. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., A. G. Salisbury, and J. Hutt. January 4th, 1926. (268,446.)

313. "Method of electrically measuring by means of a Wheatstone bridge." A. Ulitovsky and G. Sokolov-Vishnevsky. January 5th, 1926. (268,453.)

588. "Construction of electrical push-button switch." H. J. Bradbury. January 8th, 1926. (268,457.)

624. "Electric inductance coils." Siemens Bros. & Co., Ltd., and C. R. Riber. January 8th, 1926. (268,458.)

981. "Means for preventing short circuits to earth in overhead electric wires." British Insulated Cables, Ltd., and J. Nelson. January 13th, 1926. (268,463.)

1,257. "Holders or supports for thermionic valves." G. Campbell. January 15th, 1926. (268,468.)

1,289. "Thermally-actuated electric switches." Deutsche Gasgluhlicht-Auer Ges. August 3rd, 1925. (Patent of addition not granted.) (256,171.)

1,634. "Construction of cabinets and framework of wireless receiving sets." G. W. Walton and General Radio Co., Ltd. January 20th, 1926. (268,475.)

2,650. "Electric protective devices." British Thomson-Houston Co., Ltd., H. Trencham, and H. S. Petch. January 29th, 1926. (268,485.)

4,006. "Electrically-driven lawn mowers." Ransomes, Sims & Jefferies, Ltd., and W. S. Murdoch. February 11th, 1926. (268,504.)

4,995. "Electrical remote-control systems." General Electric Co., Ltd., and J. E. Collyer. February 22nd, 1926. (268,515.)

6,087. "Coil holder for wireless purposes." F. Scammel. March 4th, 1926. (268,528.)

6,182. "Geared variable condensers for wireless." F. Harwood, A. Sykes, and F. Needham. March 5th, 1926. (268,530.)

6,314. "Switching devices." International General Electric Co., Inc. March 21st, 1925. (249,499.)

6,403. "Compensated alternating-current electric motors." Deutsche Werke Akt.-Ges. March 6th, 1925. (248,775.)

6,556. "Control of electric circuits." General Electric Co., Ltd., W. Royle, and L. N. Jones. March 9th, 1926. (268,532.)

7,180. "Impulse transmitters for automatic telephone systems." Sterling Telephone & Electric Co., Ltd., N. Blades, and L. V. Marks. March 15th, 1926. (268,538.)

7,187. "Low-frequency transformers." Falk, Stadelmann & Co., Ltd., and F. S. Stuckey. March 15th, 1926. (268,539.)

8,096. "Arrangement for the reception and reproduction of sound oscillations and their transformation from and into electric currents." W. Hahnemann. March 31st, 1925. (250,221.)

8,211. "Electric steam boiler." E. Schleck. March 25th, 1926. (268,546.)

10,728. "Protection of electric systems against excess voltages." International General Electric Co., Inc. April 23rd, 1925. (251,292.)

11,194. "Electron discharge devices." British Thomson-Houston Co., Ltd. April 28th, 1925. (251,635.)

11,532. "Radiogoniometers and circuits for use therewith." E. Bellini. May 8th, 1925. (251,984.)

12,107. "Coarse and fine adjustment devices, more particularly for use with wireless components." E. T. Bennee and Ormond Engineering Co., Ltd. May 10th, 1926. (268,568.)

13,118. "Electric lampholder." H. E. Ashdown. May 25th, 1926. (268,573.)

13,181. "Impulse transmitters for use in telephone or like systems." Coventry Automatic Telephones, Ltd., and J. E. Colyer. May 25th, 1926. (268,577.)

14,763. "Reflectors for electric fires and radiators." H. H. Berry. June 11th, 1926. (268,592.)

1927.

598. "Electric ignition apparatus for internal-combustion engines." Perrem Ignition & Electric Co., Ltd., and F. C. Perrem. January 8th, 1927. (Addition to 266,174.) (268,707.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates given. In the case of foreign applications the names and addresses of the British representatives are also given:—

April 13th.

Electrolux. No. 476,992. Class 6. Machinery of all kinds. No. 469,786. Class 18. Refrigerators and cold storage chambers.—Electrolux, Ltd.

April 20th.

Hydra (lettering and design). No. 472,069. Class 8. Electrical condensers, &c.—Gesellschaft Hydrawerke, 18, Windscheidstrasse, Charlottenberg, Berlin. (Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Lebrenco. No. 472,379. All goods in Class 8.—W. H. Le Breton, trading as the Le Breton Engineering Co., Windsor House, Victoria Street, S.W.1.

Tonisator. No. 475,860. Class 11. Electric apparatus for surgical and curative purposes.—Adolf Halpern, 10, Hegergasse, Vienna. (Haseltine, Lake and Co., 28, Southampton Buildings, W.C.2.).

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALEXANDRIA (Dumbarton).—Artificial silk factory for the Scottish Artificial Silks, Ltd., Edinburgh.
ALSTON.—School, for Cumberland E.C.; director of education, Carlisle.
AUSTRALIA (Sydney).—Refuse destructor for the Municipal Council. Specifications from J. Davis, consulting engineer, 100, Victoria Street, London, S.W.1.
BARNSLEY.—Three new elementary schools; Education Committee.
BEDLINGTONSHIRE (Northumberland).—50 houses, Cambois Estate; U.D.C. surveyor.
BOURNEMOUTH.—Extensions, highways depôt, for Corporation; F. W. Burton. Business premises and flats, Exeter Road; Rebbeck Bros. Shops and houses, Wimbourne Road; F. Moorman.
BRADFORD.—Extensions to artificial silk factory for Brysilka, Ltd., Apperly Bridge.
BRAYFORD (Barnstaple).—Wesleyan church and schools; Mr. Copp, architect, Strawberry Cottage, Bideford.
BRIGHTON.—Memorial hall (£6,500); Rev. Canon F. C. N. Hicks, vicar.
BRIGHTON.—Additions to Dorset Garden Wesleyan Church (£14,000); trustees.
BURNHAM-ON-SEA.—Water supply scheme, with electrically-driven plant, Brent Knoll station, for the U.D.C.; Willcox & Raikes, consulting engineers.
CHAWLEY (Oxford).—Saw mills and engine house, for the Chawley Timber & Brick Co.; Mr. Reynolds, manager.
CHESTER-LE-STREET (Co. Durham).—Additional 42 houses, for the R.D.C.; estates surveyor.
COATBRIDGE.—Tearooms (£2,000) for A. B. Brown, Ltd., bakers; the manager.
CONISBOROUGH (Yorks).—Colliery engine house, Cadeby Colliery (several thousand pounds); Mr. Young, manager.
CROYDON.—Wesleyan schools (£8,000), with electric lighting; Alder & Turrill, architects; Truett & Steel, Ltd., builders.
DAGENHAM.—8th and 9th elementary schools; Essex Education Committee.
DERBY.—Housing scheme (88), Derby Lane site, for the T.C.; C. A. Clews, borough surveyor, Babington Lane. Boys' secondary school. Elm Tree House estate, for the borough E.C.; Macpherson & Richardson, architects, Tenant Street.
DORCHESTER.—Grammar school, Manor Road; governors.
DURHAM.—Houses (£59,078), for the T.C.; Mr. Elcoat, builder.
EASTLEIGH.—Schools, for Hants E.C.; director of education, Winchester.
EDINBURGH.—Super-cinema to seat 3,000; F. A. Lumley, proprietor.
ELLESMERE PORT.—Schools (800 places), for the Cheshire E.C.; F. A. Browne, county architect, Newgate Street, Chester.
FIFESHIRE.—Church at Rosyth (£6,200); Rev. William Stephen, Inverkeithing.
GLASGOW.—Shopping centre, High Carntyne estate; housing director.
GLOUCESTER.—Re-erection of printing works, Bell Lane, for the Crypt House Press, Ltd., and the Gloucestershire Chronicle, Ltd. (between £25,000 and £30,000).
HAMILTON.—Fire station; the burgh firemaster.
HEMEL HEMPSTEAD.—Additional housing scheme (48) for the T.C.; borough surveyor.
HORNCHURCH (Essex).—Houses (38). Rainham Road, for T. England.
HORNSEA.—Extensions, municipal buildings; U.D.C. surveyor.
HULL.—Electric lighting, Park Avenue School; education director. Re-erection of portion of oil cake mills, electrically equipped, Maxwell Street, Stoneferry, for Spencer, Isaac & Co. (several thousand pounds).
IRISH FREE STATE (Dundalk, Co. Louth).—54 houses for the U.D.C.; M. Sellars, Council surveyor.
(Thurles, Co. Tipperary).—Technical school for the North Riding Tipperary Joint Technical Committee; V. Kelly, architect, 4, Grafton Street, Dublin.
KIRKCALDY.—286 houses for District Committee (£120,000); county clerk.
LEICESTER.—Church hall (£7,000), Saffron Lane Estate, the Wesleyan trustees; secretary.
LONDON (Barking, E.).—Chemical store, Abbey Ro Chemical Supply Co., Ltd. Infectious diseases hospi for the U.D.C.; H. Hargreaves, clerk.
(Ilford, E.).—High school for girls; Essex Education Co mittee. Shops, Beehive Lane and Eastern Aven P. E. Brand, Ltd.
(West Ham, E.).—School, South Hallsville (£16,000), w electrical and heating work, for the borough E.C.; e cation architect.
(Greenwich, S.E.).—Welfare centre, with electrical a heating work (£3,700), for the T.C.; borough survey
(Sydenham, S.E.).—Additions, Technical Institute, Syd ham Hill Road; W. J. Dixon & Sons.
(Westminster, S.W.).—Buildings, Vandon Street; T. Mawson & Sons.
MACCLESFIELD.—Block of offices, for the Cheshire Bui ing Society; F. C. Sheldon, architect, 7a, King Edw Street, Mineral water works, Great King Street, G. Ray & Sons, Ltd.
MANCHESTER.—Bus garage extension, Queen's Road; c architect.
MIDLOTHIAN.—Extensions at West Calder Roman Cath school (£4,800), and extensions at West Calder High a Bonnyrigg schools; clerk, School Management Comm tee, West Calder.
MITCHAM.—Wireless transmitting station, for the Ministry.
NELSON.—Secondary school; S. Wilkinson, country arc tect, 16, Ribblesdale Place, Preston.
NEWARK-ON-TRENT.—Extensions to Kelham Hall (£75,0 for the Society of the Sacred Mission; Moss & S builders, Loughborough.
NORTHAMPTON.—Schools, Far Cotton (£16,513), for t Borough E.C.; director of education.
OLD HILL (Staffs.).—Re-erection of brush factory, for Hec Bird.
PRESTWICH (Ayrshire).—Housing scheme (76), for t T.C.; burgh surveyor.
RICHMOND (Surrey).—Central schools (£35,000), for t borough E.C.; the clerk.
SALISBURY.—Administration block extensions, for the Jo Isolation Hospital Committee; T. Walker, county arc tect, Trowbridge.
SANDBACH (Cheshire).—Cinema, for Beech & Smith; J. Price, architect.
SOUTH AFRICA (Cape Town).—Housing schemes (£160,00 city engineer. Market extensions (£58,000) for Corpo tion; J. Rubbi.
SOUTHEND - ON - SEA. — Knitting factory, electrica equipped, The Mall, Southchurch, for Parsons Bro Whitelands.
STAFFORD.—Extensions to market hall (£7,500), for t T.C.; borough engineer.
STOCKPORT.—Operating theatre, for the infirmary gov nors; Worthington & Sons, architects.
SUTTON.—34 houses, Ridge Road; U.D.C. surveyor.
SWADLINCOTE.—Housing scheme (60), Gresley, for t U.D.C.; surveyor.
SWANSEA.—Hall and shops, Portland Street and Park Stre A. Ruck. 43 houses, Grenfell Park estate; Jones Br
THORNABY-ON-TEES.—Houses (69), for the T.C.; Steph Coates, Ltd., builders, Middlesbrough.
TREDEGAR.—Additional 100 houses, Ashvale, for the U.D.C surveyor.
WARWICK.—100 houses; borough engineer.
WEST CALDER.—Extensions to schools (£4,800), for M lothian E.C.; director of education, Edinburgh.
WEST SUSSEX.—Three ultra-violet ray stations; W Sussex Education Committee and the British Red Cr Society.
WICKERSLEY.—School, Sunnyside, for West Riding E.C education architect, County Hall, Wakefield.
WIGAN.—Town hall extensions (£12,084), for the T.C.; R. Donald, borough engineer. Church, Newtown (£8,00 for the Wesleyan trustees; Rev. Francis G. Gray.
WILLINGTON (Co. Durham).—Additional housing sche (30), for the U.D.C.; surveyor.
WOMBWELL (Yorks).—Housing scheme (66), King's Ro for the U.D.C.; D. H. Roberts, architect, Park Stre
WORKSOP.—Joint municipal offices, U.D.C., R.D.C., a Board of Guardians.

The

Electrical Review

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Contents:

	PAGE
Increasing Steam Pressure	705
Saving the D.O.T.	706
The Institute of Fuel	706
Electrical Development in South Wales (*illus.*)	707
The Ideal Wiring System, by H. R. Taunton	709
The Electric Furnace in Industry	711
The Cork Broadcasting Station (*illus.*)	712
Imperial Development and Co-ordinated Investigation, by Douglas Spencer	714
Wireless Retailers' Association	715
Parliamentary News	715
Business and Industrial Notes	716
Lighting and Power Notes	720
Tramway and Railway Notes	722
Telegraph and Telephone Notes	723
Radio Notes	723
Contract Information	723
Forthcoming Events	725
Notes	725
Institution Notes	726
Our Personal Column	727

	PAGE
Financial Section—	
New Companies Registered	727
Official Returns of Electrical Companies	728
City Notes	728
Stocks and Shares	731
Swiss Foreign Electrical Trade	733
Modern Stage Lighting (*illus.*)	735
New Electrical Devices, Fittings and Plant (*illus.*)	736
Junior Institution of Engineers	737
Economic Value of Increased Steam Pressure, by H. L. Guy (*illus.*)	738
Special Motor-Generators (*illus.*)	741
Legal	741
Correspondence—	
Hiding the Light	742
A Domestic Load Diagram	742
Electric Water Heating	742
Cheap Electricity	742
Salaries of Engineers	743
A Commutation Problem	743
Published Specifications	743
Trade-Mark Applications	743
New Work for Contractors	744

Increasing Steam Pressure.

ENGINEERING practice never stands still for long. We have been privileged to watch the reciprocating engine for driving electric generators developed from small beginnings to its limits on two main lines—high speed and low speed—and to see it superseded by the steam turbine, while the Lancashire boiler has given place to the water-tube type, and parallel changes have taken place in all other branches of power-station design; but finality is apparently remote. At present the field of most active evolution is the boiler house, where the methods of combustion and the conditions of steam generation are in course of profound modification. As usual, the merits of the new departures are being keenly debated; the use of pulverised fuel on the one hand, and the adoption of higher steam pressures on the other, are questions of the first interest to the station engineer, who has to consider not merely economy, but also other factors of equal or even greater importance, such as reliability and maintenance.

With regard to the tendency towards increased steam pressures, no great departures from customary practice have been made in this country, though Mr. Thos. Roles is carrying out an interesting scheme at Bradford, involving the superposition of an 1,100-lb. boiler and turbine on plant operating at ordinary pressures. In the course of a long and interesting report presented to the Electricity Committee of Bradford Corporation by Mr. Roles, dealing with his experiences during his visit to the United States and Canada last year, he remarks that when visiting the Hudson Avenue power station of the Brooklyn Company, which is to be one of the largest in the world, he found that the steam pressure was only 265 lb. per sq. inch, the total tempera-

ture of the steam was 611 deg. F., and retort stokers were in use. At the Hell Gate station of the New York Edison Company similar conditions were met with, and on inquiry he learnt that this conservative policy had been adopted in order to make these stations as far as possible secure from breakdown, owing to the rapid increase of the load in New York and the supreme importance of reliability. It will be borne in mind, too, that the electricity supply of New York and Brooklyn is provided by stations situated close to the load, in preference to transmission from a distance, for the sake of the greater degree of reliability thus obtained. On the other hand, Mr. Roles visited the Edgar station at Boston, where a boiler has worked for 12 months at 1,200 lb. per sq. inch, and the Lakeside power station of the Milwaukee Electric Railway and Light Company, where plant to work at 1,400 lb. per sq. inch is being installed, with pulverised-fuel firing; and elsewhere he met with boiler pressures of 550 and 650 lb. per sq. inch, with which no difficulties had been experienced. Again, at the new East River station, New York, the steam pressure is to be 375 lb. per sq. inch and the temperature 700 deg. F., with pulverised-fuel firing.

With regard to turbo-generators, Mr. Roles considers that the machines made in this country compare favourably with those in use in the United States, and attain a higher efficiency than the latter; but his general conclusion in respect of boiler plant is that American practice is decidedly ahead of that which has hitherto obtained on this side of the Atlantic as regards the size of boilers, the working pressures, the construction of furnaces, and the methods of firing and control of combustion. Experiments have been carried out with steam generated at 3,200 lb. per sq. in. and 706 deg. F.—a "critical point"—at Rugby, of which we published particulars four years ago; the North Tees power station uses a pressure of 475 lb. per sq. in., at 700 deg. F., and pressures of 600 and 800 lb. per sq. in. have been used at Amsterdam and Langerbrugge, whilst experimental work has been done on the Continent at pressures up to 1,500 lb. per sq. in.

Obviously steam generation practice is in a state of flux, with a decided tendency towards the use of pressures considerably above those usually adopted hitherto. For this reason the paper read by Mr. H. L. Guy (chief engineer, mechanical department, of the Metropolitan-Vickers Electrical Co., Ltd.) before the Institution of Mechanical Engineers, in which the author provided means for determining the economic value of increased steam pressure under any given conditions, deserves the careful attention of all engineers who are interested in power production. A full abstract of the paper is concluded in this issue, from which it will be seen that the author does not advocate either high or low pressures as a general proposition; he gives data and curves which will enable any engineer, on substituting the data corresponding to the conditions which obtain in his own case, to judge for himself the most suitable pressure and temperature to employ, so far as economy is concerned. Whilst load factors of 60 and 100 per cent. are unfortunately rare exceptions in this country to-day (though not altogether unknown), the time is approaching, we hope, when many stations carrying "base load" will work with high load factors, and no new plant in "super"-power stations should be installed without having regard to that possibility. Very high load factors *must* be obtained if electricity is to be as cheap as it should be, and if the Central Electricity Board's schemes are to be successful.

Saving the D.O.T.

Some of the comments that have appeared in the Press regarding the future of the Department of Overseas Trade are so conspicuous for their want of knowledge that they call for a good deal of patience to read, and more to reply to them. From those who have reason to know from practical experience the usefulness of the organisation to all who take the trouble to avail themselves of its various services, there has been a general chorus of disapproval at the Government's intentions so far as they can be understood from the statements of the Chancellor of the Exchequer and the President of the Board of Trade. The Prime Minister has been asked to receive a deputation from the Association of British Chambers of Commerce, which has passed a strong resolution urging that the efficiency of the present Department should not be impaired. The suggestion that we may revert to the dual system by which the Foreign Office and the Board of Trade will both deal with questions affecting assistance to trade is viewed with dismay, as it well may be, remembering pre-war controversies. It has been suggested that those who approve of the termination of the Department include merchants who are interested in the sale of goods of foreign manufacture, but that British manufacturers and others concerned mainly with the sale of British products and therefore with the maintenance of British employment and the reduction of unemployment pay desire its good work to be efficiently continued. To suggest that the Department is not necessary, because it is only used by a small proportion of the nation, and that those who use it should bear the cost of it—is to express an absurdly short-sighted view. Shall we abandon all our Trade Commissioners because some traders ignore them? The criticisms of the Government proposals and speeches may be expected to be reflected in the reconsidered intentions when they are announced, but it is becoming increasingly obvious that as a measure of economy the scheme looks more like a piece of window-dressing than anything else, or, to speak more plainly, sheer nonsense. What folly to talk of abolishing a business-getting department at a time when one of the most vital concerns of the nation is to get business!

The Federation of British Industries has passed a series of resolutions offering its co-operation and help in securing economy in this matter with the least possible injury to national interests. It has offered to lay its views before the Government, as well as the experience that it has had of the problems involved in connection with an overseas organisation. We do not believe, however, that the trading community will desire the functions covered by the Department of Overseas Trade to be handled by any body which does not place its facilities at the disposal of all British manufacturers, whether organised or not.

The Institute of Fuel.

The Councils of the Institution of Fuel Economy Engineers and the Institution of Fuel Technology are to be congratulated on their decision to adopt the suggestion of Sir Alfred Mond, president of both bodies, that they should combine their forces and form one authoritative and influential Institute. As we have urged in these columns, the continued existence of two institutions with practically identical aims would have led to rivalry and dissipation of effort, and certainly it had already alienated the sympathies of many would-be members, thus weakening them both; the subject with which they deal is of vital importance to this country, and it is most desirable that its investigation shall be conducted with the maximum of efficiency and concentration.

There is now every reason to believe that a career of valuable service both to the nation and to the members lies before the Institute of Fuel, which will be able to speak and act as the sole organisation fully representative of the wide and varied interests concerned in the production and use of fuel.

Electrical Development in South Wales.

The Upper Boat Generating Station of the South Wales Electrical Power Distribution Co. has been extended so as to provide for an ultimate capacity of 100,000 kW. The recently installed plant includes a 16,000-kW turbo-alternator and eight 60,000-lb. boilers.

THE official inauguration on April 26th, by the Rt. Hon. the Earl of Plymouth, of the new extensions to the Upper Boat generating station of the South Wales Electrical Power Distribution Co., marked an important stage in the development of electricity supply in South Wales.



Fig. 1.—General View of Power Station.

The power station, fig. 1, is situated on the banks of the River Taff, and is about 10 miles distance from Cardiff and two miles south from Treforest. The company obtained its supply powers in 1900 by one of the earliest electricity Acts, and building was commenced in April, 1902, the first supply being given in early 1904. The area covered is the county of Glamorgan and as much of Monmouth as lies west of the River Usk, there being certain restrictions with regard to some of the urban districts and county boroughs. The original generating plant at Upper Boat consisted of 14 Niclausse boilers supplying steam at 200 lb. per sq. in. to three Willans-Ganz sets, 1,500 kW, 11,000 V. There were other smaller power stations on the system which were eventually shut down, thus concentrating the generating plant at the station under review. The reciprocating engines were run until 1908, when a 3,000-kW Westinghouse turbo-alternator was installed, followed in 1911 by a Willans-Dick Kerr 3,000-kW set, and in 1914 by a 5,000-kW set by the same makers. The steady growth of the demand resulted in 1920 in the placing of an order with Messrs. C. H. Parsons & Co. for an 18,750-kW turbo-alternator, a wise provision being made in specifying that this machine should be designed for a steam pressure of 350 lb. per sq. in. Even before this set was working it was found that additional plant would be required, and fresh capital was raised.

In 1923 Mr. J. S. Highfield was appointed consulting engineer to the company, and he prepared a scheme which led to the extensions which are the subject of this article. Fig. 2 illustrates the lay-out of both the old and new portions of the station.

The new boiler house accommodates eight 60,000-lb. water-tube boilers. These were supplied by Messrs. Babcock & Wilcox, Ltd., four being fitted with superheaters and air-heaters only, and four with small economisers in addition. All the boilers are equipped with chain-grate stokers driven through epicyclic gearing giving eight alternative speeds. They are arranged four on either side of a well-lit firing space along which runs a railway track to serve in the event of a failure of the coal-handling plant. Coal is brought by rail from the Maes Mawr sidings of the Great Western Railway, the wagons being hauled to the power-station yard by steam locomotives.

A well-fitted control room is situated in the boiler house. The efficiency of the boilers is 83 per cent. at full load, assuming the feed-water temperature to be 200 deg. F., and the heating value of the coal to be 12,500 B.th.u. per lb.

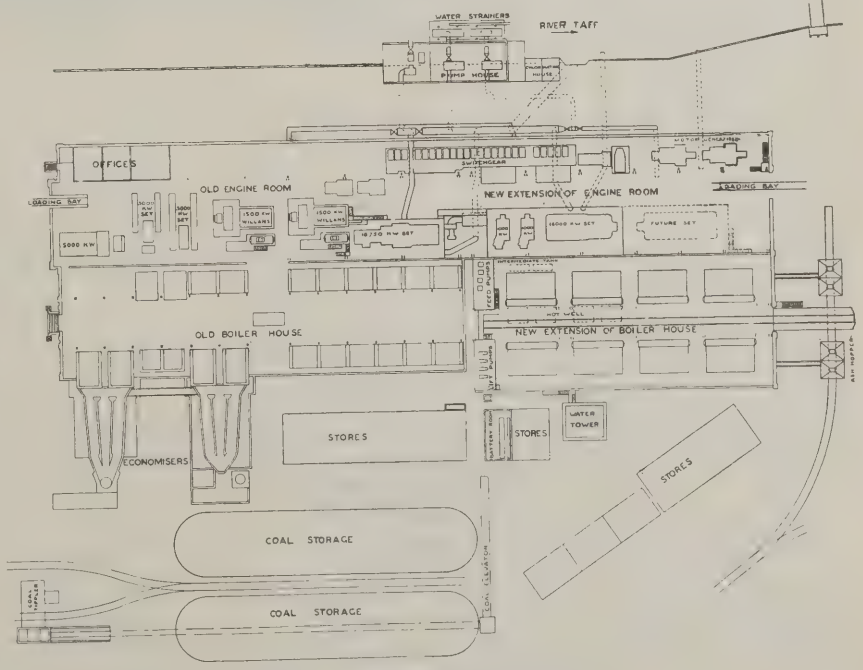


Fig. 2.—Lay-out of Upper Boat Plant.

Under the boiler house are situated two underfeed ash conveyors, each driven by a 9-h.p. motor. These remove the ash by a scraper chain from a water trough

to a 30-ton bunker outside the boiler house. Four turbo feed pumps serve the boilers, two 15,000-gal. per hour, 5,500 r.p.m., and two 27,000 gal., 4,500 r.p.m. For lifting the water from the basement hot-well tanks to those on the overhead, or fan-level floor, four reciprocating pumps are used, each having an output of 15,000 gal. per hour. The make-up water is usually taken from the river, treated and pumped into these tanks. From the head tanks the water falls to the boiler feed pumps. The induced- and forced-draught fans are housed on a floor above the boiler room, where two Weir live-steam evaporators, each capable of dealing with 3,000 lb. per hour, are installed.

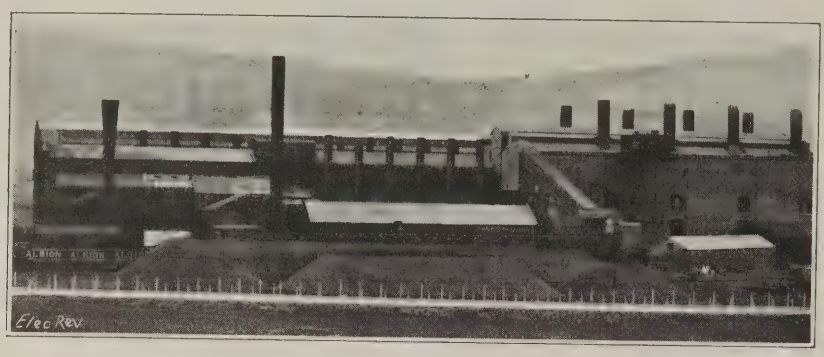


Fig. 3.—Upper Boat Station, Showing Coal-Handling Plant.

The coal-handling equipment, fig. 3, consists of a continuous-band conveyor, by Messrs. Fraser and Chalmers, which throws the coal off automatically at points where it is picked up by a travelling grab and redistributed. Successive belts take the coal into the boiler-house bunkers, each of which has a capacity of 300 tons.

The new portion of the turbine room is of modern design and well lighted, and is at present equipped with a 14,000-kW turbo-alternator, fig. 4, supplied by the English Electric Co., Ltd., 1,500 r.p.m., 11,500 V, three-phase, 25 cycles. The stop-valve steam conditions are 325 lb. per sq. in. and 725 deg. F. It is interesting to note that tenders are being invited for another turbo-alternator of 25,000-kW capacity. The turbine exhausts into a 2-flow surface condenser equipped with air pumps of the ejector type and centrifugal extraction pumps.

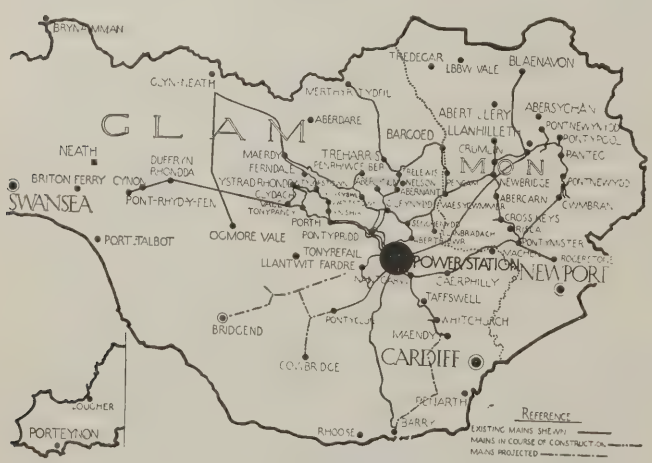


Fig. 5.—S. Wales Distribution Lines.

The new extensions also include two 600/1,000-kW turbo-alternators, supplied by Messrs. W. H. Allen, Sons & Co., Ltd., for supplying power for the station auxiliaries. The alternators are driven by the turbines through 10-1 reduction gearing. Each machine generates at 440 V. The turbines are fitted with jet condensers and the cooling water is taken from the condensate from the main turbines. This arrangement serves efficiently for heating the boiler feed water. The temperature of the water can be varied by changing the load on the machines, which is effected by transferring the station motors to or from the l.p. generators and the house transformers.

The cabling work in connection with these machines has been carried out by the South Wales Power Co.'s own staff, as also has the general wiring and switchgear cabling.

For giving a 50-cycle supply to the Great Western Railway Docks at Barry, two 2,000-kW motor-generators are installed in the works basement, where there are also two 3-phase, 4,330-kVA booster transformers arranged to give boost voltages of 250, 500, 750, or 1,000. This arrangement is necessary, as the line which is supplied by the transformers is some 20 miles in length and, at the moment, is working at only 11,000 V.

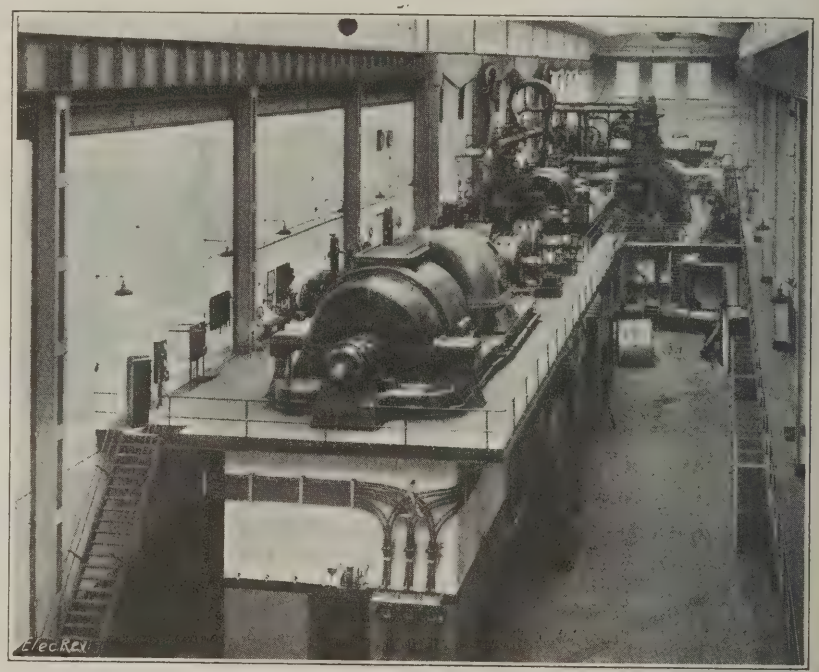


Fig. 4.—14,000-kW Turbo-Alternator.

The e.h.p. switchgear is of the Reyrolle type, and provides for the control of the alternators, motor generators, two transformer banks, and nine outgoing feeders. The bus-bars are in duplicate, coupled together through section switches. Five per cent. reactances are fitted between the two halves for limiting short-circuit currents. The solenoids operating the 11,000-V switches are controlled from the gallery above, energy being provided by a 110-V Chloride storage battery of 750-Ah capacity. This battery is housed in a building outside the power house, and is arranged to supply emergency lighting for the station.

The control room is situated in a central position. A schematic diagram in this department shows the position of all the switches, and ammeters are fixed on the diagram so as to indicate the disposition of the load. A 440-V B.T.-H. switchboard is so arranged that the various auxiliary motors can be supplied from either the turbine or transformer plant. Tirrill regulators are fitted for the voltage control, and a complete system of protective gear is fitted to both the machines and cables.

Outside the power house on the river bank is situated

the pump house and screens, and also the chlorinating plant. Owing to the sudden rise and fall to which the river is liable, this plant called for special attention. The suspended matter in the water varies greatly, and at times the contents include a good deal of slime, but it is found that the chlorination of the water materially reduces the deposit in the condensers. The screens are of the revolving type, and are fitted with two rows of internal nozzles for washing the collected matter clear. There are three main circulating pumps of Messrs. Allen's manufacture, two with capacities of 1,200,000, and one 810,000 gal. per hour.

All the feeders leaving the works are at present working at 11,000 V, although two main routes have been constructed to operate later at 33,000 V. There are approximately 102 miles of e.h.p. overhead mains and 109 miles of underground cable on the system. In every case the pressure is stepped down direct. Fig. 6 shows a section of a 33,000-V line, at present operating at 11,000 V, running down a sharp incline. A map showing the principal lines is shown in fig. 5.

The company supplies to some 80 collieries and industrial undertakings and about 22 authorised undertakers, representing an aggregate connected load of over 90,000 kW.

At the opening ceremony the Earl of Plymouth paid a high tribute to the work of the directors and staff of the undertaking, and remarked that the present output was ten times greater than that in 1908. He made a special plea for a close understanding between the directors, staff, and consumers, and remarked that the company was doing all it could for the prosperity of the district by supplying cheap power.

Mr. W. North Lewis, chairman of the company, replied to the Earl's speech, after which the visitors were entertained to tea.

We are indebted to Mr. W. A. Chamen, M.I.E.E., engineer and general manager, for the opportunity to obtain the foregoing particulars, and to Mr. C. T. Allan, M.I.E.E., deputy engineer, for his assistance in the preparation of the above notes.

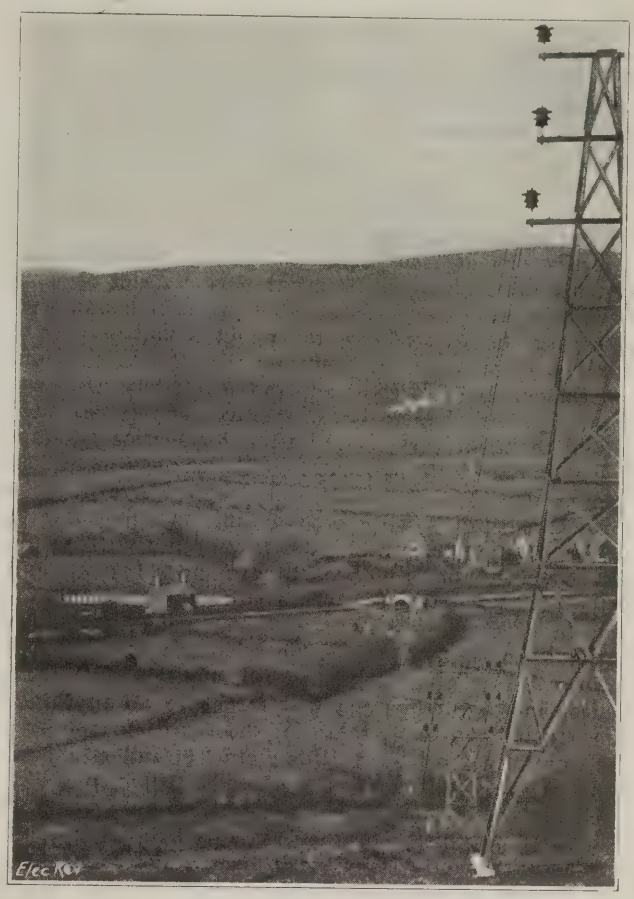


Fig. 6.—33,000-V Overhead Line.

The Ideal Wiring System.

A comparison of the several wiring systems that are available, with a view to deciding which, in the author's opinion, approaches nearest to his ideal for ordinary domestic wiring.

By H. R. TAUNTON.

(*Concluded from page* 672.)

Let us turn now to the main question of "expectation of safety." It is unfortunate that in private houses this is generally less than the high-standard heavy-gauge system can give in factories and public buildings. This is largely because there is a greater tendency in a house job to keep the tube sizes down to the barest minimum, partly to avoid cutting away and partly to avoid unsightliness. There is also a greater tendency, for æsthetic reasons, to depart from the conception of a completely ironclad system, particularly at switch and fitting points. The results are defective bonding, injury to insulation by jamming and forcible pulling-in, abrasion on the sharp edges of unbushed outlets, and so on.

But the most serious troubles in a heavy-gauge conduit system are likely to be those due to condensation. And unfortunately the best workmanship is powerless to avoid them, particularly in a private house. In a factory it is possible, with care, to arrange for a certain drainage; but in a house one cannot cut joists to varying depths to allow the conduit to slope, or arrange to drain outlets to the detriment of expensive decoration. Moreover, the effects of condensation in the very variable temperature of a house are probably more definite than in an unheated factory. A watertight system which accumulates water within is the paradox that follows, and the eventual effects on rubber and steel of continual moisture are easily imagined.

I have seen a nine-year-old conduit—light gauge—represented by a red-brown streak down the wall. It will be interesting in twenty years' time to examine the condition of the thousands of heavy-gauge installations which have been put in private houses since the system came into vogue, and to see what remains of the claims of mechanical protection, flexibility, adaptability, and all the rest of it.

Let us now consider class *d*, comprising all the many systems of metal-sheathed wires which I have loosely called "lead covered." Just as heavy-gauge is admittedly the best for the majority of public buildings, so is lead-covered (or some similar system) almost as certainly the best for private-house work, particularly for surface work. Of its merits I need say no more than I have of those of conduit—the various makers' lists will more than supply the deficiency. The only criticism that is likely to be of value in the present discussion is what will not be found in those lists: destructive criticism. Suffice it to say that lead-covered

systems give all the mechanical protection necessary in practice in a private house; that they are easier to erect and far neater when erected than conduit; and that, *a priori* at least, their chances of long and efficient life are greater, due mainly to the absence of condensation.

It is when we come to estimate their chances of being erected so as to provide a reasonable margin of safety that they are easier to criticise. Apart from the possibility of damage to the core by bruising or kinking due to careless handling, their one great defect is that their efficiency depends entirely upon the care taken by the erector to bond the system throughout.

Every one of the scores of patent metal-sheathed systems includes as an essential part a series of more or less ingenious and complicated junction boxes, with elaborate clamps and terminals and a multiplicity of fiddling little screws. Assuming that a conscientious contractor, and his foreman, and ultimately his wireman, uses one of these boxes wherever one is needed—which, to begin with, is too often a generous assumption—we have still to reckon on the chances of broken clamps, damaged terminals and dropped screws. The wireman, being a very human soul, is not going to grovel among dark and dusty joists for a microscopic bit of metal, nor is he keen to dismantle his box and replace it by a new one. There is thus a great temptation to effect some sort of wedging makeshift, which works loose as soon as the floor boards are fastened down. A slovenly workman will do the same from choice, and a careless one will forget to do anything. The result is a long tale of the familiar troubles: electrolysis, corrosion at clips, cracks and pinholes, over-heating, and continual danger of breakdown, shock and fire. I am perhaps painting an over-black picture of possibilities rather than probabilities. But they are sufficiently common to justify the argument; and that they are not more common is due more to the inherent safety of electric lighting than to the so-called "foolproof" qualities of any of these lead-covered systems.

If now we turn to the last class we have to consider, *c*—cab-tire—we find a system which, being neither metal-sheathed nor protected, dispenses at a stroke with all need of bonding and earthing, and so with all the dangers attendant on neglect to do so. It is a system so simple to erect that a man of even less than average skill and carefulness can hardly fail to secure with it the necessary margin of safety; and in this respect—which we have agreed is by far the most important—it approaches more nearly than any other the ideal of which we are in search. It must be admitted, however, that in some other respects it does not compare so favourably with either conduit or lead-covered; so that the question whether we can make it our final choice depends on whether its shortcomings in these respects are sufficiently small to be compensated for by its definite superiority in "expectation of safety."

Before leaving the question of safety, too, it must not be overlooked that there is at least one point where carelessness in erecting cab-tire may mean potential danger. In stripping off the outer sheathing when preparing the ends, a man is apt to injure the inner insulation of the conductors at the point where they are in closest contact, emerging from the sheath. There is the same danger, of course, in lead-covered twin cables, but it is somewhat greater in cab-tire, as the difference in "feel" between the sheathing and insulation is not enough in itself to arrest the knife at the crucial point. It is a risk, however, which the competent erector avoids easily enough in practice, whether with cab-tire or lead-covered.

An obvious point where cab-tire compares poorly with conduit and, in a less degree, with lead-covered, is in mechanical protection. Certainly it would not stand attack from a nail or a sharp cutting instrument as would conduit. On the other hand, such possibilities, which it has already been argued are almost negligible in a private house, can be guarded against easily enough in various ways. It has been suggested, for instance, by certain cab-tire makers that chases for concealed wires can be made good with cement floated directly over the wires. They may be right, but it is not an appealing suggestion. In such cases some form of metal protection seems to me to be preferable, such as painted steel strip, or sherardised capping, or oval tubing.

Protection for cab-tire between floors and ceilings should be less necessary than it is for v.i.r. cables threaded through joists. It is a fact, however, despite disclaimers to the contrary, that rats *will* attack cab-tire, as indeed they will v.i.r. or wood casing, or anything else they can get their teeth into. I remember, some years ago, sending to a well-known firm of cab-tire makers some samples, taken from a rat-infested country house in East Anglia, which were a convincing proof of its susceptibility to attack by vermin. The fact was beyond dispute; and in due course I was sent a special coil of cab-tire, the rubber sheathing of which, the makers wrote, had been specially impregnated with some dope abhorrent to rats. They asked me to make a test of it. As it happened, it was a long time before the opportunity occurred to install it in a suitable house; and then the results were negative. A year later the cab-tire was untouched; but that proved nothing one way or the other. However, I cannot believe that any rat—unless there are dietetic faddists among rats as among humans—would make a meal of hard rubber unless he were forced to it by circumstances. Rats, like rabbits and other rodents, are accustomed to use definite run-ways, and the probability is that the original cab-tire happened to have been fixed across one of these tracks and was only attacked by way of removing an obstacle to traffic. In rat-infested houses, therefore, it should be possible to guard against such attacks by a little discrimination in arranging the run of the cab-tire.

Another point on which cab-tire is at some disadvantage compared with lead-covered cable for surface work, is that of sightliness. Lacking a metal casing, it is less rigid and more difficult to erect in clean, straight lines. However carefully a twin 3/22 circular c.t.s. cable is erected, and with however many clips or saddles, it is impossible to run it with the mathematical neatness of, say, Stannos, or a Henley twin. The objection can be largely met by using twin 1/.044 flat instead of the stranded circular, the greater stiffness of the wires and the wider section of the sheath assisting it to keep its shape. The flat cab-tire, too, casts a smaller shadow—and it is the extent of its *shadows* which largely determines the sightliness or otherwise of any surface system, a point not always realised. In practice, the smaller the shadow the less the wiring is noticed, irrespective of its actual size. From that point of view I would suggest that a D-section cable with a smooth matt surface would be the best possible for surface work, if practicable from a manufacturing point of view.

Another drawback to the use of cab-tire is that none of its makers have provided cheap and *simple* joint boxes for use with it—or if they have they do not seem to be proud of them, for we never hear of them. In the absence of the complications of bonding it should surely be an easy matter to design a plain non-metal box with terminals for jointing, teeing, or looping. As it is, one has to make shift with such unsatisfactory substitutes as three-plate ceiling roses.

Another minor drawback—an artificial one created by the I.E.E. rules—is that it is not easy in a cab-tire installation to comply with the regulation providing for the earthing of domestic apparatus. That, however, will not unduly distress the common-sense of the contractor, unless something of the sort is needed in a bathroom, and there the proximity of waterpipes suggests an easy solution of the difficulty.

There are perhaps other small objections to cab-tire, as compared with other surface systems, which I may have overlooked—always ignoring the question of cost, which in any case is a small matter, one way or the other, with any of these systems. The sum of all its

minor drawbacks, however, does not, in my opinion at least, outweigh its manifest superiority over others in the facilities it offers for the erection of a safe and trouble-free installation. It will be gathered, then, that cab-tire is my final choice. If, as premised in the second paragraph of this article, I were wiring my own house regardless of cost, it would be with cab-tire, everywhere concealed, and protected, where really necessary, by narrow sherardised capping or the like, and fitted with solid hardwood switch and fitting blocks, fireproof lined and painted, and with some simple form of insulating junction box wherever required.

That, in fine, is my personal ideal of a wiring system for private houses. It is waiting for the ideal client of my imaginative dreams who will some day come to me and say: "I want my house wired in the safest and most permanent way, on the best possible system. I leave details to you—hang the expense!"

The Electric Furnace in Industry.

The rise of a formidable competitor to established methods of industrial heating.

(COMMUNICATED.)

A CAREFUL perusal of some of the results which are gradually becoming available of the application of electricity to industrial heating and metallurgical operations, varying from the fusion of metals down to operations at lower temperatures such as carburising, annealing, normalising, reheating, and japanning, show that for many of these processes the electric furnace has definitely passed out of the realm of laboratory appliances, and is now about to take its place as a serious competitor of some of the older established systems of heating, particularly gas and oil.

Up to the present, the amount of available information upon industrial processes served by electricity is scanty when compared with the figures which are available in respect of competitive fuels which have been longer in the field, but recent electrical process is decidedly interesting to the manufacturer who is seeking a system which combines close (and sometimes automatic) control of temperature with a cost which does not exceed that of gas. On account of the paucity of data, there is a slight difficulty in making rough comparisons in deciding which out of the many and varying figures which are available for other systems shall be taken as typical results. The fuel cost per unit of output (although it is only one of the factors which require to be considered in furnace work) is usually the most important item, and certainly one which receives first consideration when any new installation is contemplated. It is interesting, therefore, to notice that some of the recent electrical results compare favourably with the fuel costs for similar operations when gas is used, as it is probable that it is with the latter fuel that electricity compares most closely in heat-treating operations, and with which competition is likely to be keenest in the early stages of the trade. As a basis of comparison for arriving at the £ s. d. aspect of fuel costs, as distinct from actual thermal efficiency, it would be reasonable to base the respective prices upon the rates charged in a typical Midland centre where the use of both gas and electricity for general industrial purposes has been well developed by the respective supply undertakings. Electricity is taken at .75d. per unit, which is the actual figure for a low-voltage supply, although high-voltage is available on slightly more favourable terms; gas is taken at 2s. 3d. per 1,000 cu. ft. In some of the common processes which absorb the greatest numbers of furnaces of all systems, some recent results compare as follows:—

Process.	Gas per ton output. Cu. ft.	Price.	Electricity per ton output. Units.	Price.
Melting, brass	7,324	16s. 5d.	224	14s. 0d.
Annealing, mild steel ...	6,253	14s. 1d.	191	11s. 11d.
Annealing, nickel or metals at 750 deg. C.	5,734	12s. 10d.	167	10s. 5d.
Annealing, brass	4,060	9s. 1d.	121	7s. 6d.

Against the fact that the electrical results quoted are isolated instances, compared with figures selected from a mass of results obtained in an industry wherein development has been intensive for the last fourteen or fifteen years, it is justifiable to infer that even the electrical figures quoted will be improved upon as this type of furnace comes into more general use. Such figures, however, make it evident that the use of electricity for metallurgical operations is destined to increase greatly in those districts where the supply authority is sufficiently far-sighted to appreciate the influence of such a load upon revenue, and able to put into force a tariff which will encourage the development of the trade.

Apart from the consideration of price, there appear to be at present two main obstacles to be overcome before the use of electric furnaces can become as general as gas. The first is the scarcity of electrical engineers who have specialised upon the metallurgical side. An electric furnace, to be successful, has to combine the experience of the electrician and the experience of the metallurgist, and at the present time the number of instances is very small indeed of electrical training being combined with a thorough experience of the hundred and one different trades and processes to which such plant has to be applied. In the construction of coal, gas, and oil furnaces, the problems encountered are comparatively simple, and there is little in the design of such plant that an efficient engineer or designer from any other branch of the engineering trade cannot readily cope with; the most valuable part of the experience of the designer and the most difficult of acquisition is the requisite wide knowledge of trades and processes, each one of which has its special requirements and prejudices, joined to an equally thorough knowledge of the possibilities of his own medium applied to such processes. The latter must be sufficient to enable figures to be quoted as to consumption, output, and upkeep, in terms which usually have to be so precise as to amount to a guarantee if business is to be secured. If the older branches of the industry are none too well provided with designers of this wide experience, the number is bound to be far less on the newer electrical side, which obviously necessitates considerably higher qualifications, and it is this aspect of the personnel question which will have a material effect upon the rate of progress of the electric furnace for some time.

Apart from the need for increased study of metallurgical problems and general heating work by electrical engineers, the other obstacle which requires to be overcome is the scarcity of effective publicity on the subject of what can be done by electricity in this new field. Before any considerable progress can be made, there is need for publicity of the type which is so well provided by the Electrical Development Association for domestic apparatus. In this connection, it is interesting to recall that the co-operative publicity of the gas industry in the first stages of the movement was concentrated exclusively upon domestic appliances, in precisely the same way as in the electrical trade. Given the necessary publicity and continued interest, recent developments show clearly that it is in the power of electricity supply undertakings to develop a considerable industrial furnace load with profit both to supplier and user.

The Cork Broadcasting Station.

Brief technical details of the "Standard" equipment installed in the new Irish Free State station, including the latest form of condenser microphone.

THE new broadcast radio-telephony transmitting station at Cork, which was formally inaugurated on April 25th by Mr. J. J. Walsh, Minister of Posts and Telegraphs, has been built to serve the South and West of the Irish Free State, in which localities crystal set users have hitherto not had reasonable reception facilities.

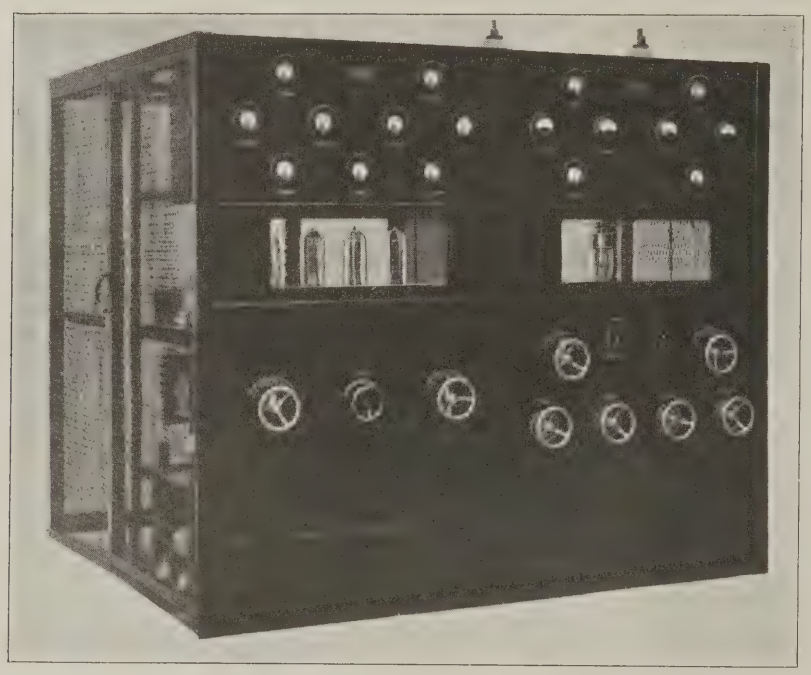


Fig. 1.—"Standard" Broadcasting Equipment at Cork.

The power required to operate the complete station is 9 kW, but its Geneva rating is 1.5 kW: that is to say, 1.5 kW is fed to the oscillator, which, in turn, delivers 1 kW of unmodulated power to the aerial system, so that with 100 per cent. modulation a "peak" power of 4 kW can be dealt with by the apparatus without introducing distortion. The station is operating on a wavelength of 400 metres and its call letters are 6CK.

The aerial and earth equipment was constructed by the Ministry, and proved to be a somewhat difficult undertaking, as it has been erected on the elevated site of the disused prison at Sunday's Well. The inverted L-type aerial, consisting of four wires each 156 ft. long, is supported by two masts 100 ft. high. The 7/22 s.w.g. buried earth mat covers an area of 20,000 sq. ft., and facilities have been provided for the use of an insulated counterpoise, if required. Motor-generators fed from the public electricity mains provide the entire power required for the plant.

The transmitter, erected by Standard Telephones and Cables, Ltd., is modelled on the same lines as 38 stations which this company and its associates have constructed in various parts of the world. In the modulation system the carrier current is generated at a very low-power level by means of a specially stable master oscillator, which maintains the frequency constant to less than 0.01 per cent., and the modulation is performed at low power, the modulated wave being subsequently raised to the output level by successive stages of power amplification. The carrier frequency is entirely unaffected by modulation, so that the highest quality is maintained, even when the transmission conditions are so bad that fading is noticeable, or when the receiver is placed in a badly-screened position.

The aerial is capacitatively coupled, which arrangement secures high quality, regardless of the percentage of modulation, and also minimises the radiation of harmonics of the carrier frequency, so that interference with wave-lengths other than that used is reduced; the characteristic is maintained approximately flat up to at least 80 per cent. modulation, and a further advantage of the system is the silence of the carrier, no sound being perceptible until modulation actually commences.

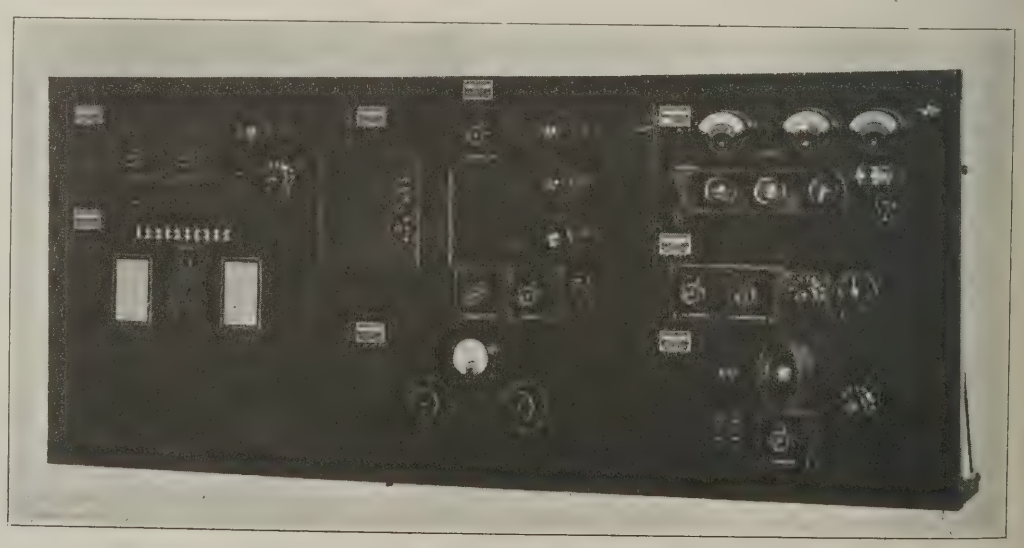


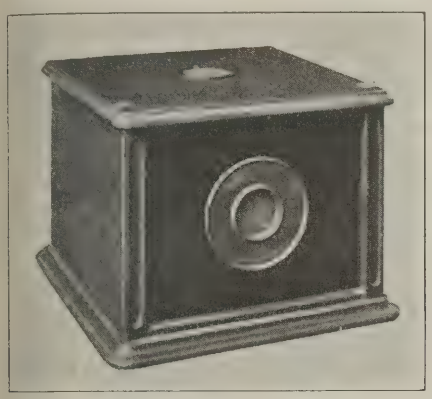
Fig 2.—Speech Input Apparatus in the Control Room Adjoining the Studio.

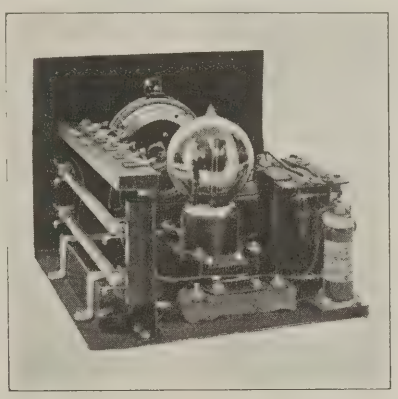
The transmitter is designed for operating upon any wave-length between 200 and 600 metres, and can be changed over from any one wave-length to any other within this range in about 20 minutes. The equipment (fig. 1) is neat and completely enclosed at the

back by a protective cage; a protective relay system has been provided, the operation of a single press button starting or stopping the whole unit.

The master oscillator, a Colpitt circuit using a 4211-D valve, is contained in a brass-lined box in order to eliminate interference by external fields: its high-frequency output is fed to the grid of a 4211-D master separator valve, the output of which is bridged by a non-inductive potentiometer, by means of which the feed to the modulated amplifier is regulated.

The level of the incoming speech currents is suitably reduced by an attenuating network and supplied to the input transformer of the 4211-D speech-amplifying valve, the output of which is choke-capacity-coupled to a 4212-D valve acting as modulator; the latter further





Figs. 3 and 4.—Condenser Microphone, with and without Cover, showing Amplifier.

amplifies the voltage variations corresponding to the speech, and sets up across a high-impedance choke coil (actually two coils in series) in the common high-voltage lead to the modulator and modulated-amplifier valve a correspondingly varying potential difference, which is thus impressed upon the high-voltage supply to the modulated-amplifier valve; the high-frequency output of this valve is thereby modulated in accordance with the voice-frequency currents supplied to the input terminals. This method of modulation is known as the "Heising" or "constant-current" method, and has been proved to give the highest-quality reproduction.

The modulated amplifier and all the subsequent ones are biassed to "cut-off," enabling the whole of the valve characteristic to be used to ensure maximum output: capacity coupling eliminates radio-frequency harmonics generated in the amplifiers, the output in each case being transferred to a tuned inter-stage circuit through a "stopping" condenser; any speech-frequency components which, if allowed to pass, would introduce distortion are bye-passed by means of large radio-frequency choke coils shunted across the tuned circuit. In each case a non-inductive resistance across the coupling generator maintains a steady load on the preceding amplifier by reducing the percentage variation due to fluctuation in the grid impedance of the next stage.

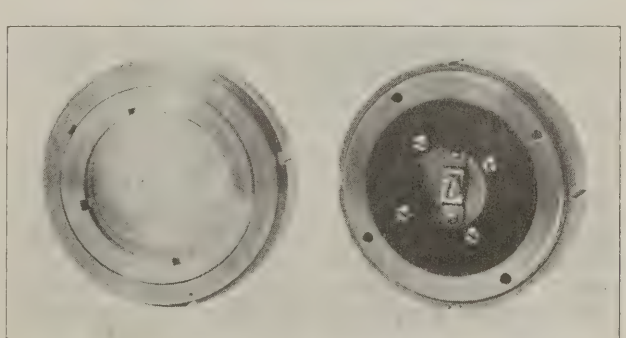
The first power amplifier stage consists of two 3212-D valves in parallel and the final stage of one 4288-A water-cooled valve; in the first amplifier stage, inter-valve oscillation or "singing" is prevented by radio-frequency chokes in the plate circuit of each valve. Initial adjustment of the tuned circuits is made at the back of the units by varying in steps both the inductance and the capacity, to permit proper matching of impedances between the output circuits and the valves: fine adjustment is made while the transmitter is actually operating by geared handwheels on the front of the panels, which operate sliders on the last three turns of the coils.

In both the power-amplifier stages the plate current return leads are connected to the electrical centre point of the filaments in order to ensure freedom from ripple and equalisation of the load on both halves of the filament; the centre point is obtained in the first stage by means of a capacity bridge across the filament bus-bars, and in the second stage by means of a resistance-capacity bridge similarly connected; both stages are fed by the same generator. In addition, in the filament circuit of the second stage there is a reversing switch for periodically changing the direction of the current through the filament and also a compensating resistance for accommodating valves having different filament characteristics, the proper adjustment being indicated by a letter etched on the glass of the valve. The oscillator-modulator also contains smoothing systems in the plate and grid supply circuits. The output of the power amplifier is transferred through a "stopping" condenser to a tuned closed circuit, which provides for the elimination of harmonics and for the proper matching of impedances in the amplifier plate and aerial circuits. Capacity coupling is used between this circuit and the aerial circuits, the coupling condensers being common to both circuits and variable for regulating the power supplied to the aerial and for enabling aerials differing in radiation resistance to be used.

The filaments of all the valves are heated by a 24-volt generator, and by inserting resistance elements the voltage is reduced to 14 for the 4212-D and to 10 for the 4211-D valves; the resistance is divided, half being placed in each side of the circuit so as to enable the electrical centre-point to apply to all filaments equally. The plate of the water-cooled power amplifier valve operates at 4,000 volts above earth potential.

In the power circuits contactor 1 is controlled by the push-button switch and, when it operates, makes the field circuit of the 24-V generator, across which is a time delay relay so set as to allow 10 seconds for the filament of the power valve to heat up before the plate voltage is applied; it can only operate when the gate switch is closed, and closes the circuit across the 250-volt generator for contactor 2, which makes the field circuits of the high-voltage machine; the field current is also obtained from the 250-volt generator. An overload relay in the high-voltage return circuit operates if the total plate current exceeds some definite value, when it makes the circuit for contactor 3, which on the second contact breaks the circuit of contactor 2 and the high-voltage generator field.

In addition, speech input equipment (fig. 2) has been provided in the control room adjoining the studio, which can be used either with a double-button carbon microphone or condenser microphone; the latter consists of two metal diaphragms separated by an air gap



Figs. 5 and 6.—Condenser Microphone, Front and Back Views.

of 1/1,000 in., 150 volts being applied between the plates and the varying capacity resulting from speech vibration used to produce the speech currents. The instrument (figs. 3, 4, 5, and 6) is identical with that used by the Comité Consultatif International des Communications Téléphoniques à Grande Distance for the construction of an "ideally perfect" telephone system for use in its laboratories as a standard for comparison.

Imperial Development and Co-ordinated Investigation.

Transport is the key: Is it possible to build electric railways in the first instance? Geological surveys, combined with systematic co-ordinated investigation of natural resources, may lead to the development of cheap electric power and the establishment of industries to form a basic market therefor.

By DOUGLAS SPENCER.

WHILE all of us feel that psychologically the British Empire is developing on the right lines, few of us, we believe, will maintain that its development physically is being carried out on lines which, from the point of view either of speed or economy, can be considered to be the best to follow.

In looking at the question of Imperial development, or settlement, one is conscious of the existence of some sort of inertia, which in itself is so complex that it is highly difficult to analyse and therefore to overcome. None the less, as compared with the pre-war rate of progress, events are moving fast. Rustic knowledge of the Empire's resources has increased enormously. The events of the war have given us a much more intimate acquaintance with the Empire's varied inhabitants. The Imperial Conference itself, though but a triennial occurrence, is undoubtedly a great educative event, which has an immense Imperial advertising value, apart from the tangible results accruing from such meetings of Imperial statesmen.

Recent events have certainly turned the thoughts of the man in the street to Imperial matters to an extent not experienced before, and his thoughts are kept in Imperial channels by such bodies as the Imperial Economic Committee and the Empire Marketing Board.

There is always an extraordinary reaction taking place between buyers and sellers. A notable example is the case of Norway, whose experiments in partial prohibition threatened her fish and other trades with the wine-producing countries. It is the old story of the contra account—as between nations; so, when the Dominions carry out a zealous campaign for advertising and selling their waves, we anticipate an increased readiness on their part to purchase our goods.

The importance of the Dominion and Crown Colony markets is obvious to all interested in electrical manufacture, and it is therefore essential that it shall not reach saturation point, but that it shall be developed by every possible means in our power—first of all, by the development of primary resources in foodstuffs and minerals.

The electrical development of the Empire to-day is in that early stage where, if it is to be speedily and economically carried out by us, we must look at the question broadly and "see it whole." The adoption of the super-station in this country is accepted as the proper method of power generation. The principle is one that holds good equally in the component parts of the Empire, to foster the development of primary industries. The difficulty is how to find a super-load in sparsely-populated districts.

In some countries the basic electrical load is industrial and domestic; in others a wood pulp and paper industry; in others electro-chemical and metallurgical; in others mining and irrigation. There is no nation in the world which has to consider such a varied set of circumstances in the matter of the application of electrical energy as is to be found in the British Empire.

In examining an electrification project of any kind, we are naturally inclined to look for population as the key to its payability. But there is reason to believe that in most of our examinations we are liable to look too much at one particular phase of the possible use of electricity.

The less developed countries are a very fruitful field for research. The Rjukan hydro-electric development in Norway were not caused by population or anything already in existence, nor were the small electric railways between Notodden and Rjukan, nor was the electric railway from Lulea to Narvik in the Arctic Circle though it is 476 kilometres long.

Wherever there is cheap power available from water as at Rjukan, or from coal as at the Witbank Colliery there is room for the examination of the development of electrical energy on other lines than those to which we are accustomed in this country.

There are electrical schemes depending on electro-chemistry alone or on electro-metallurgy with no pre-existent industry. There are railways electrified where the passenger traffic is negligible.

There are in the British Empire countries in which somewhat similar developments might take place, each by itself. There are others, in which the establishment of an electrochemical or a metallurgical industry might cause power to be developed so cheaply that the electrification of existing railways and the building of new electric railways might become possible.

Transport is undoubtedly the key to Imperial development. Electrical transport should always be a very early consideration instead of being regarded as only possible of realisation when the country is in an advanced stage of development. A far from unimportant feature in connection with railway electrification is its effect on the siting and grading of the track by reason of the increased gradients which can be dealt with by electric locomotives.

One of the first questions a pioneer Government must ask is: "Is it not possible to build an electric railway in the first instance? Can heavy power using electro-metallurgical and electrochemical industries be established to form a large basic market for power, or can other industries be fostered to help in creating a market for power so that we may have cheap and efficient transport?"

The careful geological surveys which have been carried out in the Dominions, and similar surveys which have been or are being made in the Crown Colonies, form a very real basis on which to consider this question of development of the Empire by electricity. It is a process which is gradually being carried on in certain parts of the Empire, but one, the applicability of which to other parts of the Empire is left too much to chance, instead of being taken care of by a careful and systematic examination of the resources and power possibilities of the various component parts of the British Commonwealth of Nations.

Little by little the power possibilities of the British world are being realised, but it needs the combined brains of power engineers, electrochemists, electro-metallurgists, mining engineers and electricity supply and traction experts to work out a comprehensive scheme of development.

Canada is the one outstanding example of the utilisation of power possibilities to establish what are really primary industries, though some by speedy development have taken on the semblance of secondary industries.

Intensive agricultural development is naturally the first objective, artificial fertilisers and cheap transport follow as a corollary, and later comes the smelting of the native ores.

Calcium carbide and zinc have given Tasmania its electrical opportunity. Public utility demands and agriculture have given a similar impetus to the use of electricity in New Zealand. Zinc mining gives a market of some hundred million units per annum in one district alone of the Federated Malay States. Ceylon is about to develop her water power for public utility and tea estate purposes. The cotton mills of Bombay draw their motive power from the Western Ghats. The gold mines of Johannesburg are worked by power from the Witbank Collieries.

All these developments have taken place within the last 20 years. It needs only intensive and co-ordinated thought to achieve like accomplishments in other parts of the Empire, and we should like to see closer attention devoted to the question of trying to develop similar activities in all parts of the Empire by those who are acquainted not only with the resources of those parts, but also with the means whereby those resources can be utilised.

Wireless Retailers' Association.

Annual Meeting.

THE annual general meeting of this Association was held on April 6th. The Council and officers for the ensuing year were elected, and several alterations in the rules were passed after discussion. The hon. treasurer, Mr. H. C. Willard, reported that the financial position was eminently satisfactory.

In the course of his address, the Chairman (Mr. Horsey) said that numerous manufacturers, factors, and wholesalers were being constantly seen and communicated with regarding the interests of members and dealers generally. The efforts made by the Association in connection with the allowance of discounts to persons not entitled to trade terms alone had occupied an immense amount of time and trouble. The policy of circularising the trade on matters of general interest had been continued. A questionnaire was sent to some ten thousand retailers all over the country, and resulted in a mass of valuable information which had been duly collated and considered. The increase in membership was greater than in any preceding year. There was no better way of achieving the objects of the Association in important centres than by the formation of branches. Although every encouragement was given by the Council to those who would undertake the task, it was a matter for regret that more of them had not materialised. Since the last annual meeting the two associations, the S.R.M. and the N.A.R.M.A.T., which were then in negotiation, had amalgamated in the Radio Manufacturers' Association. So far as this materialised the policy, so long advocated by the W.R.A., of one association for each section of the trade it had their warmest welcome. The new body had not yet been long enough in existence for it to be known whether it was going to be an improvement on the older organisation in putting co-operation in the forefront of its policy. It was a matter for great regret that the factors and wholesalers had not yet taken the initiative in forming an association of their own. They felt that as the other great distributing section of the trade, a separate organisation representing them collectively would be a signal advantage. One or two matters could only be remedied by very special treatment and particularised organisation. These were price maintenance and the allowance of discounts to persons not entitled to them. Some little time ago the Council appointed a committee especially to consider price-cutting, and it concluded that it was necessary to form an association equally representative of manufacturers, factors, and retailers on the basis of the Proprietary Articles Trade Association, and that the object of such an association should be the taking of all legal steps to deal with the cutting of prices and the granting of trade terms to those not entitled to them. It recommended that the leading factors should be invited to meet it with a view to a joint consideration of the matter. The W.R.A. would use its utmost endeavour to secure the establishment of an organisation framed on the lines of the P.A.T.A. A number of leading factors and manufacturers held identical views, and many of them had already discussed the subject with them. Regarding the broadcasting programmes, Mr. Horsey said that an unofficial Trade Advisory Committee had been formed, but he thought that a committee appointed by the B.B.C. would be more acceptable. They claimed that their efforts to prevent the proposed raiding of broadcasting funds resulted in greater sums being made available for the broadcasting service than had been contemplated by the Government. It was still considered that the amount now allotted to broadcasting was too small for a service of such great recreative and educational value to the whole nation.

In conclusion, he said that it was more than ever necessary for them to hold together and to make their position impregnable against all assaults. They had recently seen the payment of a considerable sum to assist the formation of a rival retailers' association and the offer of free office accommodation. It was impossible too strongly to deprecate the dependence of any retail organisation on the subsidies of manufacturers. There was only one reply to that sort of thing and that was so to organise and strengthen the Association that no inducement, however great, would be able to split the ranks of the retail trade.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Broadcasting on Trains.—On April 26th, Mr. Day asked the Postmaster-General if his attention had been drawn to the coaches attached to trains on the Continent, in which a full service of broadcasting programmes was supplied to travellers on those trains; and whether he had received representations, requests, or applications from any of the railway groups in Great Britain for permission to install a similar service on the long-distance trains in Great Britain.

Sir W. Mitchell-Thomson said that he was aware that broadcast receiving sets had been installed in long-distance trains in some countries. Experiments conducted some years ago in this country showed that it was possible to receive broadcast programmes on trains in motion, but no application had been received for a licence for the permanent installation of receiving apparatus in trains.

Electricity in Mines.—On April 27th, during a debate on accidents in mines, Mr. Paling said that in Germany, where there was a far bigger proportion of winding engines driven by electricity than in this country, the number of accidents from overwinding was very much less. He asked what was being done by the Mines Department to encourage the use of electrical winding engines in this country. At the pits where electric lamps had been adopted the illumination was much better than was obtained by the ordinary flame safety lamp. But, after nearly 15 years' experience of electric lamps, there were still in use 580,000 ordinary flame safety lamps, as against only 366,000 electric lamps. One of the best ways of getting rid of miners' nystagmus was to adopt electric lamps. The main reason for not adopting the electric lamp was expense.

Mr. Walsh contended that many of the accidents in mines were directly traceable to the use of electricity. It was time that a new inquiry into accidents should be set up, or a new code of legislation established to deal with entirely new conditions.

Col. Lane-Fox, the Secretary for Mines, in reply, said he would be surprised to learn that it really was the policy of the Labour Party and of the Miners' Federation to discourage the use of electricity in mines. By all means let them make the use of electricity safer, but to talk about electricity as a danger that ought to be avoided was not the considered judgment of either the Miners' Federation or the Labour Party. One of the complaints that the Miners' Federation made before the Royal Commission was that this country was behind the times as compared with other countries with regard to electrical equipment in mines.

Wireless Calls to America.—On April 27th, Sir F. Wise asked the Postmaster-General if he could state the number of wireless calls between Great Britain and the United States of America from January 1st to the most convenient date; and if the service was paying its way.

Sir W. Mitchell-Thomson said that the total number of calls up to and including April 24th was 769. The service was not yet self-supporting. Receipts at present covered working costs, but not interest and depreciation.

Electricity Schemes.—On April 26th, Mr. Kelly asked for the number of schemes which the Electricity Commissioners had placed before the Central Electricity Board; and how many of such schemes had been sanctioned by the Board.

Colonel Ashley said that a scheme relating to Central Scotland had already been prepared by the Electricity Commissioners and transmitted to the Board for consideration. The preparation of a second scheme, namely, for Central England, was in an advanced stage.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Metro-Vick Actors.

The Metropolitan-Vickers Dramatic and Operatic Society has added to an already long list of successful productions an excellent presentation of Ian Hay's play, "The Sport of Kings," given from April 27th to 30th in the well-equipped theatre which is part of the Metrovick Club, Stretford. The Metrovick Dramatic Society has now been in existence about seventeen years, during which time it has produced a large number of plays and musical comedies, some by well-known authors, but quite a number the original work of its own members. Amongst amusing productions in the latter category may be recalled "Polly Phase, or Life's Little Worries," and "Ali Baba and the Forty Salesmen."

Electricity in a Housing Scheme.

Upon the Richings Park Estate at Iver, Bucks., about two hundred houses, forming part of an estate, which will eventually comprise 2,000 houses, have been erected by the estate company, and each house has been equipped with electricity for lighting and heating and with electrical labour-saving appliances. Every room is installed with lighting points, and power plugs are fitted in the living rooms for use with electric fires, electric cleaners, &c. Two electric radiators are supplied as part of the property conveyed in the inclusive cost of the house, and other "owner's fixtures" include an electric cooker and electric washer in the kitchen, as well as an electric towel rail in the bathroom. Furthermore, each house is equipped with a complete two-valve radio set with loud speaker. Electricity is available at reasonable rates. The whole of the electrical fittings, fixtures, and household appliances, are of the "Magnet" type, and have been supplied by the General Electric Co., Ltd. The wireless sets are "Gecophone" models.

The Electrical Contractors' Association.

The Council has nominated Mr. W. A. Shaw, of Stockport, as president of the E.C.A. Allied Associations for 1927-28. Mr. Shaw has already occupied the position, having been president in 1912-13. Mr. W. H. Walton will continue in office as vice-chairman. The Association has produced a brochure in which are outlined the history of the organisation, its aims, and its achievements. That the Association is a "paying proposition" is emphasised in the publication, a fact which should impress those contractors who are not yet members.

Australian Company's Change of Name.

The Sydney *Sun* reports that the English Electric Co. of Australia, Ltd., proposes to change its name to Standard Waygood, Ltd. In a circular to its shareholders, the company stated that 5¼ years ago it purchased from the English Electric Co., Ltd., for £10,000 in cash, the £100,000 "A" ordinary shares issued to it eighteen months previously, when arrangements were made to use its designs and to represent the company in Australia. An agreement was made under which the company was permitted to use the words "English Electric," and to build electrical machinery of certain classes on the payment of royalties. The agreement proved unsatisfactory, and was terminated by mutual consent on February 28th last. The manufacturing licence from C. A. Parsons & Co., Ltd., was extended to cover the electrical generating plant of all descriptions.

Unemployment in Germany.

The returns of unemployment in Germany show that on April 15th the total was 1,221,000, as compared with 1,659,000 a month earlier.

Swedish Activity in Russia.

It is reported from Moscow that the Soviet Concessions Commission is in negotiation with the Svenska Allmanna Elektriska A.B., with a view to the latter's establishing works at Yaroslaff for the construction of electrical machines.

Austrian Electrical Industry.

The *Monthly Review of Central Europe*, produced by the Anglo-International Bank (Mid-April issue), states that the Austrian electrical industry is looking forward to important orders in the near future, partly in connection with schemes for public productive investments and partly from Russia.

Islington Exhibition Scheme Rejected.

The Lighting Committee recently submitted to the Islington Borough Council a proposal to hold an electrical exhibition at an estimated cost of £500. Mr. Gallichan, in opposing the motion, said that when it came to manufacturers advertising, the manufacturers should pay for it. If the Council wanted to increase its output of electricity it should abolish the guarantees required from consumers in the borough. The motion was lost, 20 voting for it and 25 against.

European v. American Meters.

In one of the last issues of the *Electrical World* to reach us (April 16th) Mr. R. H. Schofield, sales manager, Ferranti, Ltd., takes up the cudgels on behalf of meters not made in America. Earlier in the year our contemporary published an article entitled "Foreign and Domestic Meters Compared," the whole tone of which, says Mr. Schofield, was calculated to show that meters not made in America were so inferior that they were not worthy of serious consideration. We quote Mr. Schofield:—"This statement is not only contrary to the facts but is contrary to the figures of the tests as shown in the report itself. The following paragraph appears in italic type in the report: 'The committee on metering and service methods has not found any meter of European manufacture that performs as well as the American product and that can be bought f.o.b. any point in the United States for appreciably less than the domestic product.' The ambiguity of this paragraph is characteristic of the report generally. Careful reading of it discloses the following information: That European meters of a quality equal to American meters are much more expensive and that those meters which are available at a price equal to the American manufacturers' price are not good enough to use. The paragraph is so worded, however, as to indicate that the committee has not been able to find a European meter as good as the American ones. The plain facts are that European meters are available quite equal to those of domestic production, but owing to the tariff of 45 per cent., which is based upon the value of the meters in the country of origin, they are not available to the American user at an economical price. It would be misleading to your readers to assume that this condition applies in the rest of the world, where American meters are sold in competition with those of Europe in a ratio preponderantly in favour of European meters. There is no doubt that American-made meters have attained a very high standard of excellence, but it is equally true that European meters have of necessity attained a similar standard, and in reality the whole report could have been condensed into the following sentence: 'European meters of a class equal to American meters are not available to American users because of their landed cost being so much higher than that of the domestic product.'"

Platinum in the Transvaal.

Professor Kovaloff, the Russian platinum expert who has exhaustively investigated the Transvaal occurrences, has been appointed S.A. representative of the Berlin selling agency for the Russian product. He strongly urges that the establishment of a refinery in South Africa would provide the only hope of successful competition on the part of the local industry. Until recently the price of platinum had for some time ruled in the neighbourhood of £25 per ounce. It had been expected that the increase in the supplies owing to the production from Transvaal sources would be followed by a fall in value.

Unemployment.

There was an increase of over 28,000 in the number of unemployed during the week ended April 19th. At that date the total was 1,106,400, as compared with 1,078,250 on April 12th, and 996,650 on April 20th, 1926.

The Union Cable Works.

It is stated in German circles that the German Cable Works Company, of Berlin, is in negotiation for the re-acquisition of the factory at Dagenham.

Electrical Treatment at Torquay.

In a handsome official handbook of Torquay, which has been received from the authorities of that town, particulars are given of a very complete electro-medical service which is available to visitors. The modes of treatment include galvanism, faradism, sinusoidal currents, diathermy, high-frequency, combined heat and light baths, ultra-violet rays, Dowsing radiant heat, &c.

Battery Works Strike.

About 200 employés of the Sparkhill battery works of Messrs. J. Lucas struck work last week as a protest against a proposed reduction in the rates of pay. They returned upon the following day, the management having agreed to make a smaller reduction.

New Municipal Showrooms and Offices.

Morecambe Corporation Electricity Committee has asked the borough engineer to prepare a scheme for the provision of a showroom and offices for the electricity department.

Local Exhibitions.

Stepney.—An electrical exhibition, held under the auspices of the Borough Council Electricity Department (engineer and manager, Mr. W. C. P. Tapper), was inaugurated by the Mayor on April 29th, and continues until May 7th. The Council's stand serves as an inquiry bureau where information is given to visitors of the favourable terms of electricity supply, &c. The exhibition occupies two halls and a large variety of excellently displayed electrical domestic and other appliances are to be seen on the other stands, which total 30 in all. In the Winter Garden, the E.L.M.A. stand takes the form of a model shop window showing modern lighting methods; Messrs. Barrons (Leicester), Ltd., are displaying bakery machinery and butchers' meat-chopping machines; Automatic and Electric Furnaces, Ltd., exhibit electric annealing and steel-hardening apparatus; Messrs. Sager & Co. are demonstrating woodworking machinery; Messrs. Sadia, Ltd., are showing geysers and water heating apparatus; the Rowing Engineering Co. is displaying bakery machinery; and Messrs. George Nobbs, Ltd., exhibit electric water heaters and geysers. In the Queen's Hall, the stands are almost entirely devoted to the display of domestic apparatus. An extensive range of electric cookers, heaters, and general domestic apparatus is exhibited by the British Electric Transformer Co., Ltd., Hotpoint Electrical Appliance Co., Ltd., Cable Accessories Co., Ltd., Belling & Co., Metro-Vick Supplies, Ltd., Edison Swan Electric Co., Ltd., Berry's Electric, Ltd., Credenda Conduits Co., Ltd., and Jackson Electric Stove Co., Ltd. The British Thomson-Houston Co., Ltd., is making a special feature of its motors and wireless apparatus, and Messrs. John Bell & Croyden have an excellent display of Sunray and electro-medical apparatus. Motor-driven sewing machines are shown by the Singer Sewing Machine Co., Ltd., and Messrs. Wilcox & Gibbs. Lighting fittings and glassware are exhibited by the Wholesale Fittings Co., and Messrs. Hailwood & Ackroyd. In addition to its "Magnet" domestic appliances the General Electric Co., Ltd., is displaying portable tools and industrial apparatus. Messrs. Benham & Sons, Ltd., are showing electro-vapour radiators, Messrs. Aublet Homer and Co. are exhibiting cloth cutters, press irons, &c., Frigidaire, Ltd., refrigerators, the K.F.M. Engineering Co., Ltd., electric signs, and the Hart Accumulator Co., Ltd., accumulators and charging apparatus. Views of the Corporation's and the Edison Swan Co.'s stands are reproduced herewith.

The Council has introduced an assisted wiring scheme to encourage the use of electricity, and a scheme is being prepared to double the present capacity of the plant in order to meet anticipated demands.

Valuable assistance in organising the exhibition was given by the British Electrical Development Association.

Clitheroe.—The formal opening of a ten days' electrical exhibition took place on April 28th. The Corporation is introducing an assisted wiring scheme.

Glasgow.—The Corporation is recommended by a Committee to hold a Housing and Health Exhibition in the Kelvin Hall from September 21st to October 15th, 1927, and a Bakers' and Grocers' Exhibition in January and February, 1928.

New Swiss Companies.

A company has lately been formed in Neuchatel, with the title "M.S.N." Société pour la Fabrication et la Vente d'Appareils Electriques et Mécaniques, to manufacture electrical material, including radio apparatus.

A new company has been formed in Aarau under the style of the "Maxim" Fabrik Gesellschaft für Thermo-Elektrische Apparate to acquire and carry on the business of Zurlinden and Fecht, makers of electric heating and cooking appliances.

A new company has been formed at Kallnach, Canton of Berne, with the title Die Elektrochemische Werke Kallnach Gesellschaft, to acquire and carry on the Weinmann electro-chemical works in that town.

Proposed Whitley Councils Bill.

The National Joint Industrial Council for the Electricity Supply Industry was represented in a deputation from the Association of Joint Industrial Councils which attended the Ministry of Labour on April 26th in order to urge the necessity for legislation to give the joint industrial councils the same powers regarding enforcement of agreements, if and when such powers are requested, as are already possessed by trade boards and agricultural wages committees. The deputation was received by Mr. J. A. Barlow. It was emphasised that the Bill proposed by the Association did not impose powers on councils which did not seek them. An agreement would only become binding on a whole industry on application by the council concerned with that particular agreement. It was stated that 21 industrial councils and interim reconstruction committees supported the principle of the Bill; that eight which had supported it had ceased to exist largely through lack of the powers asked for; that a number of councils and committees were moribund owing to lack of powers; and that unless some legislative help was forthcoming the whole movement was in danger of collapse. The support of the Trade Union Congress and of the National Union of Manufacturers was also claimed for the principle of the Bill.

Mr. James Slevin stated that the Joint Industrial Council for the granite and roadstone quarrying industry in the South-West of England was holding together only in the hope of legislation. Employers who were loyal to their federation and who observed the agreements were suffering from grossly unfair competition. Peace in the furniture removal industry, it was stated by another speaker, was based on the hope of legislation. Mr. Bostock, ex-president of the Boot and Shoe Manufacturers' Association, stated that the only alternative to legislation was some sort of boycott of the offending employers or the withdrawal of labour by the unions. Mr. Barlow, who said that the Department had an open mind on the matter, promised to bring all that had been done to the notice of the Minister.

The Department of Overseas Trade.

The Times reports that the Swansea Chamber of Commerce has passed a resolution that the Chamber, "while deeply anxious that reduced national expenditure should be brought about, feels that the Department of Overseas Trade is of considerable value to the commerce of this country, and desires to remind the Government of the repeated requests of British Chambers of Commerce over many years for a Ministry of Commerce, and therefore urges upon the Government the desirability of continuing the Department in its present form."



Special Press]



[*London.*

Stands at the Stepney Exhibition.

D

Safety Lamps Order.

The Secretary for Mines on April 13th made an Order under Section 33 of the Coal Mines Act, 1911, approving for use in all mines to which the Act applies the following types of electric safety lamps, *viz.*:—

Beacon, Type B.
Derby Alkaline, Pillarless.
Derby Alkaline, Pillared.
Dominit, 2-volt.
Dominit, 4-volt.
Derby Bull's-Eye Type (for officials and for special purposes).
Wefco Hand Torch (for officials).

The Order also amends specifications of types of safety lamps (electric and flame) already approved.

New French Companies.

A company has been formed in Paris (10, Rue d'Uzes), with a capital of 18 million francs and the title La Société des Téléphones Grammont. The object of the new concern in which the Société des Etablissements Grammont of Paris, the General Electric Co., Ltd., London, and the Western Telephone Co., of Chicago, are reported to be interested, is to undertake part of the contract for the conversion of the telephone system in the Paris area to automatic operation.

La Société Central Lumière Province is the name of a company which has lately been formed in Paris (9, Place de la Bourse), with a capital of 500,000 fr., to establish electricity supply undertakings in the Vendée Department.

Trade Announcements.

The MULLARD WIRELESS SERVICE Co., LTD., has opened a new depôt at 13, Deansgate, Manchester. The depôt will carry large stocks, and is under the management of Mr. Y. W. P. Evans.

The address of the HALIFAX & BERMUDAS CABLE Co., LTD., and the DIRECT WEST INDIA CABLE Co., LTD., is now Spencer House, 4, South Place, E.C.2. Telephone: London Wall 9802; telegrams: "Quiescent, Ave, London."

MR. MAURICE BOBIN, 21, Warwick Lane, E.C.4, is shortly opening offices in Paris, and will be pleased to hear from British manufacturers wishing to be represented in France.

On and after May 9th the address of OLIVER PELL CONTROL, LTD., and TOK SWITCHES, LTD., will be Kingsway House, 103, Kingsway, W.C.2. (Telephone: Holborn 5303.)

MR. J. E. DAWSON, radio engineer, has opened new showroom premises at the corner of High Street, Boston.

MESSRS. CURRY'S, LTD., dealers in wireless and electrical goods, have opened a new branch business at 61, Hallgate, Doncaster.

MR. W. W. HITCHING, who, as announced in the ELECTRICAL REVIEW for February 25th, 1927, p. 299, purchased the business of Brittain's Electric Motor Co., Eastdown Works, Dermody Road, Lewisham, S.E.13, of which he had been general manager for many years, asks the trade to take note that a new company styled as Brittain's Electric Motor Co., Ltd., ELEC. REV., December 3rd, 1926, p. 925, is not in any way connected with his firm, and cannot supply the original Langdon-Davies or Brittain motors, or their spares or replacements.

POWER CONTRACTS, LTD., has opened offices at 78, King Street, Manchester, where Mr. J. Ditchfield, late sales manager to Messrs. E. Brook, Ltd., is in charge of sales and Mr. F. Bertwhistle in charge of estimating. Manufacturers' catalogues are asked for.

ELECTRIC ART SHADES, Feering Factory, Kelvedon, Essex, are opening a showroom under the supervision of Mr. G. York, late of the electrical department of Messrs. Harrods, Ltd., on May 16th, at Roxburghe House, Regent Street, W.1. (Tel.: Ambassador 9667.) Mr. K. G. GOULD, late of Messrs. Newmans, Ltd., has been appointed representative for the Midlands and Northern Counties, and Mr. R. T. HUNT has been appointed representative for the East and South-East Coast.

MESSRS. PRITCHETT & GOLD AND E.P.S. Co., LTD. (with which is incorporated Messrs. Peto & Radford), have appointed Mr. F. H. Durrant as their district representative for Northants, Beds., Berks., Bucks., Herts., and Oxfordshire.

New Catalogues and Lists.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Catalogue H.107—Mining Cables and Accessories, containing illustrated particulars of v.b., rubber, and paper-insulated cables, cable boxes, jointing materials, cable racks, insulators, wood poles, condensers for p.f. improvement, &c. Also an illustrated brochure (P.210) describing "Prescot" paper pinions.

DIXONIA, LTD., 4, Portsmouth Street, Kingsway, W.C.2.—A priced and illustrated list of lighting fittings, switches, and other automobile accessories.

The RAWLPLUG Co., LTD., Rawlplug House, Cromwell Road, S.W.7.—An illustrated booklet dealing with the many uses of "Rawlplugs" and methods of fitting them, and a leaflet containing particulars of the company's competition for builders, electricians, and others.

MESSRS. DAVIDSON & Co., LTD., Sirocco Engineering Works, Belfast.—An illustrated brochure detailing the achievements of a number of installations of the company's patent flue dust collectors.

The BRITISH THOMSON-HOUSTON Co., LTD., Crown House, Aldwych, W.C.2.—A folder containing illustrations and prices of electric lighting pendants of many designs, and hall lanterns.

IMPORTERS & DISTRIBUTORS, LTD., 173-175, Great Portland Street, W.1.—An illustrated price list of electric lamps.

MR. FRED J. DOWN, 90-93, Fenchurch Street, E.C.3.—Illustrated and priced pamphlets describing the "Scrulix" and "Harpoon" guy anchors for staying poles, steel chimneys, &c.

AUTO-BULBS, LTD., Sphinx House, Hatton Garden, E.C.1.—A price list of "Sphinx" electric lamps for house lighting.

W. T. HENLEY'S TELEGRAPH WORKS Co., LTD., Holborn Viaduct, E.C.1.—Leaflet No. 298, dealing with the company's c.t.s. trailing cables.

MESSRS. A. C. COSSOR, LTD., Highbury Grove, N.5.—An illustrated and priced folder dealing with the company's automobile lamps; arranged for overprinting.

MR. W. H. AGAR, 19, Whitecross Place, E.C.2.—A priced and illustrated list of oak and mahogany cabinets for Mullard receiving sets.

VAC-TRIC, LTD., 12-13, Henrietta Street, W.C.2.—A priced and illustrated pamphlet dealing with the "Vac-Tric" suction cleaner.

MESSRS. H. E. ASHDOWN (BIRMINGHAM), LTD., Perry Barr, Birmingham.—A mailing card describing the "Ashdown" shockproof lampholder.

HART ACCUMULATOR Co., LTD., Marshgate Lane, Stratford, E.15.—A pictorial showcard advertising "Hart" motor starting and lighting batteries. Also a calendar-blotter for May.

POPE'S ELECTRIC LAMP Co., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—May calendar-blotter advertising the company's lamps.

THE UNITED ELECTRIC Co. (BIRMINGHAM), LTD., Coolex Works, Caroline Street, Birmingham.—An illustrated price list of "Coolex" fuse units, ironclad fuses, and distribution boards.

The RADIO COMMUNICATION Co., LTD., 34-35, Norfolk Street, W.C.2.—List R/427, describing, with illustrations, a long-range receiver, Type R.29, designed for the reception of signals from the Rugby high-power station.

Bankruptcy Proceedings.

C. P. MOODY (trading as the South-Eastern Manufacturing Co.), Crown Works, Finck Street, Lambeth, S.E.—The public examination of this debtor was held on April 29th at the London Bankruptcy Court, the accounts showing total liabilities of £773 (unsecured £716), and net assets valued at £140. In reply to Mr. Allcorn, Official Receiver, the debtor stated that in March, 1920, he commenced business as a battery maker under the above style; the trading was successful for a time, but subsequently declined owing to competition. In March, 1924, he discontinued making batteries, and had since dealt in lamp shades. Witness attributed his failure to keen competition and to depression in the lamp-shade business owing to change of fashion. The examination was concluded.

HARRIETT SPENCER, trading as Spencer & Son, 30, Watergate, Grantham, Lincs., wireless and cycle dealer.—The first meeting of creditors was held on April 22nd, at the Official Receiver's offices, Nottingham. The statement of affairs showed ranking liabilities of £349 and a deficiency of £323. Debtor attributed her failure to taking over the liabilities on the purchase of an insolvent business. She stated that the concern had belonged to a relative, and she and her husband had for some time assisted in the management. Debtor only admitted knowledge of her position a few days before the date of the receiving order, when the writ was served. The matter was left with the Official Receiver as trustee of the estate.

E. TEMPLE and JANE E. BURKETT, trading as "The Westoe Electrical Company, 105, Canterbury Street, South Shields, wireless dealers and electrical contractors.—The first meeting of the creditors of the above was held recently at the Official Receiver's office, Newcastle-on-Tyne. The statement of affairs showed liabilities of £950, against assets of £331. The creditors resolved to appoint Mr. A. J. Gray, accountant, of 48, Pilgrim Street, Newcastle, as trustee of the estate.

J. ATKINS (Atkins & Co.), electrical engineer, 59, Church Street, Tewkesbury, Electricity Works, Northleach, Glos., and at High Street, Winchcombe.—Receiving order made April 21st, on debtor's own petition. First meeting and public examination, May 12th, at the Court House, Cheltenham.

A. A. SMETHURST (A. Smethurst & Co.), electrical engineer, 62, Bernard Street, Southampton.—Receiving order made April 20th, on debtor's own petition.

P. FORD, electrical contractor, 4a, Macdonald Lane, Corporation Street, Manchester.—First meeting held May 4th, at the Official Receiver's offices, Byrom Street, Manchester. Public examination, May 27th, at the Court House, Manchester.

T. A. WICKHAM, electrical engineer, Snaresbrook, Station Road, New Milton, Southampton.—Trustee, Mr. H. Ashton, Official Receiver, Midland Bank Chambers, High Street, Southampton, released April 8th.

W. K. COXON (separate estate), trading together with E. R. Weare as the Western Mfg. Co.), electrical engineer, Nurshill, Lydney, Glos.—Last day for proofs for dividend, May 11th. Trustee, Mr. C. Latham, 78, New Oxford Street, W.C.

A. E. S. CHALLENER, wireless engineer, 277, St. Sepulchre Gate, Doncaster.—First and final dividend of 1s. 8d. in the £, payable at the Official Receiver's offices, 14, Figtree Lane, Sheffield.

H. Nutter, electrical engineer, 246, Yorkshire Street, Rochdale.—Receiving order made April 25th, on debtor's own petition.

A. H. Duffin and G. Kershaw (A. H. Duffin & Co.), electrical engineers and contractors, Provincial Buildings, Conway Road, Colwyn Bay.—Last day for proofs for dividend, May 11th. Trustee, Mr. I. D. Hooson, Official Receiver, St. Peter's Churchyard, The Cross, Chester.

E. Temple and J. E. Burkett (Westoe Electrical Co.), wireless dealers and electrical contractors, 105, Canterbury Street, South Shields.—Trustee, Mr. A. J. Grant, 48, Pilgrim Street, Newcastle-on-Tyne, appointed April 26th.

J. Turner, electrician, 62, Blackburn Road, Great Harwood.—Receiving order made April 26th, on debtor's own petition.

L. Bell (C. Bell), mechanical and electrical engineer, Joseph Street, Leeds Road, Bradford.—Receiving order made April 25th, on debtor's own petition. First meeting to be held May 6th, at the Official Receiver's offices, 12, Duke Street, Bradford. Public examination, May 24th, at the County Court, Bradford.

Company Liquidations.

Radi-Arc Electrical Co., Ltd., Bennett Street, Chiswick, W.—A meeting of creditors was held on April 27th, at the Institute of Chartered Accountants, E.C., when a statement of affairs was presented which disclosed liabilities of £3,598, of which £1,222 was due to the trade, the bank was creditor for £726 in respect of an overdraft, and there were partly secured creditors for £1,750, holding security valued at £100, leaving a balance of £1,650 to rank as unsecured. The net assets were £1,235, leaving a deficiency of £2,363. The liquidator, Mr. Ernest James, St. Lawrence House, Trump Street, E.C., said that the bank was guaranteed by Mr. Blaiberg, the loan creditor. The company was incorporated in February, 1919, under a different name. The name was changed to the present style in 1922. The business was formed by Mr. Blaiberg's son, but for the past two years he had been unable to do any work in connection with the company, and it had been managed for him, and had been financed by his father. The share capital was £200, all of which was put up in cash. The loan had been paid in cash; nothing had been charged by way of interest and no directors' fees had been paid. The company did a considerable amount of experimental work during the early months of its trading, and did not commence dealing in wireless goods until February, 1924. The loss sustained through the experimental work was about £200. According to a profit and loss account for the period to November, 1924, there was a loss of £1,148. During the next year to November, 1925, there was a profit of £760, and the last completed accounts, to September 30th, 1926, showed a loss of £809. Mr. Blaiberg might have been prepared to carry on the business, but recently three of the creditors issued writs, and subsequently the necessary resolutions for voluntary liquidation were passed. Mr. James said that a gentleman who was interested in wireless had offered to take over the business and pay the creditors a composition of perhaps 6s. or 7s. in the £. Mr. James, however, was instructed to make no definite offer, and even if an offer of 6s. or 7s. in the £ were made he would not advise the creditors to accept it at the moment. Mr. P. Houstoun, of the British Traders' Association, proposed that Mr. James should be continued as liquidator, together with a committee of inspection consisting of three of the principal trade creditors. That resolution was carried. The following are creditors:—

	£		£
Art Publicity Service ...	92	Hurst, H., & Co.	30
London Metal Warehouses	55	Brandes, Ltd.	26
Marconi Co.	62	Rad Vaco, Ltd.	25
Portable Wireless Co. ...	55	Trader Publishing Co. ...	24
Radio Communication Co., Ltd.	35	Heywood, N.	23
Houghton-Butcher (Gt. Britain), Ltd.	35	Mullard Wireless Service Co., Ltd.	22
Tudor Wireless Co. ...	35	Stevens, J. R.	21
American Hard Rubber Co.	27	Electron, Ltd.	20
		Standard Telephones & Cables, Ltd.	20

National Wireless Corporation, Ltd., 14, Cursitor Street, Chancery Lane, W.C.—Under the compulsory liquidation of this company, Mr. E. T. A. Phillips, Official Receiver and liquidator, has issued his report in great detail. We have not space to print it here. The winding up order was made last December on a creditor's petition. Mr. Phillips reports, *inter alia*, that the company was incorporated as a private company on February 24th, 1925, with a nominal capital of £1,000, subsequently increased to £3,500, in shares of 1s. each, for the purpose of carrying on the business of radio and general engineers, manufacturers, merchants, &c. The directors appointed by the articles were W. Wrentmore and R. M. Reith. H. N. Westgate, Sir Alexander Spearman, Bt., and H. C. Cowan were subsequently appointed directors. At the date of the winding up Wrentmore was the sole director. The statement of affairs lodged on January 27th, 1927, shows assets valued at £322, including a debenture in Natwirco, Ltd., £250 and 50 ordinary shares in Burndept Wireless. Unsecured creditors are returned in the statement at £388. On March 2nd, 1927 (in view of the fact that the interest on the debenture issued to the corporation by Natwirco, Ltd., had not been paid and that that company had discontinued its business, the Senior Official Receiver appointed himself receiver of the property charged under the debenture, and has since sold it for under £30. As the debenture, which was estimated to produce £250, was the corporation's principal asset, there appears to be no prospect of a dividend for the unsecured creditors or shareholders. The failure of the corporation is attributed by Wrentmore to the competition of amateur wireless manufacturers and to insufficient capital with which to open the multiple shops as intended. Turner agrees with Wrentmore's second cause of failure, and adds as a further cause the large commission paid to Hills, of the British Fiduciaries, Ltd., for capital obtained by him.

Electric Light & Power Contracts Finance Corporation, Ltd.—A petition for the winding up of this company has been presented to the High Court by Messrs. H. Saunders, Ltd., 40-41, Great Charles Street, Birmingham, and will be heard in London on May 10th.

Robins Wholesale Electrical & Wireless Co., Ltd.—A meeting of members is called for May 30th at 31, Queen Street, Cardiff, to hear an account of the winding up from the liquidator, Mr. S. E. Clutterbuck.

Electrical Cabinet Works, Ltd.—Last day for proofs for dividend, May 11th. Liquidator, Mr. H. E. Burgess, Senior Official Receiver, Carey Street, W.C.

Private Arrangements.

E. Edwards & Co., Great Eastern Street and High Street, Shoreditch, E., electrical and wireless factors.—A further meeting of creditors was held on April 29th, at the Institute of Chartered Accountants. The chair was occupied by Sir Harold Moore, 4, London Wall Avenue, E.C. The creditors were first called together in February, when the liabilities were stated at £28,867, against net assets of £17,564, and it was then intimated that bankruptcy proceedings would be instituted on behalf of a creditor. Sir Harold Moore stated that after the last meeting he was approached by a number of the larger creditors, and at their request a deed of assignment was executed to him on February 16th, and duly registered. There were difficulties in the way of an immediate realisation, and it was not at all certain when the deed was executed that the estate would not, within a very short time, be in the process of administration in bankruptcy. It was, however, desired to avoid that. He had carried on the business since his appointment, and reduced expenses. Certain of the preferential claims and the current expenses had also been discharged, and there was now cash at the bank to the extent of £4,074. There was still a substantial amount of stock in hand for realisation. At the moment there were two outstanding bankruptcy petitions. Resolutions were passed appointing a committee of five of the principal creditors to act with Sir Harold Moore in dealing with the estate under the deed of assignment; and asking the committee to take any steps necessary to oppose the bankruptcy petitions.

J. I. Lloyd, 36, Church Road, Ton Pentre, wireless dealer, &c.—The creditors were called together last week at Cardiff, when a statement of affairs was presented which showed liabilities of £495, all due to the trade. The net assets were £27, leaving a deficiency of £468. A resolution was passed agreeing to accept a composition of 3s. 4d. in the £, payable in two months and secured to the satisfaction of a committee consisting of the representatives of the South Wales Wireless Installation Co., Ltd., Messrs. Clarke, Dovey and Co., and Messrs. E. T. Collins & Son.

Book Notices.

"The *Electrician* Annual Tables of Electricity Undertakings, 1927." (Pp. vii+194). London: Benn Bros., Ltd. Price 10s. net.—An innovation in this, the 40th, edition is a complete index of the British undertakings dealt with in the tables. It is claimed that particulars are given of upwards of 800 British and 1,300 Colonial and foreign undertakings.

"Science Abstracts" (A. and B.). Vol. XXX. Part 4. April 25th, 1927. London: E. & F. N. Spon, Ltd. Price 3s. each, net.

"British Railway Operation." By T. B. Hare. Pp. 156. London: Modern Transport Publishing Co., Ltd. Price 3s. 6d., net.

"Working Model Railways; How to Build and Run Them." By J. Davidson. Pp. 64; figs. 63. London: Percival Marshall and Co. Price 9d.

"Electric Circuit Theory and Calculations." By W. P. Maycock. Third edition. Pp. xiv+355; figs. 120. London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d., net.

Scientific Papers of the U.S.A. Bureau of Standards.—No. 543, "Linkage-current Diagram for Representing Magneto Operation" (20 cents). No. 544, "Effect of Eddy Currents in a Core consisting of Circular Wires" (10 cents). No. 545. "Determination of the Magnetic Induction in Sheet Steel." (10 cents.)

"Technologic Papers of the U.S.A. Bureau of Standards." Vol. 21, No. 335. "Thermal Expansion of Graphite." (5 cents.)

"Quarterly Bulletin of the British Cast-Iron Research Association." No. 16, April, 1924.

"Dielectric Phenomena," by S. Whitehead. Pp. 176+42 figs. London: Ernest Benn, Ltd. Price 16s. net.

"Transformateurs de Puissance," by M. Mathieu. Pp. 305; figs. 82. Paris: A. Blanchard. Price 18 fr.

Messrs. Crosby Lockwood & Son will shortly publish "The Timber Trade of the United Kingdom," by Mr. Thomas J. Stobart; two volumes. 5s. each net.

The British Broadcasting Corporation has issued a 24-page booklet, illustrated with portraits of some of the lecturers, containing full details of the series of talks, lectures, and religious services that are to be broadcast simultaneously from all stations from May to July, inclusive.

Recent Contract.

The consulting engineers for the Ross-shire Electric Supply Co., Ltd., Messrs. Murdoch, Macdonald & Partners, have placed the contract for the supply and erection of the pipes, water turbines, and electrical plant required for the station at the outlet of Loch Luichart, with Messrs. James Gordon and Co., Ltd. The plant as at present designed covers the installation of two 750-h.p. Francis turbines working under a head of 110 ft. and running at 600 r.p.m. coupled to two 500-kW generators, together with switchgear, transformers, &c., and some 40 miles of transmission lines. The whole plant will be manufactured in Great Britain under the stipulations of the Trades Facilities Acts.

Callender's Hockey Champions.

The accompanying picture shows Callender's Ladies' Hockey Team which has secured the London Business Houses Cup by



Callender's Ladies' Hockey Team.

defeating the Railway Clearing House ladies' team in the final round of the competition.

Electric Power in Industry.

Further trades are dealt with in Preliminary Report No. 9 upon the 1924 Census of Production published with the *Board of Trade Journal* for April 28th. The hosiery trade reported an increase in the installed generating plant from 827 kW in 1907 to 1,495 kW in 1912, and 3,661 kW in 1924. Motors aggregating 2,763 h.p. were driven by internally produced power, while electricity for a further 13,911 h.p. was purchased. In the glove-making industry only 10 kW of generating plant was in use in 1907; in 1924 the total was 370 kW. The electric motors in use totalled 665 h.p. (power for 478 h.p. purchased). The generating plant installed in the musical instrument trades was 304 kW in 1907, 2,369 kW in 1912, and 3,137 kW in 1924. The motor capacity was 14,644 h.p. (power for 8,740 h.p. purchased). The needle, pin, fish-hook and button trades reported 200 kW of generating plant in 1907, 307 kW in 1912, and 489 kW in 1924. There were 4,047 h.p. of electric motors, power for 3,609 h.p. of which was purchased.

Schools of Salesmanship.

The National Union of Commercial Travellers is making an investigation into the effect of Schools of Salesmanship upon the status of commercial travellers, and Mr. C. J. Kebbell, the honorary secretary (42, Blackfriars Road, London, S.E.1), asks any of our readers who have been in touch with such schools to send him particulars of their experiences. It is desired to make the inquiry an impartial one and views, favourable or otherwise, are invited.

For Sale.

Crowborough District Gas and Electricity Co. invites offers for one Taylor Scotson voltage regulator, with switch panel. Redheugh Colliery, Ltd., has for disposal one electric winder, complete with 255-h.p. Siemens motor and switchgear, electrically-driven main and tail haulers, air compressor, transformers, switchgear, &c. Whitley U.D.C. Electricity Department has for disposal one 100-kW Parsons turbo-alternator, with spare armature. Severalls Mental Hospital, Colchester, has for disposal one 75-b.h.p. semi-Diesel oil engine, complete with spares. Mr. J. H. Shaw will sell by auction on May 11th, at 13, High Holborn, W.C., trade stocks of wireless and electrical goods, &c. (See our advertisement pages to-day.)

Indian Companies.

The Aligarh Electric Supply Co. has been formed for the purpose of supplying electricity to the town of Aligarh, which has a population of 70,000. The capital of the company is Rs. 10 lakhs. The Punjab Government has recently given a licence to the Eastern Engineering and Commercial Co., Ltd., for the supply of electrical power to the town of Meerut.—*Reuter's Trade Service* (Bombay).

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.	Price May 3rd.	Fortnight's inc. or dec.
a Acid, Oxalic ... ... per lb.	5¾d.	...
a Ammoniac, Sal ... ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£13 10s.	...
a Sulphur, Commercial ... ... ,,	£9 10s.	...
a ,, Roll ... ... ,,	£9 10s.	...
a Soda, Chlorate ... ... per lb.	3¾d to 3¾d.	...
a ,, Crystals ... ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots... ... ... per ton.	£107 to £112	...
b ,, Wire ... ... per lb.	1/6 to 2/-	...
b ,, Sheet ... ... ,,	1/8 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net.	£261	£11 dec.
Grade II ... ... ,, ,,	£182	£7 dec.
Grade III... ... ... ,, ,,	£94	£3 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	9⅝d.	...
c ,, Tubes (solid drawn) ... ,,	11½d. to 11¾d.	...
c ,, Wire, basis ... ... ,,	9⅝d.	...
c Copper Tubes (solid drawn) ... ,,	1/0½	...
c ,, Bars (best selected) ... per ton.	£86	...
c ,, Sheet ... ... ,,	£86	...
c ,, Rod ... ... ,,	£86	...
d ,, (Electrolytic) Bars ... ,,	£61 10s.	30/- dec.
d ,, ,, Sheets ... ,,	£148 10s.	...
d ,, ,, Wire Rods ,,	£71 10s.	30/- dec.
d ,, ,, H.C. Wire per lb.	9⅛d.	⅛d. dec.
f Ebonite Rod ... ... ,,	2/3 to 2/6	...
f ,, Sheet ... ... ,,	2/3 to 2/6	...
n German Silver Wire ... ... ,,	2/2	...
h Gutta-percha, fine ... ... ,,	8/-	...
h India-rubber, Para fine ... ... ,,	1/5	¼d. dec.
l Iron Pig (Cleveland No. 3.) ... per ton.	122/6	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English pig ... ... ,,	£27 5s.	20/- dec.
g Mercury ... ... per bot.	£22 15s. to £23	...
e Mica (in original cases) small ... per lb.	3d. to 8/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	...
p ,, ,, rolled strip & sheet ,,	1/2⅝	...
p ,, ,, wire... ... ... ,,	1/3½	...
o Platinum ... ... per oz.	£23	...
d Silicium Bronze Wire ... ... per lb.	10½d.	½d. dec
r Steel, Magnet, in bars ... ... ,,	7½d.	...
n Tin, Block (English) ... ... per ton.	£294 to £295	£9 dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co,. Ltd
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
W. F. Dennis & Co.

Reporting on April 30th, Messrs. James Forster & Co. stated:—"Closing prices for lead yesterday were £25 11s. 3d. for April, and £26 1s. 3d. for July, or about 10s. a ton lower on the week. . . . A little more interest has been shown this week by home consumers, though this does not apply to the cable trade, where makers are anxiously awaiting Post Office orders to keep their works employed. Arrivals, on the other hand, are still on the heavy side, and stocks have probably been increased this month to a small extent. Conditions on the Continent are steadily improving, and the weakness in the position has now shifted from there to America."

Lighting and Power Notes.

Ayrshire.—Special Order.—The Electricity Commissioners have made a Special Order authorising the Ayrshire Electricity Board to supply electricity for public and private purposes within the burghs of Girvan, Maybole, and Largs.

Barrow.—Extension Scheme Sanctioned.—The *Manchester Guardian* reports that, following upon the persistence of the Corporation's Electricity Committee, the Electricity Commissioners have sanctioned the extensions to the electricity works at a cost of £60,000. Originally this proposal was rejected, the suggestion being made that arrangements should be made with Messrs. Vickers for additional supply.

Bedford.—Loan.—The Corporation Electricity Committee is applying for sanction to a loan of £10,000 for services.

New Sub-Station.—The Committee is to erect a sub-station at Sandy.

Blackburn.—INQUIRY.—Criticisms of the Corporation Electricity Department in Blackburn are stated to be unjustified, but to reassure the public it has been decided to hold an inquiry into the general administration. The Town Clerk (Sir Lewis Beard) will be asked to name experts who may be selected to conduct the inquiry, the holding of which has met with the approval of the borough electrical engineer.

Bridlington.—ELECTRICITY SUPPLY.—The Corporation Electricity Committee has received a letter from the Electricity Commissioners stating that the question of extensions to the electricity works has been deferred in order that the question of the future of the Scarborough and Hull electricity undertakings may be generally considered as affecting the three centres. The Commissioners suggest that the Council should consider the advisability of collaborating with the Scarborough Corporation in order to examine the possibilities of either the joint purchase of electricity in bulk, or, alternatively, the erection of a joint station. The Committee's views in the matter are invited, and it proposes to ask Mr. S. B. Donkin, consulting engineer, to confer with the consulting engineer of Scarborough, the electrical engineer of the Hull Corporation, and the Electricity Commissioners, as to the advisability of both Scarborough and Bridlington taking a bulk supply from Hull, or the erection of a joint station for Bridlington and Scarborough, and to report to the Council.

Cardiff.—ASSISTED WIRING SCHEME.—The borough electrical engineer (Mr. Morley New) has submitted a report to the Electricity Committee on the proposed assisted wiring scheme. The installation costs would be £8 7s. 1d. for five points, £9 6s. 4d. for six points, and £10 5s. 6d. for seven points. The proposed charge for electricity is 8d. per kWh until the cost of installation has been met. The Committee has adopted the report which has been passed on to the Finance Committee for approval.

Carlisle.—INAUGURATION OF POWER STATION.—The new electricity works will be formally inaugurated by the Mayor on May 26th, and the first set will set put in motion by the chairman of the Electricity Committee. Sir John Snell will be the chief guest at the subsequent luncheon.

Continental.—BELGIUM.—In order to meet the increasing demand for electricity, considerable extensions are in hand at the central power station in Brussels of the Société Bruxelloise d'Electricité. The number of boilers is being increased to 18, and a new 6,000-kW steam turbo-generator is being installed which will bring the capacity of the plant up to 33,000 kW.

SWITZERLAND.—Our Swiss correspondent states that at the last board meeting of the Vaudois company "Forces Motrices des Lacs de Joux et de l'Orbe" some important decisions were arrived at, whereby the company henceforward will be linked up with the lines of the power-houses belonging to the "Energie-Ouest-Suisse," the connection being made at Romanel. The result of this arrangement will be that the surplus energy of the Peuffaire at Bex (due, under contract, to the "Forces Motrices des Lacs de Joux et de l'Orbe") will be distributed to the power stations of Ch. Bertolus, at Bellegarde, over the high-pressure lines of Romanel to Geneva, belonging to the E.O.S. Company.

The Energie-Ouest-Suisse Company has now resolved to construct a high-pressure line between the Chèvres power-house at Geneva and the French-Swiss frontier. There will be a measuring station at Chèvres, a relaying station at Romanel, a high-pressure line from Vernayez to Romanel, together with a transforming station at the latter; the E.O.S. will also finish the works at Champsec in the valley de Bagnes, as well as the high-pressure line from Champsec to Martigny, which will entail a cost of some ten million francs (Swiss).

POLAND.—La Société Centrale Electrique du Bassin de Cracovie, which is supplying electricity in the Cracow district, is increasing the capacity of its generating plant from 10,000 to 22,000 kW. The Société Centrale Electrique de Pruskow, which supplies electricity to the town of Pruskow and the industrial suburbs of Warsaw, is also increasing the capacity of its plant from 8,500 kW to 18,500 kW. A contract has recently been secured by this concern to supply the power required for the Warsaw-Grodzisk section (20 miles) of the Société Chemins de Fers Electriques Suburbains.

Eastbourne.—ELECTRICITY EXTENSIONS.—At a recent meeting of the Electricity Committee the proposed extension of area of supply was considered, and the town clerk was instructed to proceed with the application for the proposed Special Order and to oppose the applications for Special Orders which have been lodged by various companies to enable them to supply electricity in districts which it is proposed to include in the Eastbourne area.

Glasgow.—PROGRESS DURING MARCH.—Under the Corporation Electricity Committee's assisted wiring scheme 126 houses were wired in March, bringing the total to date to 3,478. The agreements during March under the ten years' hire-purchase scheme numbered 176, bringing the total up to 248. The hire of appliances in March numbered 174, making the total to date 14,749.

Guildford.—ELECTRICITY IN BULK.—At a recent meeting of the Corporation Electricity Committee the borough electrical engineer submitted correspondence with the borough electrical engineer, Aldershot, inquiring upon what terms the Corporation would be willing to give the borough of Aldershot a supply of electricity in bulk, and by what date the supply would be available. The Corporation replied that it would be in a position to submit terms and conditions for a bulk supply at an early date.

Hornsey.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to a loan of £6,500 for mains and switchgear.

India. — PUNJAB HYDRO-ELECTRIC SCHEME. — Considerable progress is reported with regard to the hydro-electric scheme on the Uhl River in the Mandi State in the Punjab. This scheme will supply electricity to the whole of the Punjab and is expected to cost about Rs. 8 crores. All preliminary work is now nearly complete. As the construction plant necessary for a scheme of this size involves a large and continuous demand for power, it was decided to erect a small water plant, and this of 960-kW installed capacity, under a 700-ft. head, is nearing completion. The power will be generated at 3,300 V a.c., and transmitted to the works area at 11,500 V. A system of electrically-operated cable haulage-ways up the hill side is being laid with connecting tramways at the crest and junction points. It is expected that the local power supply will be available, the tunnel drilling plant erected, and the driving of the tunnel commenced by July or August. As far as the transmission system is concerned, the survey of the trunk line from the power station in Mandi down to Pathankot has been nearly completed, and similar work has been started for the rest of the system.

Irish Free State.—PEMBROKE (DUBLIN).—On April 28th, the chairman of the Electric Lighting Committee formally started the new 840-b.h.p. Diesel engine which has been installed at the Urban District Council's electricity works at a cost of £12,000.

Japan.—NEW POWER STATION.—It is reported that the South Manchurian Railway authorities have under consideration the erection of a power station at Dairen with a capacity of from 30,000 to 40,000 kW.

Llandudno.—ELECTRICITY CHARGES.—The Electricity Committee of the Urban District Council has discussed the question of the price charged for electricity supplied to the Llandudno and Colwyn Bay Electric Railway, Ltd., and has decided to offer the company a reduction of 1/10d. per kWh in the present rate, to take effect from July 1st.

London.—BATTERSEA.—A Joint Committee of the Borough Council, reporting upon the application made by the London Power Co., Ltd., to the Electricity Commissioners for sanction to erect a generating station at Nine Elms, states that the three principal matters which arise are: (1) The liability to nuisance from smoke and coal dust; (2) the possibility of the company sinking wells and diminishing the well-water supply at Nine Elms baths; and (3) the already congested condition of Nine Elms Lane and Battersea Park Road so far as underground mains are concerned. The Committee has approved an agreement with the company giving the Council protection on the three points mentioned. The Committee states that the London County Council, the Westminster City Council, and the Great Western Railway are each dealing with the application so far as their respective interests are involved.

ST. MARYLEBONE.—The Borough Council has been notified that the terms of agreement with the Hampstead Borough Council for bulk supplies of electricity have now been approved by the Electricity Commissioners and the London and Home Counties Joint Electricity Authority.

Application is to be made for sanction to a loan of £27,338 to cover excess expenditure on the Council's plant extension scheme.

Lowestoft.—LOAN.—The Corporation Electricity Committee has received a report from the electrical engineer as to the plant required in connection with the taking of a bulk supply of electricity from Gt. Yarmouth Corporation, and recommends that application be made for sanction to a loan of £30,000, made up as follows:—22,000-V switchgear, £5,500; transformers, £3,000; 6,600-V switchgear, £2,700; converting plant and switchgear, £13,800; d.c. feeder panels, £1,000; alterations to main cables, £400; foundations and alterations to buildings, £3,000; contingencies, £600.

EAST ANGLIAN BILL.—The Corporation Electricity Committee reports that the promoters of the East Anglian Electricity Bill have now omitted the whole of the County of Essex from the Bill, and have agreed to insert therein certain clauses for the protection of authorities who are also authorised to supply electricity in the remaining part of their proposed area. The Corporations of Great Yarmouth, Norwich, and Ipswich have submitted additional clauses intended to exclude the promoters from supplying electricity in areas for which the Corporations hope to obtain powers to supply electricity in future, and to exclude from the scope of the Act the right of the promoters to have the powers of the Central Board delegated to them under the Electricity Supply Act, 1926. These further clauses have not been accepted by the promoters. The Committee is of opinion that so far as the interests of Lowestoft are concerned, the clauses which the company is prepared to insert may be accepted as a fair compromise, and it has accordingly authorised the withdrawal of the Council's opposition to the Bill.

Manchester.—LOAN.—The Corporation Electricity Committee is applying for sanction to the borrowing of £252,500 for services.

Morecambe.—Supply for Housing Estate.—The Corporation Electricity Committee is to supply electricity to the South Grove housing estate at a cost of £1,500 for mains and services.

Railway Supply.—At an Electricity Committee meeting the borough electrical engineer reported correspondence with the railway company with respect to the supply of electricity for the working of its railway between Heysham, Morecambe, and Lancaster. The chairman and electrical engineer have been appointed to enter into an agreement with the railway company for this purpose.

Plymouth.—Electricity Extensions.—Cable extensions, at an estimated cost of £3,268, to a site at St. Budeaux upon which houses are to be erected for Admiralty employés, were authorised by the Electricity Committee on April 26th. The linking up of the cable at Saltash Passage and extensions to ten further streets were also sanctioned.

Portsmouth.—Electricity Extension.—In connection with the proposed bulk supply of electricity to Midhurst, the Corporation Electricity Committee has received an application from the Chichester Corporation that a h.p. cable be laid by the Council from the Fishbourne sub-station to Sennicotts Corner, on the understanding that the Chichester Corporation will pay half of the sinking fund and interest charges on the cost until such time as the cable is continued to Midhurst, and that the 10 per cent. abatement in respect of the Summersdale area on the unit charge will be waived for two years if this is done. As the cable in question forms the first part of the proposed extension to Midhurst, the Committee recommends that the request be complied with, and that a h.p. cable be laid from the Fishbourne station to Sennicotts Corner accordingly.

Loan Sanctioned.—The Committee has received sanction to a loan of £1,693 for the erection of a sub-station in Crown Street.

Prestatyn.—Loan.—The Urban District Council is to borrow an additional £5,000 for electricity extensions. It is anticipated that the Council will be in a position to take electricity from the North Wales Power Co., Ltd., in the course of a few days.

Preston.—Assisted Wiring Scheme.—The Electricity Committee has submitted a report on an assisted wiring scheme to the Council for approval. The report states that there are 70,000 houses in the borough not wired for electricity, which it is estimated would yield an additional revenue of £150,000 if electricity was installed. On the proposal "that the work in connection with the scheme be carried out by the Electricity Department by direct labour or by the employment of contractors," an amendment was moved that this clause be deleted. The chairman of the Electricity Committee stated that it was not prepared to commit itself to direct labour entirely until it had some proof that it was the best thing that the Department should carry out the work. On the vote being taken, the amendment was lost by 18 votes to 13.

Prestwich.—Street Lighting.—The surveyor has submitted to the Urban District Council a comparative statement of the cost of converting the public lamps in the district from gas to electric lighting, and it has been decided to take no action in this connection, but to consider the relative merits of gas and electricity when the question of the provision of additional public lighting facilities is considered.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Edinburgh.—Lighting: From 4¾d. to 3½d. per kWh. Power: From 1.6d. for the first 1,000 kWh per annum and 0.9d. for all energy above 31,000 kWh per annum to 1.4d. and 0.7d., respectively, with a discount of 6 per cent. for all energy over 31,000 kWh for 3-phase supply. Domestic heating: From 1.2d. per kWh for the first 100 kWh per term and 0.825d. beyond, to 1d. and 0.625d., respectively.

Oswestry.—Lighting: From 9½d. to 8d. per kWh.

Bury.—The increases of 10 per cent. for lighting, and 15 per cent. for power, made owing to the coal dispute, have been withdrawn.

Manchester.—To all consumers, except those under special agreement: A reduction of ¼d. per kWh.

Rothesay.—New Power Station.—The plant installed at the Town Council's new power station, which was recently inaugurated, includes a 5-cylinder 250 b.h.p. Mirrlees-Diesel engine, made by Messrs. Mirrlees, Bickerton & Day, Ltd., Stockport. The engine is direct-coupled to a 170-kW Metropolitan-Vickers generator. The consulting engineers for the scheme were Messrs. Stevenson & McGuffie, of Glasgow.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Spalding Urban District Council authorising it to supply electricity in the rural district of Crowland, and part of the rural district of Peterborough; the Llanelly and District Electric Supply Co., Ltd., to extend its area of electricity supply so as to include the borough of Kidwelly, and parts of the rural districts of Carmarthen, Llandilo Fawr, and Llanelly; and the Crowborough District Gas and Electricity Co., to supply in the parish of Rotherfield.

Stoke-on-Trent.—All-Electric Houses.—At a recent meeting of the Corporation Electricity Supply Committee it was reported that considerable public interest was being taken in the two all-electric houses in Avenue Road, Shelton, and that up to March 30th the number of people who had inspected the houses was estimated at 14,500. The Committee decided to ask the Housing Committee to erect a further 22 all-electric houses in Avenue Road, Hanley, and to allocate 200 houses on the Abbey Hulton housing site as all-electric houses to be wired for lighting, heating, and cooking by, and at the cost of, the Electricity Supply Committee.

Taunton.—Loan.—The Town Council has applied for sanction to a loan of £1,500 for transformers and transformer sub-stations.

Whitburn (Durham).—Street Lighting.—The Parish Council has decided to adopt electric lighting for the streets of Whitburn and Marsden, and has accepted the tender of the Durham County Electrical Power Co., Ltd., for its installation and maintenance.

Tramway and Railway Notes.

Australia.—Melbourne.—The *Industrial Australian and Mining Standard* reports that the Melbourne and Metropolitan Tramways Board has been authorised to raise a further loan of £250,000. Mr. A. Cameron, chairman of the board, explained that the money would be used for tramway conversions and duplications, the construction of new cars and other tramway purposes.

Brighouse.—Purchase of Route.—Negotiations between the Halifax and Bradford Corporations have resulted in the former offering to sell to Bradford the running rights of its tramway from Brighouse to Bailiff Bridge (a little over a mile in length, and joining up with the Bradford system) for £5,000. The Bradford Tramways Committee, on April 27th, decided to recommend the City Council to accept the offer, thus giving Bradford a tramway service through to Brighouse. The Halifax lines are only 3 ft. 6 in. gauge, and if the purchase is made it is likely that the permanent way will be widened to the gauge of the Bradford track, which is 4 ft.

Burnley.—Purchase of Cars Deferred.—The General Purposes Committee has decided to defer consideration of the purchase of five double-deck tramcars until the end of September. It is stated that the Corporation owns 53 double-deck cars and 19 single-deck cars. No additional double-deck cars have been purchased since September, 1912. The passengers carried increased from 16 millions in 1913 to 24 millions in 1926. In the opinion of the Tramways Committee it is necessary to increase the rolling stock to enable the Department to deal with the demands of increasing traffic. The cost of the new cars is £9,800, which the Department proposes to meet out of revenue, spread over five years.

Continental.—Hungary.—The Chamber of Commerce of Miskolcz has submitted to the Hungarian Minister of Commerce a detailed plan for electrifying the Miskolcz-Bánréve railway, Hungary's most important communication with Czecho-Slovakia. It is proposed to erect a power station near the mines of the Sajo Valley.—*Reuter's Trade Service* (Budapest.)

Glasgow.—Garage Equipment.—The Corporation Cleansing Committee has instructed the engineer and manager of the Electricity Department to prepare the specifications, &c., for all the electrical apparatus required in the new garage at Govan in connection with the charging of the batteries of the electric vehicles, &c. The Measurer is to be instructed to arrange that the electric lighting of the garage will be included in the specifications and schedules of quantities to be issued by him for the construction of the building. It was also agreed that the engineer and manager of the Electricity Department should be asked to supervise the construction of the electrical work.

Heywood.—New Route.—The *Manchester Guardian* reports that at a recent meeting of the Town Council it was reported that all the sanctions had now been received for the widening of Middleton Road and the laying of a tramway to connect the Manchester tram service at Middleton with the Heywood service at Hopwood, and so provide a through service from Heywood to Manchester. The cost is estimated at £100,000, and grants will be received from the Ministry of Transport, the Lancashire County Council, and the Unemployment Grants Committee.

Increase of Charges.—The Minister of Transport has made an Order under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, authorising certain fare changes by the Dundee Corporation Tramway.

Middlesbrough.—Fares.—The Corporation Tramways Committee has approved a scheme by which it will be possible for passengers to take omnibus tickets from the Hartlepools, cross the transporter bridge over the River Tees, and then go on by the Corporation tramway service to a point where other 'buses can be taken.

Telegraph and Telephone Notes.

Bolivia.—MARCONI CONTRACT.—Under a twenty years' Government contract, Marconi's Wireless Telegraph Co. has undertaken the control and operation of the entire postal telegraph and wireless services of Bolivia; the services were taken over on May 1st. This is the second contract of its kind entered into by Marconi's Co. in South America, the first being with the Peruvian Government in 1921. Modern apparatus will be introduced.

France.—NEW RADIO SERVICE.—The official inauguration of direct wireless communication between France and French Equatorial Africa took place on April 29th. The station at Brazzaville is another link in the chain of wireless stations which are being constructed in accordance with the plans of the Government; it will not only be used for the transmission of commercial messages, but will also serve for the dissemination of weather forecasts, time signals, and all information of use to shipping. The construction of the new station was begun in 1920; it will be staffed by nine Frenchmen, aided by natives.—*Reuter.*

Germany.—CHEAPER TELEPHONES.—A reduction of 33⅓ per cent. in the charges for the public telephone service took effect on May 1st, bringing the price down to ten pfennigs (roughly one penny per call). Hitherto it has been fifteen pfennigs, which odd price necessitated all users of public telephones purchasing special disks, slotted and nicked in a special way to deter "coiners," for insertion in the telephone boxes. For the lowered rates new boxes have been introduced which will take the ordinary ten-pfennig pieces.—*Reuter* (Cologne).

Hull.—FOREIGN TELEPHONES.—The Hull Corporation Telephone Committee has accepted a tender for Belgian automatic table telephones and bell sets at a cost of £337; the lowest British tender was £475.

Portugal.—MARCONI "BEAM" STATIONS.—An extension of wireless telegraph facilities took place on April 30th with the inauguration of services between Lisbon and the Portuguese colonies of Cape Verde, Angola, and Mozambique. The opening of these services completes the network of wireless communication which Marconi's Wireless Telegraph Co., Ltd., undertook to construct for the Portuguese Marconi Co. in accordance with the concession obtained from the Portuguese Government in November, 1922. Direct wireless communication is now established between Lisbon and all the principal Portuguese colonies, which also have a complete system of wireless communication with one another. Services to the Portuguese Islands of Madeira and Azores were opened on December 15th last. Direct services between Lisbon and London, Paris, and Berlin have also been opened during the last few months, and a direct service with Rio de Janeiro is expected to be opened almost immediately. The English group of stations with which the Portuguese stations at Lisbon communicate are the Marconi stations at Ongar and Brentwood, in Essex. The transmitters for communication between Portugal and South America, Mozambique, Cape Verde, and Angola are operated on the short-wave "beam" system.

Turkey.—REOPENING OF TELEGRAPH STATIONS.—A convention was signed on May 1st with the Eastern Telegraph Co. organising the opening of the Company's stations at Constantinople and Smyrna for a period of 30 years.—*Reuter* (Constantinople).

Transatlantic Cables.—NEW DIRECT SERVICE.—The Western Union Telegraph Co. announces that on May 10th direct cable-working in each direction will be inaugurated between London and Boston, Mass., U.S.A., over one of the nine Atlantic cables operated by the company.

The cable steamer *Teleonia* recently arrived at Valentia, Kerry, Irish Free State, where she is to undertake some repairs to the transatlantic cable.

Radio Notes.

Australia.—LICENCES.—According to returns prepared by the Postal Department, the number of broadcast receiving licences held throughout the Commonwealth at the end of February was 197,872, which represents 3.2 per cent. of the population. Victoria was first amongst the States with a total of 114,428 licences, compared with 51,154 in New South Wales, 20,425 in Queensland. 15,773 in South Australia, 4,014 in West Australia, and 2,078 in Tasmania. The number of persons per 100 of the population in each State who held receiving licences at the end of February were as follows:—Victoria, 6.1; South Australia, 2.7; Queensland, 2.3; New South Wales, 2.2; West Australia, 1; Tasmania, 1.

Irish Free State.—LICENCE REVENUE.—The fact that in January, February, and March, 1927, the authorities collected £8,315 in licence fees alone is considered by the *Cork Examiner* to be evidence in itself that radio broadcasting in Ireland "is an extremely businesslike proposition."

Licences.—STILL INCREASING.—At the end of March, 1927, the number of Post Office receiving licences current was 2,253,845, an increase of 18,845 as compared with February, 1927, and an increase of 241,845 as compared with May, 1926.

Rhodesia.—NEW STATION.—A broadcasting station to be established in Southern Rhodesia within the next ten months to operate in conjunction with the Johannesburg station, and will relay the evening programmes transmitted therefrom, says *The Times*. The African Broadcasting Co. is applying to the Southern Rhodesian Government for a licence, and is asking for alterations in the existing regulations in order that "pirates" may be dealt with.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—June 1st. Victorian Government Railways. Electric time-releasing mechanisms. (B.X. 3451.)*

July 5th. State Electricity Commission. One 15,000-kW steam turbo-generator and accessories. (B.X. 3369.)*

July 4th. 66,000-V and 22,000-V insulators for the Yallourn brown coal scheme. (See this issue.)

June 28th. Postmaster-General's Department. Jacks, switchboard instruments, &c. (B.X. 3474.)*

SYDNEY.—June 22nd. New South Wales Government Railways. Remote-control switchgear. (B.X. 3442.)*

June 20th. Municipal Council. Turbo-alternators for Bunnerong power station. (B.X. 3443.)*

BRISBANE.—May 18th. City Electric Light Co., Ltd. Outdoor switchgear. (B.X. 3456.)*

Barking.—May 9th. County of London Electric Supply Co., Ltd. Cables and accessories for the Barking power station. (April 1st.)

Belgium.—May 18th. Service du Matériel des Chemins de Fer Belges, 21, Rue de Louvain, Brussels. Supply of 7,500 metres of insulated cable, 1,550 metres of bare copper wire, 6,000 metres of wire, and 1,000 metres of annealed copper flexible cable for brushes. Particulars (Cahier des Charges Special, No. 50-199-182) for 2½ fr.

May 18th. Belgian Post and Telegraph Authorities at La Salle Madeleine, Brussels. 46,235 metres paper-insulated armoured cable, 48,627 metres ditto, but with outer armouring. Particulars (Cahier des Charges Special No. 3-238) for 14 fr.

Chile.—SANTIAGO.—July 18th. Chilean State Railways. Materials for electric lighting and power (Group 20). Materials for electric lighting of locomotives and coaches (Group 32). August 22nd. Signalling telegraph and telephone supplies (Group 36). (C.X. 2271.)*

Darton.—May 17th. West Riding Education Committee. Electric lighting installation at Darton Kexborough new school. Specifications from Education Department, County Hall, Wakefield.

Darlington.—May 23rd. Electricity Committee. One 500-kW rotary convertor, with transformer. (See this issue.)

Dewsbury.—May 13th. Electricity Committee. Six months' supply of washed smalls required at the electricity works. Mr. R. W. Grubb, borough electrical engineer, Bradford Road.

Dublin.—May 23rd. Electricity Department. Pipework for the 5,000-kW turbo-alternator. (See this issue.)

Dundee.—May 19th. Electricity Department. 2-core and 4-core l.p. cable. D.c. and a.c. house-service meters. (See this issue.)

Edinburgh.—May 16th. East Lothian Education Authority. Works, including electric lighting installation, for the extensions, &c., at Macmerry Public School. Schedules from the surveyors, Messrs. R. & A. K. Smith, 44, Queen Street, Edinburgh.

Egypt.—Cairo.—May 24th. Director-General of Prisons. Twelve months' supply of electric lamps, &c. (C.X. 2268.)*

June 4th. Egyptian State Railways, Telegraphs and Telephones, Chief Inspecting Engineer, Queen Anne's Chambers, S.W. Underground cables (approx. £E12,000 to £E113,000). —*Reuter's Trade Service* (Cairo).

May 28th. Ministry of Education. Electrical equipment for Beni Suef Trades School. (B.X. 3488.)*

Epsom.—Electricity Department. E.h.p. cable. (See this issue.)

Glasgow.—May 18th. Electricity Department. Cables, small i.r. insulated cables and flexibles, meters and carbons for 12 months. (See this issue.)

May 9th. Education Authority. Electric lighting installations in a number of schools. Forms, &c., from Education Offices, 129, Bath Street, Glasgow.

London.—St. Marylebone.—May 18th. Electricity Department. L.p. and e.h.p. cables for 12 months. (April 15th.)

Islington.—June 1st. Electricity Department. Steel-tube lamp columns, 2,200-V feeder switchgear, rotary and/or static power factor correctors. (April 22nd.)

Metropolitan Asylums Board.—May 18th. Installation of a multiple roller ironing machine; new steam boiler, &c.; steam main; electric power in laundry, &c., at Darenth Tramway Colony; conversion of mechanical stokers to hand firing at North-Eastern Fever Hospital. (April 29th.)

London County Council.—May 17th. Electrical installation at the Albion Road, Stoke Newington, Central School (approx. 133 points). (See this issue.)

Manchester.—May 10th. Tramways Committee. Trucks, motors, and controllers for electric tramcars; tramway poles, span-wire brackets, trolley wire, and copper bonds. Steel girder tramway rails. Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly, Manchester.

14th May. Electricity Committee. Twelve months' supply of cast-iron junction boxes and socket bends, weldless steel lamp columns, fittings, and street lanterns. Mr. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall.

New Zealand.—Wellington.—June 21st. Public Works Department. Sub-station switchgear and metering equipment for Arapuni. (B.X. 3398.)*

June 7th. Railway sub-station equipment, Lake Coleridge electric power scheme. (B.X. 3295.)*

June 13th. New Zealand Railways. Machine tools, workshop equipment and overhead electric travelling cranes. (A.X. 4344.)*

June 6th. Six electric locomotives. (A.X. 4355.)* Overhead equipment for the Christchurch-Lyttelton electrification scheme. (B.X. 3301.)*

Invercargill.—May 31st. Southland Electric Power Board. Transformers. (B.X. 3379.)*

June 15th. 66,000-V oil circuit breakers. (B.X. 3378.)*

Lyttelton.—July 20th. Harbour Board. Four 5-ton electrically-operated portal cranes, and ten electrically-operated capstans. (A.X. 4352.)*

Auckland.—July 4th. Auckland Electric Power Board. Switchgear. (B.X. 3471.)*

Salford.—May 14th. Public Health Committee. Electrical installation at Drinkwater Park Hospital, Prestwich. Specifications from Medical Officer of Health, 143, Regent Road, Salford.

Sleaford.—May 17th. Electricity Department. Cables, boxes, &c. (April 29th.)

Scarborough.—June 3rd. Corporation. Installation of electrical pumping plant in duplicate for the new Irton water scheme No. 2. Specifications (£5) from Dr. H. Lapworth, engineer, 25, Victoria Street, S.W.

Thorne.—May 17th. West Riding Education Committee. Electric lighting installation at new boys' school. Specifications, &c., from Education Department, County Hall, Wakefield.

Uruguay.—Montevideo.—June 15th. State Electricity Supply Works. 15 transformer sub-station equipments (6,600/220 V, 50 cycles). (B.X. 3371.)* Five overhead transformer sub-stations mounted on tubular or section iron columns. (B.X. 3430.)*

Whitley.—Electricity Department. One 1,000-kW turbo-alternator, with condenser, pumps, air filter, &c.; one 200-kW semi-Diesel or heavy-oil engine alternator. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bedford.—Electricity Committee.

Feed-water heater and pipe work (£296).—Ledward and Beckett. (Accepted.)

Overhead cable in connection with supply to Ampthill (£4,600).—R. M. Russell. (Recommended.)

Brighton.—Lighting Committee. Accepted:—

Switchgear (£251).—Metropolitan-Vickers Electrical Co., Ltd.

Cheltenham.—Electricity Committee. Accepted:—

Renewing parts of grate stoker (£152).—Babcock & Wilcox, Ltd.

Czecho-Slovakia.—Messrs. Standard Telephones & Cables, Ltd., has received a contract to manufacture and install a 3-kW standard broadcasting radio equipment at Kosice (Kassa).

Erith.—Urban Council. Accepted:—

Cables for a year (£4,361).—Callender's Cable & Construction Co., Ltd.

Glasgow.—Electricity Committee. Recommended:—

Ash tank for boiler house at Dalmarnock power station (£671).—Babcock & Wilcox, Ltd.

Tramways Committee. Accepted:—

Storage battery for power station and sub-stations.—Tudor Accumulator Co., Ltd.

Telephone and test cable.—Hackbridge Cable Co., Ltd.

Special track work.—Thermit, Ltd.; Edgar Allen & Co., Ltd.; and Titan Trackwork Co., Ltd.

Gloucester.—Electricity and Light Railways Committee. Cables, &c., in connection with the supply of electricity to the Gloucester Rural District (approx. £46,945).—British Insulated Cables, Ltd. (Recommended.)

Hull.—The Corporation Telephones Committee has accepted a Belgian tender for automatic table telephones and bell sets at £337. The lowest British tender was £475.

Ilford.—Town Council. Accepted:—

Electricity meters.—Edison Swan Electric Co., Ltd.; Ferranti, Ltd.; R. Hornsby & Co., Ltd.; Landis and Gyr, Ltd.; and Measurement, Ltd.

Lamp Contract.—

Nine months' contract for "Osram" metal-filament and "Robertson" carbon-filament lamps for the Bolsover Colliery Co.—General Electric Co., Ltd.

London.—Battersea.—Electricity Committee. Accepted:—

Insulated glazed platform for switchgear gallery (£160).—British Luxfer Prism Syndicate, Ltd.

Poplar.—Electricity Committee.

Earthing at new power station. Five neutral-point earthing cubicles for machines in old station; 1 limiting resistance for old station; 1 limiting resistance for new station, complete with indicating device to show which machine is earthed:—

Metropolitan-Vickers Electrical Co., Ltd. (Recommended.)	**£546**
General Electric Co., Ltd.	555
Johnson & Phillips, Ltd.	789

Metropolitan Asylums Board.—Hospitals Committee. Recommended:—

X-ray equipment at Northern Hospital (£125).—Newton and Wright, Ltd.

Portsmouth.—Electricity Committee.—The following tenders were received for the installation of coal-handling plant at the power station:—

	Part 1. £	Part 2. £	Total. £
Aldridge & Ranken, Ltd. ...	6,249	6,005	12,254
(Alternative)	6,739	6,444	13,183
Babcock & Wilcox, Ltd. ...	6,579	6,423	13,002
(Alternative). (Recommended.)	**7,037**	**6,423**	**13,460**
Ed. Bennis & Co., Ltd. ...	7,800	6,088	13,888
Fraser & Chalmers Engineering Works	8,269	7,459	15,728
Strachan & Henshaw, Ltd.	—	—	16,350

Cable (£1,038).—Johnson & Phillips, Ltd.

Sheffield.—Electric Supply Committee. Accepted:—

Automatically-operated traction sub-station equipment, comprising one 750-kW convertor, with switchgear and accessories (£4,300).—English Electric Co., Ltd.

Smethwick.—Estates Committee. Accepted:—

Electric pump (£160).—Tangyes, Ltd.

Warrington.—Tramways Committee. Accepted:—

Manganese crossing.—Hadfields, Ltd.

Electricity Committee. Accepted:—

Repairs to 3,000-kW set.—English Electric Co., Ltd.

York.—Education Committee. Recommended:—

Installation of electric lighting at Tang Hall school (£563). —A. E. White, York.

Forthcoming Events.

Junior Institution of Engineers.—Friday, May 6th. 39, Victoria Street, S.W. 7.30 p.m. Ordinary meeting.

Chemical Engineering Group.—Friday, May 6th. Imperial College of Science and Technology, South Kensington, S.W. 6 p.m. Annual general meeting. 8 p.m. "Chemical Fire Extinguishers." Dr. W. R. Ormandy.

Royal Society of Arts.—Monday, May 9th. 8 p.m. Cantor lecture. "The Measurement of Light." Mr. J. W. T. Walsh. (Lecture III).

Wednesday, May 11th. 8 p.m. "English Railways." Prof. W. E. Dalby, F.R.S.

Institution of Electrical Engineers (Western Centre).—Monday, May 9th. Plymouth. Summer meeting.

Institution of Civil Engineers.—Tuesday, May 10th. London. 6 p.m. Annual general meeting.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, May 14th. South Wales Institute of Engineers, Cardiff. 6 p.m. Annual meeting.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the name and address of makers of the following:—

Daycolite fittings.

Notes.

Extensions at Aldershot.

On April 25th a ceremony at Farnborough took the form of the laying of a foundation corner stone, by Councillor T. Cochrane, chairman of the No. 11 District Joint Industrial Council for the Electricity Supply Industry, for the future extensions of the North Camp and Farnborough Works of the Aldershot Gas, Water and District Lighting Co. With the advent of an Extension of Area Order now emerging it is estimated that the electricity output of the company for 1931 will be 3 million units, and for 1933, 5 millions. The policy of the undertaking with regard to the generation of electricity has been to link up the various primary departments. The company has two large works, one at North Camp, occupying an area of 30 acres, and another at Ash Road, Aldershot, covering 46 acres. The former site has certain peculiar advantages in favour of the installation of a large generating station. The main railway line between Dover and the North runs through the works, and the River Blackwater forms a boundary of the site. Further, it is in a favourable position geographically for linking up with other districts, such as Ascot, Guildford, and Winchester.

At the ceremony the chairman of the company, Mr. R. W. Edwards, compared the charges which the company was to introduce from the Midsummer quarter, with those prevailing in the London and Home Counties Electricity District, where the average lighting, power, and heating and cooking rates were 6.75d., 2.81d. and 2.07d. per kWh, respectively. The minimum Aldershot charge would be 1.875d. per kWh. He pointed out that the load factor of the station compared very favourably with those of some of the largest undertakings. The highest weekly load factor for 1925 was 48.0 per cent., and for 1926, 42.9 per cent. This was attributable to the unity of working between the various departments of the company.

The Electrical Trades Benevolent Institution.

The annual general meeting of the E.T.B.I. was held on Thursday last week, with Dr. W. H. Eccles, president I.E.E., in the chair. The report of the Committee of Management for the year 1926 showed that the income from contributions was £7,415, making with the receipts from dividends and other sources the total income of £8,651. An amount of £7,219 had been carried to capital account after the payment of grants and expenses. In respect of the year the sum of £1,571 had been invested, bringing the total of invested funds to £26,176 at cost. The necessity of the Institution was more strongly demonstrated than in any previous year, the number of grants having been 75, amounting to £1,105, compared with 81, amounting to £934, in 1925. Every qualified applicant received assistance.

The activities of the Local Advisory Committees had continued to be of great benefit, not only in increasing the contributions, but also in enabling persons requiring assistance to know that it could be obtained from the Institution. The Committee hoped that further committees of this kind would be created, and invited the co-operation of leading persons in large towns. There were such committees in Cardiff, Manchester, Newcastle-on-Tyne, and Glasgow.

The annual festival, held on November 10th, 1926, was presided over by Sir Hugo Hirst, Bart., president of the Institution. Thanks to the extraordinary efforts made by the president, his appeal resulted in the collection of £6,912.

Commenting on the report and accounts, the chairman pointed out that the income for the year was £8,651, compared with £3,128 in 1925. The income resulting from the annual festival exceeded the largest amount previously collected at a festival; the previous best was that which was collected in 1914, and the chair on both occasions was occupied by Sir Hugo Hirst, as president. The contributions resulting from the efforts of the Newcastle Local Committee were almost double those collected in the previous year. The thanks of the Institution must be given to them and to the committee of the Engineers' Ball, and to the executors of the late Mr. A. P. Lundberg who, acting on what they thought would be his desire, generously gave a contribution of £50. The dividends on investments for 1926 were £1,234, compared with £1,175 in the previous year. The total administration expenditure amounted to £296, as compared with £299 in the previous year. Since the end of 1926 £5,261 had been invested.

The report and accounts were adopted, and new rules prepared by a special sub-committee and carefully considered by the Committee of Management were adopted in place of the existing rules; they have to be confirmed at a subsequent general meeting. Reference was made to the death of Captain R. J. Wallis-Jones, who was one of the most energetic members of the Committee.

The Committee of Management was elected, and was empowered to constitute the Council under the new rules if, and when, the new rules were confirmed.

Educational.

A special course of six lectures on "Electrical Engineering Economics," by Mr. D. J. Bolton, B.Sc., will be held at the Regent Street Polytechnic, London, on Thursdays commencing May 12th (excepting June 9th), from 6.30 to 8.30 p.m. The course is intended for electrical students who wish to gain an insight into the economic calculations upon which so many engineering decisions depend. The fee for the course to students residing or employed within the administrative county of London, or residing in Middlesex or Kent, is 7s. 6d.

A Scottish Power Consumers' Association.

It has been decided to form an Ayrshire Electric Power Consumers' Association, and a meeting will be held on May 12th to adopt a constitution and rules. The objects of the Association are to advise members on matters relating to the use and application of electrical energy, to protect the interests of members in respect of cost and conditions of supply, and generally to safeguard and promote the interests of the members as consumers. All consumers, other than for domestic purposes, are eligible for membership. The secretary is Mr. J. D. Wyllie, solicitor, 37, Bank Street, Kilmarnock.

B.E.S.A. Publications.

Two British Standard Specifications for Instrument Transformers (No. 81, 1927), and Graphic (Recording or Chart-Recording) Ammeters, Voltmeters and Wattmeters (No. 90, 1927), have recently been issued by the British Engineering Standards Association. These are revisions of the 1919 editions, and have been brought into line with other B.S.S.'s for electrical instruments, there now being a series of four up-to-date specifications: Indicating Instruments, No. 89; Graphic (Recording) Instruments, No. 90; Electrical Protective Relays, No. 142; Instrument Transformers, No. 81.

No. 81 deals with the testing of current and voltage transformers, the rated secondary current or voltage, ratios of transformation, limits of temperature rise and the rated burdens. Each type of transformer is graded into four classes, according to the use to which the transformer will be put, and the limits of error for each class are laid down. A useful series of appendices are included, dealing with such matters as the conditions affecting the construction and use of transformers, terminal markings, notes on the selection of current transformers, the limitations of single-turn current transformers, and the method of measuring temperature rise.

Publication No. 90 is in effect a sister specification to B.S.S. No. 89, special attention being devoted to the driving mechanism and to the effect of the pen-to-paper friction. Chart speeds and chart rulings are also dealt with, as are also the limits of error and the methods of testing for accuracy. The allowances to be made for the effect of external magnetic fields, changes in frequency, power factor, and the amount of ink, &c., are specified. Appendices are included, dealing with notes on the accuracy of different types of instrument, charts and driving mechanism, terminal markings, and so on.

Copies of the revised specifications may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1, price 2s. 2d. each, post free.

Appointments Vacant.

Assistant master in electrical engineering, for the Rugby Technical School. Charge engineer for the City of Stoke Electricity Department. Canvasser (£257) for the Hammersmith Borough Council Electricity Department. Telephone inspector (£300) for the Government of British Guiana Post Office Department. Assistant district engineer (approx. £630) and assistant installation engineer (approx. £490) for the Municipal Commissioners of Singapore Electricity Department. (See our advertisement pages to-day.)

Irish Free State Electricity Supply.

The Irish Free State Government's Electricity Supply Bill last week passed its final stage in the Dail by 36 votes to 17, and now awaits consideration by the Senate. It is expected that the Bill will be passed into law this month, but various urgent appeals have been made to the Senate to exercise its constitutional powers to hold it up pending the result of the Dail General Election in June. The Government's position is held to be precarious, and should it not return to power the part of the scheme which aims at consolidating the distribution of electrical power in the State might be abandoned. In the Dail, Mr. Johnson, leader of the Labour group, said the Bill's main defect was the absence of any Parliamentary supervision. The refusal of the Minister for Industry and Commerce to make any concession on any vital point has aroused fresh indignation. He would not even agree that the members of the Board should be experts in electricity management. Major Bryan Cooper remarked that the position was that the Board of Control was to be given a blank cheque with power to do as it liked.

At a meeting of Rathmines Urban Council, Sir S. Maddock, chairman, alluded to the confiscatory powers of the Bill, dwelling on the claim that the town's electricity undertaking had been developed by the ratepayers' money, and that they now had a substantial yearly surplus from it. They had no assurance that under the Government Bill the town would be as well served.

Mr. A. R. Monks, chairman of the Cork Electric Tramway and Electric Lighting Co., at the annual meeting, said that the future of the company was uncertain in view of the Government's Bill.

The Minister for Industry and Commerce having given his sanction to the raising of a loan of £150,000 by the Dublin City Administrative Commissioners for work in connection with the city's electricity concern, the Commissioners have decided to create redeemable stock, and an issue will be made accordingly.

Artificial Sunlight.

"Sunlight baths," by the use of mercury-vapour lamps recently installed at the Bradford Corporation Central Baths, were opened to the public on April 25th. The first installation, for which four dressing cubicles have been set aside, has cost £200 and is for gentlemen only, but the treatment will shortly be available for ladies also. The bath periods vary from one to ten minutes, and an electrical timekeeper is being installed to ensure against overdose. It is anticipated that a future development may be the installation of sunlight lamps over the big swimming bath.

University of London.

On Tuesday next, May 10th, graduates in science of the University of London, who are members of Convocation, will elect three graduates to fill vacancies among the five Convocation members of the Senate who represent Science. None of the Science representatives hitherto has been an engineer in practice, though many engineers have graduated in Science at the University, and it is very desirable that the special needs of the engineering profession should be adequately put before the Senate; we are very glad, therefore, to learn that Mr. Roger T. Smith, B.Sc., M.Inst.C.E., Past-president of the Institution of Electrical Engineers, and partner in the firm of Highfield and Roger Smith, consulting engineers, Westminster, is a candidate for one of the vacancies, and we venture to urge all engineers who are science graduates and members of Convocation to help to secure representation on the Senate by voting for him. Mr. Roger Smith, who is an official candidate of the XXth Century Society of London Graduates, has held many public appointments in connection with scientific and engineering movements, both national and international in scope, and has made a special study of educational problems relating to the profession of engineering, the development of pure and applied science, and the advancement of research; he is backed by an imposing list of nominators and supporters, including Professor W. E. Dalby, Dr. W. H. Eccles, Prof. J. A. Fleming, Sir T. Gregory Foster, Sir Oliver Lodge, and Dr. W. C. Unwin. The matter is of importance in view of impending changes in the Constitution of the University, and we hope that readers who are voters will do their utmost to ensure the election of so efficient a representative of science and engineering.

Works Visit.

Arrangements have been made for the Birmingham Electric Club to visit the works of the English Electric Co., Ltd., and the Siemens & English Electric Lamp Co., Ltd., at Preston, on May 20th. Reserved saloon accommodation will be provided from New Street Station, Birmingham, 9.10 a.m. Members wishing to take part in the visit should communicate immediately with the Hon. Soc. Secretary, Mr. F. W. Martin.

Institution Notes.

Institution of Electrical Engineers.

North-Eastern Centre.—The report of the Committee presented at the annual meeting at Newcastle-upon-Tyne on April 25th shows that nine ordinary meetings, two informal meetings, and a Faraday Lecture (on two occasions) were held, the average attendance being 74, as compared with 88 in 1925-26. Over 500 persons attended at the November Faraday Lecture, and so many were unable to obtain admittance that Dr. Thornton repeated the lecture in January. The membership of the Centre decreased by 12 to 510. The Tees-side Sub-Centre membership is approximately 20 per cent. of the total, and the Committee notes with regret the falling-off in the membership of the Students' Section. It is hoped that the proposed amendments of the membership regulations now under consideration by the Council of the Institution will remove some of the difficulties which have led to complaints from Students and Graduates. Negotiations are in hand for the establishment of a library, which will be housed in the Armstrong College Library. Detailed particulars will be issued shortly to members. The committee for the next session is as follows:—*Chairman*: Hugh Paterson; *vice-chairmen*: E. Fawssett and P. F. Allan; *hon. secretary*: H. B. Poynder; *new members of committee*: W. T. Maccall, L. E. Mold, H. L. Riseley, B. A. Robinson, and F. H. Williams.

Mersey and North Wales (Liverpool) Centre.—The Committee for the 1927-28 session is as follows:—*Chairman*: Prof. F. J. Teago; *vice-chairmen*: S. E. Britton and Prof. E. W. Marchant; *hon. secretary and treasurer*: Oscar C. Waygood; *new ordinary members of committee*: H. C. Hazel, W. M. Horsfall, F. V. L. Mathias, and J. L. F. Vogel.

Scottish Centre.—On April 12th a paper on "The Application of Machinery at the Coal Face," by Mr. Sam Mavor, was, owing to his absence in London, read by his nephew, Major J. B. Mavor. There was a good attendance of members, and representatives of the Association of Colliery Managers, the Mining Institute of Scotland, the West of Scotland Iron and Steel Institute, and the Institution of Mining Electrical Engineers were also present, and a discussion ensued. The following office bearers for the 1927-28 session were duly elected:—*Chairman*: D. M. Macleod; *vice-chairmen*: G. Morgan and E. Seddon; *hon. secretary*: Joseph Taylor; *asst. hon. secretary*: H. V. Henniker; *committee*: Prof. F. G. Baily, F. H. Whysall, J. Macdonald, N. C. Bridge, H. W. Bewsher, Prof. S. Parker Smith, A. S. McWhirter, R. B. Mitchell, J. C. Macfarlane, J. K. Murray, D. S. Munro, J. M. Scott-Maxwell, and F. Frain, P. Philip, and R. K. Robertson (representatives of the Dundee Sub-Centre).

Excursion.—On Saturday, April 30th, members took part in an excursion by road to Dunkeld, where luncheon and tea were served in the Atholl Arms Hotel, the party returning to Dundee *via* Perth and the Carse of Gowrie. A large number of members and friends, including ladies, took part, the excursion being greatly enjoyed by all.

The Institute of Fuel.

A joint meeting of the vice-presidents and members of the Councils of the Institution of Fuel Technology and the Institution of Fuel Economy Engineers was held under the chairmanship of Sir Alfred Mond on Friday, April 29th. As president of both Institutions, in November last, Sir Alfred Mond, having found a general desire both amongst those most closely associated with the problems of fuel economy and amongst those throughout the country who had a general interest in the question, that the two existing Institutions should be merged into one, suggested terms of fusion. The following terms of fusion were subsequently accepted by the Councils of both Institutions:—

(1) That the name of the merged Institutions be "The Institute of Fuel."

(2) That the Councils of both Institutions as constituted at present be merged and form the Council of the "Institute of Fuel," and that in the autumn following the inauguration of the Institute of Fuel, a new Council shall be elected by ballot of the members of the Institute.

(3) That the present honorary secretaries of each present Institution be joint honorary secretaries of "The Institute of Fuel."

At the meeting the final steps for the fusion of the existing Institutions and the inauguration of the "Institute of Fuel" were taken. Sir Alfred Mond expressed his great gratification that the fusion had been successfully accomplished, and thanked the vice-presidents, chairmen, and members of the Councils of both Institutions for their co-operation in bringing about the present happy result.

Junior Institution of Engineers.

In a paper entitled "The Design and Balancing of 3-phase Low-Tension Systems," read before the Institution on April 29th, Mr. W. Fordham Cooper, B.Sc., put forward some theories for the design of cable networks in developing areas. He said that the deliberations recorded in his paper arose from his experiences during the last six months, when the heating load on the system with which he was concerned was increasing at an alarming rate. He had tried to find some definite basis on which to go forward, a basis which,

although obtained from theories deduced from past experience, would be better than mere rule of thumb. Mr. Cooper set out in detail particulars and calculations relating to the theories that he advanced; he said that many of the results which were given were admittedly tentative and awaited confirmation by experience.

Mr. E. Ambrose, in the discussion, criticised Mr. Cooper's use of theoretical formulæ. He said that mains engineers had a fund of collected knowledge and experience which constantly progressed and served a more useful purpose than sets of formulæ which periodically had to be changed.

Institute of Transport.

The sixth Congress of the above Institute is to be held at Birmingham from May 19th to 21st. The president, Mr. R. H. Selbie, C.B.E., will receive members and visitors in the Warwick and Dudley Rooms, Queen's Hotel, from 7 to 10 p.m. on Wednesday, May 18th. The proceedings will include the reading and discussion of papers, and visits to works, &c. The papers to be read will include "Traffic Control," by Mr. J. H. Follows, C.B.E., L.M.S. Railway, and "Transport in England—A Brief Historical Survey," by Principal C. Grant Robertson, Birmingham University.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. Johnstone Wright, M.I.E.E., electrical engineer and general manager of the Belfast electricity undertaking, has been offered and has accepted an important appointment under the Electricity Commission of Great Britain.

Mr. V. Delebecque, who ceases to be general manager of Electric Fans, Ltd., from to-morrow, May 7th, asks for correspondence to be addressed to him at 26a, St. Peter's Square, Hammersmith.

At the annual dinner of the Bradford Engineering Society, held on April 29th, Alderman J. W. Longley, deputy chairman of the Bradford Corporation Electricity Committee, was presented with a clock, with Westminster chimes, in appreciation of his services to the Engineering Society.

On leaving Glasgow to take up an important appointment on the engineering staff of the Central Electricity Board in London, Mr. C. W. Marshall received a presentation from the officials and staff of the Glasgow Corporation Electricity Department at a dinner given in his honour on April 28th, at which Mr. R. B. Mitchell, engineer and manager, presided. Mr. Mitchell, in making the presentation, complimented Mr. Marshall on his loyal and efficient service with the Electricity Department, and congratulated him on securing the appointment.

The Glasgow Corporation Electricity Committee has appointed Mr. Alexander P. McKim, laboratory assistant, to the position of chief technical assistant rendered vacant by the departure of Mr. C. W. Marshall.

Reuter's correspondent at Wellington states that Mr. A. Gibbs, chief telegraph engineer of the New Zealand Postal Telegraph Department, is leaving on a world tour to investigate developments in wireless broadcasting, telegraphic and telephone services. He will also represent New Zealand at the International Radio-Telegraph Conference at Washington in October.

Mr. E. E. Hoadley, M.I.E.E., borough electrical engineer at Maidstone, and Mrs. Hoadley, celebrated their silver wedding on April 29th.

Mr. F. Fernie has recently joined the staff of Messrs. Watsham's, Ltd., Windsor House, Victoria Street, S.W.1, electrical contractors for cable and overhead line work.

Bedford Corporation Electricity Committee reports that under the unit system the salary of the borough electrical engineer will now be £1,060 per annum.

Many distinguished electrical and other gentlemen were present at the Savoy Hotel on Wednesday night last week, when the directors of the Charing Cross Electricity Supply Co., Ltd., gave a dinner to Mr. John M. Gatti, the new chairman of the London County Council.

Mr. F. W. H. Wheadon, M.I.E.E., engineer and manager of the Adelaide Electric Supply Co., Ltd., has been elected to a seat on the board with the title of managing director.

Mr. Clifford Mitchell, late works manager to Marconi's Wireless Telegraph Co., Ltd., of Chelmsford, has been appointed general works manager of the Crittall Manufacturing Co., Ltd., of the same town.

Mr. Oswald G. Cook, who was for some years with the Morecambe Corporation Electricity Department, and later under the War Department, was one of six selected applicants (out of over 400) to appear before the Committee for the post of engineer to the Hendon Union Redhill Hospital.

In our last issue we erroneously stated that Alderman W. T. Dagnall had been elected chairman of the South-East Lancashire Electricity Advisory Board in succession to Alderman W. Walker. Ald. Dagnall was *re-elected* to the position, which he has held since the formation of the Board.

Mr. Treece, who has been works manager of Messrs. Electricars, Ltd., of Birmingham, for the past six years, has been appointed general manager. In future his time will be divided between London and Birmingham.

On Monday last Mr. L. W. Oliver, mains superintendent, Aylesbury Electricity Undertaking, was presented with a silver cigarette case by Mr. Turnbull, the chief engineer, on behalf of the staff, upon leaving to take up an appointment with the British Electric Transformer Co., Ltd. He joined the Aylesbury undertaking as an apprentice in 1915.

Mr. H. G. Baker has relinquished his position as London sales manager of Messrs. Falk, Stadelmann & Co., Ltd., after 18 years' service. He will operate on his own account as a wholesale distributor of electrical accessories at 56, Millman Street, London, W.C.1, for the present.

Mr. Sidney Green, for many years with the St. James's and Pall Mall Electric Light Co., Ltd., and the Central Electric Supply Co., Ltd., has been transferred to the London Power Co., Ltd., on the engineer-in-chief's staff, as stores superintendent and buyer. He took up his duties at Horseferry Road, S.W.1, on May 2nd.

Obituary.—Mr. W. E. Wimhurst.—The death occurred on April 24th, at Dawlish, at the age of 59 years, of Mr. W. E. Wimhurst, who was for 32 years with Callender's Cable and Construction, Ltd., of Erith, and at his retirement was cashier at the Belvedere factory.

Viscount Cowdray.—We regret to record the death of Viscount Cowdray, which occurred on Sunday morning last at the age of 70 years. As head of the firm of S. Pearson and Son, public works contractors, he was responsible for the construction of some of London's underground tube railways.

Mr. A. Campbell.—*The Times* records the death, which occurred at Felbridge, East Grinstead, on April 30th, in his 78th year, of Mr. Archibald Campbell, "late M.I.E.E."

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

J. Roberts, Sons & Eccles, Ltd.—Private company. Registered April 13th, in Belfast. Capital, £2,000 in £1 shares. To carry on the business of engineers, importers and manufacturers of and dealers in auto-electrical accessories, &c. The first directors are:—J. W. Roberts, 9, Grove Terrace, Belfast, electrical engineer; Mrs. R. A. Roberts, 9, Grove Terrace, Belfast; C. E. Eccles, 1, Victoria Crescent, Sydenham, Belfast, secretary. Qualification, 10 shares. Secretary: C. E. Eccles. Registered office: 12-14, York Lane, Belfast.

D. A. R., Ltd.—Private company. Registered April 25th. Capital, £100 in 1s. shares. Objects: To carry on the business of manufacturers, merchants, and distributors of the preparation called Dar, used for desulphating and prevention of sulphation in electric storage batteries; to open service stations, to act as merchants, distributors, &c. The first directors are:—A. E. Whitelaw, Park Lane Hotel, Piccadilly, W., soap merchant; G. R. Whitelaw (same address), sales manager. Qualification, one share. Remuneration as fixed by the company. Secretary: W. F. Sanders. Registered office: Australia House, Strand, W.C.2.

D. X. Coils, Ltd.—Private company. Registered April 29th. Capital, £250 in 1,000 ordinary shares of 1s. each and 200 6 per cent. (free of income tax) preference shares of £1

each. Objects: To carry on the business of a manufacturing, contracting, commercial, promoting, financial, developing and producing association, especially wireless components, &c. The first directors are:—J. H. Nichols, 102, King Edward Road, E.8; G. Nichols, Rye House, Highams Park, E.4 Registered office, 4 and 5, Glebe Road, Kingsland Road, E.8.

Official Returns of Electrical Companies.

Attaix, Ltd.—Debenture dated March 30th, 1927, to secure all moneys not exceeding £500, for which the holder (S. Rogers, 4, Rotunda Terrace, Montpelier, Cheltenham) may become liable by virtue of a guarantee given to the company's bankers, charged on the company's property, present and future, including uncalled capital, but excluding 106, High Street, Southampton. Also debenture of same date to secure all moneys not exceeding £800 for which the holder (H. Burger, South-Western Hotel, Southampton) may become liable by virtue of a guarantee given to the company's bankers. Property charged: as above.

Tungstalite, Ltd.—Capital, £3,000 in £1 shares. Return dated April 11th, 1927. All shares taken up. £2,700 paid. £300 considered as paid. Mortgages and charges, nil.

Coley & Swinnerton, Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1926 (filed March 2nd, 1927). 1,001 shares taken up. £1,001 paid. Mortgages and charges, nil.

Radio Supply Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 30th, 1926. 599 shares taken up. £599 considered as paid. Mortgages and charges, nil.

E. Shipton & Co., Ltd.—Capital, £6,000 in 4,000 preference and 2,000 ordinary shares of £1 each. Return dated October 22nd, 1926 (filed January 1st, 1927). All shares taken up. £300 paid. £5,700 considered as paid. Mortgages and charges, nil.

National Electric Lamp Co., Ltd.—Capital, £100 in £1 shares. Return dated November 19th (filed December 15th), 1926. All shares taken up. £100 paid. Mortgages and charges, nil.

H. E. C. Electric Co., Ltd.—Capital, £1,000 in 400 preference and 600 ordinary shares of £1 each. Return dated December 30th, 1926. 170 preference and 202 ordinary shares taken up. £172 paid on 170 preference and 2 ordinary shares. £200 considered as paid on 200 ordinary shares. Mortgages and charges, nil.

Embleton & Barker, Ltd.—Capital, £1,000 in £1 shares. Return dated October 26th, 1926 (filed March 2nd, 1927). All shares taken up. £500 paid. £500 considered as paid. Mortgages and charges, nil.

Rubon, Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1926. 2 shares taken up. Nil called up. Mortgages and charges, £500.

Rhayader Electric Light and Power Co., Ltd.—Capital, £2,000 in £5 shares. Return dated November 4th, 1926. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Kye, Ltd.—Capital, £12,000 in £1 shares. Return dated November 30th, 1926 (filed January 27th, 1927). 11,307 shares taken up. £11,307 paid. Mortgages and charges, nil.

Electrical Importers (Hull), Ltd.—Capital, £205 in £1 shares. Return dated December 9th, 1926. 4 shares taken up. £4 paid. Mortgages and charges, £1,000.

Auto Welding and Engineering Co., Ltd.—C. W. Foster, of 100, Finchley Road, N.W.3, was appointed receiver and manager on April 20th, 1927, under powers contained in debentures dated April 24th, 1923.

Radio Communication Co., Ltd.—Satisfaction to the extent of £5,500 on April 21st, 1927, of debenture dated April 14th, 1926, securing £81,500 (£15,000 outstanding).

International Electrolytic Plant Co., Ltd.—Mortgage dated March 31st, 1927, to secure £500 further advances and costs and all moneys for which the mortgagee may become liable by virtue of guarantees up to £1,200 given to the company's bankers, charged on a debt of about £9,517, owing to the company from Société des Engrais Azotes et Composes, Paris. Holder:—H. Rowlands, 41, Temple Row, Birmingham.

Skegness Electricity Supply Co., Ltd.—Issue on March 18th, 1927, of £50 debentures, part of a series already registered.

Lissen, Ltd.—Capital, £3,000 in £1 shares. Return dated December 31st, 1926 (filed April 12th, 1927). 502 shares taken up. £502 paid. Mortgages and charges, nil.

J. Churley Cann, Ltd.—Debenture dated April 7th, 1927, to secure £3,700, charged on company's property, present and future, including uncalled capital. Holder:—A. C. Sufforn, Hill Head, Fareham, Hants.

C. Shardlow & Co., Ltd.—F. Dixon, of National Chambers, 4, Horsefair Street, Leicester, ceased to act as receiver on April 11th, 1927.

Ledger, Taylor & Co., Ltd.—A. T. Winter, of 7, Bridgegate, Retford, I.A.A., was appointed receiver on April 12th, 1927, under powers contained in debenture dated March 11th, 1925.

Samestophone, Ltd. — A. W. Watson, incorporated accountant, of 5, Waterloo Street, Birmingham, was appointed receiver and manager on April 13th, 1927, under powers contained in certain debentures dated January 20th, 1926.

B. N. B. Wireless, Ltd.—Satisfaction in full on March 7th, 1927, of second debentures dated November 22nd, 1923, securing £100.

Horley and District Electricity Supply Co., Ltd.—Mortgage on freehold land and buildings in Victoria Road, Horley, Surrey, dated April 1st, 1927, to secure £1,500. Holder: C. G. Selfe, Massetts Road, Horley, Surrey.

Alpha Electric Welding Co., Ltd.—Debenture dated April 8th, 1927, to secure £2,000, constituting a specific charge on land at Newport, Mon., and all other freehold and leasehold property of the company and a floating charge on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd., 15, Bishopsgate, E.C.2.

Hellyar & Sons, Ltd.—J. M. Moore, of 15, New Street, Bishopsgate, E.C.1, ceased to act as receiver or manager on March 25th, 1927.

Gillespie Valve Manufacturing Co., Ltd.—Capital £200 in 1s. shares. Return dated January 18th, 1927. All shares taken up. £100 2s. paid, £99 18s. considered as paid. Mortgages and charges, nil.

Cecil Hodges & Co. (Overseas), Ltd.—Capital, £1,000 in £1 shares. Return dated September 15th, 1926 (filed January 1st, 1927). 11 shares taken up. £11 paid. Mortgages and charges, nil.

Allerton Electrical Supplies, Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1926. 1,500 shares taken up. £1,500 paid. Mortgages and charges, £1,400.

Waltham Radio, Ltd.—Capital, £1,000 in £1 shares. Return dated February 17th, 1927. All shares taken up. £1,000 considered as paid. Mortgages and charges: £500 debenture.

Stevenage Electric Light and Power Co., Ltd.—Capital, £16,000 in £1 shares. Return dated March 15th, 1927. All shares taken up. £16,000 paid. Mortgages and charges, nil.

Robson, Paling & Co., Ltd.—Capital, £2,000 in £1 shares. Return dated October 27th (filed November 15th), 1926. 1,380 shares taken up. £600 paid, £780 considered as paid. Mortgages and charges, nil.

Prince's Electrical Clocks, Ltd.—Capital, £3,000 in £1 shares. Return dated December 16th, 1926. All shares taken up. £1,000 paid, £2,000 considered as paid. Mortgages and charges, nil.

E. H. Maisner & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated April 5th, 1927. 490 shares taken up. £490 paid. Mortgages and charges, nil.

City Notes.

Electric Supply Corporation, Ltd.

The annual meeting was held last week, Mr. J. G. B. Stone (chairman) presiding. Introducing the report (*vide* Electrical Review, April 22nd, p. 651), the chairman said that although there was an increase in gross earnings during 1926 the profits, which included dividends on investments, were reduced. The only increase made in the charges was in the case of contracts embodying a scale varying with the cost of coal. The lighting rates were not only not increased, but in some cases were actually reduced. In the smaller towns they were charging the maximum rates authorised by the Orders. Their costs had risen by over £8,000, but the adoption of Diesel engines in certain of their stations saved them from the full effects of the enhanced cost of coal. Generally speaking, the coal stoppage cost them £10,000, of which £6,000 was recovered from the large industrial contracts. Their holding in the Hendon Company was increased by 9,253 bonus shares. The Dumbarton Burgh and County Tramways Co. was passing through a bad period owing to bad trade and unrestricted competition. The North Berwick Company had been purchased by the local authority, and they had received a considerable premium upon their shares. The Hendon and Dawlish Companies were both doing well. The Dalkeith undertaking had been taken out of the accounts. Referring

to the development account, Mr. Stone said that in order to replace those undertakings which had been purchased, or which might be purchased, by local authorities the board had decided to extend the field of operations. Mr. K. A. Scott-Moncrieff (managing director) seconded the motion, and made reference to the Electricity (Supply) Act, 1926, and said that if the scheme matured the company would obtain its electricity in bulk and would be relieved of the responsibility of generating plant. The report and accounts were adopted, and subsequently a resolution was passed for the creation of 500,000 £1 shares, raising the authorised capital to £500,000.

South Wales Power Co., Ltd.

Presiding at the annual meeting on April 26th, the chairman (Mr. W. North Lewis) reminded the shareholders that the company held the bulk of the capital of the South Wales Electric Power Distribution Co. (the Parliamentary Company) and proceeded to refer to the working of the latter company during 1926 (*vide* ELECTRICAL REVIEW, April 22nd, p. 650). He said that the actual output, in spite of the coal stoppage, had only fallen by 14 per cent., but, naturally, generating costs were high. At the commencement of the dispute they had large stocks which obviated the purchase of dear and inferior coal for several months. He claimed that the company had demonstrated its importance in the industrial life of the area. Although South Wales industry was recovering very slowly, the company's output showed a further record; if the rate was maintained there was every reason to hope that it would be possible to pay an ordinary dividend for the current year. The company's plant had been kept up-to-date. They had advanced from 1,500-kW sets to capacities of 16,000 and 18,750 kW, and they hoped during the next few months to place an order for a 25,000-kW set. At the same time their steam plant had been improved, and they were now working with high-pressure, high-temperature boilers with a capacity of 60,000 lb. per hour. That afternoon the Earl of Plymouth was to open the extensions to the power station which had been proceeding for the past four years. The directors intended to continue the improvement and in preparation were asking for an increase in the authorised capital from £850,000 to £1,100,000 and the conversion of certain ordinary shares into ordinary stock. Mr. Lewis said that now that the Electricity Act was on the Statute Book they would do their best to make it a success; they had confidence in the *personnel* of the Electricity Board.

The report and accounts were adopted, and at an extraordinary general meeting which followed the authorised capital was increased.

Indo-European Telegraph Co., Ltd.

In presenting the report for 1926 at the annual meeting on April 28th, Mr. H. L. M. Tritton (chairman), after referring to the successful working during the year, dealt with the question of radio-telegraphy. He said that, although remarkable use had been made of the discoveries in radio transmission, he was convinced that as the telegraphing habit grew, there would still be room for both wired and wireless communication, and, in his opinion, the cable and land-line companies would continue to hold their own. The company had introduced a number of special services which were much appreciated by the public. The difficulties attending the re-opening of the Black Sea cable had not yet been overcome, although no stone had been left unturned to restore direct communication between Odessa and Constantinople. Negotiations had been proceeding with the Turkish authorities, but had not yet reached finality; it was feared, also, that difficulty would be experienced in repairing the fault in the cable. In December last he (the chairman) paid a visit to Moscow, and interviewed the heads of the Russian Government telegraph and telephone services; he was courteously received, and hoped that his visit would prove of mutual benefit. He also went to the company's Odessa headquarters and met members of the British and Russian staffs. The chairman then reviewed the financial results, which were summarised in our last issue (p. 690), and the report and accounts were adopted.

Mexican Light and Power Co., Ltd.

Particulars have been published of a scheme for dealing with the arrears of bond interest and preference dividends. With regard to the 5 per cent. second mortgage bonds, the interest on which is about £750,000 in arrears, it is proposed to allot £7 10s. in cash for each £100 bond and £50 par value of bonds of the same issue. The arrears on the 6 per cent. cumulative income bonds ($3,532,757) will be satisfied by the allotment at par of 10-year unsecured notes bearing no interest but provided for by a sinking fund to the extent of $200,000 every half year. The holders of the 7 per cent. cumulative preference shares (the arrears of dividend on which amount to $5,670,000) are to receive new 4 per cent. cumulative redeemable second preference shares in the proportion of $95 of new shares for each $100 of existing shares. The new preference shares will be redeemed by means of a sinking fund. The board also proposes to convert the ordinary shares into shares of no par value. If the scheme is approved, it is thought that the company will be able to pay the current dividends on the two classes of preference shares and still have a surplus.

Vickers, Ltd.

Speaking at the annual meeting on April 29th, the chairman (General Sir H. A. Lawrence) referred to the losses engendered by the industrial disputes of the past year and to the steps taken by the directors to get rid of unremunerative subsidiary concerns. He said, *inter alia*, that the company's interests in Vickers-Petters, Ltd., had been sold; that company had not given any return for some years, and had involved additional finance. They had closed down the British Lighting and Ignition Co., Ltd., and the sale of the assets had realised more than the written-down book value. The Metropolitan-Vickers Electrical Co., Ltd., continued to progress; the overseas business had shown expansion and the net profit for the year had improved. Metro-Vick Supplies, Ltd., which had not shown the results which should have accrued from that branch of the business, had been reorganised, and now showed good possibilities of development. The chairman denied that there was any intention of amalgamating the company's business with that of Sir W. G. Armstrong, Whitworth & Co., Ltd., but said that conversations had taken place in order to ascertain whether some working arrangement could be made between similar departments of the two companies with a view to more economical production. There was, at present, nothing definite to report.

Chelsea Electricity Supply Co., Ltd.

The annual meeting was held on April 28th. Mr. W. R. Davies (chairman), who presided, in moving the adoption of the report and accounts (ELEC. REV., April 22nd, p. 651), referred to the reorganisation, and said that their dividends in future would be limited to 1s. 9.3d. per share until 1931, and to 1s. 4.8d. per share for the forty years thereafter, unless the reduction of charges below the standard price permitted the payment of more. Allowing for the bonus, the dividends stated represented 14.2 and 11.2 per cent. respectively on the old capital. After referring to the increased expenses of the past year, Mr. Davies said that the cost of electricity would be lower this year, and that would enable them to effect important reductions in their charges to consumers. The benefit of generation at large stations had still to be felt, but he was sure that the policy would be justified and that the consumers would benefit materially. That in turn would lead to an acceleration in the rate of increase of business. The report and accounts were approved and a resolution increasing the directors' remuneration was adopted.

Notting Hill Electric Lighting Co., Ltd.

The report for 1926, which is to be presented at the annual meeting on May 10th, shows a profit of £64,336 and after making various allocations, including interest, sinking fund, income tax, and £1,386 to the staff under the co-partnership scheme, there remains a balance of £29,113. After paying the preference and standard ordinary dividends, there is a balance of £7,594. Referring to the capitalisation of the reserves, the report says that the amount standing to the credit of the special reserve fund for capitalisation is £76,216, and to that will be added the company's share of the free reserves of the Kensington and Notting Hill joint undertaking Until the latter figure has been ascertained it is not proposed to deal with the capitalisation. It is proposed to issue during this year the balance of the preference shares (£56,000). With a view to the simplification of the capital account, it is proposed that the deferred shares shall be merged with the free reserves into ordinary shares, and that the two issues of preference shares shall be consolidated and made cumulative. Meetings of all classes of shareholders will be held after the annual meeting to give effect to these arrangements.

Anglo-American Telegraph Co., Ltd.

The report for the past year states that three quarterly dividends of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, and final dividends of £1 10s. per cent. on the ordinary stock, £1 10s. per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock have been paid. These payments, together with £52,500 for income tax, absorbed altogether £262,500, being the rent paid by the Western Union Telegraph Company for the year. The balance at credit of revenue account (£72,977) includes £7,352, interest received, and the balance of £65,625 is available for the payment of dividends for the quarter to March 31st, 1927. The directors have decided to apply the accumulated interest above mentioned, amounting to £7,352, to the creation of a capital reserve fund, and to credit that fund with all future interest received. The death of the chairman, Sir Herbert S. Leon, Bt., is recorded. Mr. R. H. Benson has been appointed chairman, and Lord Cochrane of Cults has been elected a director.

Brompton and Kensington Electricity Supply Co., Ltd.

Mr. H. R. Beeton (chairman) presided at the annual meeting on April 28th, and in presenting the report and accounts (ELEC. REV., April 22nd, p. 651), said that, although under the new conditions comparison was difficult, the company had continued to progress. They had not yet been able to enjoy the benefits of consolidated generation, but they had achieved a low relative cost per kWh generated. The general effect of the altered conditions had been to extend their

tenure until 1971. Up to 1931 the dividend on the present ordinary capital would be 8¾ per cent. and 7 per cent. thereafter, with the possibility of an additional benefit under the provisions of the sliding scale. The consumers were now even more interested in the progressive development of the undertaking, and he would urge upon them that the more electricity they used the cheaper it would become. They claimed to be pioneers in the provision of electricity for domestic purposes, and their showrooms contained a display of appliances unrivalled among supply companies. They had taken steps to form a staff superannuation fund; that would act as further incentive to the staff to promote the prosperity of the company. The report and accounts were adopted and additional remuneration was voted to the directors for their work in connection with the London Electricity (No. 2) Act, 1925.

West London and Provincial Electric & General Trust, Ltd.

The report for the 15 months ended March 31st last states that the remainder of the capital has been issued. The profit and loss account shows receipts of £14,621, and there is a profit of £10,918, to which is added £2,379 brought forward, making £13,297. It is proposed to pay a final dividend of 5 per cent., making 8 per cent. for the period, to place £2,500 to reserve, and to carry forward £3,059.

The annual meeting was held on April 29th. Mr. H. Kahn presided, and in moving the adoption of the report said that the balance sheet could not be compared with that for the previous period, nor could it be taken as a guide to future accounts. Over 67 per cent. of the company's investments came under the heading of electric light, power and tramways, the total value being £115,624. Included in that were £2,860 debentures of the Chiswick Electricity Supply Corporation, and practically the whole of that company's ordinary capital. Thus the future of the trust was largely bound up with that of the Chiswick Company; the latter had continued to make substantial progress and was an asset of great value.

Calcutta Electric Supply Corporation, Ltd.

The directors' report for 1926 shows that the amount of energy sold by the company rose from 100,587,227 kWh to 108,895,477 kWh. The net revenue, after providing about £137,000 for depreciation and renewals, was £330,240, as against £307,369 in 1925, when £115,000 was allocated to depreciation and renewals. The addition of £33,048 brought forward makes available £363,288, and after providing for debenture interest, preference dividend, &c., it is proposed to transfer £50,000 to reserve, £3,000 to insurance fund, and £1,000 to retiring gratuity fund; a final ordinary dividend of 7 per cent. is recommended, making 12 per cent. for the year, leaving £31,600 to be carried forward. It has been decided to capitalise part of the reserves and to issue 136,671 new ordinary shares to existing shareholders in the ratio of one to ten, fractions being paid in cash. The meeting was to be held on Wednesday last.

Cork Electric Tramways and Lighting Co., Ltd.

The annual meeting was held on April 22nd. Mr. A. R. Monks, who presided, said that owing to the high prices ruling during the strike they paid for their coal supply £14,600 more than they would have paid under their contracts. Of this amount only £4,500 was passed on to consumers, so that the net cost of the coal strike to the company was £10,000. The lighting and power business again showed a satisfactory increase. The Free State Electricity (Supply) Bill, 1927, gave exceedingly wide powers to the Electricity Supply Board which it was proposed to create to control the distribution of electricity in the Free State, and consequently the company's future was rather uncertain. The Electricity Board might desire them to take a bulk supply or it might decide to acquire the undertaking, which in the terms of the Bill they might purchase on the basis of paying a sum equal to the fair value of the undertaking as a going concern.

British Electric Traction Co., Ltd.

The directors propose to issue to ordinary stockholders, in the form of deferred ordinary stock, a portion of the amount standing to the credit of the undivided profits account equal to 10 per cent. on the ordinary stock. The existing ordinary stock will be converted into an 8 per cent. non-cumulative preferred ordinary stock, and the new stock will receive anything which but for the scheme the ordinary stock would have received above 8 per cent. While the preference stockholders remain unaffected, if the scheme is adopted they will receive for the past year an additional 2 per cent., making 8 per cent. for the year.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted:—

American Telephone and Telegraph Co.—$13,639,500 capital stock.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Ascot District Gas and Electricity.—357 six per cent. preference "E" shares of £10 each, fully paid, Nos. 13,144 to 13,500.

Chiswick Electricity Supply Corporation.—100,000 ordinary shares of £1 each, fully paid, Nos. 1 to 100,000.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the register and they are thereby dissolved:—

B. Barnett (Electrical Engineers), Ltd.
British Generator Co. (1922), Ltd.
British Homo. Wireless Co., Ltd.
Broadcasting Installations, Ltd.
Eclat Electrical Accessories (Paddington) Co., Ltd.
Electronic Devices, Ltd.
Hull Wireless Co., Ltd.
Prior's Television (Parent) Co., Ltd.
Radio Products, Ltd.
Reynard Electrical Co., Ltd.
Wilmore's Wireless, Ltd.
Wireless Enterprises, Ltd.

Mackay Companies.

The report of this group for 1926 records income and profits from investments of $4,922,811. Operating expenses absorbed $296,640, leaving $4,626,171, to which is added a surplus brought in, making $6,771,513. The dividends required $4,611,111, leaving a surplus of $2,160,402. It is stated that during the past 20 years all extensions have been made from reserves and earnings, and in the last six years no less than $25,000,000 has been spent on capital assets, including Atlantic cables. The Atlantic business continues to expand satisfactorily, but the net profit rises at a lower rate owing to the extended use of the low-rate services. The report shows that the group does not fear the competition of the "beam" system, and places great hope in the development of loaded cables.

Lanarkshire Tramways Co.

This company sustained a further loss on working of £11,568 during the past year; this is attributed to motor-'bus competition, local rates, the general strike, and the coal dispute. Several local authorities have prepared by-laws for the regulation of motor-'buses which, if enforced, should eliminate the loss on the company's services. The local rates are partly based on profits made during the period before motor-'bus competition set in, and the debit for the year in this direction was £6,500; the debit for the current year will be less than £1,000.

Reading Electric Supply Co., Ltd.

The revenue for the past year was £84,156, and the gross profit £33,875 (as compared with £39,329 for 1925). It is proposed to pay a dividend of 8 per cent. on the ordinary shares, as in the preceding year, leaving £2,781 to be carried forward. During the year an issue of £150,000 of 6 per cent. debenture stock was made to enable the balance of the 7½ per cent. debenture stock (£93,400) to be redeemed, and to provide further working capital; the issue was fully subscribed.

Provincial Tramways Co., Ltd.

The net revenue for the past year was £14,675, and to this is added £5,784 brought forward, making £20,459. After providing for debenture interest and sinking fund, there is a balance of £15,115. It is proposed to pay the preference dividend for 1924, leaving two years' dividend in arrears, and to place £6,000 to general reserve (making £32,787), leaving £3,116 to be carried forward. The capital expenditure during the year was £14,343, and it is estimated that £12,000 will be expended during the current year.

Swansea Improvements and Tramways Co.

The revenue for the past year was £137,160 (against £149,986). After meeting all expenses, including £20,000 for renewals, there is a balance of £7,560 (as compared with £13,847 in 1925). A balance of £7,968 brought forward is added, making £15,528. It is proposed to repeat the dividend of 6 per cent. and to carry forward £8,130. The reduction in revenue is, of course, attributable to the general strike and coal dispute.

International Automatic Telephone Co., Ltd.

An extraordinary meeting was held last week, when special resolutions were confirmed authorising the creation of 200,000 preference shares of £1 each; and providing for the cancellation of the option of Messrs. Theodore Gary & Co. upon the 170,338 issued preference shares, substituting an option to subscribe for an equivalent number of new shares at the same price, *viz.*, 21s. 6d. each.

Ever-Ready Co. (Great Britain), Ltd.

The directors recommend a final dividend of 5 per cent. on the preference shares, making the maximum of 10 per cent. for the year. The ordinary shares (including those issued in November last) are to receive a dividend of 25 per cent. The old shares received an interim dividend of 10 per cent.; the total is thus 35 per cent. for the year, as against 25 per cent. last year. The net profit was about £174,500 against £139,500.

Newmarket Electric Light Co., Ltd.

The report, which was presented at the annual meeting on April 25th, showed a net profit of £2,346, plus a balance brought forward of £608, making £2,954. A dividend of 8 per cent. was declared and £829 was carried forward.

New Issues.

County of London Electricity Supply Co., Ltd.—An issue of £4,250,000 of 5 per cent. debenture stock was made this week. The issue price was £96 per cent., and the stock is redeemable in 1972 at par. The stated objects of the issue were:—"To repay the loan from the company's bankers to provide funds for the extension of the Barking power house, and for further capital expenditure in the company's areas inside and outside the Administrative County of London, in order to cope with the developments taking place in every direction."

Rushden and District Electric Supply Co., Ltd.—The directors are offering to existing shareholders or their nominees an issue of 10,664 £1 shares at 24s. per share, in proportion to their holdings. The list closes on May 17th.

Urban Electric Supply Co., Ltd.

The balance of the 1926 net profit and loss account, after providing for debenture interest, &c., is £90,171. To this is added £18,683 brought forward, making £108,854. A total of £1,524 is devoted to the purchase of funded dividend certificates, £35,000 is placed to depreciation reserve, and £15,000 to general reserve. After paying a dividend of 7 per cent. on the ordinary shares, a balance of £19,548 is carried forward. Meeting: May 12th.

Columbia Gas and Electric Corporation.

The gross earnings for the year ended February 28th last were $92,850,286 and the net operating earnings $31,581,455, to which were added miscellaneous receipts of $3,460,444. The net income was $25,693,548. The directors have declared a quarterly dividend of $1.25 per share on the no-par value common stock, payable May 15th.

West Gloucestershire Power Co., Ltd.

The report for the past year shows that in the face of the industrial troubles of the period, the energy sold rose by 264,226 kWh to 7,423,673 kW, and the revenue by £8,363 to £45,760. During the year 50,000 participating preference shares of £1 each were issued, 30,000 of them to existing shareholders at par.

Craigpark Electric Cable Co., Ltd.

Out of the profit for the past year £2,000 is written off for depreciation, and it is proposed to pay a dividend of 7½ per cent. (against 12½ per cent.), leaving £1,585 to be carried forward.

City of Buenos Ayres Tramways (1904), Ltd.

A dividend of 1s. 3d. per share has been declared for the quarter ended March 31st.

German Companies.

The *Concordia Electricity Company*, Dusseldorf, reports net profits of 221,000 marks, against 239,000 marks in 1925, the dividend remaining at 5 per cent.

The report of the *Duisburg Cable Works Company* reports a net profit of 649,000 marks, as compared with 652,000 marks in 1925; the dividend is 8 per cent.

The *Emag Electricity Company*, Frankfort-on-Main, is increasing its dividend from 5 to 6 per cent., the net profit for 1926 having been 68,000 marks, against 53,000 marks.

The *Dr. Paul Meyer Company*, Berlin, reports net profits of 251,000 marks for 1926; the dividend is 6 per cent.

The *Mix and Genest Telephone and Telegraph Works Company*, Berlin, is paying 9 per cent., as against 6 per cent. in 1925. The ordinary share capital is to be raised by 2,500,000 marks to 9,500,000 marks.

The *Company for Electrical Undertakings*, Berlin, has declared a dividend of 10 per cent., as in 1925.

The *German Cable Works Company*, Berlin, reports that the works were well employed in 1926, and although sale prices were low, the value of the turnover was almost 50 per cent. greater than in the previous year. Besides the home contracts, large orders for h.p. and l.p. cables were received from abroad. A dividend of 6 per cent. (as in 1925) has been declared out of net profits of 381,000 marks.

The *Hartmann and Braun Company*, Frankfort-on-Main, states that a perceptible improvement took place in the second half of last year, but the working results could not be considered satisfactory. The net profits amounted to 216,000 marks, as compared with 122,000 marks in 1925, and the dividend is 8 per cent., as against 5 per cent. in 1925.

The *North German Cable Works Company*, Neukoln, reports net profits of 229,000 marks, as against 25,000 marks in 1925, and the dividend is 8 per cent., as against *nil* for 1925.

The *Felten and Guilleaume Carlswerk Company*, Cologne-Mulheim, reports that products last year included 50,000-V cables; and the development of cables for over 100,000 V had so far progressed that it was hoped to be able to introduce them on a large scale shortly. The company also laid last year a telephone and telegraph cable of a length of 165 kilometres between Holland and England, and executed large deliveries of telephone cable for other countries. The accounts show net profits of 4,102,000 marks, as against 4,077,000 marks in 1925, and the dividend is again 6 per cent.

The *Bergmann Electricity Works Company*, Berlin, reports net profits of 3,160,000 marks, as compared with 2,600,000 marks in 1925, and the dividend is 8 per cent., as against 6 per cent. in 1925.

French Companies.

The *Compagnie des Forges et Ateliers de Constructions Electriques de Jeumont* recommends an increase in the dividend from 20 fr. to 27.50 fr. per share for 1926; the *Compagnie Continentale Edison*, from 37.50 fr. to 40 fr.; the *Compagnie Générale de Télégraphie Sans Fil*, from 45 fr. to 50 fr.; the *Compagnie Radio-France*, from 30 fr. to 46.80 fr.; and the *Compagnie Radio-Orient*, from 30 fr. to 35 fr.

The *Société Française des Electrodes*, Lyons, proposes to pay a dividend of 12 per cent. for the past year.

The *Société de Construction Electrique*, Lyons, has decided to distribute 5 fr. per share out of the available surplus of 354,000 fr. for 1926.

The *Compagnie Française Thomson-Houston*, Paris, reports a credit balance of 30,326,000 fr. for 1926, as compared with 11,754,000 fr. in the previous year. It is proposed to apply 18,000,000 fr. to writing down purposes and to carry forward the balance of over twelve millions. If this recommendation is adopted the directors intend to pay a dividend of 20 fr. per share in the middle of this year.

Belgian Companies.

The *Société des Ateliers de Constructions Electriques de Charleroi* reports a net credit balance of 9,065,000 fr. for 1926, as against 7,159,000 fr. It is proposed to pay a dividend at the rate of 25 fr. (10 per cent.) per share as compared with 20 fr. in 1925.

The *Compagnie Générale de Railways et d'Electricité*, Brussels, reports net profits of 10,684,000 fr. for 1926, as compared with 7,945,000 fr. The dividend is 42.50 fr. per ordinary share, as against 40 fr.

The report of the *Société Générale Belge d'Entreprises Electriques* states that the net profit for 1926 was 7,420,000 fr., as against 4,783,000 fr. in 1925. It is proposed to pay a dividend of 60 fr. per share, against 55 fr.

Dutch Company.

The *Nederlandsche Kabelfabriek Maatschappij*, the Hague, reports a net profit of 1,082,204 guilders for the last financial year, as compared with 883,359 guilders in 1925. The dividend on the capital of 2½ million guilders is being increased from 21 to 24 per cent.

Austrian Company.

Brown, Boveri and Company, are paying a dividend of 12 per cent. out of net profits of 550,000 schillings, as compared with 10 per cent. in the previous year.

Stocks and Shares.

Monday Evening.

So long as monetary conditions give encouragement to the idea that there may be a reduction to 4 per cent. in the Bank Rate, so long is it certain that prices of investment stocks will remain what the Stock Exchange terms "good." The lowering of the minimum to 4½ per cent. on April 21st gave the signal for the unloosing of a flood of new issues; many of them of the best class and of substantial extent.

The County of London Electric Supply Company has offered 4¼ million pounds of 5 per cent. debenture stock at 96. The stock will be redeemable at 100 in 1972. Ample security, the prospectus shows, exists for the stock and its interest. The latter works out to £5 4s. 2d. per cent. on the money at the issue price of 96. The amount offered is a large one, but the County of London Electric board shows its faith in the public appreciation of the investment by the fact that the underwriting commission mentioned in the prospectus is no more than 1¼ per cent. For more than a year past there has been lively curiosity as to the shape which the long-expected County issue would assume, and occasional bouts of speculation occurred on the circulation of rumours now set at rest by this week's prospectus. No changes have occurred in the company's ordinary and preference shares.

Electric Supply Corporations are a strong market, with a net rise of 1s. 9d. to 32s. ex dividend. London shares are steady. Holders of electricity supply investments are watching with keen interest the anger aroused amongst gas consumers at the remarkable increase in most customers' bills presented for the March quarter. The gas companies' innocent surprise at the protests is observed with a certain twinkle of the eye. One result will infallibly be to turn public attention to electricity for cooking, and the practical exposition of its advantages, dwelt upon in the supplement to last week's Electrical Review, makes useful propaganda at a moment when gas customers are feeling sore and indignant with their current accounts.

The tendency of investment to look ahead in the purchase of shares in the provincial undertakings is again exemplified in to-day's price-lists. Newcastle-on-Tyne ordinary are 1s. up, Lancashires 6d., and several others have gained the turn.

Urbans have put on 1s. 6d., with a rise to 27s., although the dividend of 7 per cent.—the same as that of a year ago—led to a little disappointment. It had been thought that 8 per cent. might have been declared. Edmundsons at 26s. 9d. have gained a few pence.

Chiswick Electric Supply ordinary are maintained at 53s. 9d., at which price the return on the money is nearly 6 per cent. on the basis of last year's dividend of 16 per cent. This rate was paid also in 1925, following 15 per cent. for 1924 and 12½ per cent. for 1923. Richmond (Surrey) Electric ordinary can be bought at 30s., yielding 6 per cent. on the 1926 dividend of 9 per cent., which compared with 10 per cent. in each of the three preceding years. The reduction last year was due to the effects of the coal strike.

The new County of London 5 per cent. debenture is comparable to London Power 5 per cent. debenture, obtainable at 97½ ex the interest due a month ago. There is a small amount of Llanelly and District 5 per cent. first mortgage debenture on offer at 93, June and December interest, yielding £5 7s. 6d. on the money.

Tokio Electric 6 per cent. sterling bonds have shed two or three points, to 87½, in consequence of the recent financial crisis that disturbed the price of most Japanese securities.

Investment demand is at work amongst the cable stocks and shares. Eastern ordinary, Eastern Extensions and Globes are all better, although Globe preference parted from its gain of a week ago. Indo-Europeans are firm at 45½, the recent meeting producing a good impression. The chairman mentioned the curious fact that as there is no intermediate transmission, the actual time of transit of telegrams was practically nil between London and Karachi. The re-opening of the Black Sea cable, which will restore direct communication between Odessa and Constantinople, has not yet become practicable. Anglo-American Telegraph stocks are both better, on the issue of the report. The feature amongst telephones is a fresh jump in United River Plates, to £9. Bogota Telephones are firmer at 35s., and the company is making such progress as to suggest that the shares are a sound speculative investment of the lock-up order.

It may be noticed that we have removed Cuba Submarines from our weekly price-list. So little public interest is now taken in the shares that no purpose appears to be served by their regular quotation.

Wireless shares are quiet, and with the subsidence of the recent agitation, Marconis are left at 17s. 6d., nor is any fresh attention likely to be directed to them until rumour begins to sport with the dividend possibilities which are expected to materialise in the late autumn. Johnson and Phillips announce a profit for 1926 of £115,100, against £209,900 in 1925, and £162,000 in 1924. The dividend of 7½ per cent. makes 12½ per cent. for the year, against 17½ per cent., of which 7½ per cent. was paid on a smaller capital than the present £600,000. Reserve get nothing this time, and the carry-forward of £82,475 is £8,600 more than was brought in. The price of the shares remains at 47s. 6d., at which the return is 5¼ per cent. on the money. Report has it that the company is now very busy. Ever Ready (Great Britain) has done well, making a profit of £174,500 in the year just ended, an increase of £35,000 over 1925-26, and nearly £70,000 more than in the previous twelve months. The ordinary shares, after a dip to 4¼ sellers, braced up to 4⅜ on the dividend of 25 per cent., making 35 per cent. for the year. The 7 per cent. participating preference, which will receive their full 10 per cent., are quoted at 29s. 6d.

Brazilian Tractions, insatiably bought by Brussels, are up 3¼ at 143 ex dividend. Barcelona Tractions, on the report mentioned last week, are better at 53, and Sidros have gone ahead to 17¼.

Calcutta Electric Supply publishes an excellent report, the figures being extremely good. The previous dividend of 12 per cent. is to be repeated, and a bonus distribution, of one share for every ten shares held, will be made from reserves. The price of the old is better, on the announcement, at 44s. Calcutta Trams stand at 16s. La Plata Trams eased off to 4s. 1½d. The preference, at 20s., are ex the dividend of 1s. 6d. Anglo-Argentines reacted after their brisk advances. On the other hand, the Mexican Utility group is better, and fairly active speculation in Mexican Light preferred shares has raised the price to 108. It is of some interest—if only by way of showing what we can miss—to recall that Brazilian Tractions a year ago were 93, or 50 points below their present level.

Substantial improvements have been secured by the Underground Railway stocks, in which Metropolitans and Metropolitan Districts are included. Districts are 2½ to the good, and now stand no more than a point below "Mets.," while Underground £1 shares at 18s. 6d. have added another 1s., and occupy the proud position of paying 1⅝ per cent. to a purchaser. That the dividend will be shortly increased is of course taken for granted. Central London ordinary at 71 is 1 higher.

Babcocks have regained the dividend deducted last week from the price, and are 55s. ex dividend. Iron, coal and steel shares are mainly better, upon the improvement shown by the Vickers report and the hopes of better trade in the industry as a whole. The rubber share market is inanimate, and the reduction in the exportable allowance to 60 per cent., which comes into force this month, has been almost ignored so far as the prices of shares are concerned.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1925.	1926.	Price May 2, 1927.	Rise or fall.	Yield. p.c.
	£					
Bournemouth and Poole	1	14	14	£8/3xd	—	4 16 3
Brompton Ordinary	1	10	8⅜	25/6	—	7 5 3
Charing Cross Ordinary	1	15	8½	25/-	—	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	12	8⅝	25/-	—	5 12 0
City of London	1	15	10	1⅜	—	5 1 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	31/-	—	5 3 3
County of London	1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	26/9	+6d.	5 19 8
do. 7% Pref.	1	6	7	23/6	—	5 19 2
Elec. Supply Corporation	1	10	10	32/-xd	+1/9	6 5 0
Kensington Ordinary	1	15	8	25/-	—	5 12 0
Lancs. Light and Power	1	7½	7½	27/-	+6d.	5 11 1
London Electric	1	10	8½	24/-	—	5 16 8
do. do. 6% Pref.	5	6	6	5½	—	5 9 1
Metropolitan	1	11	8	28/6	—	4 18 3
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary	1	7	5	23/6	+1/-	4 5 1
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-xd	+6d.	5 9 1
St. James' and Pall Mall	5	17½	8	25/6	—	5 9 10
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1½	—	6 3 0
Urban Ordinary	1	4	7	27/-	+1/6	5 3 8
do. 6% Pref.	1	6	6	1⅛xd	+6d.	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	1	8	8	29/6	—	5 8 4

Home Rails.

Central London Ord. Assented	Stock	4	4	71	+1	5 12 8
Metropolitan	,,	5	3	64	+1½	4 13 9
do. District	,,	3½	3½	63	+2½	5 11 0
Underground Electric	£1	Nil	1½	18/6	+1/-	1 12 5
do. do. Income	Bonds	6	6	102	—	*5 17 8

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	101xd	+¼	5 19 0
do. Def.	,,	1½	1½	24⅛	+¼	6 3 9
Automatic Telephone	1	3	10	46/3xd	—	4 6 7
Chili Telephone	5	5	6	6⅞	—	4 13 2
Eastern Extension	10	10	10	17⅜	+⅛	*5 12 8
Eastern Tel. Ord.	Stock	10	10	175½	+1	*5 14 0
Globe Tel. and T. Ord.	10	10	10	18⅝	+⅛	*5 6 6
do. do. Pref.	10	6	6	10⅞	—⅛	5 10 4
Great Northern Tel.	10	20	20	27⅜	+½	7 4 0
Indo-European	25	8½	10	46½	—	*5 7 6
Marconi	1	Nil	Nil	17/6	—	... ...
Marconi-Marine	1	7½	8⅜	23/9	—	7 7 4
Oriental Telephone Ord.	1	12	12	52/6	—	*4 11 5
United R. Plate Tel.	5	8	8	9	+3/16	*4 9 0
Western Telegraph	10	10	10	17½	—	*5 16 0

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5⅝	3 1/16	—1/16	8 0 0
do. do. 2nd Pref.	5	6	6	3 11/16	—⅛	8 2 8
do. do. 5% Deb.	Stock	5	5	71⅛	—	7 0 0
British Electric Traction Ord.	,,	8	—	151	+1	5 6 0
do. do. 6% Pref.	,,	6	6	112	+3	5 7 2
Brazil Traction	100	5	6	143	+2	4 4 0
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	6⅜	6¼	117½	—	5 6 5
do. do. Deferred	,,	8	—	158	—	*5 1 3
do. do. Deb.	,,	4¼	4¼	80½	—	5 5 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	7/9	—	Nil
London United Tram. Deb.	Stock	4	4	51	—	7 16 10
Mexico Trams, 5% Bonds	—	5	5	75	+1½	6 13 4
Mexican Light Common	100	Nil	Nil	45		Nil
do. Pref.	100	Nil	Nil	108	+1	Nil
do. 1st Bonds	—	5	5	68½	—	7 6 0
Yorkshire (West Riding)	1	5	—	8/9	—	... ...

Manufacturing Companies.

Babcock & Wilcox	1	13	13	55/-xd	+1/6	4 14 6
British Aluminium Ord.	1	12½	10	44/6	—	4 10 0
British Elec. Transformer Pref.	1	Nil	7	18/3	+3d.	7 13 6
British Insulated Ord.	1	15	15	70/-	—	4 5 9
Brush Ord.	1	10	—	28/3	—	7 1 7
Callenders	1	15	—	3½	—	4 5 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	10	30/	—	6 13 4
Enfield Cable Pref.	1	7½	7½	1½	—	6 6 4
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	8	—	12/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	1	20	—	90/-	—	4 8 11
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1⅛	+5/32	*4 9 0
Johnson & Phillips	1	17½	12½	2⅜	—	5 5 3
Met.-Vickers Ord.	1	8	8	27/6	—	5 11 4
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	7½	—	26/9	—	5 12 2
Telegraph Construction	12	10	10	28½	—	4 4 2

* Dividends paid free of Income Tax.

Swiss Foreign Electrical Trade.

THE following statistics, showing the import and export trade of Switzerland in electrical and allied goods in 1926 have been taken from the recently-issued official trade returns. The figures for 1925 have also been given, and notes added of any increases or decreases. The returns show the most important but not all the countries of origin or destination of the goods. An asterisk has been placed where the absence of a figure means not necessarily that there has been no trade but that it has been of comparatively slight importance in the year indicated; in such cases the precise increase or decrease cannot be given.

The sixteen classes of imports which are set out in our list form an aggregate of 21,088,000 fr. for 1926, as compared with 19,940,000 fr. in the preceding year. The most important class, telegraph and telephone apparatus, is the one which showed the greatest rise. The class second in order, unspecified electrical apparatus, showed the greatest decrease. Great Britain's share of the imports of the classes shown fell from 2,831,000 fr. in 1925 to 2,089,000 fr. in 1926; this decrease was accounted for mainly by the decline in our supplies of unspecified electrical apparatus. Switzerland's electrical exports in the fifteen classes shown in the list increased in the aggregate from 73,159,000 fr. in 1925 to 75,030,000 fr. in 1926. There was a small decline in the largest class, *viz.*, dynamo-electric machines and electric transformers of all kinds, and the value of exported meters also fell. The machinery and unspecified apparatus classes showed increases. The share of the United Kingdom in Swiss exports of the classes specified declined from 6,574,000 fr. in 1925 to 5,786,000 fr. in 1926. The figures show that Switzerland has a very substantial balance in her favour in her foreign electrical trade—of the order of 50 million fr. in each of the two past years. This is reflected in the figures of the trade with this country; Switzerland's exports to Great Britain exceeded the imports from this country by about 3,700,000 fr. in each year.

Imports.

	1925. Thous. fr.	1926. Thous. fr.	Inc. or dec. Thous. fr.
Electrical cable, not insulated—			
Total	75	254	+ 179
From Germany	50	87	+ 37
,, France	15	19	+ 4
,, United States	*	146	—
Insulated cable not lead covered or iron armoured—			
Total	500	404	− 96
From Germany	290	302	+ 12
,, France	29	22	− 7
,, Italy	5	4	− 1
,, Belgium	139	57	− 82
,, Holland	4	*	—
,, United Kingdom	29	11	− 18
Cable covered with lead—			
Total	289	389	+ 100
From Germany	287	388	+ 101
Cable covered with lead and iron armoured—			
Total	198	200	+ 2
From Germany	55	195	+ 140
,, Italy	52	1	− 51
,, France	90	3	− 87
Cable insulated with rubber or paper and covered with textiles—			
Total	866	694	− 172
From Germany	355	293	− 62
,, Italy	36	32	− 4
,, France	12	19	+ 7
,, Belgium	304	101	− 203
,, Holland	136	215	+ 79
,, United Kingdom	*	17	—
Cable ditto covered with lead—			
Total	383	520	+ 137
From Germany	215	201	− 14
,, Belgium	44	139	+ 95
,, Italy	13	3	− 10
,, United Kingdom	85	92	+ 7
Dynamo-electric machines and electric transformers—			
Total	1,787	1,957	+ 170
From Germany	1,064	1,011	− 53
,, France	241	387	+ 146
,, Italy	62	92	+ 30
,, United Kingdom	87	157	+ 70
,, United States	103	149	+ 46
,, Belgium	87	25	− 62
,, Holland	*	107	—
Accumulators, batteries, electrodes in combination with rubber or celluloid—			
Total	1,676	1,952	+ 276
From Germany	702	698	− 4
,, Italy	120	86	− 34
,, France	400	419	+ 19
,, United States	71	148	+ 77
,, Austria	95	137	+ 42
,, United Kingdom	262	410	+ 148
Accumulators, &c. (other)—			
Total	224	314	+ 90
From Germany	94	139	+ 45
,, France	57	77	+ 20
Steam engines, cranes, pumps, turbines, &c.—			
Total	475	246	− 229
From Germany	401	157	− 244
,, United Kingdom	48	44	− 4
,, France	5	32	+ 27
,, United States	8	*	—
Electric arc lamps—			
Total (mainly from Germany)	28	26	− 2
Electric incandescent lamps, mounted—			
Total	2,400	2,318	− 82
From Germany	636	613	− 23
,, Austria	184	254	+ 70
,, Holland	1,274	1,072	− 202
,, France	96	139	+ 43
,, Hungary	183	170	− 13
Insulators, mounted—			
Total	119	601	+ 482
From Germany	88	119	+ 31
,, United States	7	294	+ 287
,, Denmark	10	142	+ 132
Electric meters—			
Total	571	626	+ 55
From Germany	504	495	− 9
,, France	38	63	+ 25
Telegraph and telephone apparatus—			
Total	5,923	7,085	+1,162
From Germany	3,342	2,597	− 745
,, United Kingdom	512	351	− 161
,, Sweden	12	119	+ 107
,, France	484	1,161	+ 677
,, Belgium	1,318	2,395	+1,077
,, United States	*	180	—
Electrical apparatus not elsewhere mentioned—			
Total	4,426	3,502	− 924
From Germany	1,913	1,864	− 49
,, France	324	292	− 32
,, United Kingdom	1,808	1,007	− 801
,, United States	57	80	+ 23
,, Holland	*	81	—

Exports.

	1925. Thous. fr.	1926. Thous. fr.	Inc. or dec. Thous. fr.
Dynamo-electric machines and electric transformers of all kinds—			
Total	28,077	26,828	−1,249
To Germany	1,986	2,165	+ 179
,, Austria	688	580	− 108
,, France	4,133	2,221	−1,912
,, Italy	2,313	1,817	− 496
,, Belgium	1,479	872	− 607
,, United Kingdom	1,520	1,243	− 277
,, Egypt	383	267	− 116
,, Spain	2,572	3,044	+ 472
,, British India	223	34	− 189
,, Poland	1,460	904	− 556
,, Rumania	249	755	+ 506
,, Colombia	18	13	− 5
,, Brazil	1,101	1,374	+ 273
,, Argentina	1,074	967	− 107
,, Netherlands	1,170	1,907	+ 737
,, Norway	922	438	− 484
,, Netherlands Indies	311	482	+ 171
,, China	196	231	+ 35
,, Japan	1,570	1,544	− 26
,, Peru	336	162	− 174
,, Australia	654	714	+ 60

	1925. Thous. fr.	1926. Thous. fr.	Inc. or dec. Thous. fr.
Accumulator batteries, electrodes in combination with rubber or celluloid—			
Total	164	207	+ 43
To France	47	121	+ 74
,, Italy	38	10	− 28
,, United Kingdom	1	2	+ 1
,, Poland	1	4	+ 3
,, Germany	30	40	+ 10
Accumulators, &c. (other)—			
Total	145	36	− 109
To France	6	1	− 5
,, Italy	1	*	—
,, United Kingdom	74	1	− 73
,, Brazil	27	3	− 24
,, Spain	*	11	—
,, Turkey	*	4	—
Insulators, mounted—			
Total	109	167	+ 58
To Germany	14	7	− 7
,, France	7	5	− 2
,, Italy	58	91	+ 33
,, Spain	5	19	+ 14
,, United Kingdom	2	1	− 1
,, Norway	*	11	—
,, Argentina	*	16	—
Electric cable, not insulated—			
Total	1,433	1,455	+ 22
,, France	436	847	+ 411
,, Austria	95	35	− 60
,, Italy	33	35	+ 2
,, United Kingdom	660	405	− 255
,, Norway	22	9	− 13
,, Jugo-Slavia	34	*	—
,, Czecho-Slovakia	53	84	+ 31
Insulated cable, not lead covered or iron armoured—			
Total	919	900	− 19
To France	25	111	+ 86
,, United Kingdom	701	521	− 180
,, Denmark	5	*	—
,, Austria	14	11	− 3
,, Sweden	16	5	− 11
,, Hungary	19	46	+ 27
,, Egypt	45	15	− 30
,, Peru	*	4	—
Cable, lead covered—			
Total	16	36	+ 20
To France	10	*	—
,, Rumania	*	10	—
,, Venezuela	*	18	—
Cable, lead-covered and iron armoured—			
Total	35	8	− 27
To France	*	1	—
,, Jugo-Slavia	14	*	—
,, China	10	*	—
,, Brazil	1	*	—
,, Spain	*	4	—
Cable, insulated with rubber or paper and covered with textiles—			
Total	322	201	− 121
To France	40	32	− 8
,, Belgium	172	1	− 171
,, United Kingdom	35	2	− 33
,, Denmark	55	129	+ 74
Electric locomotives—			
Total	2,141	2,354	+ 213
To United Kingdom	156	50	− 106
,, South Africa	*	620	—
,, Japan	490	387	− 103
,, France	1,489	3	−1,486
,, Venezuela	*	445	—
,, Chile	*	848	—
Telegraph and telephone apparatus—			
Total	582	640	+ 58
To France	80	156	+ 76
,, Italy	68	80	+ 12
,, Germany	78	52	− 26
,, Spain	14	11	− 3
,, Dutch East Indies	40	*	—
,, Greece	25	48	+ 23
,, United Kingdom	39	23	− 16
,, Belgium	*	74	—
,, Egypt	*	38	—
Electric incandescent lamps, mounted—			
Total	2,300	1,464	− 836
To Austria	1	—	− 1
,, France	1,050	1,120	+ 70
,, Italy	1,080	269	− 811
,, Portugal	2	10	+ 8
,, Germany	26	5	− 21
,, Norway	19	4	− 15
,, Algeria	1	17	+ 16
,, Greece	36	*	—
,, United Kingdom	23	13	− 10
Steam engines, cranes, pumps, turbines, &c.—			
Total	14,480	17,729	+3,249
To Germany	286	558	+ 272
,, France	2,354	2,078	− 276
,, Belgium	2,170	1,163	−1,007
,, Holland	592	1,419	+ 827
,, British India	344	120	− 224
,, Japan	989	2,850	+1,861
,, United Kingdom	1,560	1,739	+ 179
,, Spain	396	204	− 192
,, China	118	456	+ 338
,, Argentina	1,746	1,829	+ 83
,, Egypt	152	123	− 29
,, Rumania	79	322	+ 243
,, Russia	89	*	—
,, Portugal	17	160	+ 143
,, Colombia	*	3	—
,, Chile	*	49	—
Electric meters—			
Total	12,300	10,543	−1,757
To Germany	565	389	− 176
,, Austria	265	288	+ 23
,, France	2,733	1,579	−1,154
,, Italy	1,119	1,183	+ 64
,, United Kingdom	1,337	1,270	− 67
,, Belgium	1,301	1,227	− 74
,, Spain	1,035	700	− 335
,, Japan	727	212	− 515
,, Netherlands	340	472	+ 132
,, Czecho-Slovakia	565	779	+ 214
,, Australia	467	421	− 46
,, United States	*	501	—
Electrical apparatus not elsewhere mentioned—			
Total	10,136	12,462	+2,326
To Germany	423	674	+ 251
,, Austria	468	938	+ 470
,, France	1,504	1,693	+ 189
,, Italy	658	669	+ 11
,, Belgium	1,408	1,327	− 81
,, Netherlands	401	591	+ 190
,, United Kingdom	466	516	+ 50
,, Spain	833	1,493	+ 660
,, Portugal	168	187	+ 19
,, Norway	101	120	+ 19
,, Czecho-Slovakia	469	818	+ 349
,, Egypt	232	183	− 49
,, China	62	61	− 1
,, Japan	334	181	− 153
,, United States	1,110	886	− 224
,, Argentina	271	477	+ 206
,, Peru	36	112	+ 76
,, Rumania	60	176	+ 116
,, Poland	230	258	+ 28

* Not specified.

The F.B.I. and the Abolition of the D.O.T.

The proposed abolition of the Department of Overseas Trade was considered by the Grand Council of the F.B.I. on April 27th, and resolutions were passed recording the appreciation of the Federation of the valuable services rendered to industry and commerce by the Department and its officers abroad. The Federation considers that the maintenance of many of the functions of the D.O.T. is essential, as their abolition would seriously prejudice industrial and commercial interests, and in particular that it is essential that adequate arrangements should be made for the collection and recording by the Government of information regarding such subjects as foreign tariffs, Customs regulations, &c. The hope was expressed that the services of the commercial diplomatic officers and trade commissioners abroad should be retained. It is realised that there is a need for the strictest economy in Government expenditure, and the F.B.I. offered to help the Government to secure economy with the least possible injury to national interests. The Federation desires to have an early opportunity of laying its views before the Government, and of ascertaining its proposals as to the future of the Department. A committee, chosen from amongst the past presidents of the Federation and members of the Overseas Committee, has been appointed by the Council to carry the matter further.

Modern Stage Lighting.

Some interesting features of the new equipment introduced by Messrs. Holophane, Ltd.

FROM the scientific point of view theatre stage lighting has been sadly neglected in the past, with the result that to-day in many theatres obsolete and crude equipment is still to be found. Some recent developments in this connection should, however, contribute towards remedying this, including the equipment recently introduced by Messrs.

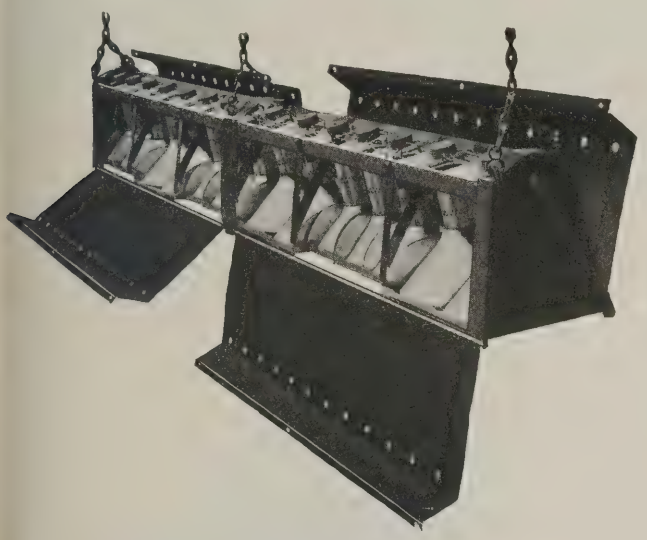


Fig. 1.—Holophane Stage-lighting Batten.

Holophane, Ltd., of which we have obtained the following particulars. This new apparatus is designed to assist, and not neutralise, the artistic efforts of the craftsmen, the required intensity of light being obtained from comparatively only a few lamps used in conjunction with scientifically designed reflectors, which utilise and distribute the light in such a manner that only a very small proportion of the current consumption usually required for the open-type batten is necessary, and which give a good intensity and distribution of light in the direction of the wings.

The equipment is made up in two sizes in standard lengths of 4 ft., the width of the larger size being 11 in. The actual lighting fittings are contained in an iron frame-

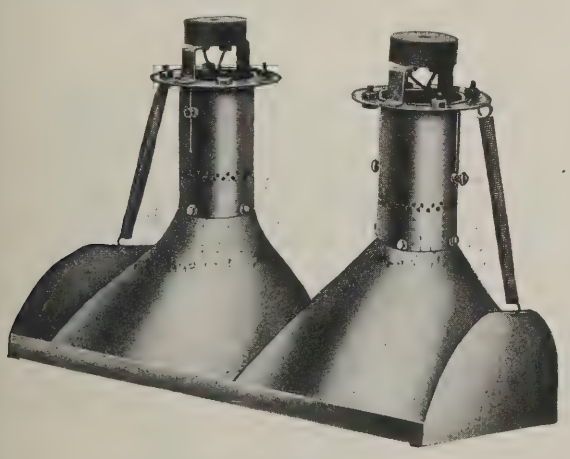


Fig. 2.—Special Reflector Unit.

work, fig. 1, about which are folded protecting doors, covering the whole length of each section, which are hinged at the bottom so as to allow them to drop downwards. The doors are fastened at the top by special clips, and can be opened in a few seconds. With the exception of the bottom of the equipment, the whole is enclosed by the doors, which are quite plain, so that the exterior is free from any projections which might get caught in the scenery.

The lampholders are insulated from the metal of the casing, while the insulated cables connecting them to the terminal blocks are additionally protected by insulating beads. They are so constructed that they can be taken out together with the connecting cables without disturbing the supply circuit; alternatively, a circuit can be rewired without touching the holders or the connecting cables.

Fig. 2 shows a special reflector-unit which can be supplied for ensuring that, in the event of a lamp burning out, the distribution of light will remain the same, and so produce no bad effects on the scenery. Similarly, by a combination of these reflectors the bad effects from the failure of a whole circuit or a number of individual lamps can be guarded against.

Holophane clear prismatic glass reflectors, specially designed for the conditions under which they are employed, are installed in the special casings. Fig. 3 shows one of these reflectors, the construction of which, it is claimed, ensures that the rays of light are split up and diffused in such a manner as to avoid the striation effect due to the image of the lamp. Further, it is claimed that the light distribution is such that no matter whether a backcloth is fixed close to a batten or at some distance away, it may be lighted efficiently from top to bottom without assistance from floats or proscenium drops. Each reflector is provided with a special opaque covering shrunk over the outside, fig. 3, which keeps all dust and dirt from the prismatic surface, and at the same time prevents the glassware from being shattered, even if it is violently knocked. The reflector housing is made up of a terminal block, canopy, lampholder, reflector, and a frame at the base for the colour screens. The units can be placed in any part of the batten, and the spacing between them adjusted to suit the requirements of the par-

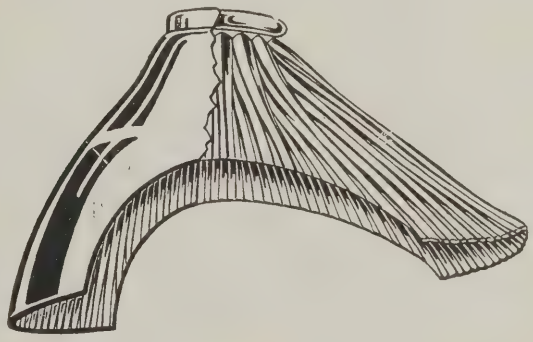


Fig. 3.—Prismatic Glass Reflector.

ticular stage to be illuminated. The parts of each unit may be rapidly dissembled, but it is impossible, it is claimed, for them to come apart of their own accord. Each unit is provided with a simple focusing device which ensures that the best results are obtained from the reflectors and allows of the use, within certain limits, of different sizes of lamps.

It is interesting to note that the advantages and features of the apparatus described above have been embodied in Holophane footlight equipment. The reflectors are built into similar units and housed in a suitable framework. Of course there are certain modifications in this apparatus to meet the necessarily different requirements.

A Severe Lamp Test.

The Edison Swan Electric Co., Ltd., has sent us a copy of a letter it received recently from the Sign Construction Co., Ltd., which indicates how the modern electric lamp will withstand long and hard service. Referring to some Royal Ediswan lamps which were picked out at random from a sign employing about 400 lamps, the Sign Co. mentions that they have been working for approximately 4½ years with an average illumination period of 1,500 hours per annum. The lamps have been used in a horizontal position and subjected to considerable traffic vibration and the usual rough handling during periodical overhauls of the sign. It is calculated that each lamp had been flashed at least 250,000 million times. The lamps had lost nothing of their illumination and there was no appreciable filament sag.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Treble-Scale Miniature Instrument.

Fig. 1 shows a new miniature milliammeter which has been put on the market by Messrs. A. H. Hunt, Ltd., Tunstall Road, Croydon. The normal range of the instrument is, as indicated on the scale, 0-5 mA; but by means of two

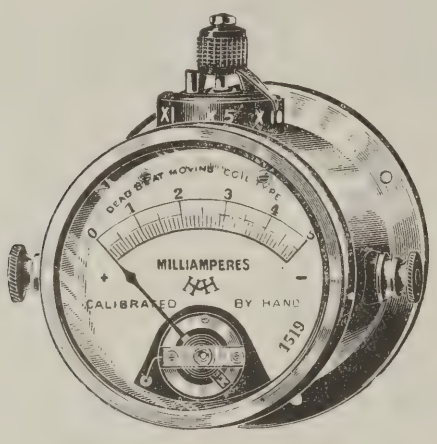


Fig. 1.—Miniature Milliammeter.

shunts which are enclosed within the instrument case, and which are controlled by the indicating knob at the top, twice or five times the normal reading range can be obtained.

A Rectifier for Ultra-Violet Apparatus.

A distinct disadvantage to the user of electro-medical apparatus for the production of ultra-violet rays has been the cost of the necessary converting equipment in cases where only an a.c. supply is available. This has to a considerable extent been overcome by means of a new rectifier apparatus which has been put on the market by the Medical Supply Association, Ltd., 167-185, Gray's Inn Road, London, W.C.1. The set embodies a 4-cell electrolytic-type rectifier, the cells being connected up in the well-known Gratz method, an auto-transformer, and the necessary switchgear and connecting terminals. The cells are housed in a convenient polished-wood box, to the outside of which is attached the transformer. The apparatus is used in conjunction with a specially

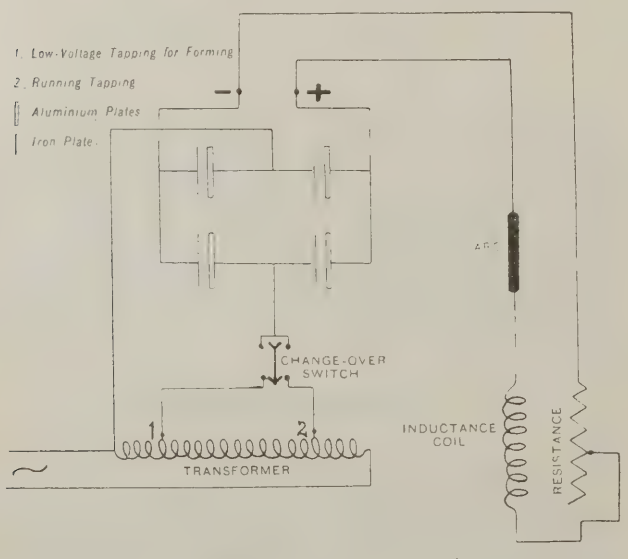


Fig. 2.—Rectifier and Lamp Connections.

designed induction coil, placed in series with the arc, which smoothes out the d.c. wave from the rectifier sufficiently to allow either mercury-vapour lamps or tungsten arcs to work satisfactorily on it. Fig. 2 represents the arrangement of the various parts of the rectifier and the lamp when in use. The function of the auto-transformer is to supply a low pressure for forming the plates before use; the change-over switch provides for the necessary alterations of the connections.

Illuminated Flowers.

Artificial flowers with small electric bulbs concealed in the blossoms are a recent creation, for the decoration of car interiors, of the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2. They are supplied in sprays consisting of either one iris, two roses, three cape gooseberries, three daffodils, or three fuchsias. The whole of the material and labour employed in the manufacture of these illuminated flowers is British. When unlighted they are claimed to be indistinguishable from natural blossoms. They are supplied with standard Osram steering-pillar lamps. The current consumption is a negligible quantity, being in most cases less than that of one sidelight lamp. The illumination from one spray is claimed to be sufficient to render entering or alighting from the car a safe procedure, and when placed in the rear corners of the saloon, they furnish an adequate reading light.

An Electric Vulcanising Bath.

We have received from Messrs. Electric Fires, Ltd., Heatrae Works, Norwich, some particulars of an electric paraffin-wax vulcanising bath, fig. 3, which they have recently placed on the market. It is intended primarily for use in

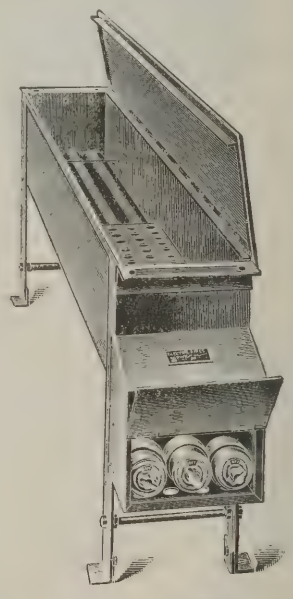


Fig. 3.—Electric Vulcanising Bath.

mines and large factories where repairs to cables have to be carried out on the job. The apparatus consists essentially of a welded steel trough with three 2-in. steel tubes fitted near the bottom, in which are contained removable heating units. The tubes are covered by a perforated grid to prevent the cables coming into contact with them. A light-steel cover is provided for the bath; this is not hinged as suggested by the illustration, but is entirely removable by means of two handles. The heating elements are controlled by 3-heat switches, which are conveniently housed in a box attached to the side of the apparatus. The internal dimensions of the bath are 5 ft. by 9 in. by 10 in. deep. The maximum loading is 9 kW, and the elements are of equal capacity. It is claimed that on the total loading the wax can be melted and raised to 300 deg. F. in one hour. The bath can be supplied to suit any supply pressure up to 600 V, d.c. or a.c. Cable clamps are provided at each end of the trough.

An Egg-Cleaning Machine.

Another use, this time in the cleaning of eggs, has recently been added to electricity's long list of practical applications. The new method, it is said, has greatly reduced the cost of handling and packing eggs at Petaluma, California, U.S.A., a city frequently referred to as the "Nation's Egg Basket." It is in adding that final touch of perfect cleanliness that electricity has made its latest triumph; formerly this was done by hand, an experienced egg cleaner being able to perform ablutions upon about seven cases of eggs a day. After much experimenting, engineers of the General Electric Co. of America applied an electrically operated centrifugal compressor which directs a blast of sand upon a continuous procession of eggs, moving on an automatic conveyor. The blast

f sand removes all extraneous substance immediately, and mparts a fine, even finish to the most untidy egg. The irect results of this innovation in the egg industry have been o increase the speed of cleansing eggs by 80 times, to reduce reakages to a minimum, and to do a much better job—in hort, to place cleaner and finer eggs in the kitchens of merica.

A Double-Time-Lag Device.

A recent production of Mr. GEORGE ELLISON, Perry Barr, Birmingham, is an adjustable double-time-lag device, figs. and 5, for motor-control circuit breakers. This is designed to vercome the difficulty where the setting is such as to restrain he releases for a time long enough for the motor to run ıp to speed, but the time is excessively long on ordinary verloads. The apparatus is of the ordinary oil-dash-pot type, ut has a by-pass valve fitted in position. The valve closes nder the relatively heavy pull caused by the motor-starting urrent, and this action has the effect of increasing the time f retardation long enough for the motor to run up to speed. When the heavy starting current has subsided, the valve

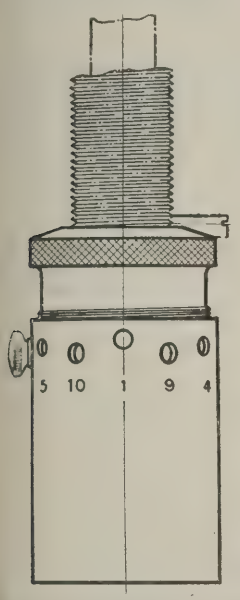


Fig. 4.—Double-Time-Lag Device.

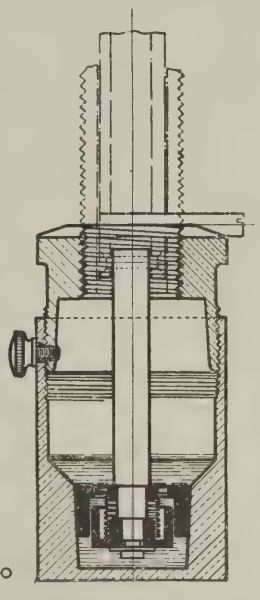


Fig. 5.—Sectional View.

n the piston opens, when the piston is able to rise in a reasonably short time on normal overloads. As the lag has an inverse time element both during starting and running, it releases almost instantaneously on short circuit under both conditions. The device should prove useful on circuit breakers protecting coal cutters, where peaks occur of the magnitude of starting currents, but the breaker must not trip unless the excessive load is sustained. A number of different settings permit a wide range of retardation to be obtained, a screw being provided to lock the cylinder in any desired setting.

An Electric Bathroom Fire.

The accompanying illustration, fig. 6, is of the "Xcel" bathroom fire, a recent introduction of MESSRS. SIEMENS AND ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames

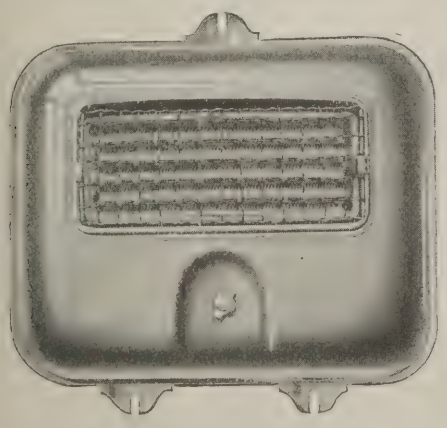


Fig. 6.—Electric Bathroom Fire.

Street, London, E.C.4. It has been designed in response to the demand for a low-consumption fire for use in the bathroom, corridors, and so on. The body is of clean cast-iron, finished in porcelain ivory enamel, and the casing is washable. The switch is sunk into a recess, with only the porcelain knob projecting. The element is of the maker's standard "1607 type, and is protected by a neat guard. Suitable lugs provide for wall fixing, and small projecting pieces keep the fire from the wall. An earthing screw is provided. The loading is 750 W.

Junior Institution of Engineers.

Annual Dinner.

THE annual dinner of the Junior Institution of Engineers was held at the Monico Restaurant, London, on April 26th, when Engineer Vice-Admiral Sir Robert B. Dixon, K.C.B., president of the Institution, took the chair.

Following the honouring of the loyal toast, Brig.-Gen. P. R. C. GROVES, C.B., proposed "The Institution." He referred to the backwardness of this country in developing aviation, and criticised the policy adopted of waiting for a more reliable and economical form of engine. He believed it would be right in this country to subsidise research as was done in other countries. Where an air line had been established along the West Coast of Australia the population had been doubled. Aviation would assist to distribute our population, and as it was developed it would increase the demands on other forms of transport. Scepticism was the greatest barrier to development; it had been to every form of transport. He looked forward to the time when there would be an engineering department in the Air Force, having a trained engineer at its head with a seat on the Council. One of the roots of backwardness had been neglect of the engineering side.

In reply, Mr. R. L. KIRLEW, chairman of the Institution, said that the members of the Institution were associated with all branches of engineering, and were alive to their own possibilities. They would endeavour to solve the difficulties of the Air Ministry. The membership of the Institution was approaching 1,700, and the applications were increasing. The financial position was also good, and they were going ahead.

Mr. H. T. TIZARD, C.B., proposed "The Engineering Industry." He said the engineer was always to the fore in the battle of progress. The hard part of the work often began after the laboratory research was done. At no time was the need for the engineer greater than at present, and at no time were the opportunities greater. The motor cycle and wireless were proving incentives, and great educational work was going on in those directions. Referring to the engineering work of the Navy, he said that Sir R. Dixon had the duty of applying progress to satisfy the exacting demands of the Service; perhaps, if we knew the results achieved, we would pay the taxes more readily.

Sir R. DIXON, responding, said that the engineering industry was passing through an unparalleled period of depression which must soon pass away. One good effect of such a depression was that it showed up the faults and where economies could be effected. The training of engineers and skilled mechanics was of the utmost importance to this country. The status of the engineer depended on his general education. A good general education broadened the view of the engineer and opposed the somewhat narrowing tendency of the purely technical training. It was difficult at present to get apprentices for mechanics; it was necessary to encourage a good class of apprentice in the skilled trades. Engineering in the past had been largely a matter of rule of thumb, but now a technical education was necessary, and also a knowledge of physics, chemistry and metallurgy. Research work was better provided for in other countries, with the result that inventions of British origin were often developed and exploited in other countries. Industry would not prosper without proper co-ordination between employer and employed, and every effort should be made to dissipate any misunderstanding between the parties. Once distrust was overcome the revival of the engineering industry would be remarkably quick.

In proposing "Our Guests," Mr. H. P. WRIGHT, vice-chairman, warmly welcomed the visitors present, and the toast was responded to by Sir Henry Fowler, K.B.E., president of the Institution of Mechanical Engineers, and Sir Murdoch Macdonald, K.C.M.G., president-elect of the Institution. Sir HENRY said that the Junior Institution was giving the engineer the opportunity to express himself. The whole country was depending upon the engineer who was materially concerned with transport. Sir MURDOCH said that in the political world matters of engineering were constantly turning up, and members with interest in the engineering industry should be in the House.

Mr. W. M. HURRELL, vice-chairman, proposed "The Chairman," commenting on the success of the evening, which was due largely to Sir R. Dixon.

In his reply Sir ROBERT paid a tribute to Mr. Riddell, the secretary, from whom he had received great help.

Mr. RIDDELL replied, and commented on the existing comradeship in the Institution ranks.

Sir HENRY FOWLER proposed "Our Hosts," and this was supported by Capt. W. C. Watts, Naval Attaché, American Embassy. Capt. WATTS said that engineering on each side of the Atlantic would progress together. There would be a great impetus to the industry within the next few years.

Mr. W. A. TOOKEY replied to the toast.

Selected artistes rendered items between the speeches, adding to the general cheeriness of the evening.

Economic Value of Increased Steam Pressure

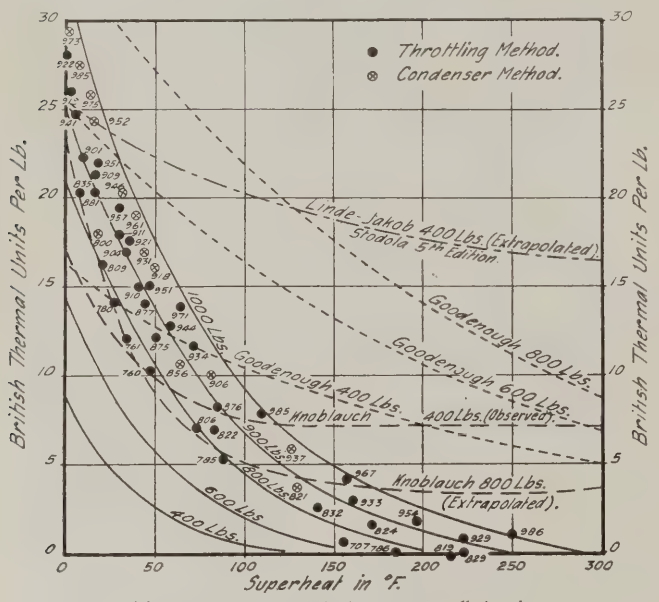
Some results of investigations on the effects of steam-pressure increase on operation and plant efficiencies and costs, with considerations on the selection of particular pressures.

By H. L. GUY.

(*Abstract of a Paper read before the* North-Western Branch *of the* Institution of Mechanical Engineers.)

(*Concluded from page* 699.)

In his last report, Prof. Callendar carried the work up to a pressure of 1,000 lb./sq. in., and observations have since been made up to nearly 2,000 lb. Fig. 7 shows the difference between the observed total heat of steam and that given in Callendar's tables, the latter value being the greater. Prof. Callendar has suggested that the discrepancy may be due to the lag which takes place in his experimental apparatus as the steam is rapidly heated in the superheater. It is questionable whether the actual conditions met with in the operation of power plant are not identical with those of Prof. Callendar's experiments. In all probability such modification in the estimates of thermal efficiency as may be necessary when the experimental work has been completed will probably be of such a nature as to slightly decrease the gains to be expected from increased pressure.



The numbers indicate absolute pressure, lb./sq. in.

Fig. 7.

In order to arrive at the effect on thermal efficiency of the use of regenerative feed heating, several pressures from 200 lb. to 2,000 lb./sq. in. were chosen, and an investigation made from which a series of curves of the type shown in fig. 8 were deduced for turbines designed for 600 lb. working. It was assumed that the total temperature rise was equally divided between the feed heaters, that the feed water leaving any heater reached a temperature 10 deg. F. less than the temperature of the steam supplied to that heater, that the mechanical efficiency of the turbine was 98 per cent., and that the radiation coefficient was 1.05. The full-line curves hold for boiler plant having an economiser, but no air heater; and those in dotted lines apply to a boiler plant fitted with both an economiser and an air heater, the latter being so proportioned that as the temperature of the gases leaving the econo-

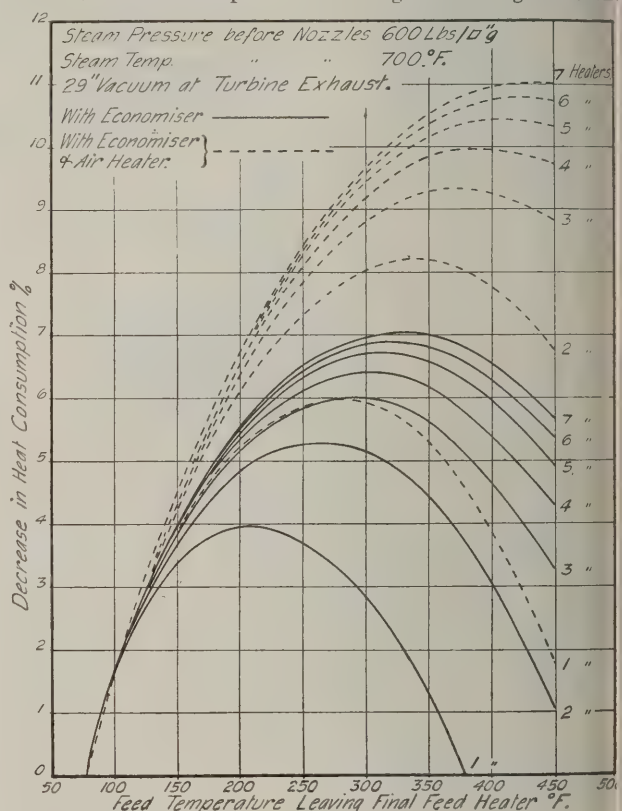


Fig. 8.

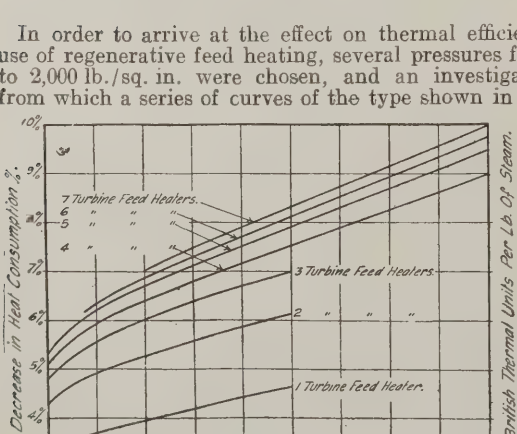


Fig. 9.

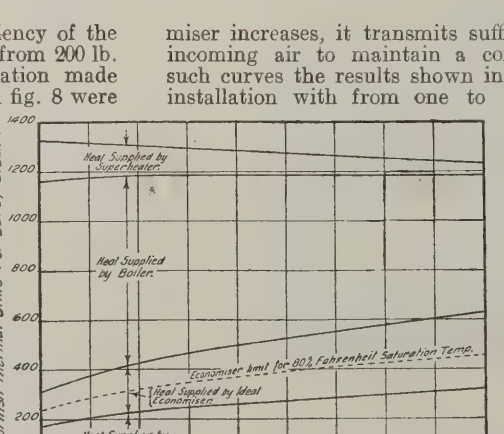


Fig. 10.

700 deg. F., 29-in. vac.

In order to arrive at the effect on thermal efficiency of the use of regenerative feed heating, several pressures from 200 lb. to 2,000 lb./sq. in. were chosen, and an investigation made from which a series of curves of the type shown in fig. 8 were deduced for turbines designed for 600 lb. working. It was assumed that the total temperature rise was equally divided between the feed heaters, that the feed water leaving any heater reached a temperature 10 deg. F. less than the temperature of the steam supplied to that heater, that the mechanical efficiency of the turbine was 98 per cent., and that the radiation coefficient was 1.05. The full-line curves hold for boiler plant having an economiser, but no air heater; and those in dotted lines apply to a boiler plant fitted with both an economiser and an air heater, the latter being so proportioned that as the temperature of the gases leaving the econo-miser increases, it transmits sufficient additional heat to the incoming air to maintain a constant chimney loss. From such curves the results shown in fig. 9 were obtained for a installation with from one to seven feed heaters and a economiser, but no a heaters. The decrease i heat consumption is co tinuous with increasin pressure, but the rate increase is most rapid f the first increase in pre sure. The number of fe heaters chosen for furth consideration, *i.e.*, four, perhaps more than usually adopted at presen A constant number of fe heaters has been chosen spite of the rather small gain in efficiency at low pressures resulting fro the addition of the four heater, because its incl sion is equally justifie when the increasing co with increasing pressure of incorporating such a feed heat into the system is taken into account. In fig. 10 the quanti of heat supplied per lb. of steam from each main source plotted for a system employing four feed heaters but no a heater.

If the temperature of the water leaving the economiser is limited to 80 per cent. of the saturated steam temperature, the maximum quantity of heat supplied is given by the intercept between the dotted line and that giving the heat supplied by the turbine feed heaters. The line corresponding to the "ideal economiser" shows the limiting economiser input if the water can be raised to boiling temperature.

Figs. 11 and 12 show the corresponding curves for a system in which the boilers are equipped with both economisers and air heaters. The addition of the air heater increases the improvement in heat consumption resulting from regenerative feed heating at approximately 50 per cent. The distribution of the heat input to the steam, fig. 12, emphasises the decreased range of usefulness of the economiser. If the limitation

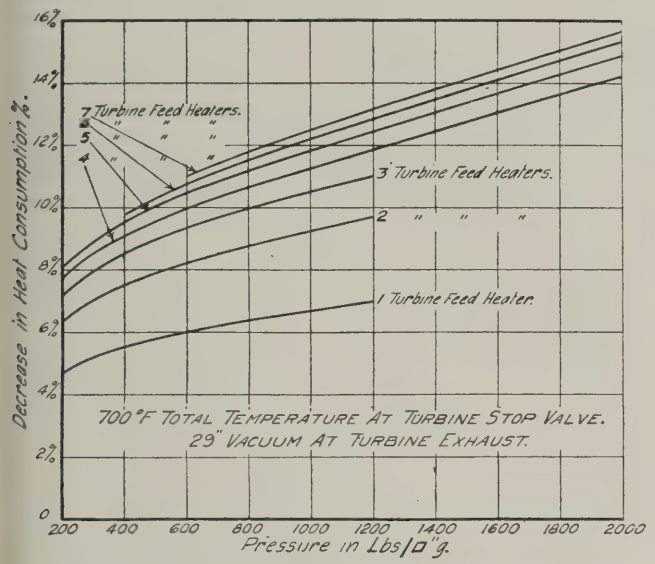


Fig. 11.

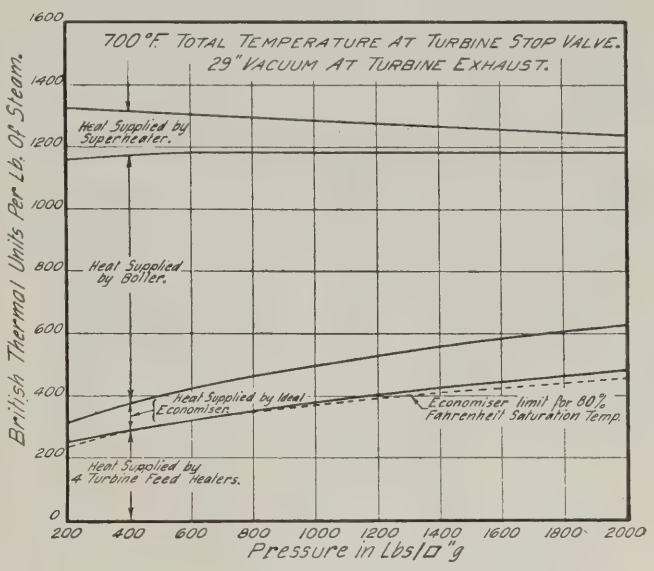


Fig. 12.

of the maximum temperature of water leaving the economiser is still imposed, its range of usefulness practically disappears, but if water can be heated up to the saturation temperature, an important sphere of usefulness is still available to it; as otherwise the amount of heat to be absorbed in the air heater may prove to result in too high an air temperature for comfortable working.

The heat dissipation per pound of steam for an installation incorporating four feed heaters, economisers and air heaters is shown in fig. 13. These figures relate to a pound of steam and not to the steam required per kW generated. Consequently the diminishing proportion shown of heat converted into work is not indicative of decreasing efficiency, because the heat supplied to the steam per kW by the fuel is itself continuously decreasing, as has been shown in fig. 3. When feed heating

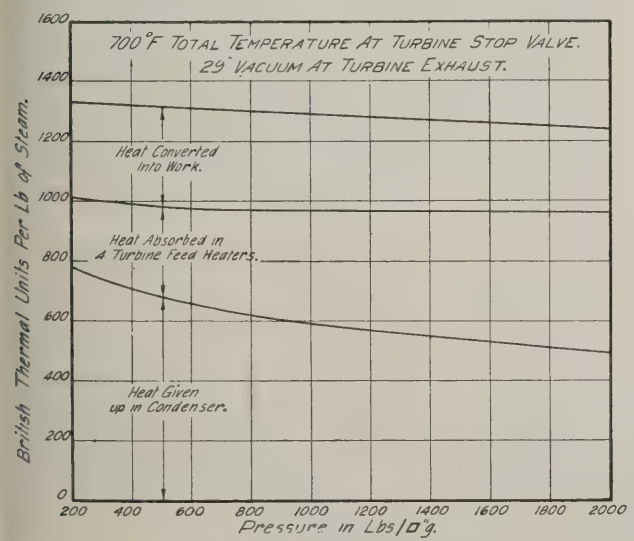


Fig. 13.

is carried out to the extent indicated, the proportions of the steam passages in different parts of the machine are very materially modified. Relatively to a turbine designed without feed heating, the steam quantity entering the first stages has to be very considerably increased to compensate for lost work capacity of the steam diverted to the various heaters. The areas through the blading in the early stages must therefore be increased on this account. The fact that a large proportion of the total steam is diverted to feed heaters naturally results in the blade areas in the final stage of the machine being substantially reduced.

Fig. 14 shows for various initial pressures how the blade proportion of turbines designed for four stage feed heating should compare with those of turbines designed without feed heating. Consider the blading areas of a 20,000-kW turbine designed for an initial pressure of 1,200 lb./sq. in. with four feed heaters. Then, compared with one designed without feed heaters, it will be built up as follows:—The first ¼ will have blading appropriate to 25,000 kW, the next ¼ appropriate to 22,500 kW, and the next ¼ to 20,000 kW: the following ¼ will have blading appropriate to 18,000 kW, and the final ¼ to 16,000 kW.

The magnitude of the difference is such that it is obvious that the conditions of steam flow in a turbine having blading proportioned on the basis that the feed heaters are in operation will be profoundly modified when it is operated with the feed heaters out of commission, and *vice-versa*. As such modifications in the steam flow conditions would result in some loss of efficiency, the turbine should be designed for the internal conditions holding when the feed heaters are in operation. Estimates of steam consumption with the feed heaters out of commission must be given with reserve.

When considering the influence of resuperheating on thermal efficiency, a change in the total temperature of from 700 to 750 deg. F. was made. This involved the use of plant designed for 800 deg. F. In addition to the assumptions common to the former investigations, a pressure loss in the resuperheater and its connections of 5 per cent. was postulated, but no allowance was made for loss due to radiation to and from the resuperheater. Fig. 15 shows the way in which this affected the thermal efficiency at different pressures. The chain dotted curves were obtained by making a wetness correction at the

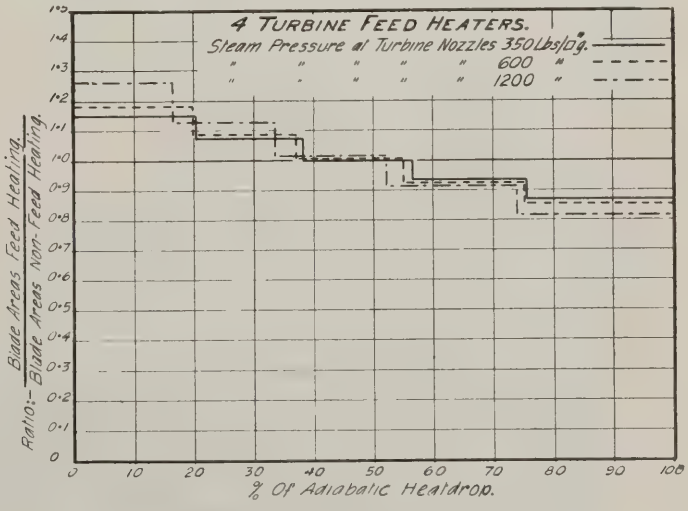


Fig. 14.

rate of 1 per cent. loss in efficiency for 1 per cent. mean wetness in the stage concerned. The variation of the proportion of the complete expansion which should precede admission to the resuperheater is depicted in the upper portion of fig. 16, while in the lower part the maximum gain in thermal efficiency resulting from resuperheating is shown. The gain in thermal efficiency resulting from resuperheating, if the full wetness correction is made, is more than one-third greater at 2,000 than at 200 lb./sq. in. The gain at the higher pressure is only one-quarter of that at the lower pressure if this correction is omitted. While many tests have shown that the

usual rate of correction for wetness gives results in conformity with experience with normal h.p. condensing turbines, such experience as has been accumulated on resuperheating installations to date indicates results not in conformity with the predictions on this basis. Judging by the results at present available, the gain due to resuperheating does not exceed the mean estimated on the two bases under discussion. The dotted line shows the locus of this mean.

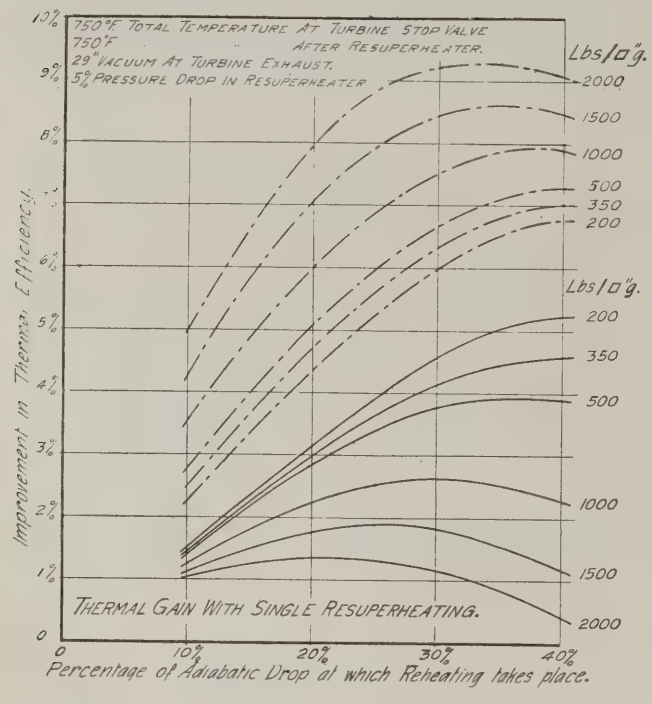


Fig. 15.

There is still a possibility that the resort to resuperheating may be imperative if high pressures are adopted. With the conditions assumed, but without resuperheating, the quantity of water present in the steam in the lower stages of expansion increases very rapidly with the initial pressure. With an initial pressure of 200 lb./sq. in. the fraction of the original steam which is water on leaving the last row of blades is 9.5 per cent.; at 600 lb. this rises to 15.25 per cent., and at 1,200 lb. reaches 20.3 per cent. In a turbine loaded at 40,000 kW, with steam at 1,200 lb./sq. in. initial pressure—assuming that the conditions are stabilised from stage to stage—over 33 tons of water per hour are passed through the last blade. It

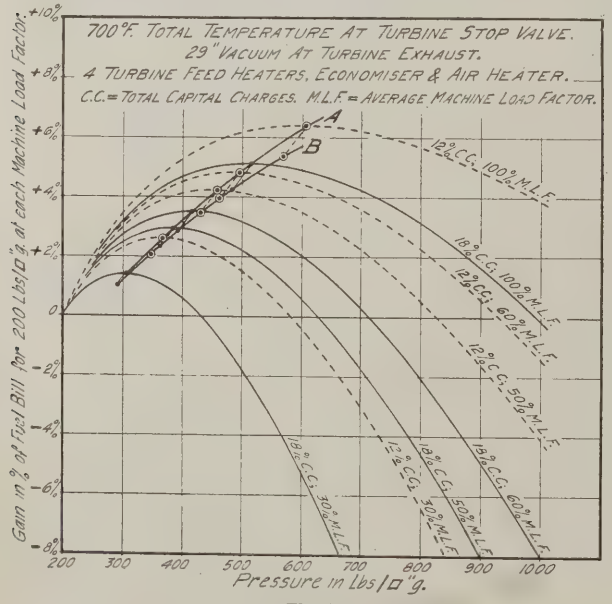


Fig. 17.

has still to be proved by experience whether at pressures as high as 500 lb./sq. in. the erosion which may result from such conditions will set a term to the useful life of the blading shorter than that usual with more moderate conditions.

Consideration must be given to the financial advantages likely to result from its adoption. Statistics were carefully compiled co-ordinating cost of plant with the variations resulting from increased pressure in the type of plant herein dealt with. The average mean temperature difference in the four feed heaters is 1.92 times that in the condenser for the 200-lb. installation, the figure rising to 2.46 at 1,000 lb. The mean cost of feed-heater surface per square foot in the latter case is 2.5 times that of the condenser surface.

While the total kW cost of the condenser plant decreases with the initial pressure, that of the feed heaters increases so that the combined cost at first decreases slightly, then takes an upward trend. The cost of the turbines themselves continuously increases with pressure, so does the combined cost of

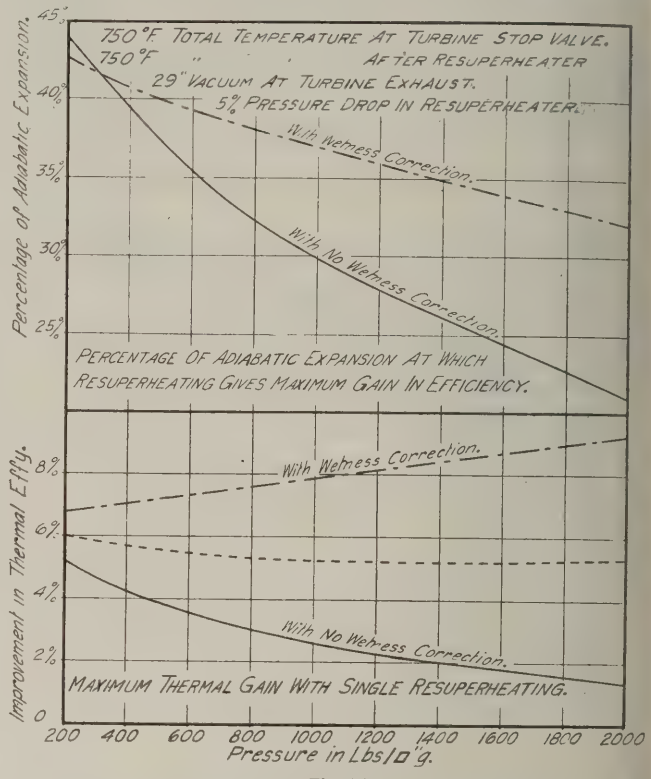


Fig. 16

the boilers, economisers and preheaters. On the other hand, the cost of the boiler house decreases. The total increased capital cost per kW installed at economic rating was found to be not less than that given in the following :—

Table III.

Pressure — lb./sq. in. g. ...	200	300	400	500	600	700	800	900	1,00
Increased cost per kW. ...	£0	0·158	0·353	0·600	0·884	1·211	1·579	1·990	2·44

The costs above 800 lb./sq. in. were obtained by extrapolation.

In order to assess the annual value of the fuel savings, coal was valued at 15s. per 11,500 B.th.u., and the turbine thermodynamic efficiency at 200 lb./sq. in. g. was taken as 80 per cent. The generator and boiler efficiencies are assumed to be 96 per cent. and 84 per cent., respectively, at economic load. From this basis fig. 17 was obtained, showing the saving expressed as a percentage of the fuel bill at certain constant load factors and for two specified rates of capital charges. The

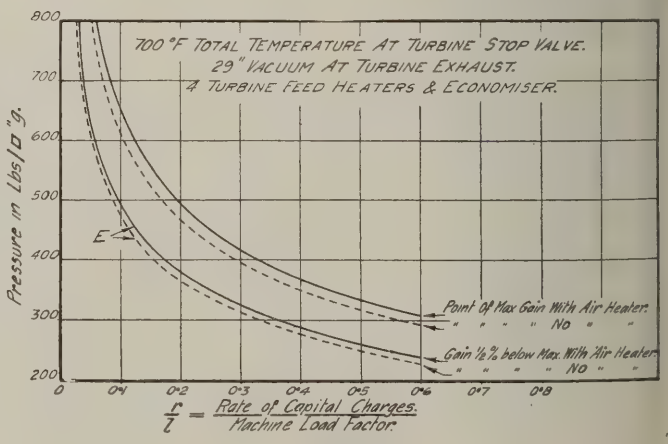


Fig. 18.

12 per cent. rate can be considered as made up of 5 per cent. rate of interest, 5 per cent. depreciation, and 2 per cent. maintenance. With the 18 per cent. rate these charges would probably be 6 per cent., 7 per cent., and 5 per cent., respectively. In any one year the machine load factor is necessarily less than the station load factor.

The locus of the maximum points shown by curve A was checked by arriving at the expressions which corresponded with the ascertained capital cost per kW installed, and the annual fuel saving, thus obtaining the net saving, and differentiating.

The expressions were found to be as follows:—
Net saving in pounds sterling per annum=

$$l\{0{\cdot}610 - [189{\cdot}(p + 110)]\} - r[(2{\cdot}11/10^6)p^2 + (5{\cdot}22/10^4)p - 0{\cdot}1888] = lF - rC.$$

Where l=machine load factor,
p=pressure adopted in lb./sq. in. g.,
r=rate of capital charges,
F=annual kW value of fuel saved at 100 per cent. load factor, and
C=additional capital cost per kW.

The curves in fig. 18 co-ordinate the pressures corresponding to maximum return on additional investment with the ratio r/l. The net annual gains for other costs of fuel can be obtained by making use of the relation that the gain is constant if the price of fuel multiplied by the load factor is constant. Thus, the curve in fig. 17 relating to coal at 15s. per 11,500 B.th.u. and 100 per cent. load factor holds also for coal at 30s. per 11,500 B.th.u. if the load factor is 50 per cent Curve A gives the locus of the maxima for installations which include an air heater and economiser, whereas curve B gives the corresponding points if the air heater is omitted. From fig. 17 it will be found that the pressures at which the maximum return is possible vary with the load factors as follows:—

TABLE IV.

	Rate of capital charges.	Load factor 100%	60%	50%	30%
With air heater ...	12%	606	495	459	367
Without air heater	12%	575	466	433	350
With air heater ...	18%	516	417	385	306
Without air heater	18%	477	396	366	293

Special Motor-Generators.

Recent Developments by Messrs. Bull Motors, Ltd., in the production of High-Frequency Machines.

PROGRESS in wireless telegraphy and telephony has made some very exacting demands upon the technical resources of those firms which have been courageous enough to keep pace with the times by developing the special generating plant that is continually being called for by radio

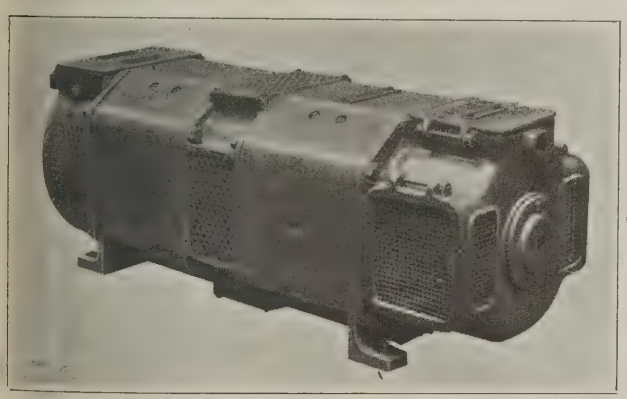


Fig. 1.—Ship's Motor-Generator.

engineers. Included among such firms are Messrs. Bull Motors, Ltd., from whom we have received the following particulars concerning special plant which they have produced.

Fig. 1 shows one of a number of special motor-generators which have been supplied for ship's wireless sets. One section of the double armature, fig. 3, carries the motor winding and also an auxiliary generator winding for supplying 275 W at 25 V for filament heating. The other or generator armature is wound so as to give 0.5 A at 2,400 V d.c., and is fitted with a special h.p. commutator of maximum possible diameter. The set revolves at 3,000 r.p.m., and the h.p. end, which is claimed to be as sparkless as any high-class industrial motor, has been subjected to a flash test of 5,000 V a.c. to earth. Similar tests are in construction for 3,000 volts d.c.

Fig. 2 shows a special 1,000-cycle, single-phase, 110-V, 500-W alternator, having 32 poles, coupled to a d.c. motor revolving at 3,750 r.p.m., the inherent voltage regulation of the alternator from no load to full load being 8 per cent. at 0.8 power factor—a satisfactory achievement when one considers the intricate problems involved in designing a.c. plant for frequencies of the order given. In spite of the high frequency, the overall efficiency at full load is claimed to be 52.1 per cent. The alternator is designed with a rotating field system and an unexpected difficulty was encountered due to the very high windage loss. This was greatly reduced, however, by suitably modifying the outline of the rotor, with a resulting increase of 8 per cent. in efficiency. Very careful attention is given to the design of the rotor poles in this type of machine, as with so many poles in a small diameter flux leakage is a serious matter, and the least departure from correct design may so increase the leakage as to prevent the alternator

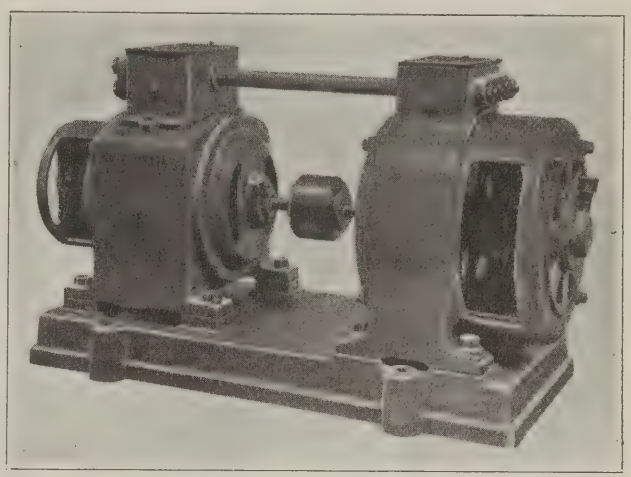


Fig. 2.—1,000-cycle Alternator.

developing its full designed voltage, in spite of the fact that the stator flux density has to be extremely low in order to avoid excessive iron losses.

In the design of the former sets every effort was made to eliminate commutator ripple, and in the latest models this is claimed to have been fully achieved. Similar "Bull" motor generators are in use for heating the filaments of high-power wireless transmission valves.

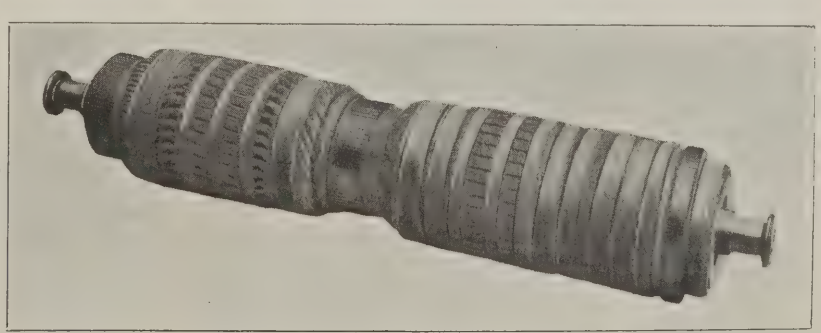


Fig. 3.—Special Armature for Fig. 1.

Legal.

Shocks from an Electric Drill.

AT Haslingden recently, Messrs. F. S. Scott, Laneside Foundry, were ordered to pay costs for a breach of the Workshops Act. The proceedings arose from an accident at the firm's works when two men received serious shocks whilst using a portable electric drill. The Factory Inspector said that the energy was obtained from an ordinary lampholder. A flexible wire was used whereas there should have been a heavy c.t.s. cable, and metallic connector. Cotton-coated flexible cable and ordinary connectors were used, and the shocks were due to the insulation being bared by a connector. Defendants had now adopted proper connectors and cable.

Electric Light Plant Dispute.

BEFORE Mr. Justice Tomlin, in the Chancery Division, on April 27th, Mr. R. W. P. Dawson, engineer, claimed an injunction restraining the Effingham Estates Co., Ltd., from trespassing in rooms which he said had been leased to him, an order on them to block up the entrance which they had made, and also to remove the electric light plant, and damages for loss alleged to have been sustained by his being unable to use the space occupied by the plant.

Mr. ALEXANDER GRANT, K.C. for the plaintiff, said that the defendants suggested originally that he had agreed to buy the

plant. It was true that each party appointed a valuer to fix a price, but they could not agree, and there was no sale. Neither the plaintiff nor the defendants wanted the plant. What the plaintiff complained of was that the defendants were using the plant for their own premises. When he told them that they must take it away they broke into the rooms and worked it for themselves.

His Lordship considered the case a trivial one, and after lengthy negotiations, following this hint, the parties came to a settlement. His Lordship said he would make an order staying the proceedings on the terms agreed with liberty to mention it to him at any time when a formal minute had been drawn up and signed.

Automatic Telephone Mfg. Co.'s Patent Application.

Mr. Justice Tomlin, in the Chancery Division, on April 29th, heard the application of the Automatic Telephone Mfg. Co., Ltd., Liverpool, for the extension of three patents relating to automatic telephony, because the war had deprived it of the benefit it would otherwise have obtained from them.

Giving judgment, his Lordship said that before the war broke out the company received orders from the Postmaster-General to install its "Director" system in many towns, but during the war it was compelled to refuse to undertake other orders because it was engaged in making munitions. The application, he said, was opposed by persons interested in an American system called the "panel" system. They said that the delay caused by the war was really an advantage to the applicants because it had enabled them to develop their system in such a manner as to compete successfully with the "panel" system. If he had had to decide which system obtained the most advantage from the war he would have said it was the "panel" system, because being an American system it could be worked in countries not affected by the war. He granted the applicants an extension of the patents up to January 18th, 1931.

Fraudulent Conversion Charge.

At the Guildhall on April 28th, Elie Stacey Charlier, company promoter, was again before Ald. Sir Harold Moore upon a charge of the fraudulent conversion of funds entrusted to him in respect of the formation of a Canadian electric railway company. Sir Frederick Mills, chairman of the Ebbw Vale Steel, Iron & Coal Co., whose name was said to have been used by the prisoner, gave evidence that, after investigation, he decided to have nothing to do with Charlier. The accused pleaded "Not guilty" and reserved his defence. He was committed for trial, bail of £250 being allowed.

Correspondence.

Correspondents should forward their communications* as early as possible.** ***No letter can be published unless we have the writer's name and address in our possession.

Hiding the Light.

Is the advantage of electricity for power purposes being brought to the notice of potential customers with sufficient energy? A brief investigation in a large town boasting an up-to-date system has revealed the following:—

A brattice cloth works was working both day and night shifts for the greater part of the year. Artificial light was supplied by two fairly large inverted gas fittings, the mantles of which were in a sad state of disrepair. Inquiries elicited the fact that, owing to draught, mantles were a costly item. The mills were driven by a steam engine of about 12 horse power supplied with steam at about 50 lb. pressure from a large and poorly lagged boiler. It is true a certain amount of steam was used for heating the drying rolls, though there does not appear to be any reason why this could not be done, and probably with more efficiency, electrically. The clay wash was thrown on by hand, a process that would be improved by the use of a small motor-driven pump. I was informed that the electric mains passed these works.

At a dry dock, the pumps, capable of dealing with the total contents of the dock in four hours, were steam driven. Should the dock be in use for but a short time, as during the painting or surveying of a vessel, the boilers are kept banked. At other times the fires are allowed to die out. The engines are non-condensing and will probably take in the region of 30 lb. of steam per h.p.-hour.

At a fuel works a self-contained power house of about 1,000-kW capacity has been installed.

A considerable amount of traffic takes place over about three miles of canal. The Canal Company will not tolerate self-propelling barges, its objection being that the wash disturbs the banks. The barges are, therefore, horse-drawn, though there appears to be no reason why a battery tractor could not be used with charging stations at the loading and discharging termini.

Many other smaller fields were met with, such as bakehouses, garages with plant, cabinet makers, saw mills, &c. These are not able to meet the cost of changing from gas or oil to electricity, and it is to be hoped that at an early date undertakings will hire out motors in such cases. Bakehouses, in particular, would provide a load when the distributing system is otherwise lightly loaded, especially were electric ovens used.

April 26th, 1927. **Electrician.**

A Domestic Load Diagram.

On page 630 of your issue of to-day, Mr. Ross's diagram of a domestic load for 24 hours, if my reading is correct, appears to total (hatched *areas*):—

	kWh.
Radiators	32.8
Water storage	17.0
Cooking	14.8
"Other" uses	14.4
Baths	4.0
Clothes washing	1.0

One day's consumption 84 kWh. Load factor 28 per cent.

The left-hand margin is divided into 13 numbered equal spaces with no unit named. Are the above *areas* kelvins?

Do you agree that if the unit is named and the size of home defined, it will materially add to the value of the diagram?

London, *April 22nd*, 1927. **Theodore Stevens.**

[The ordinates are, of course, graduated in terms of kilowatts; the areas, therefore, are kilowatt-hours.—Eds. Elec. Rev.]

Electric Water Heating.

Mr. Meares's article of the 22nd inst., and letter of the 29th inst., draw attention to a state of affairs much neglected by those who are presumed to have the industry at heart, and he is to be thanked for so doing.

As the load curve in my article is based on several years' practical experience gained in my own home, and in other homes similarly conditioned, Mr. Meares may safely take it as quite representative of its purpose. His suggested auto-switched water tank is the one solution of what may conceivably become a source of trouble as domestic load develops. That industrial load will undoubtedly take second place, as American experience is showing clearly to-day, and one fine day little communities of 10,000-20,000 homes or more will switch on 13,000-30,000 kW for the morning meal as against half that amount for the mid-day and evening meals. True, the period of high load is short. But it must be taken care of by the sub-station at least, and unless the domestic load curve is flattened appreciably by some such arrangement as Mr. Meares suggests, considerable capital is likely to be used increasing the power price needlessly.

On the other hand, presuming the point to be taken care of, even in the most residential localities, the road to cheap power is barred by the present high capital cost of the very means to obtain the end. I don't doubt for a moment that Mr. Meares's switch *could* be made at a reasonable price, but what of the water tanks? For tanks to meet all household needs the modest price of £10 to £25 must be paid. Where does the money go to in the production of such tanks? Even an ordinary household boiler can be converted for little more than the cost of an immersion heater plus some slag wool.

The lowest possible capital outlay is essential, and it is gratifying to note Mr. Sharp's broad hint at immediate favourable developments. The industry is on the verge of doing great work, and that with quite satisfactory remuneration, but will selfish profits override the willing horse and thwart the backer?

Manchester, *April 30th*, 1927. **Eric G. Ross.**

Cheap Electricity.

I should like to endorse a sentence in the letter of Mr R. B. Matthews in your last issue, wherein he emphasises "the great difficulty there is in refuting the arguments put forward in favour of the small independent plant." The word "small" must not be given too narrow a significance in this connection. Indeed, there are many special instances where the larger the size of the independent plant the more difficult it is to refute the arguments in its favour. It must be remembered that the difference between the steam consumption per kelvin of a well-loaded 2,000-kVA steam turbine and one of 10,000 kVA is not very great for equal steam pressure and temperature, and this difference is usually much less than that portion of the cost per kelvin which is due to distribution.

Thus, in general, if a consumer has a load factor considerably higher than the average load factor of the local generating station, and if his plant is large enough to warrant the use of a turbo-generator exceeding about 1,500 kVA, the commercial advantage is very often in favour of the private plant. But this does not settle the question completely: there are considerations other than the purely commercial, which become more evident as experience of local supply increases. The owner of a works requiring electric power often realises that it is better for him not to divide his energies between his own proper business and the problems incidental to the

roduction of power. Although no accountant could put the alue of this concentration into a profit-and-loss account, yet s effect is not the less real on that score.

William Cramp.

The University, Birmingham.
May 2nd, 1927.

The Salaries of Engineers.

The article in your issue of the 22nd inst. by "P.B.E." once gain calls attention to the inadequate remuneration of 90 er cent. of electrical engineers. A short time ago a friend ought my advice with reference to making his son an elec-rical engineer. He was under the impression that if he nd his family made the necessary sacrifices to enable his n to take a diploma or degree in electrical engineering, the tter's future on an adequately remunerated basis would be ssured. I therefore felt it my duty—whilst not desiring discourage his son from entering the electrical profession—place the facts, so well brought out in the above article, efore him. I also considered it was my duty to tell him hat many friends of mine who are themselves engineers ave avoided putting their sons into the engineering pro-ession. This state of things is, of course, deplorable, and hould be remedied. It is no doubt largely brought about hrough the ignorance of parents as to the real conditions n the engineering world, and to the great desire of boys—nany of whom have exceptional ability—to take up engineer-ng. With the same ability most of these boys would probably ave done better to have followed some other vocation, which vould have called for less sacrifice on the part of the parents nd would have placed them in better positions to bring up nd educate their own families in due course.

I make this contribution to the discussion because the re-nuneration and financial position of so many hard-working nd able electrical engineers call for the attention of the eaders of the profession and industry, on whom the respon-ibility for rectifying the present position should largely devolve.

Ernest T. Williams.

London, *April 30th*, 1927.

A Commutation Problem.

The writer is at a loss for an explanation of the cause of trouble with some small dynamos supplied by a fairly well-known firm, and could not think of a better place to seek it than your columns (with your permission).

The machines are 10 amps., 30 volts, at 2,400 revs., and the trouble has been that, while they all ran apparently perfectly when new, or for some time after re-turning of commutators, in a few weeks they were sparking slightly, and this increased cumulatively until in three months the commutators would be black and scored, and would require turning up. Nothing in the way of changing brushes, adjusting the rocker, or cutting down micas has cured this, and the makers, on having an armature sent up, only turned up the commutator and sent it back.

Now, the armature winding is 432 conductors of 18 gauge, divided into 12 double coils, there being 12 slots ($\frac{3}{8}$ in. wide) and 24 commutator bars. Armature diameter is $3\frac{1}{4}$ in., length 3 in. The magnetic and electrical loading data come out at about 20,000 lines per square inch in the gap, and 230 ampere-turns per inch of armature periphery, respectively, and this does not seem to be an abnormal design.

The writer's theory is that there are not enough slots, and, assuming the 18 wires in each double-coil assembly to be roughly evenly distributed in the half slot, the conductors are, at the best, on the average $7\frac{1}{2}$ degrees from the correct neutral position when undergoing commutation, and this is enough to prevent sparkless running for any length of time. Slots are open and have parallel sides.

If this problem is not too trifling for insertion, an opinion from one or more of your many expert readers would be greatly valued.

A. O. Griffiths.

Caergwrle, *April 25th*, 1927

[Several letters have been received too late for inclusion in this issue.—EDS. ELEC. REV.]

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

27,151. "Apparatus for electrically indicating or transmitting to a distance the angular settings of any device." R. A. W. Watt. October 29th, 1925. (268,691.)

30,041. "Electrical indicating instruments and control systems therefor." W. G. Nagel Electric Co. December 5th, 1924. (244,085.)

30,265. "Aerial tuning with reaction units for radio service." J. Taylor and H. Rustige, jun. December 1st, 1925. (268,848.)

30,915. "Radio receiving apparatus." B. B. Minnium. December 8th, 1924. (244,131.)

33,005. "High-tension batteries." Ross, Courtney & Co., Ltd., and L. F. Brockman. September 16th, 1926. (268,856.)

1926.

143. "Armatures of electric motors and generators." F. W. Lanchester and Lanchester's Laboratories, Ltd. January 4th, 1926. (268,859.)

324. "Automatic and semi-automatic telephony." Standard Telephones and Cables, Ltd., and E. P. G. Wright. January 5th, 1926. (268,862.)

407. "Wireless receiving apparatus." J. S. Northcote. January 6th, 1926. (268,866.)

415. "Mounting of electric fuses." English Electric Co., Ltd., and A. M. Pooley. January 6th, 1926. (268,867.)

556. "Alternating-current generators." Standard Telephones & Cables, Ltd. (Western Electric Co. Inc.). January 7th, 1926. (268,880.)

622. "Oil-immersed electric switches." A. Reyrolle & Co., Ltd., and W. Anderson. January 8th, 1926. (268,882.)

634. "Rotary electric transformers for coupling two alternating-current networks." Siemens-Schuckertwerke Ges. January 17th, 1925. (246,133.)

635. "Electric switch casings or containers." W. F. Holmes. January 8th, 1926. (268,883.)

639. "Telephone systems." Standard Telephones & Cables, Ltd. (F. de Fremery). January 8th, 1926. (268,884.)

704. "Sound-reproducing apparatus such as loud speakers." British Thomson-Houston Co., Ltd. January 9th, 1925. (245,796.)

715. "Thermionic amplifiers." E. H. Trump. January 9th, 1926. (268,887.)

1,140. "Automatic control of electric switches." G. Pailin and Ferguson, Pailin, Ltd. January 14th, 1926. (268,897.)

1,559. "High-frequency radio-transmission systems." C. Lorenz Akt. Ges. February 13th, 1925. (247,538.)

2,195. "Means for automatic regulation of electric amplifiers." C. Robinson, A. C. Timmis and C. A. Beer. January 25th, 1926. (268,906.)

2,253. "Variable pole windings for alternating-current dynamo-electric machines." Siemens-Schuckertwerke Ges. and H. Weinert. January 26th, 1926. (268,909.)

2,261. "Electrical switches." E. Dobson and Foster Engineering Co., Ltd. January 26th, 1926. (268,910.)

2,404. "Inductance coils used in wireless telegraphy and telephony." G. Turner. January 27th, 1926. (268,911.)

2,604. "Miners' electric safety lamps." T. A. Hodgkiss and W. E. Smith. January 29th, 1926. (268,913.)

2,856. "Systems of electric ship propulsion." British Thomson Houston Co., Ltd., and A. A. Pollock. February 1st, 1926. (268,914.)

3,161. "Electrolytic systems for protection of condensers, tanks, and such like vessels against corrosion." A. S. Gush and M. C. Gush. February 3rd, 1925. (247,198.)

3,345. "Control of electrically-driven lifts and cranes." Smith, Major and Stevens, Ltd., and P. H. Stevens. February 5th, 1926. (268,918.)

8,756. "Electric arc lamps." R. V. Boardman. March 31st, 1926. (268,958.)

10,271. "Telephone receivers." Sterling Telephone & Electric Co., Ltd., N. Blades and J. R. Beard. April 19th, 1926. (268,971.)

12,492. "Electric incandescent lamps." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). May 14th, 1926. (268,986.)

12,643. "Electric switching apparatus." E. B. Thurston. May 17th, 1926. (268,991.)

12,644. "Electric control systems." E. B. Thurston. May 17th, 1926. (268,992.)

13,898. "Apparatus for the electrolysis of water." Dr. L. Casale. June 1st, 1926. (268,998.)

15,430. "Coil junction box for signalling conductors." Felten & Guilleaume Carlswerk Akt.-Ges. July 9th, 1925. (255,038.)

15,897. "Apparatus for the production and application of ultra-violet rays." F. E. Kewley and S. F. Balls. June 24th, 1926. (269,014.)

15,906. "Sound conduits for sound-recording and sound-reproducing instruments." E. Finking. June 24th, 1926. (269,015.)

17,456. "Insulators." Soc. Nouvelle de la Manufacture de Porcelaines de Sainte Foy l'Argentiere. February 13th, 1926. (266,281.)

17,746. "High-tension cable." International General Electric Co. Inc. July 16th, 1925. (255,473.)

18,552. "Electrical apparatus, particularly wireless receiving sets." J. E. Bates. July 26th, 1926. (269,027.)

18,709. "Head-lights for vehicles." M. E. Power. July 27th, 1926. (269,029.)

19,086. "Wireless receiving set for compensating disturbances." Dr. S. Loewe. August 1st, 1925. (256,266.)

19,190. "Thermionic valves." A. A. Thornton (Radio Rhoren-Laboratorium Dr. G. Nickel Ges.). August 3rd, 1926. (269,032.)

20,386. "Means for regulating and synchronising electric motors and the like." Marconi's Wireless Telegraph Co., Ltd. August 19th, 1925. (257,272.)

20,721. "Electrically-heated tools for pyrography, soldering, and like purposes." H. Gamard. August 23rd, 1926. (268,631.)

21,181. "Process for removing the residual gases from the metal casings of electric discharge tubes." Siemens-Schuckertwerke Ges. August 28th, 1925. (257,620.)

21,598. "Brush gears for dynamo-electric machines." M. Urbinati. September 3rd, 1925. (257,935.)

21,934. "Methods and apparatus for fusing metals by the electric arc process for welding, cutting, and other purposes." British Thomson-Houston Co., Ltd. September 5th, 1925. (257,955.)

22,051. "Magneto generators." Ruppe Motor Ges. April 29th, 1926. (268,640.)

22,466. "Draw-out trucks for electric switchboards." Johnson & Phillips, Ltd., and P. M. Wood. September 11th, 1926. (269,051.)

22,487. "Electrical control apparatus." R. Maclaren. September 13th, 1926. (Addition to 254,821.) (268,645.)

22,699. "Sparking plugs and testing means therefor." C. E. Perks. September 15th, 1926. (268,648.)

22,792. "Centrifugal brakes for the call dials of automatic telephone installations." Fabriques des Montres Zenith. September 22nd, 1925. (258,860.)

24,175. "High-tension electrical transformers." Metropolitan-Vickers Electrical Co., Ltd., and H. B. Smith. October 1st, 1925. (259,223.)

24,555. "Process for manufacturing electric cables." Siemens-Schuckertwerke Ges. October 5th, 1925. (259,250.)

24,662. "Piezo-electric crystal control system for wireless transmission." Wired Radio, Inc. October 24th, 1925. (260,231.)

24,677. "Time-lag mechanism for electric relays." O. Janzen. October 5th, 1925. (259,253.)

26,456. "Electrodes for electric accumulators and a process for their production." P. Hagspihl. February 13th, 1926. (265,918.)

1927.

2,759. "Electric lamps." British Thomson-Houston Co., Ltd. January 30th, 1926. (265,237.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 27th :—

Supronic. No. 476,822. Class 5. Wire made of a copper-nickel alloy.—L.P.S. Electrical Co., Ltd., Avenue Road, Acton, W.3.

Semper Idem (lettering and design). No. 464,283. Class 8. Electric batteries and parts thereof.—Atlas Carbon and Battery Co., Ltd., 56, Southwark Bridge Road, S.E.1.

Spioscope. No. 478,415. Class 8. Optical apparatus and instruments.—Television, Ltd., Motograph House, St. Martin's Lane, W.C.2.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Infirmary (£257,000); Dr. Kelly, architect.

ANDOVER.—Elementary school; Hampshire Education Committee.

ARGENTINA (Buenos Aires).—New Federal sanitary service (30,750,000 pesos) for the Government.

BEDFORD.—Millwrights' stores, Queen's Engineering Works; W. H. Allen, Sons & Co., Ltd.

BEXHILL.—Houses, Terminus Road, Mill View, and Collington Avenue; J. H. Lye, Chepbourne Road. Houses, Barnhorn Lane; Matthews & Co.

BIRMINGHAM.—Baptist Church Hall, Brook Lane, Billesley; trustees. Schools and assembly hall, Lyttleton Road, Stechford; trustees.

BRADFORD.—First portion of new infirmary scheme (£75,000, total scheme, £500,000); secretary, Board of Governors, Royal Infirmary.

BRIERLEY HILL.—Warehouse, Chapel Street, Pensnett, for Gill & Weaver, wholesale grocers (several thousand pounds).

BRIGHTON.—Factory, South Road; A. Darling & Sons, Ltd. 32 houses, Barnett Road; Hayward (Brighton), Ltd. Alterations, Abbots Hotel, Regency Square; C. E. Martin. Adaptation of Continental Hotel for municipal offices; borough engineer.

BURSLEM.—Electric furnaces, Furlong Tile Works; T. A. Simpson & Co., Ltd.

CANTERBURY.—Practical instruction school, for the borough E.C.; P. H. Warwick, city surveyor.

CHADDERTON.—Secondary school; Lancashire Education Committee.

CHELMSFORD.—50 flats, Boarded Barn estate; borough engineer. Warehouse, Victoria Road; Denham & Archer.

CRAYFORD (Kent).—Houses (71), Slades Green, for the U.D.C.; Clarke & Leahy, Ltd., builders.

DEWSBURY.—Church and Presbytery, at Moorthorpe; Holton & Fox, Corporation Street.

ELLESMERE PORT (Cheshire).—Church, Grace Road (£3,000); Slater Bros., builders.

FALKIRK.—Garage (£1,900); M. Millar, Woodside Garage.

GLASGOW.—Extensions at Knightswood Hospital for Corporation Public Health Department; medical officer. Cinema, &c., Byres Road, for Botanic Gardens Picture House, Ltd.; the secretary. Hall at Tallcross, for Salvation Army; officer commanding. 1,000 houses for Corporation; Balshagray Building Co. 1,000 houses, for Corporation; John McDonald (Contractors), Ltd. Electrical installation, Garscube Home; medical officer.

GRAVESEND.—School, Ordnance Road, for the borough E.C.; education architect.

GRAYS.—Extensions, Stifford Long Lane Hospital, for Orsett Joint Hospital Board; C. M. Shiner, architect, "The Barn," Dell Road.

GUILDFORD.—Assize Courts, Stoke Park; borough engineer.

HAMPSHIRE.—Mental colony, Portsmouth, Bournemouth, and Southampton Corporations.

HIGH WYCOMBE.—Factory extensions, Totteridge Road, for W. S. Toms, Ltd. Additions to chair factory, Richardson Street, for Smith & Co. Printing works extensions, High Street, for Bucks Free Press, Ltd.

IRISH FREE STATE (Queenstown).—Electric lighting at warehouse for the Pilotage Committee of the Cork Harbour Board.

IRLAM.—Central school, Lancashire Education Committee.

KINGSMEAD.—Hospital accommodation, residential school; Herts. Medical Officer.

LEAMINGTON.—Showroom, Russell Street; Midland Autocar Co. Additions, pump room filter house, for U.D.C.; R. P. Gathercole.

LEICESTER.—Mental institution, Birstall; city engineer.

LITCHURCH (Derby).—Church (£5,500), for the Wesleyan trustees; secretary.

LITTLE THURROCK (Essex).—Block of 22 shops, Purfleet-Tilbury Road, for F. C. Stark.

LLANBISTER.—School, for Radnorshire E.C.; T. W. Wishlade, county surveyor, Llandrindod Wells.

LLANDUDNO.—Suggested town hall extension; U.D.C., surveyor.

LONDON (Bow, E.).—Salvation Army Hall, Kerbey Street; Oswald Archer.

(Poplar, E.).—Additions, Dockland Settlement, East Ferry Road; J. Greenwood, Ltd.

(E.C.).—Building, 49-52, Houndsditch; Stone & Drew. Subway and vaults; Bankside Finance and Industries, Ltd.

(Finchley, N.).—Roman Catholic school; Catholic trustees. Canteen, Woodberry Grove; Metropolitan Electric Tramway, Ltd.

(Battersea, S.W.).—Adaptation of rooms at Central Library as museum; borough engineer. Synagogue, rear of 104, Bolingbroke Grove; D. Pierson.

(Hammersmith, S.W.).—Electric light and heating installation, Western ambulance station; chief engineer, Metropolitan Asylums Board.

MAIDENHEAD.—Adaptation of Crauford College as mental hospital; Middlesex C.C.

MANSFIELD.—Houses (113), Ravensdale estate, for the T.C.; R. Moore, builder, Stockwell Gate.

NEWCHURCH.—Elementary school, Lancashire Education Committee.

NORTHAMPTON.—Factory extension, St. James' Street; Wareings, Ltd.

PADIHAM.—Adaptation of West Bank House as clinic; Lancashire Education Committee.

PAIGNTON (Preston).—Lecture hall; Bridgman & Bridgman, the Palace Avenue, architects.

POCKLINGTON (East Yorkshire).—Assembly hall (to seat 500) for Pocklington School; Crickner & Foxley, architects, 1, Lincoln's Inn Fields, London, W.C.2.

PORTSLADE.—'Bus garage, Victoria Road; Southdown Motor Services, Ltd.

PORTSMOUTH.—Bank, High Street, Cosham; Lloyd's Bank, Ltd. Boiler house, Eldon Street, for Portsmouth United Breweries; Gallaways, Ltd. Factory, off Target Road; Hays Waterproof Glue Co., Ltd. Alterations and additions, 109-115, Commercial Road: Lloyd's Bank, Ltd. Drainage scheme at Cosham (£68,000); city engineer.

PRESTWICH.—Salvage and disposal scheme; U.D.C. surveyor. Shops and houses for Messrs. J. & W. Leach and Sons, Bury New Road; W. F. Pinfold, surveyor.

ST. ANDREWS.—Residence hall for men students for St. Andrews University Court; the principal.

SOUTHAMPTON.—Proposed theatre, Commercial Road, for Moss Empires, Ltd., London.

STAFFORD.—New St. John's Church; Rev. Frank W. Jones, vicar.

STIFFORD (Essex).—Alterations and additions, Ford Place, for Col. R. M. Laurie. Development of estate, Nutberry, for residences, for Col. F. H. D. C. Whitmore.

STIRLING.—Police court and offices (£11,750), for the T.C.; burgh surveyor.

STOKE-ON-TRENT.—Extensions, nurses' quarters at hospital; city engineer. Electrical installation, Saw Mills, Copeland Street; F. G. Chambers & Co., Shelton Wharf.

STOWE (Bucks).—Chapel, Stowe School (£40,000); Sir Robert Lorimer, architect.

SWADLINCOTE.—School, Newhall, for Derbyshire E.C.; H. W. Skinner, clerk, County Offices, Derby.

THAMES HAVEN (Essex).—Power station, for the London and Thames Haven Oil Wharves, Ltd.

TROWBRIDGE.—Bank, Fore Street, for the Westminster Bank, Ltd.

TYNEMOUTH.—73 houses, Ogle Terrace; 15 blocks of maisonettes, Balkwell; borough engineer. Smallpox hospital; borough engineer.

WALSALL.—Additional 40 houses, Rushall, for the R.D.C.; surveyor.

WARRINGTON.—School, Bewsey, for the borough E.C.; director of education.

WEM.—School, and extensions to Grammar School, for Salop E.C.; director of education, Shrewsbury.

WEST LOTHIAN.—Central school at Bo'ness; clerk, Education Authority, Bathgate.

YORK.—Church and school, Fulford Road; Christian Scientist Community.

The

Electrical Review

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Contents:

	PAGE
London's Electricity Supply...	745
The Salaries of Engineers ...	746
The Central Scotland Scheme ...	746
Publicity for Supply Undertakings, by Edward E. Hamar ...	747
Internally-Heated Furnaces (*illus.*) ...	748
Wireless Telegraph Communication, by Lieut.-Col. Chetwode Crawley ...	749
The Measurement of Sheath Losses in Cables, by R. A. Brockbank ...	751
The Ascertainment of "Kilowatt Maximum Demand," by Fredk. W. Purse ...	752
Central Scotland Electricity Scheme, 1927 (*illus.*)...	754
Business and Industrial Notes ...	755
Lighting and Power Notes ...	758
Tramway and Railway Notes ...	760
Telegraph and Telephone Notes ...	761
Radio Notes ...	761
Contract Information...	762
Forthcoming Events ...	763
Notes ...	764
Institution Notes ...	767
Our Personal Column ...	767
Financial Section—	
New Companies Registered ...	768
Official Returns of Electrical Companies ...	768
City Notes ...	769
Stocks and Shares ...	771
The Electrical Imports of India ...	773
The Electrical Trade of Holland ...	774
New Electrical Devices, Fittings and Plant (*illus.*) ...	775
Selected Radio-Telephone Apparatus ...	776
The Institution of Electrical Engineers...	777
H.P. Transmission ...	778
The Trade Disputes Bill ...	779
Powdered Lignite in America ...	780
Parliamentary News ...	780
Correspondence—	
Electroculture ...	781
The Ideal Wiring System ...	781
Off-Peak Supplies ...	782
Bad Business Methods ...	782
A Commutation Problem ...	782
Legal ...	782
Published Specifications ...	783
Trade-Mark Applications ...	783
New Work for Contractors...	784

London's Electricity Supply.

WE recently abstracted the report of the London County Council on electricity supply in the London and Home Counties Electricity District, and complimented the Council on the issue of these annual reports, which now comes to an end. No doubt the Joint Electricity Authority will take up the task, and keep us equally well informed as to the progress and development of the electricity supply industry in this area, which embraces one-fifth of the population of Great Britain.

By the two Acts of 1925 and the Electricity District Order of 1925 the supply of electricity was entrusted to the Joint Electricity Authority, which supervises 89 undertakings forming three groups, namely, a group of four companies; a group of ten companies (styled the London Power Company, which now owns or leases all the generating stations of the ten companies and supplies them with electricity in bulk); and the remainder of the companies and all the local authority undertakers, numbering 75 in all. The two company groups have a large measure of freedom to conduct their own affairs, but the undertakings in the third category come directly under the control of the J.E.A., which is preparing to erect a large power station at Chiswick for bulk supply.

In the hands of so many authorities, the supply has taken almost as many forms, varying from place to place in frequency and voltage, as well as in kind; worse still, perhaps, is the chaos of prices and tariffs which prevails. In view of the differences between the methods of charging, the only safe comparison must be based on the average revenue received per kilowatt-hour. For private lighting, power, and heat the average revenue of local authorities in the District in 1924-25 was 2.23d.; within the County the average was 2.12d., and outside its boundaries 2.40d. The figures for the companies were nearly a penny more—that is, 40 per cent. higher; their average revenue was 3.16d. (intra-London 3.14d., extra-London 3.24d.). Of the local authorities, the lowest was at Gravesend, 1.44d.; West Ham came next with 1.53d., then Woolwich, 1.57d., and Poplar and Erith, 1.62d. The highest in the County was Southwark, 3.57d., and Stoke Newington was also over 3d.; outside the County, Reigate, Epsom and

Maidenhead top the list with average receipts from 5.74 to 5.31d. Of the companies, West Kent has the best record with 1.8d., followed by Uxbridge with 1.96d., and by the North Metropolitan with 2.28d.—all outside the County. The highest company revenue was also extra-London—9.43d. at Caterham (Urban Electric Supply)—with Edmundson's at Dorking a good second, 8.78d. Ascot District Gas and Electricity Co. and the Urban Co. at Weybridge and Walton scored 7.79d. and 7.70d. respectively. Within the County, Brompton and Kensington, Notting Hill and Chelsea—all pioneer companies—head the list with 4.91d. to 4.88d.; no other company undertaking makes a worse showing than 4d., or a better one than 2.42d. (South Metropolitan). The London Electric Supply Corporation's figures include the supply to the Southern Railway and are not comparable with the others.

Although additional returns for the company undertakings are given for 1925 in an appendix, they are not sufficiently complete to allow of a similar analysis, but West Kent again takes the honours with 1.35d., closely followed by Uxbridge and North Metropolitan as before.

The three London companies with capital expenditure over three millions sterling—the City of London, County of London, and the Metropolitan—were also the three with the largest total revenue, and the largest profits. The City Company, charging an average of 3.32d. per kWh for private supply, paid £223,402 interest and dividends, and transferred £166,704 to reserve; the County Company, receiving 3.48d., distributed £355,772 and put no less than £491,316 to reserve; the Metropolitan received 3.94d. per kWh, distributed £199,676, and put £206,250 to reserve. On the basis of "capital called up" in 1924, these companies respectively disposed of 17.15, 20.8, and 15 per cent. in the form of dividends, interest, and reserve funds. The larger the reserves, capitalised under the Acts of 1925, the worse for the consumers of the future; and those reserves have been provided by the consumers of the past.

Compared with the low prices charged by most of the local authority undertakers, the company figures make a bad showing; they illustrate the contrast between private profit and public service, and suggest that after all there was some justification for the claim that public-service monopolies should be in public hands. We hope that under the new *régime*, which is intended to ensure the supply of electricity at the cheapest possible rates, the spirit of service will prevail and that the public interest will be the ruling consideration.

The Salaries of Engineers.

That it is the hope of reward that sweetens labour is a principle which lies at the very foundation of public and private service, whether the desired reward be fame, fortune, or the consciousness of duty done. With the first and last of these considerations we are not here concerned, though both are powerful incentives to work and have exercised immense influence on the development of civilisation—we wish rather to comment on the financial aspect of the subject, in the light of the correspondence which has been in progress in our columns during the past two months.

The profession of engineering has an inherent fascination for a large proportion of our race, and electrical engineering in particular possesses attractions which have drawn into its ranks a greater number of recruits than is justified by its requirements; throughout the past 30 years the profession has been overmanned, and complaints have been uttered by those who felt that their merits had not received just recognition. Unfortunately it is only too true that the standard of remuneration of electrical engineers in general has been, and is, far below the scale obtaining in other professions which can be entered with less arduous and lengthy training and entail no greater responsibilities, and whilst we look forward hopefully to a bright future, it is impossible to ignore the existing situation.

Various proposals have been put forward with a view to finding a remedy. The efforts of the Electrical Power Engineers' Association have met with a considerable measure of success; not only have its members in electricity supply undertakings secured a recognised schedule of salaries, but also it has gained the respect and confidence of the employers' side of the industry, and has been able to improve the lot of its members in private employ. The Society of Technical Engineers, which is not in a position to adopt the methods of the E.P.E.A., has promoted a Bill for the Registration of Engineers, with a view apparently to restricting the area from which posts can be filled. The bogy of Socialism has been invoked to frighten employers, and the policy of educating employers and the public has been advocated. The Institution of Electrical Engineers has been repeatedly charged with indifference to the interests of its junior members, and urged to take official action in the matter; but this, we know, is impossible, as the Charter of the Institution specifically debars the Council from concerning itself with questions of wages and salaries, and, as the President pointed out at the annual general meeting last week, even the Appointments Register has to be conducted unofficially, quite independently, by a voluntary committee in order to comply with the law. It is useless, therefore, to appeal to the Institution as a body, but the fact does not absolve its members from a measure of responsibility with regard to their fellows, and we welcome the suggestion of Mr. E. T. Williams that the leaders of the profession should interest themselves in the question.

In this, as in many other social matters, education is the soundest means to secure reform. The first step is to bring it home to the public that engineers are not adequately rewarded for their labours; the next, to induce employers to recognise their responsibilities and to remove the reproach under which they lie.

The Central Scotland Scheme.

The publication of the scheme which the Electricity Commissioners have forwarded to the Central Electricity Board, marks the commencement of the operations of that body, which came into office on the first of this month. An outline of the scheme is given on a later page, from which it will be seen that practically the whole of the industrial area of Scotland is embraced within its scope; the Board could hardly wish for a more favourable field in which to put its principles to the test, as the district includes collieries, engineering and shipbuilding, and manufacturing industries in abundance, whilst it is compact, so that long-distance transmission of electricity will not be required, and densely populated centres are numerous, so that the main lines can be tapped with profit. During the next seven years the Board will spend over five millions sterling, of which the greater part will be devoted to the standardisation of frequency, and the owners of selected stations will spend £850,000—a total of six millions, as against about 3.3 millions that would have had to be spent on the basis of individual development in the absence of the scheme; and in ten years' time the area will have an abundant supply of electricity from eight capital stations interconnected by ring mains. Let us hope that the supply will also be cheap; the Commissioners estimate that in the first four years—*i.e.*, 1930-34—there will be a saving of £894,000. On the other hand, at the end of that period the capital charges on the transmission system, up to then suspended, will be brought into account and the Commissioners anticipate a deficit in 1933-34 and later years, which is to be met by a uniform average charge of 0.0475d. per kWh supplied by the Board from the commencement.

A mass of estimates and data has been published by the Board, which will be studied with interest by all concerned with electricity supply.

Publicity for Supply Undertakings.

Simple Language and Plain Statements Essential.

By EDWARD E. HAMAR (Shropshire, Worcestershire and Staffordshire Electric Power Co.)

As one interested in the publicity side of a supply undertaking which distributes power in large industrial and rural areas, I feel that I can offer a few suggestions as to what is a good business-getting style of advertising.

Engineers are too much inclined to take things for granted, that is, they expect the consumer or prospective consumer to know almost as much about the business as they do themselves. The public are certainly becoming more educated in the uses, but not the technicalities, of electricity; therefore only the uses, with the cost of operation, should be spoken of.

It is astonishing how many people who would welcome a supply do not even know how to obtain it. In order to appeal to the public, all advertising literature, whether explaining a particular appliance or the cost of operation, must be in very simple language. The leaflet or booklet may be a work of art in appearance, but if in its pages there appear numerous calculations with such words as volts, amperes, watts, &c., in most instances it will not be understood, and instead of the leaflet being put on one side for reading at leisure, it will be committed to the fire or waste-paper basket.

The periodical circulation of leaflets of seasonal character, commencing with one dealing with "Our Service and How to Obtain It," leads to a marked influx of new and additional business. This initial pamphlet should commence with a simple and brief outline of the generating side of the business, followed by distribution and a simple explanation of how the costs of an electricity supply undertaking are made up, and concluding with detailed information of what to do to obtain a supply and a few of the most important uses to which electricity can be applied. The circulation of such a pamphlet should be followed by a personal call from a canvasser, who should be the type of man who has been educated to talk in a language which is intelligible to the lay mind, that is, simple and non-technical. Seasonal literature, which can be enclosed with the quarterly accounts, should take the form of attractive leaflets giving illustrations of the different electrical appliances, with an explanation and the cost of operation.

It is very pleasing to note that contributions to the non-technical Press generally on electrical service are improving, but in reading between the lines of many of the articles there is still a certain lack of confidence in electrical appliances. This lack of confidence can be largely accounted for by the fact that it is only during recent years that perfection has been attained in certain apparatus. Electricity has developed so rapidly within a short period that many are inclined to think of appliances as they were some few years ago, and not as they are to-day. Quite recently I read an article, excellent in many respects, on electric cooking, and some of the smaller electric domestic labour-saving appliances. Unfortunately, however, it mentioned the great care and attention that was called for, in addition to which a large amount of stress was laid on the fragility of these appliances. I agree that electrical appliances have to be handled with a certain degree of care, but no more care is necessary than would be called for if other methods offered the same convenience and were of an equally portable character.

There is also the question of cost of operation which, in most instances, is dealt with on the lines that electricity is exceedingly expensive if particular attention is not given to control of heat and the like, and that electrical appliances should be handled by the housewife and not the maid, otherwise a very heavy account may be expected at the end of the quarter. Now, such conditions apply to other methods, such as coal, oil or gas, but there is always a very pronounced emphasis upon the cost of electricity. This is in all probability due to the fact that the advance in the knowledge of the writers has not kept pace with the progress of electrical apparatus. Such statements, which are made with no intended malice towards our business, are very harmful to both the manufacturer and supply undertaking. I feel that each of us in our own publicity can do much towards regaining the confidence of the public, for with the perfection of electrical appliances we are now in a position, based on practical experience, to give true facts regarding both reliability and cost of operation.

My comments so far have chiefly dealt with prospective business. Now for a few words regarding the existing consumer, for the loading-up of existing services is as essential as new business. I find from experience that the forerunner of any campaign for obtaining additional loading of service connections should be in the form of a booklet, which could be entitled "Our Service, and What it Will Do." The booklet should be illustrated, with a concise explanation of the appliances, how to use them, and the cost of operation. This can be followed up a few days later by the call of a canvasser, and in many instances it will be found that the booklet has already obtained the desired interest in some appliance or other, and all that remains to complete a sale, or the hire of apparatus, is a few further details. There always appears to be a certain degree of objection to canvassers, for many are inclined to think of a canvasser as one who only considers commission, with no regard to the truth of his statements. Suitable publicity preceding the call will, however, make all the difference in the attitude of the prospective purchaser, and also make it easier for the canvasser.

A further tried suggestion is a house-to-house inventory of all electrical appliances in use or discarded. It is surprising how much apparatus has been put on one side owing to small defects, and apart from this, the information obtained will be found exceedingly useful for other purposes. Here we come to the point as to whether a reasonable allowance could not be made for the old discarded appliances towards replacing them with more modern types. This, in my opinion, is a business proposition, for apart from the resultant increased revenue by again having the apparatus in commission, the confidence of the consumer in electrical appliances is retained. It is really nothing more than a service to which the consumer is entitled and if we wish to see the hoped-for development in the domestic side of our business, service has got to be given.

The Electrical Development Association is now issuing some very attractive publicity matter both in the form of leaflets and posters, and I should like to see a larger display of the latter on the hoardings of towns and villages throughout the country. Good posters leave that lasting impression which in publicity is the goal for which we strive.

Internally-Heated Furnaces.

A recent development in the total enclosure of the heating elements of resistance furnaces by means of specially shaped bricks which are built up to form the furnace lining, providing adequate support and uniform heating.

OF the varied problems encountered by the designer of large internally-heated electric furnaces, that of ascertaining the most effective method of installing the heating elements is by no means the easiest to solve. Numerous forms of construction have been tried both in this country and abroad, differing in type no less than in the difficulties presented by their employment: for instance, the use of knobs of porcelain, or other material, fixed to the walls and roof of the furnace chamber, on which the nickel-chrome wire or strip heating element was wound, led to early failures, the failure of the knobs being in some instances due to heat and in others to mechanical damage; cast nickel-chrome grids have also been employed, but this form of heating element does not satisfactorily permit of floor heating and possesses other disadvantages.

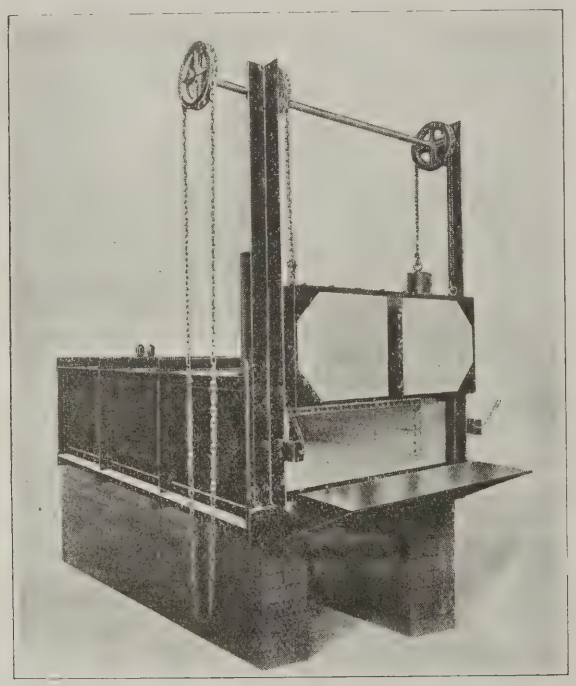


Fig. 2.—A Muffle Furnace, 36 kW at 440 Volts.

The designing of large types of electric furnaces to meet the requirements of manufacturers so far as uniform heating is concerned and, at the same time, guard the heaters and their supports from mechanical damage has been no easy matter. It must be borne in mind that furnaces of large capacity must be of rugged construction to withstand rough usage and the very heavy abrasive wear occasioned by the continuous introduction of heavy articles and their removal from the chamber; this fact led to the decision that heating units in such furnaces should be entirely enclosed, and it was also considered advisable that the bricks forming the lining, and certain other parts of the furnace, should be free to expand and contract during the period when they were being heated and while they were cooling. As the result of the above-stated conclusions, the form

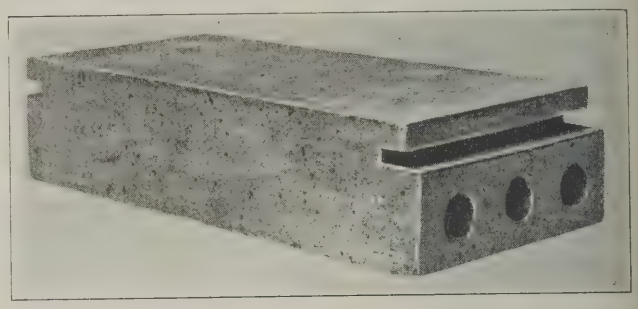


Fig. 1.—Furnace Lining Brick.

of brick construction depicted by the accompanying illustrations has been designed by Automatic and Electric Furnaces, Ltd. The type of brick used in Wild-Barfield internally-heated furnaces is, as shown in fig. 1, pierced with longitudinal holes, so that when the bricks are built up to form a chamber the holes in each adjacent brick coincide to form tunnels through which special spiral heating elements, or rods, can be freely drawn, thus allowing uniform heating conditions throughout the entire chamber; the wire spirals or rods, being entirely enclosed in separate tunnels, are prevented from coming into contact with any material being heated in the furnace, and an arrangement of bus-bars at the far end allows of the linking-up of the various units to meet the requirements of one-, two-, or three-phase supply. Fig. 2 shows a rectangular muffle furnace having a heating chamber 56 in. by 28 in. by 8 in., the input being 36 kW at a pressure of 440 volts on a three-phase supply circuit.

One great advantage of this type of electric furnace construction is the ease with which the heating units can be divided to suit various conditions of supply. In this particular case there are 18 spiralled coils to each phase, the arrangement being six coils in series and three in parallel per phase. The maximum working temperature in the chamber is 1,000 deg. C., and the control is automatically accomplished by means of

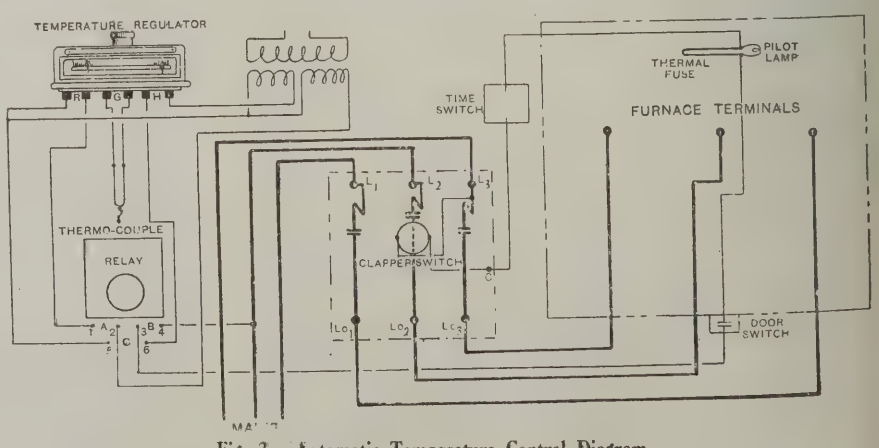


Fig. 3.—Automatic Temperature Control Diagram.

a combined Cambridge regulator and clapper switch. Fig. 3 shows the circuits, and it will be noted that in

the local energising circuit is a patented thermal fuse, which enters the heating chamber and is connected in series with the relay, time switch, door switch, and the energising coil of the clapper switch; it will be seen that the complete circuit may be broken at four different points. The thermal fuse is shunted by a red pilot lamp, so that, in the event of overheating, the red lamp will light immediately the fuse melts. The door switch is automatic in action, *i.e.*, when the door of the furnace is open, the main heating circuit is broken, so that there can be no possibility of shock to the operator; when the door is closed, the circuit is once more made. The time switch is (1) for the purpose of early morning switching on before the works open, so that the furnace is hot when the operatives arrive, and (2) for night operation when the furnace is timed to come into operation after the works are closed, the heating charge being controlled by the automatic temperature control mechanism.

Fig. 4 shows two large Wild-Barfield hot plates, each measuring 6 ft. square, to operate on a 200-volt, 2-phase supply circuit; they have been constructed for a special purpose, uniform heating and simplicity of temperature control being essential; the loading of each plate is 25 kilowatts, and they operate at a temperature of 780 deg. C. It will be noticed that the bricks in which the heating spirals are laid, unlike the furnace bricks shown in fig. 1, have open grooves, so that the heating elements in this case are actually exposed. Many internally-heated electric furnaces are in operation both in this country and abroad, their use not being confined to the heat-treatment of steel, but being equally important in the annealing of non-ferrous metals, glass, &c. In addition, special furnaces of this construction are designed to suit various industrial requirements.

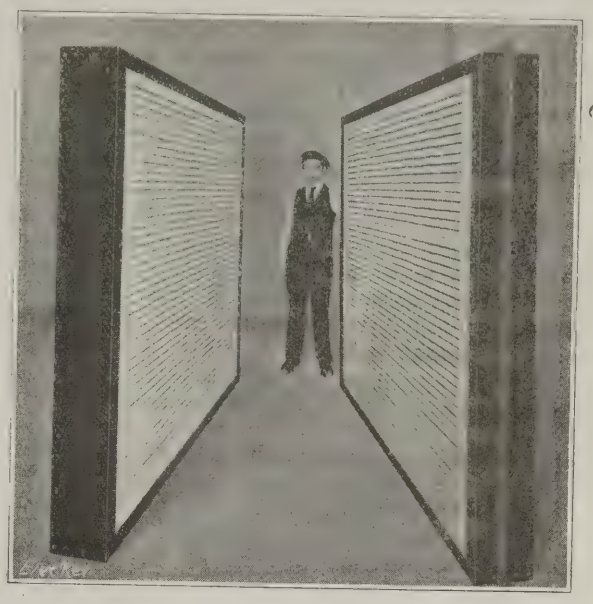


Fig. 4.—Two 25-kW Hot-plates, 200 Volts.

Wireless Telegraph Communication.

A review of the present position of maritime safety services, commercial communication, and point-to-point telegraphy in view of the proposed modified requirements and regulations to be discussed at the International Conference to be held in the United States next Autumn.

By Lieut.-Col. CHETWODE CRAWLEY, M.I.E.E.

(*Continued from page 676.*)

(III) Point-to-Point Wireless Services.

THERE were practically no commercial point-to-point wireless services in operation when the last International Conference was held in 1912, so that the whole field of point-to-point communication will be virgin soil for the International Conference to be held this autumn at Washington.

It is likely that spark waves will be prohibited for international point-to-point communications, owing to their causing such wide bands of interference, but in any case there are now no important point-to-point stations using spark transmission. Rules to regulate the allowable widths of wave bands will no doubt be formulated, and the question whether wireless telephone services should be confined to certain definite wave bands will be considered.

Wave-lengths.—Attempts were made just after the war to formulate some broad principles for regulating the wave-lengths to be used for long range communications. One attractive suggestion was to divide the world into geographical zones so that the receiving stations in any given zone would all be receiving from distant stations waves which, though close together, would not cause mutual interference as the signals would all be of much about the same strength and could be easily sorted out, whereas the strong signals transmitted from stations in that zone, though not differing much in wavelength from one another, would be well separated in wavelength from the signals being received from the distant stations and could thus be eliminated in the receiving circuits. No definite scheme however was adopted, and the network of international wireless communications which has since grown up has been regulated, successfully on the whole, by a policy of compromise and common sense. It is unlikely now that any attempt will be made to allocate wavelengths on geographical or national bases.

There are only about 100 long waves available for the use of high-power stations, so that it would be extremely difficult to arrange for any great expansion of long-wave working, but fortunately the newly discovered possibility of using short waves for long distances has eased the situation

Theoretically there are some 3,500 waves under 100 metres available for long-range work, but it must be remembered that the advent of wireless telephony on short waves for long ranges will before long absorb a great number of waves which would otherwise be available for telegraphic purposes. There are, too, the difficulties that all short waves are not equally suitable for all distances, that short waves which are suitable for certain communications at one period of the day or night are not necessarily suitable at another, and that waves which are suitable at one season of the year may not be so suitable at another. The theoretical

number of available waves, therefore, may be much reduced in practice.

History however will no doubt be repeated, and new avenues for advance will be opened up as in the past. The assumption of the existence in the upper atmosphere of a Heaviside layer which is to some extent conductive due to the presence of free electrons may perhaps, again come to the rescue by allowing advantage to be taken of the skip distance effect of short waves so that waves may be made to skip areas where they would otherwise cause interference. But this solution presents great difficulties as the skip effect is very variable, and a more practical line of advance seems to be presented by the development of beam signalling so as to admit of interference being reduced by confining the greater part of the transmission to definite paths.

It is often said that in this country we are slow starters, which makes it all the more satisfactory to realise that in the utilisation of short-wave beams for great distances we are actually first in the field with our Empire scheme of beam stations. The beam stations for transmission to Canada and South Africa are situated at Bodmin, and for Australia and India at Grimsby, with receiving stations at Bridgwater and Skegness respectively. The wireless valve transmitters are operated by high-speed apparatus in the G.P.O., London, and the wireless signals received are relayed from the receiving stations to the recording machines which are placed alongside the keying apparatus. The Canadian and Australian services are in satisfactory operation, and the others will be ready shortly. These stations, which were erected by the Marconi Company, are to be operated by the Post Office, and in addition the Marconi Company now has a beam service in operation to South America.

In the Empire at the beginning of the year we had working or under construction eight long-range short-wave stations, including the beams, as compared with two in the United States, one in Italy, one in Germany, and one in the Argentine, and we had nine smaller ones, compared with nineteen throughout the rest of the world.

The advantages of using short waves, compared with long waves, are that for long ranges the possible number of stations in operation is enormously increased; as explained above, the power required for operation is much less than that required for long waves, thus greatly reducing capital cost and running expenses; interference from atmospherics is much less, and the signalling speeds obtainable are much greater. The only disadvantage is that, at present, communication by short waves is not nearly so reliable as by long waves due to fading and similar phenomena which are so far little understood and for which remedies have still to be found.

As regards high-power stations using long waves, we cannot boast of numbers as we have only 5 in the whole Empire, compared with 15 in the United States, 9 in France, and 18 in the rest of the world. But on the other hand, it is satisfactory to note that, with the co-operation of the United States, we have inaugurated the first long-range telephone service, the London-New York circuit, and that we have at Rugby the most powerful all-round station in the world.

Operation.—Three systems are used for long-wave transmission over great distances, valves, arcs, and alternators, and we have an example of each in this country.

The Post Office station at Rugby uses valve transmission on an 18,740-metre wave. It broadcasts Government communiqués to ships and stations all over the world free of charge, transmits commercial traffic to ships in any part of the world at an inclusive charge of 1s. 6d. a word, and, in conjunction with a receiving station, is used simultaneously for the transatlantic telephone service on a wave between 5,000 and 6,000 metres from 1.30 p.m. to 7 p.m. daily except Sundays at a charge of from £15 to £17 8s. for three minutes' conversation. For telegraphy, the Rugby station is operated, as are all the Post Office point-to-point stations, over land lines from the G.P.O., London, and for wireless telephony it is operated by the sender's voice over a trunk line from London, the received messages from New York being relayed to London from the wireless receiving station at Wroughton. A new receiving station for this service is being completed at Cupar. A medium-power long-wave set and a short-wave valve set are also being installed at the Rugby station for point-to-point services.

The Post Office arc station at Oxford uses waves of 12,350 metres and 8,750 metres, and transmits commercial traffic to Cairo and Press messages to Halifax. There is, too, a short-wave set at the Oxford station, which is used to supplement the long-wave transmission.

The similar Post Office arc station at Cairo, which will shortly be turned over to the Marconi Company, transmits on an 11,000-metre wave to Oxford, Germany, France, Italy, and Basra, and broadcasts meteorological messages on behalf of the Egyptian Government.

The Marconi Company operates a high-power alternator station at Carnarvon for the transmission of traffic and Press messages to America on waves of 14,200 metres and 9,400 metres. A high-power valve transmitter is also installed at this station as an alternative.

The Post Office operates medium-power long-wave valve stations at Northolt and Stonehaven for transmission to Italy, Cezcho-Slovakia, Hungary, Russia, Poland, Esthonia, and Danzig, and, in case of cable interruptions, to Germany, Norway and Iceland.

All messages received are relayed to the G.P.O., London, from the Post Office receiving station at St. Albans, with the exception of messages from the beam stations, which relay from their special receiving stations.

The Marconi Company operates a group of medium-power long-wave valve stations at Ongar for transmission to France, Spain, Portugal, Sweden, Austria, Jugo-Slavia, Switzerland, and Russia. The company is also free to open services with various other European countries and with countries outside Europe, but all stations for communication with the Empire will be operated by the Post Office.

All the Marconi Company's transmitters are operated from its office at Radio House in London, to which the received messages are relayed from its wireless receiving station at Brentwood.

The Marconi Company also conducts a telephotographic service which is available for the transmission of pictures, printed matter, &c., between London and New York. There is no television service yet in commercial operation.

As a rule the sending apparatus at point-to-point stations is operated by Wheatstone transmitters, and the speed of signalling in the case of the long-wave stations is from 50 to 100 words a minute, and from 100 to 200 words a minute in the case of the short-wave stations. The received messages are normally recorded in Morse code by Wheatstone or undulator instruments, or as printed letters by Creed apparatus. The latter arrangement saves writing up the messages, but is not so suitable as the former ones when receiving conditions are unsatisfactory.

The rates for radiotelegrams are as a rule the same as for cables and land lines, and where no route is specified by the sender the Post Office selects the route according to circumstances at the time of transmission. When the rates differ, the wireless rates are the lower, as in the case of the Australian beam service and the service to Egypt. The rates for the beam services to South Africa and India have not yet been announced.

The broadcasting services can hardly be considered as commercial point-to-point services, but it is interesting to note the number of stations now in operation. In North America there are about 800 (700 in the United States), in Europe 170, in South America 40, in Oceania 30, in Asia 20, in Africa 10, making a total of about 1,070 stations throughout the world.

The Measurement of Sheath Losses in Cables.

The accurate determination of sheath losses in single-core cables is of great importance in connection with the transmission of energy at very high pressures, but has presented great difficulties. The author describes a simple, quick, and accurate bridge method of measurement.

By R. A. BROCKBANK, B.Sc.

CONSIDERABLE attention has been directed recently by cable manufacturers to the determination of sheath losses in cables, in view of the possibility of employing single-core armoured cables for very-high-voltage transmission. The subject has formed the basis of several theoretical studies, but several assumptions have to be made about which the various authors are not in entire agreement, so that it becomes necessary to correlate any differences between experimental data and calculated results in order that the losses may be predetermined with fair accuracy from the physical characteristics of any cable.

Up to the present the published results appear to have been obtained almost exclusively by the use of the electromagnetic wattmeter. This instrument, whilst offering apparently a simple solution to the problem, suffers, even in skilled hands, from many disadvantages, the most serious being:—

(i). Corrections due to the phase angles of the two coils.

(ii). Very low sensitivity with small currents and relatively short lengths.

(iii). Necessity for an absolutely constant voltage supply; the loss varies as the square of the voltage.

(iv). Necessary arrangements for giving various current ranges.

(v). Accurate calibration of voltmeters and ammeters in conjunction with their leads.

(vi). Interpolated resistance readings between each wattmeter reading due to the change in resistance caused by the large currents.

The following method of measuring sheath losses was evolved in the E.H.T. Research Laboratories of Messrs. Standard Telephones and Cables, Ltd., for a special line of research requiring the highest sensitivity, where the electromagnetic wattmeter had to be abandoned owing to its insensitivity and inaccuracy.

The schematic diagram is shown in fig. 1 and consists essentially of a superimposed a.c. and d.c. bridge. The cable (z_1) is connected in series with a standard resistance R_3 of the order of 0.01 ohm. The other side of the bridge consists of two 10,000-ohm decade resistance boxes in series, R_4 being shunted with a 2-mfd. variable mica condenser (C_4). By means of the switch S_1 a d.c. galvanometer or a.c. vibration galvanometer can be thrown across the junction joints of the arms R_1 R_3 and R_2 R_4. The bridge is supplied by a low-voltage loading transformer, and provision is made for balancing the bridge on d.c. by switches S_2 S_3, which admit a 4-volt battery into the circuit. S_2 is a heavy-current-carrying-capacity switch (500 amps). S_4 opens the a.c. supply. The current through the cable is determined by measuring the voltage drop across R_3.

Consider the case when the bridge is in balance on alternating current. Then the impedance of arm (4) $= R_4/(1 + jw\ C_4 R_4)$.

Thus in the balance condition $z_1 \times R_4/(1 + jw\ C_4\ R_4) = R_2\ R_3$, whence $z_1 = R_2\ R_3/R_4 + j\ (w\ C_4\ R_2\ R_3)$
and the phase angle of the cable
$z_1 = \tan^{-1} w\ C_4\ R_2\ R_3 \times R_4/R_2\ R_3 = \tan^{-1}\ w\ C_4\ R_4$.

Therefore $R_2\ R_3/R_4$ will be the equivalent resistance of the cable which multiplied by (current)^2 will give the cable loss.

The bridge is balanced by keeping R_3 and R_4 constant and varying R_2 and C_4; the absolute value of C_4 is not required, unless a knowledge of the phase angle or inductance of the cable is desired.

The d.c. copper resistance of the cable is obtained by switching in the d.c. galvanometer and including the battery in place of the alternating current. R_2 is adjusted for balance.

The sequence of readings to obtain the various losses is as follows:—

(i) Put the bridge on d.c. and adjust R_2 to a value R_o for balance.

(ii) Put the bridge on a.c. with the lead open-circuited. Adjust R_2 and C_4 for balance. Let the value of R_2 be R_a.

(iii) Bridge on a.c. with lead bonded. Adjust R_2 and C_4 for balance. Let this value of R_2 be R_b.

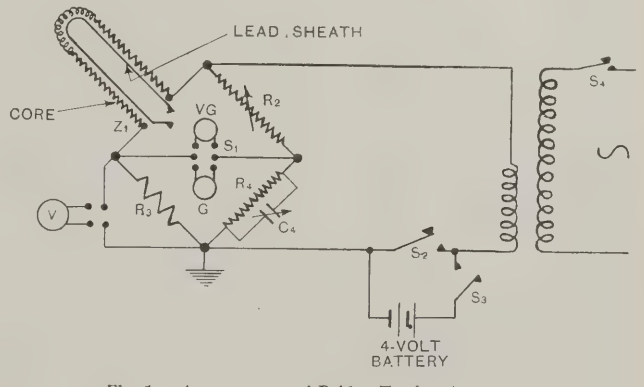


Fig. 1.—Arrangement of Bridge Testing Apparatus.

From these values of R_o, R_a, and R_b—
100 $(R_a - R_o)/R_o$ = loss due to eddy currents, skin effect, &c., as a percentage of the copper loss.
100 $(R_b - R_a)/R_o$ = loss due to circulating sheath currents as a percentage of the copper loss.
and 100 $(R_b - R_o)/R_o$ = total sheath loss as a percentage of the copper loss.
Also $I^2\ R_o$ = "dead" copper loss (on d.c.).
$I^2\ (R_a - R_o)$ = eddy and skin resistance loss.
$I^2\ (R_b - R_a)$ = circulating bonded lead loss.
$I^2\ (R_b - R_o)$ = total bonded loss.

A typical result on a short length of 66,000-volt, single-core, lead-covered cable with 6 inches between axes gave the following results:—

$R_3 = 0.01$ ohm; $R_1 = 4{,}000$ ohms; $R_o = 1{,}980$ ohms; $R_a = 2{,}029$ ohms; $R_b = 2{,}537$ ohms;

therefore loss due to eddy-current and skin effect as a percentage of the copper loss $= 100\ (R_a - R_o)/R_o = 2.47$ per cent.

and circulating bonded loss as a percentage of the copper loss $= 100\ (R_b - R_a)/R_o = 25.7$ per cent.

Therefore total sheath loss $= 2.47 + 25.7 = 28.17$ per cent.

The a.c. and d.c. galvanometers had sensitivities of 100 and 50 mm/microamp. respectively.

A check test on the circulating bonded loss from a knowledge of the lead open-circuit volts and lead and copper resistances gave the following result:—

Core current, 50 amps.; core resistance, 0.004951 ohm.

Lead voltage (open circuit), 0.290 volt; lead resistance, 0.02450 ohm.

Lead inductance (calculated), 20.5×10^{-6} henries.

Therefore, sheath loss $= 0.29^2 \times 0.0245/[0.0245^2 + (314 \times 20.5 \times 10^{-6})^2] = 3.205$ watts;

and copper loss $= 50^2 \times 0.004951 = 12.38$ watts.

Hence ratio sheath loss/copper loss $= 3.205/12.38 = 0.259 = 25.9$ per cent., which is in very good agreement with the measured value of 25.7 per cent.

The advantages which are claimed for this method are:—

(1) *Simplicity and Ease of Control.*—The method is a null method and only requires the adjustment of a resistance and a capacity; the value of the latter need not be known. No readings are taken from deflectional instruments.

(2) *Time of Reading.*—The three readings take from 3 to 5 minutes.

(3) *Accuracy.*—The accuracy depends solely on the accuracy of the decade box R_2, which has a value of 4,000 ohms, and only requires calibration to the nearest ohm to indicate a change in R_1 of the order of 2.10^{-4} ohms.

(4) *Sensitivity.*—The sensitivity is extremely high, and measurements can be made with currents as low as 5 amps. on a few yards of cable if the ratio arms R_3 and R_4 are reduced in value. The balance point is extremely sharp.

(5) *Wave Form.*—As the vibration galvanometer is tuned to the fundamental, only the loss due to a pure sine wave is measured.

(6) *Range.*—Measurements can be taken from 5 amps. upwards without any alteration to the circuit. The only limit is the ultimate carrying capacity of R_2.

Measurements on lead-covered cables do not require to be taken with the operating value of the core current, as the ratio of the sheath to copper losses is independent of the current. In the case of armoured cables, however, the loss must be measured separately for each working current, as the loss is a function of the permeability of the armour, which varies with the magnetising force.

Due primarily to the sensitivity and accuracy which this bridge method offers for measuring the losses on very short samples and small currents (for lead-covered cables), a large number of experimental data have been accumulated which have been correlated with theoretical calculations to a high degree of accuracy.

Ascertainment of "Kilowatt Maximum Demand."

A criticism of the method of obtaining the kilowatt maximum demand defined in the Electricity (Supply) Act, 1926.

By FREDK. W. PURSE, M.I.E.E., M.I.Mech.E., Chief Engineer, West Ham Electricity Department.

WITH the passing of the Electricity (Supply) Act, 1926, the question is brought into prominence of ascertaining the "kilowatt maximum demand" on which the charges for supply are to be based. It will be interesting to quote the exact words in the Act (Section 52 (3) b) and [Seventh Schedule]:—

"For the purposes of this (sub-Section) [provision], the (number of kilowatts of) maximum demand (for) [in respect of] any month shall be deemed to be twice the largest number of units of electricity supplied (to the undertakers) [from the generating station] during any consecutive thirty minutes in that month: Provided that if the number of kilowatts of maximum demand so ascertained [for any particular month] shall be less than the number of kilowatts of maximum demand (in) [for] any previous month of the same year of account (payment shall be made on) the higher numbers [shall be taken as the maximum demand for the first mentioned month]."

This is the first time that public legislation has actually set out how the kW m.d. shall be ascertained; the system prescribed singularly differs from other methods, and it is difficult to understand the basis of its foundation.

Theoretically speaking, the fixed charge per kW should produce exactly the total of the fixed costs when applied to the respective maximum demands, if these have been correctly ascertained.

In considering this matter it will be useful to enumerate the generally accepted methods of ascertaining the kW m.d.:—

(1) The highest recorded in any year of account to be charged throughout the whole year.

(2) The highest recorded each quarter to be charged for that quarter.

(3) The highest recorded in each month to be charged for that month.

Note.—To avoid severe fluctuations in monthly accounts this method can be applied by charging each month the average of the previous twelve months.

(4) The new method in the Electricity Act, which can be called the "Government method."

It will be obvious that to raise a total "fixed charge" of, say, £100,000, the amount to be levied per kW m.d. will be a varying figure under the methods enumerated above.

It will be lowest under (1), highest under (3), some intermediate figure under (2), and indefinite under (4), depending upon the month in which the m.d. occurs.

What concerns supply engineers, however, is which of the methods, when applied, whilst producing the same result to the undertaking, will be most equitable to all the consumers.

A hypothetical example will be of some assistance, and for simplicity's sake it has been assumed that the

undertaking is supplying two consumers only, as follows:—

	A. Registered. kW.	B. Registered. kW.	Undertaking. Registered. kW.
April	40,000	25,000	65,000
May	40,000	15,000	55,000
June	35,000	10,000	45,000
July	30,000	10,000	40,000
August	30,000	15,000	45,000
September	35,000	15,000	50,000
October	45,000	20,000	65,000
November	50,000	30,000	80,000
December	55,000	45,000	100,000
January	55,000	45,000	100,000
February	50,000	40,000	90,000
March	45,000	35,000	80,000
12 months total	510,000	305,000	815,000
Ave. monthly kW	42,500	25,416	67,916

Now assume that the undertaking's fixed costs amount to £407,500. This sum must be obtained in one way or another through the kW m.d., and represents (*a*) £4,075 per kW reckoned on the highest m.d. on the undertaking, or (*b*) 10s. per kW m.d. per month on the actual monthly demand (NOTE.—The same charge of 10s. per month would apply if the average of the twelve months were taken, as mentioned above), or (*c*) £1.2936 per quarter per kW m.d. if charged on the highest m.d. in the quarter.

To clearly see the effect of the method inserted in the Electricity Act, it will be necessary to repeat the above table, but modified to show the figures on which the charges will be made:—

	A. Charged under Government method. kW.	B. Government method. kW.	Undertaking. Registered (as in previous table). kW.
April	40 000	25,000	65,000
May	40,000	25,000	55,000
June	40,000	25,000	45,000
July	40,000	25,000	40,000
August	40,000	25,000	45,000
September	40.000	25,000	50,000
October	45,000	25,000	65,000
November	50,000	30,000	80,000
December	55,000	45.000	100,000
January	55,000	45,000	100,000
February	55,000	45,000	90,000
March	55,000	45,000	80,000
12 months' total	555.000	385,000	815,000
	940,000 kW.		

In this case, to produce the same total fixed cost as before, the charge to A and B will, in accordance with the Act, have to be 8.67 shillings per kW m.d. per month.

If the total costs to each consumer A and B are worked out for the respective methods, they will be found as follows:—

	A	B	Total.
(1) Annual max. demand ...	£224,125	£183,375	£407,500
(2) Quarterly max. demand ...	239,400	168,100	407,500
(3) Actual monthly demand ...	255,000	152,500	407,500
(4) Government method ...	240,598	166,902	407,500

It is obvious that the four methods, giving such varying results, cannot all be right; possibly not one is correct, but one may be the nearest approximation that is obtainable.

Which one is it?

Perhaps if another set of illustrations be worked out with somewhat different characteristics it may throw some more light on the subject.

In the following example the maximum load of each consumer is the same, but one occurs in the summer and the other in the winter, and the total maximum load on the station is the same as in the previous example, *viz.*, 100,000 kW, so that the total fixed costs of £407,500 remain the same.

	A. Registered. Kilowatts.	B. Registered. Kilowatts.	Undertaking. Registered. Kilowatts.	Govt. method. A.	Govt. method. B.
April ...	50,000	45,000	95,000	50,000	45,000
May ...	60,000	30,000	90,000	60,000	45,000
June ...	75,000	12,000	87,000	75,000	45,000
July ...	80,000	12,000	92,000	80,000	45,000
August ...	80,000	15,000	95,000	80,000	45,000
September ...	60,000	30,000	90,000	80,000	45,000
October ...	50,000	50,000	100,000	80,000	50,000
November ...	30,000	65,000	95,000	80,000	65,000
December ...	20,000	80,000	100,000	80,000	80,000
January ...	20,000	75,000	95,000	80,000	80,000
February ...	30,000	70,000	100,000	80,000	80,000
March ...	40,000	60,000	100,000	80,000	80,000
	595,000	544,000	1,139,000	905,000	705,000
				1,610,000	

The respective charges would be:—

(1) Annual maximum demand, £2.547 per kW.

(2) Quarterly maximum demand, 17.34 shillings per kW per quarter.

(3) Actual monthly demand, 7.155 shillings per kW per month.

(4) Government method, 5.06 shillings per kW per month.

The total costs apportioned would be as follows:—

	A.	B.	Total.
(1) Annual max. demand ...	£203,750	£203,750	£407,500
(2) Quarterly max. demand...	212,500	195,000	407,500
(3) Actual monthly demand...	212,874	194,626	407,500
(4) Government method ...	229,060	178,440	407,500

Some curious results emerge from these examples.

In the first set of conditions the quarterly m.d. and the Government method give approximately the same results, but under the second set of conditions the quarterly and monthly m.d.'s give almost identical results.

If the second set of conditions are examined, it will be noticed that consumer A represents a class of load eagerly sought after, *viz.*, a high summer peak and a low winter peak, such as would obtain with a supply to an ice factory.

Yet it will be seen that (assuming the year of account commences in April) this consumer pays the highest amount under the Government method, and in no case less than the other consumer whose m.d. is identical and occurs at the usual time in December.

Generally, the consumer with such a special summer load is quoted a lower rate than other "peak-load" consumers because he is being supplied from plant that would be otherwise standing idle, but this is no logical reason, since this consumer, if he were using his own plant, would have to carry his fixed charges whilst his plant was standing idle in the winter.

The fixed charge is, of course, made on the consumers' kWh m.d., and it would be obviously unfair to base it only on the consumers' demands which coincided with the m.d. on the station, especially under the second set of conditions given above.

The lower rate quoted for what is called a non-peak load should not obtain because of the so-called non-peak; it is a lower rate because all the rates move in sympathy, and this is seen above where the rate under the first set of conditions is £4.075 per kW of annual m.d., compared with £2.547 in the second set of conditions.

It would appear generally that method 1 would give the nearest approach to equality as between consumer and consumer without introducing complicated records and calculations.

If the consumer desires to pay his account according to his monthly or quarterly m.d., it should be at a rate which produced the same result as by applying the approximate rate to the annual maximum demand.

Thus in the first set of conditions consumer A's quota should be £224,125 paid on his annual m.d.

On his quarterly m.d. the charge to produce this sum would be £1.211 per kW, as compared with £1.2936.

On his monthly m.d. the charge would be 8.8 shillings per month, as compared with 10 shillings per month.

Naturally, consumer B's rate on such a quarterly or monthly basis would not be the same, but they would both pay at the same rate per kW of annual maximum demand, *viz.*, £4.075 per kW.

Certain factors may come in to cause variations, such as the total amount of load, whether high voltage or low voltage, power factor, and others which need not be enumerated, but there is not the same difficulty in making adjustments for these.

The fundamental basis to be determined is the correct allocation of the fixed costs as between consumer and consumer according to their loads, and maybe each of the methods enumerated above departs sufficiently from a correct allocation to make them all equally unsound.

The matter has received considerable attention in the United States, and even now there does not appear to be a generally accepted method of ascertainment and application.

In view of the prominent place that two-part tariffs will occupy, both as regards the number of undertakings that will be supplied in bulk by the Central Electricity Board and the number of consumers, domestic in particular, that will be supplied by the respective undertakings, the author suggests that the matter should be specially investigated by some authority or committee with a view to a definite and agreed basis being formulated that could be universally applied by all suppliers of electricity.

Central Scotland Electricity Scheme, 1927.

Prepared by the Electricity Commissioners in pursuance of Section 4 of the Electricity (Supply) Act, 1926, and published by the Central Electricity Board.

THE Electricity Commissioners have prepared the above-named scheme and "transmitted" it to the Central Electricity Board. It deals with an area of 4,980 square miles, as outlined on the accompanying map, including roughly, the whole of the industrial, shipbuilding, and coal-field areas of Scotland, and extending from Montrose and Brechin, in the county of Forfar, to the southern boundary of the county of Ayr.

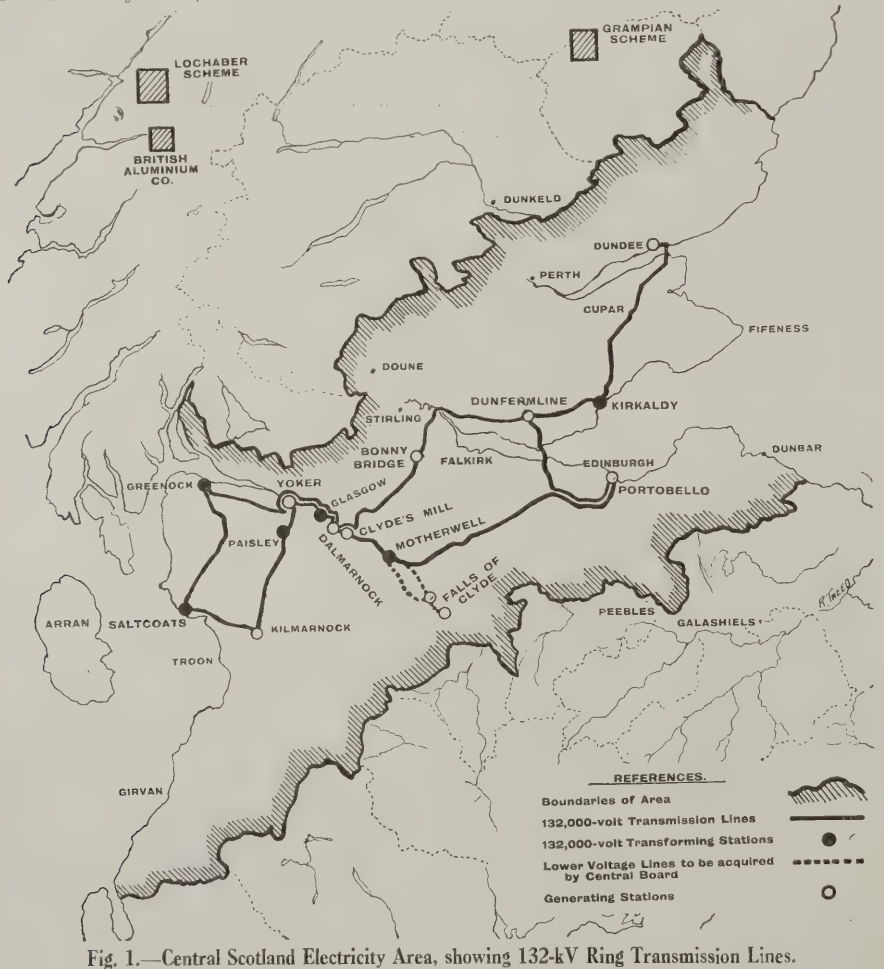


Fig. 1.—Central Scotland Electricity Area, showing 132-kV Ring Transmission Lines.

At present there are 42 authorised undertakers in the area, owning between them 36 generating stations; it is proposed that the following 10 stations shall be selected and operated for the Board: Clyde's Mill and Yoker (Clyde Valley Electrical Power Co.); Dalmarnock (Glasgow Corporation); Portobello (Edinburgh Corporation); the Falls of Clyde (Stonebyres and Corra Linn) hydro-electric stations (Lanarkshire Hydro-Electric Power Co.); Bonnybridge (Scottish Central Electric Power Co.); Carolina Port (Dundee Corporation); Dunfermline (Fife Electric Power Co.); and Kilmarnock (Ayrshire Electricity Board); the four last-named will be required for limited periods only, and will later be dispensed with.

The extension of the following four stations is contemplated: (i) Clyde's Mill; an addition of 50,000 kW for operation by the winter of 1935-36, and a further addition of 50,000 kW for operation by the winter of 1936-37. (ii) Dalmarnock; an addition of 25,000 kW for operation by the winter of 1932-33, and a further 25,000 kW for operation by the winter of 1935-36. (iii) Portobello; an addition of 50,000 kW for operation by the winter of 1937-38. (iv) Yoker; an addition of 25,000 kW for operation by the winter of 1933-34, and a further 50,000 kW for operation by the winter of 1934-35; all to be 3-phase, 50-cycle plant.

The erection of two new 3-phase, 50-cycle capital generating stations, the first section of each to be of not less than 100,000 kW, is contemplated for operation by the winter of 1937-38; the commencement of station B in the east is subject to arrangements which may be made by the Central Board for obtaining electricity from other sources, such as the hydro-electric works authorised by the Grampian Electricity Supply Acts, 1922 and 1924.

It is estimated that by the end of the financial year 1933-34 the capital expended under the scheme will be as follows:—

(*a*) By the Central Board on transmission lines and transforming stations (including capitalised interest), £2,204,034, and on the standardisation of frequency £2,921,250.

(*b*) By the owners of selected stations on extensions (56,250 kW), £850,000.

On the basis of individual development in the absence of the scheme, authorised undertakers would have to provide for the installation in existing or new stations of 250,000 kW (inclusive of the above-mentioned 56,250 kW) to meet the load in that year, representing a capital expenditure of £3,312,320.

Broadly speaking, the scheme looks forward to the area being supplied in ten years' time by 8 capital stations (*i.e.*, 6 existing and 2 new), which will be interconnected by a series of high-pressure main transmission lines. The transmission system is designed to form a series of ring mains, so that there will be alternative routes to points of supply, and consequently greater security against breakdown. Incidentally, the interconnection will release for revenue-earning purposes about 88,000 kW of plant now kept as spare, and representing about £1,670,000 of capital.

The following main transmission lines are to be constructed by the Board for interconnection of selected stations with one another and with the systems of authorised undertakers: Three-phase overhead lines, designed for operation at 132,000 volts between phases and capable in each case of transmitting not less than 50,000 kW, from—(1) Clyde's Mill to Yoker *via* Dalmarnock and Port Dundas (date of completion, October, 1928). (2) Portobello to Dalmarnock *via* Dunfermline and Bonnybridge (date of completion, October, 1929). (3) Portobello to Clyde's Mill *via* Motherwell (date of completion, October, 1930). (4) Dalmarnock to Greenock direct (date of completion, October, 1931). (5) Dunfermline to Dundee *via* Kirkcaldy (date of completion, October, 1931). (6) Yoker to Greenock *via* Paisley, Kilmarnock and Saltcoats (date of completion, October, 1932).

In connection with the aforesaid overhead lines, transforming stations are to be provided at the undermentioned places, each to aggregate a rating in kVA of not less than that specified unless otherwise determined:—

	KVA.		KVA.
Bonnybridge ...	40,000	Kirkcaldy	20,000
Clyde's Mill ...	90,000	Motherwell	30,000
Dalmarnock ...	150,000	Paisley	90,000
Dundee	30,000	Port Dundas ...	90,000
Dunfermline ...	30,000	Portobello	90,000
Greenock	40,000	Saltcoats	20,000
Kilmarnock ...	30,000	Yoker	60,000

Transmission lines are to be acquired by the Board as follows:—Two 3-phase, 11,000-volt, single-circuit main transmission lines from Corra Linn to Stonebyres; two 3-phase, 11,000-volt, double-circuit main transmission lines from Stonebyres to Motherwell.

The Electricity Commissioners have also forwarded with the scheme a series of supplementary particulars in which they have outlined a plan of working the selected stations, with the necessary estimates. These suggestions are, of course, tentative, since the practical working of the scheme, including the fixing of tariffs, is the responsibility of the Board; but, taking the figures as they stand, it is of interest to note that the Commissioners contemplate that the Board should be able to commence supplying in August, 1929, and estimate that in the four years 1930-34 there will be a gross saving to the undertakers in the area of no less than £894,000, or an average of nearly one-quarter of a million per annum. It must be remembered that these savings apply only to a single area in the early days of the Board's work, and should improve steadily even in this area as the use of electricity grows. While the estimates of the Commissioners show that there will be an immediate and substantial saving, the full benefits to the consumer in the shape of reduced prices can only be realised as the progressive economies take effect. The capital already spent on the 30 less efficient stations now existing, but which the scheme contemplates will be closed down, must be paid off, or discharged, and it is only when this has been done that the full advantage of the new system will accrue.

The scheme involves a large measure of standardisation of frequency: no fewer than 11 undertakings and 5 generating stations will have to be altered from 25 to 50 cycles. The Commissioners, in a prefatory memorandum, state that as comprehensive regional schemes cannot be carried out with full economy in areas where there are differing systems without first effecting standardisation, they have advisedly given early attention to industrial areas in which a non-standard frequency has been widely developed. The object is to avoid future expenses on non-standard plant, and to hasten the time when manufacturers as well as undertakers (and consequently consumers) will obtain the benefits arising out of the production of electrical machinery for one uniform frequency only.

Copies of the scheme and supplementary particulars may be purchased for 1s. and 2s. 6d., respectively, from H.M. Stationery Office. Authorised undertakers and other persons may make representations thereon by registered letter addressed to the Board not later than June 14th, 1927. After considering such representations, the Central Board will adopt the scheme, either with or without modification, as need be, and will put the scheme into operation.

The Commissioners have in preparation other schemes dealing with Central England; Yorkshire, Lancashire and Cumberland; South-East England, including London and the Home Counties; South-West England and South Wales, and thereafter for the remaining areas as may be expedient.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Union Cable Co.

With reference to the paragraph published on page 716 of our last issue under this title we are glad to be able to publish a statement based upon information received from the Union Cable Co. The report was based upon a longer one which appeared in another form in the *Frankfurter Zeitung*, and which we are assured is totally incorrect. There have been no negotiations whatsoever between the Union Cable Co. of Dagenham and the German company mentioned, or with any other German interests. The Union Co. has never been approached either directly or indirectly, and we are informed that the board would not on any account entertain any suggestion of such a nature.

Electric Power in Industry.

Further important industries are dealt with in Preliminary Report No. 10 upon the 1924 Census of Production (*Board of Trade Journal*, May 5th). The first is the jute, hemp and linen group, which is stated to have had 6,076 kW of electric generating plant in 1907, 12,964 kW in 1912, and 12,573 kW in 1924. The trades had 23,132 h.p. of electric motors in 1924, power for 12,368 h.p. of which was purchased. The electrical generating plant possessed by the rope, twine and net trades rose from 575 kW in 1907 to 3,205 kW in 1924. Motors aggregating 14,281 h.p. were installed in 1924, and power for 10,470 h.p. of these was purchased. The canvas goods and sack trades had 92 kW of generating plant in 1907 and 614 kW in 1924. The motors aggregated 5,279 h.p. (power for 4,833 h.p. purchased). The linoleum and oilcloth trades reported 3,564 kW of plant in 1907, 6,129 kW in 1912, and 10,364 kW in 1924. The motor power was 15,831 h.p., and power for only 539 h.p. was purchased.

The Department of Overseas Trade.

The Times says that a new movement to save the Department of Overseas Trade from the fate which threatens it has been inaugurated by a number of Conservative members. They are anxious to obtain facilities for a discussion on the following motion:—"That whereas the Department of Overseas Trade has proved its efficiency and value to the satisfaction of trade and industry generally, at whose urgent request it was established, and whereas by its constitution it has been able to co-ordinate and energise the commercial work of the Consular services, Trade Commissions, and other commercial representations throughout the Empire as well as in foreign countries in a manner which past experience has shown to be impossible under the control of any one of the senior Departments, and whereas any apparent small saving in expense of discontinuing it as a separate Department would prove a false economy, as it would be far more than counterbalanced by the loss direct and indirect to trade as well as in the efficiency of the transferred services, this House is of the opinion that the continued existence of the Department of Overseas Trade as a separate Department is essential to the development of trade and industry throughout the whole Empire."

Wages in the Engineering Industry.

As we have already reported, the considered reply of the Engineering Employers' Federation to the engineering trade unions' request for an offer of increased wages will be given at a joint conference on May 19th. In the interval, a meeting of the London District Joint Committee has been held, and a resolution has been passed calling upon the trade union representatives to demand a definite reply from the employers, and, failing the receipt of this, to empower the London Committee to take action to enforce its claim.

The 1927 Radio Exhibition.

We have received from the Radio Manufacturers' Association a mass of details relating to the National Radio Exhibition which is to be held at Olympia from September 24th to October 1st. This includes a form of application and agreement for prospective exhibitors, full regulations, drawings of typical stands, particulars of charges, and plans of the ground floor and gallery, with the costs and sizes of each stand shown. Positions will be allotted by ballot among firms whose applications are received by June 14th. The primary ballot will be for exhibitors at the 1926 exhibition, whether members of the R.M.A. or not.

A "Cosmos" Valve Display.

One of the windows of the premises of Metro-Vick Supplies, Ltd., Charing Cross Road, W.C.2, is illustrated in the accompanying picture. It advertises in a simple but effective way "Cosmos Shortpath" radio valves.



A "Cosmos" Valve Window.

Bankruptcy Proceedings.

John Atkins, trading as Atkins & Co., 59, Church Street, Tewkesbury, The Electricity Works, Northleach, late High Street, Winchcombe, Gloucestershire, electrical engineer.—The receiving order in this matter was made on April 21st on debtor's own petition. The statement of affairs shows liabilities of £803, against assets of £535, leaving a deficiency of £268. Debtor attributes his present position to the failure of an undertaking for the supply of electricity at Winchcombe, and pressure by creditors. In May, 1920, he commenced business in partnership with another at Windsor as electrical engineers. He provided a capital of £270 in stock and cash, and his partner agreed to provide a capital of £200, but only paid a sum of £45. During the partnership they carried out contracts with two companies for the installation of plant and supply of electricity for two towns in Wales. In addition they did the principal portion of the wiring for the consumers in respect of these undertakings. The partnership was dissolved, and in November, 1924, debtor continued trading on his own account. In 1924 he commenced a contract to install the plant and provide the electricity supply for a Northleach company. This transaction was a success, and he also did the wiring for the consumers. Debtor states that his wife advanced him various sums amounting to £696, and that the amount still owing is £153. He also states that in January, 1925, he commenced negotiations for the supply of electricity to Winchcombe, near Cheltenham, and in October, 1925, a company was incorporated to carry out the undertaking. He was later advised to abandon the scheme, as the necessary permit would only be granted to a large supply undertaking. In the meantime the debtor had incurred considerable expense in the promotion and formation of the company, and a signatory who had made advances was claiming the money from him personally. The debtor had also done work to the value of £163 in wiring and fitting for electric light, which was not payable until the electricity supply had been taken to Winchcombe, and the consumers' premises were connected.

W. J. Broome, trading as the Stockport Electrical Company, Garrick Place, Daw Bank, Stockport, electrical engineer.—The public examination of this debtor was held on May 3rd at the Court House, Stockport. The statement of affairs showed gross liabilities of £582, and a deficiency of £486. Debtor stated that he commenced business on his own account in January, 1925, with £15 capital. For a time he was successful, but later it appeared that he overbought about £250 worth of stock. One of his creditors, who had obtained a judgment order against him for goods supplied, secured a committal order. Debtor said that he advertised the business extensively, but had not been able to maintain it long enough to secure the benefits of the advertising. He admitted that he had under-estimated for jobs and then had to sublet them at a larger figure. After further questions the examination was closed.

Jacob Segal, gas and electrical accessories merchant, 2, Vine Street, Tooley Street, S.E.—This debtor failed in September, 1926, with total liabilities £3,344, of which £2,044 is expected to rank, and assets "nil." According to Mr. D. Williams, Official Receiver, the debtor attributes his insolvency entirely to his liability (£2,044) to the petitioning creditor in respect of three guarantees for which he received no consideration. The debtor attended last week before Mr. Registrar Mellor at the London Bankruptcy Court, and was allowed to pass his public examination.

L. Wintle, late of 27, Stafford Street, Market Drayton, electrical engineer.—This debtor attended for his public examination at Crewe Bankruptcy Court on April 29th. The statement of affairs showed gross liabilities of £237, and assets of £1. He said that in October, 1922, his brother commenced business as an electrician, but in January of the following year left to become an employé of an electricity company. On the invitation of his brother he took over the management of the business, which was not successful. The examination was closed.

L. Bell, Joseph Street, Leeds Road, Bradford, trading as Charles Bell, mechanical and electrical engineer.—The first meeting of creditors was held on May 6th at the Official Receiver's office, Bradford. The statement of affairs showed gross liabilities of £3,132, of which £3,067 was expected to rank, against assets of £1,707. The creditors resolved to appoint Mr. John Lund, I.A., as trustee, while a committee of inspection was also nominated.

A. Smethurst (A. Smethurst & Co.), electrical engineer, 62, Bernard Street, Southampton.—First meeting held May 12th, at the Official Receiver's office, Midland Bank Chambers, High Street, Southampton; public examination, May 18th, at the Court House, Southampton.

J. Turner, electrician, 62, Blackburn Road, Great Harwood, Lancaster.—First meeting, May 16th, at the Official Receiver's offices, 11, Winckley Square, Preston. Public examination, June 15th, at the Court House, Blackburn.

A. P. Pacifico (A. Pacy) (partner in the firm of Comton Wireless Manufacturing Co.), 41, Carlton Mansions, N.16.—Discharge subject to consenting to judgment for £5 being entered against him (£5 paid to the trustee in lieu of entering up judgment).

E. G. Batt, electrical engineer, 20, Iverna Gardens, and Magnet House, Kingsway, W.C.—Application for discharge to be heard June 1st at Carey Street, W.C.

C. J. Brookes, wireless dealer, 6, Cross Street, Wigston Magna, Leicester.—Trustee, Mr. E. Barlow, Official Receiver, 1, Berridge Street, Leicester, released April 25th.

A. L. Weekes, electrical engineer, 13, Crescent Road, Luton.—Receiving order made April 28th, on creditor's petition.

Company Liquidations.

Electricity Finance & Distribution Corporation, Ltd.—A petition for the winding up of this company has been presented to the High Court by F. E. Passmore, of Hollyhurst, Wroxham, T. Passmore, of 83, Cannon Street, E.C., and R. P. Higgs, of Crown Works, South Lambeth Road, S.E., executors of J. E. Passmore, deceased, late of Hollyhurst, Wroxham, and will be heard in London on May 17th.

B.D.S. Wireless, Ltd.—A meeting of members is called for June 8th, at 26, Corporation Street, Birmingham, to hear an account of the winding up from the liquidators, Messrs. H. S. Willmott and F. E. Bendall.

Southern Counties Electric Light & Power Supply, Ltd.—First meetings of creditors and contributories, May 12th, at Carey Street, W.C.

Dissolutions of Partnership.

T. W. Bruce & Smith, plumbers, electrical and heating engineers, 23, Strathmartine Road, Dundee.—Mr. T. W. Bruce and Mr. W. S. Smith have dissolved partnership. Mr. Smith will attend to debts and continue the business under the same style at the old address.

South Coast Electric Welding Co., electric welders, 44, Shelbourne Road, Bournemouth.—Messrs. A. E. Gibbs, T. G. Leach, F. W. Wild and F. C. Duell have dissolved partnership.

Ball & Marchant and the Reliance Garage, motor and electrical engineers and garage proprietors, 8, Warwick Street, and South Street, Tarring, Worthing.—Mr. R. Ball and Mr. C. H. Marchant have dissolved partnership. Mr. Ball will attend to debts and continue the business.

Canning's New Works.

Messrs. W. Canning & Co., Ltd., of Birmingham, have placed a contract for their new engineering works to be built in Constitution Hill, in close proximity to their principal premises. The work will be completed in about 15 months' time.

Chinese Dry Battery Organisation.

The *Chinese Economic Bulletin* reports that a Guild of Dry Battery Factories has been formed in Shanghai with a view to the elimination of the "cut-throat" competition which is prevalent. The members number 35, and the first action of the Guild has been to increase prices.

New Catalogues and Lists.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—A May calendar-blotter advertising the "Samson" coal cutter.

BROOK MOTORS, LTD., Empress Works, Huddersfield.—Sheets 161 and 162, announcing the prices of "L" type squirrel-cage and slip-ring motors.

X-RAYS, LTD., 11, Torrington Place, W.C.1.—A profusely illustrated brochure describing the company's X-ray equipment. Fully priced.

MESSRS. L. MCMICHAEL, LTD., Wexham Road, Slough, Bucks.—A circular letter dealing with the company's radio apparatus and a blotter and leaflet (priced) advertising the "Dimic Three" receiving set.

SADIA, LTD., 30, Ely Place, E.C.1.—List H, containing illustrated details of "Sadia" water heaters and auxiliary equipment, with prices and particulars of running costs. Also a folder upon the same subject.

HOPKINSON INDUCTION MOTORS, Willesden Lane, North Acton, W.3.—May stock list of a.c. motors.

MESSRS. YOUNG & WILDSMITH, LTD., 20, Bloomsbury Street, W.C.1.—A net trade price list of electrical materials, accessories, and appliances.

MESSRS. GARNETT, WHITELEY & Co., LTD., Lotus Works, Broadgreen Road, Liverpool.—A series of leaflets dealing with "Lotus" radio components, including a remote-control system. Illustrated and priced.

THE RELAY AUTOMATIC TELEPHONE CO., LTD., Marconi House, Strand, W.C.2.—"The Relay Recorder" for May, containing, in addition to notes on the "Relay" system, a number of interesting little articles.

WESTINGHOUSE ELECTRIC INTERNATIONAL CO., Westinghouse Building, 2, Norfolk Street, Strand, W.C.2.—Three illustrated pamphlets describing the company's "Sentinel" circuit breakers for washing machines, &c., line-starters for squirrel-cage motors, and the thermal overload relay used with the latter, enclosing a sample of the metal employed.

THE MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—Coloured showcards illustrating various types of "Sterling" variable and fixed condensers, and examples of transformers and chokes.

THE ARMORDUCT CABLE CO., LTD., AND REDUCED, 159, Westminster Bridge Road, S.E.1.—A booklet describing a new non-breaking non-kinking damp-proof flex.

THE FACTORY EQUIPMENT CO., 180, Windsor House, Victoria Street, S.W.1.—A price list of various types of pulley blocks.

THE EDISON SWAN ELECTRIC CO., LTD., 123-125, Queen Victoria Street, E.C.4.—A pamphlet describing the R.C.610 valve for resistance coupling.

MESSRS. PETTERS, LTD., Westland Works, Yeovil.—A brochure dealing with "M" type oil engines and their applications.

MESSRS. WARD & GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester.—List No. E.12, describing battery eliminators for radio work, including valve, electrolytic, and d.c. types. Priced and illustrated.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—May price sheet of electrical materials, appliances, and accessories.

MESSRS. LACY-HULBERT & Co., LTD., 91, Victoria Street, S.W.1.—A pamphlet containing illustrated details and prices of "Boreas" electrically-driven air compressors and tire inflators.

MESSRS. FREDERICK J. GORDON & Co., LTD., 92, Charlotte Street, W.1.—A priced and illustrated catalogue of the leading makes of accumulators and dry batteries and accessories.

MESSRS. J. H. TUCKER & Co., LTD., King's Road, Tyseley, Birmingham.—An illustrated folder containing details and prices of small ironclad switch- and fuse-gear.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—May stock list of dynamos and motors.

Aluminium in America.

We quote the following from an April issue of the *American Metal Market*:—"Several railroads in the country have constructed trains employing aluminium extensively, 'bus makers are expanding rapidly, and the general automotive trade is swinging back to aluminium and its light alloys on a scale unsuspected by the uninformed observer. The aircraft industry, destined to become one of the chief outlets for aluminium, is probably operating at a heavier rate to-day than at any time since the war, with encouraging prospects for still greater activity in the near future. In the high-voltage transmission field aluminium is established and recording almost uninterrupted gains from year to year."

Wimbledon's Electricity Service.

The chief engineer and manager of the Wimbledon Corporation electricity undertaking (Mr. A. E. McKenzie) has sent us a recently-issued booklet. This announces reductions in the prices of electricity, and contains a great deal of information regarding the hire and hire-purchase of appliances of all kinds. A number of the leading electrical manufacturers advertise their cookers, washers, water heaters, &c., many of which are supplied by the department. A novel feature of the cooker-hiring scheme is the fact that no rental is charged for the December or March quarters if the quarterly consumption of the appliance is 300 kWh or more.

Unemployment.

The official returns dated April 25th show that the total number of unemployed was 1,044,800, as compared with 1,106,440 on April 18th, a decrease of 61,640. The total on April 26th, 1926, was 981,877.

The Paris Fair.

Among the exhibitors at the Paris Fair which is being held from May 14th to 29th is the Compagnie Française Wild-Barfield, which will show examples of its electric furnaces.

Local Exhibition.

STEPNEY.—Mention was made in our last issue of the electrical exhibition organised by the Stepney Borough Council at



The G.E.C. Stand at Stepney.

the People's Palace, Mile End Road. Among the exhibitors was the General Electric Co., Ltd., whose excellent display is shown in the accompanying illustration.

Book Notices.

"Standards Year Book, 1927"; Miscellaneous Publication No. 77 of the U.S.A. Bureau of Standards. Pp. 392; figs. 39. Price $1.—This book outlines the activities and accomplishments of the Bureau of Standards and other agencies of the Federal Government and the States and Municipalities, and also the American societies and associations of which standardisation is a major or very important activity.

"Simplified Practice Recommendation" of the U.S.A. Bureau of Standards. No. 56. Carbon brushes and brush shunts (5 cents).

Circular of the U.S.A. Bureau of Standards. No. 319. Alphabetical index and numerical list of U.S. Government master specifications, promulgated by the Federal Specifications Board.

The Admiralty has issued tables of the velocity of sound in pure water and sea water, for use in echo-sounding and sound-ranging (H.D. 282). They are to be obtained from Mr. J. D. Potter, 145, Minories, London, E.1, price 1s. 2d. post free.

"Hydro-Electric Hand Book," by W. P. Creager and J. D. Justin. Pp. xxiv+897; 494 figs. London: Chapman and Hall, Ltd. Price 40s. net.

We have received from British Insulated Cables, Ltd., a well-printed 35-page brochure, wherein is reproduced a series of photographs illustrating the overhead trolley wire supporting structures, some of which are of unusual designs, in connection with the electrification work which the company carried out for the Great Indian Peninsula Railway.

Electrical Appliances on an L.C.C. Estate.

The whole of the heating and cooking apparatus for the L.C.C. housing estate, Castelnau, Barnes, will be supplied by the CABLE ACCESSORIES CO., LTD., and the kettles and irons by PREMIER ELECTRIC HEATERS, LTD.

A Siemens-Schuckert Development.

It is announced that the Siemens-Schuckertwerke has taken over from the Swiss Brown, Boveri Co. the majority of the shares hitherto held by the latter in the Isaria Meter Works Co., of Munich. This means an extension of the sphere of the Berlin company, which only a few weeks ago was able to establish itself industrially in the western coal and steel region by the acquisition of the electro-technical department of the Deutsche Maschinen A.G.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during March last amounted to a value of only £35,949, as compared with £38,065 in the corresponding month of 1926. The aggregate imports during the first three months of the present year are returned at £108,322, as compared with £129,187 in the first quarter of the last year.

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E.D.A. Activities.

Among the latest publications of the British Electrical Development Association is a booklet dealing with battery-charging equipment for electric vehicles (E.D.A. 653). This contains notes for non-technical users on modern apparatus and methods, with a number of illustrations.

A Colonial Conference.

A conference of representatives of the Colonies was held at the Colonial Office this week. Among the questions discussed were trade agencies in London and radio communication and broadcasting.

The Liverpool Cable Co.'s Football Team.

The stalwart group depicted herewith is the football team of the Liverpool Electric Cable Co., Ltd. The team has had a



The Liverpool Cable Co.'s Football Team.

very successful season, winning the Liverpool Citizens' League Championship Cup and the Liverpool Citizens' Challenge Cup.

Sussex Contractors' Dinner.

The annual dinner of the Sussex Branch of the Electrical Contractors' Association was held at Brighton on May 4th. Mr. H. L. Smith, who was chairman for two years, presided, and the guests included the president of the Association (Mr. H. J. Miles) and the Mayor of Brighton. The chairman, proposing the toast of "The Corporations of Brighton and Hove," said that the relations of those bodies with the contractors, by means of working agreements, were very amicable; the Mayor of Brighton replied. Mr. F. Winstanley proposed the toast of "The E.C.A. Allied Associations and Officials." In reply, Mr. Miles referred to the fact that the attendance that evening was over 80, whereas only 13 or 14 attended the first annual dinner. That growth was typical of the growing strength of the Association. He called upon members to aid the Government in making the new Electricity Act a success. Mr. L. C. Penwill (secretary, E.C.A.) also responded. Among the other speeches was one by the newly-elected chairman of the branch (Mr. H. L. Holford), who proposed the visitors' health.

Merchandise Marks Acts.

The *Board of Trade Journal* for May 5th contains a joint memorandum by the Board of Trade and the Commissioners of Customs and Excise respecting the requirements as to marks on imported goods.

Trade Announcements.

Mr. Marcel Porn, of 72-78, Fleet Street, London, E.C.4, has converted his business into a private limited company, under the name of Porn & Dunwoody, Ltd. Particulars appeared in our issue of April 29th, page 688. Mr. Porn is managing director of the new company.

Mr. M. Thorburn, 14, Cavendish Vale, Sherwood, Nottingham, formerly representative in Nottinghamshire, Derbyshire, and Lincolnshire for the Siemens & English Electric Lamp Co., Ltd., and other companies, has now joined Messrs. H. R. Cleare & Co., Ltd., Bristol, and will represent them in the same area.

Mr. H. A. Chard, late sales manager to the Electric Art shades, of Kelvedon and Regent Street, W.1, has been appointed general manager of the firm.

Messrs. Hough Bros., radio engineers, have opened premises in High Street, Huntingdon.

The County Electrical and Wireless Stores, Ltd., Deal, has closed its premises at 7, South Street, and the business will now be carried on at 19, High Street.

Messrs. A. Emanuel & Sons, Ltd., have opened a new electrical fittings showroom at 9, George Street, Manchester Square, W.1. A very wide selection of lighting fittings is on view.

The General Radio Co., Ltd., has opened large radio display and demonstration rooms at 105, Regent Street, W.1, in which all kinds of up-to-date receiving apparatus and testing equipment are shown in use.

Recent Contract.

The Electric Furnace Co., Ltd., informs us that the aluminium-annealing furnace which it is supplying to a Scottish undertaking (*vide* Elec. Rev., April 29th) embodies the Wild-Barfield principle of grooved bricks.

The American Refrigerator Industry.

Mr. A. Williams, vice-president of the New York Edison Co., recently stated that 600,000 electrical refrigerators will be manufactured this year, as compared with 200,000 last year. The estimate for 1927 is based on the sales during the first quarter. Reports of the manufacturers, Mr Williams said, indicate that the electrical refrigerator is finding favour not only in the cities and towns, but in many out-of-the-way places. Wherever electrical power is available, it is being installed rapidly. In 1914 only 600 electrical refrigerators were sold in the United States. In 1924 the sale had risen to 24,000, in 1925 to 75,000, and in 1926 to 200,000. These figures do not include the larger refrigerators sold for hotels and other commercial purposes.

Hungarian Radio Import Regulations.

By a recent ordinance radio receiving apparatus may now be imported into Hungary without restriction by anyone having a licence for the "production, sale or maintenance and use" of a receiving apparatus. The importation of radio broadcasting apparatus and parts is, however, still subject to the permission of the Minister of Commerce. Consignments of apparatus will still be cleared by the Budapest Central Customs Office, and will only be delivered to the addressee if he can produce the necessary licence. The regulations also apply to the movements of apparatus within the country.

Storage Batteries in Australia.

In the course of a recent debate in the Federal House of Representatives, reports the *Daily Telegraph* (Sydney), Mr Coleman (N.S.W.) said that complaints had been made that storage batteries, which were provided for in the last tariff schedule, and which prior to their manufacture in Australia were sold at £11 10s., were now being dumped. There were now six manufacturers in Australia, and the overseas article had been reduced to £5 5s. and £6 6s., with a 40 per cent discount to garages, as against 25 per cent. previously. Mr Pratten, Minister for Trade and Customs, said the statement suggested a triumph of protective policy, in the direction of reducing prices to the consumer by the competition created by local manufacture.

Correction.

We wish to direct our readers' attention to an error which occurred in the advertisement of Messrs. Parmiter, Hop and Sugden on page xxviii in our last issue. The company's old address was given instead of Fluvent Electric Works, Vernon Street, Longsight, Manchester.

For Sale.

Darlington Corporation Electricity Committee invites offers for one 220/280-kW steam generating set. (See our advertisement pages to-day.)

Prices of Raw Materials.

Messrs. James Forster & Co., in their report on lead, state on May 7th:—"The market has been marking time this week with small daily fluctuations. . . . A fair amount of buying by home consumers has been seen, cable-makers taking moderate quantities, but not enough to give the needed filli to the market. . . . Reports from the Continent are optimistic. . . . The weak spot is in America, and the future largely depends upon the course events take in that country."

Messrs. F. Smith & Co. report, May 10th:—Copper (electrolytic) bars, £61 15s., 5s. inc.; do. do., sheets, no change; do. do. wire rods, £71 15s., 5s. inc.; do. do. H.C. wire, no change.

Messrs. James & Shakespeare report, May 10th:—No change in the prices of copper bars (best selected) sheet and rod. English pig lead, £27, 5s. dec.

Messrs. Edward Till & Co. report, May 10th:—No change in the price of india-rubber, para fine.

Lighting and Power Notes.

Algeria.—New Power Station.—In order to meet the increasing demand for electricity supply the Société Algerienne d'Eclairage et de Force is about to commence the establishment of a new steam-operated power station on the Mole at the port of Algiers. The output of the existing station advanced last year to 44,463,925 kWh from 39,033,907 kWh in 1925.

Australia.—Cairns (Q.).—The Cairns Hydro-Electric Board has received a report from Mr. P. A. W. Anthony recommending the harnessing of the Barron Falls without delay. The cost of the scheme is estimated at £202,500, made up as follows:—Plant, £180,000; transmission line and reservoir, £19,500; line to Cairns, £3,000.

Shoalhaven River Development.—The *Electrical Engineer of Australia and New Zealand* states that investigations are being made of the economics of a proposal to generate hydro-electric power from the Shoalhaven River, N.S.W. It is estimated that 50,000 kW can be developed at a cost of £2,413,000 from power stations at Sewell's Point and Murray's Bend. This scheme would provide energy for Canberra amongst other places.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—Projects which will entail large expenditure in the development of natural resources in Albert and Westmoreland counties of south-eastern New Brunswick are before the Government and Legislature of the Province. A Bill, which has received its first reading, is to incorporate the Petitcodiac Tidal Power Company and would give the right to develop hydro-electric power on the confluence of the Memramcook and Petitcodiac rivers. It has been estimated that a minimum of 100,000 h.p. and a maximum of 200,000 h.p. can be developed and that the cost of the entire development would be $23,000,000.

Development of Albert County oil shales is also before the Government. The Maritime Education Co., Ltd., has been interested in this project and has carried out preliminary work. It is proposed to spend $150,000 this summer on plant erection, and the undertaking has been underwritten by New York financial interests.

Chichester.—ELECTRICITY IN BULK.—The Corporation, on the recommendation of the Electric Light Committee, has consented to the Bognor Gas Light and Coke Co. laying a cable within the Corporation's area of supply, *viz.*, from the boundary of the parish of Pagham to the Corporation's sub-station at the Anchor Inn, Sidlesham, for the purpose of enabling the company to receive a supply of electricity in bulk, the draft agreement, as altered on behalf of the company for the supply through the Chichester cables, having been approved.

Cornwall.—INAUGURATION OF POWER STATION.—The first stage in the electrical development of the Fowey, Par, St. Blazey, and St. Austell districts of Cornwall was completed on May 7th, when the Lord-Lieutenant of the county inaugurated the new power station of the St. Austell and District Electric Lighting and Power Co., Ltd., at Pont's Mill, St. Blazey. The plant includes two 300-h.p. and one 200-h.p. Diesel engines and three dynamos. Electricity is transmitted to Fowey, Par, St. Austell, and other places. Provision has been made for further extensions as required.

Continental.—FRANCE.—The Société Electrique du Nord-Ouest, in its report for the past year, states that all its power stations are now interconnected so that a supply can be given throughout the whole of its area, which includes the towns of Amiens, Arras, Dunkirk, Calais, Boulogne, and Abbeville. The company has now about 280 miles of 45,000-, 90,000 and 150,000-V transmission lines in operation. The sales of electricity during the last financial year showed an increase of 21 per cent. over 1925-26.

Steady progress is being made with the construction of the hydro-electric power stations which the Société de l'Energie du Rouergue is establishing to utilise the water power of the River Tarn. The company has recently secured the concession for a h.p. transmission line from Le Truel to Beziers with an extension to Pinet and a branch to Màdiere. Contracts have also been secured for the supply of large quantities of electrical energy to the Société Sud Electrique, the Société d'Energie Electrique de la Sorgue et du Tarn, the Office Nationale de l'Azote of Toulouse, and the Société Vieille Montagne, whose hydro-electric plant at Thuries, which has an output of 20 million kWh per year, will be connected with the transformer station at Pinet, and in future be operated by the Rouergue Co.

ITALY.—The output of the various plants of the Società Ligure Toscane d'Elettricità during the past year amounted to 189,019,400 kWh, as compared with 171,084,400 kWh in 1925. In order to meet the increasing demand the company is engaged on the construction of a new steam-operated power station of 60,000 h.p. and the erection of a 120,000-V transmission line to connect with the power stations at Valdarno and Adamello.

Epsom.—ELECTRICITY FOR HOUSING ESTATE.—The Urban District Council has applied for sanction to a loan of £3,100 for laying cables to supply electricity to Council houses on the Horton Estate. It has also decided to purchase 120 electric cookers to be installed in the houses.

Grangemouth.—ELECTRICITY SUPPLY.—The Town Council has granted an application by the Scottish Central Electric Power Co., for permission to lay a 6,000-V cable underground along Earl's Road, from Larbert to a sub-station in Bridge Street, Grangemouth. Consent was refused to an application by the Scottish Midlands Electric Supply Co., Ltd., to erect an overhead l.p. line between Grangemouth and Skinflats.

Hull.—LOAN SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £3,150 for the purchase of land for railway sidings at Sculcoates Lane generating station and for sub-station sites in Clarendon Street and Plane Street.

SUPPLY TO HOUSING ESTATE.—The Committee has informed the Housing Committee that it will be prepared to lay mains on the East Hull Housing Estate if the Housing Committee will undertake to wire the whole of the houses on the estate.

Iceland.—HYDRO-ELECTRIC DEVELOPMENT.—It is announced from Copenhagen that the Lower House of the Icelandic Alting has approved by 12 votes to 9 the granting of a concession to the Norwegian A.S. Titan for the utilisation of the water power of the River Tjorsaa in the South of Iceland to the extent of 160,000 h.p. Under the concession the company would have to construct a railway from Reykjavik to the South of Iceland, and the State would participate in the expenditure on this line. The bill is now under the consideration of the Upper House.

Irish Free State.—DUBLIN.—At a recent meeting of the City Commissioners it was reported that the Department of Industry and Commerce had sanctioned the expenditure of £150,000 on the work in connection with the electricity undertaking.

Leeds.—LOAN SANCTIONED.—The Corporation Finance and Parliamentary Committee has received sanction to the borrowing of £500,000 for the erection of the new power station on Bedcote Farm Estate, Kirkstall.

Leicester.—LOAN.—The Electricity Committee has recommended to the Corporation that application be made for sanction to a loan of £640,000 for extensions to the electricity undertaking.

Liverpool.—LOANS.—Application is being made by the Electricity Committee for sanction to the borrowing of the following loans: Main transmission line, Lister Drive to Aintree, £36,742; transforming plant, £18,291; switchgear, £9,500; construction of main transmission lines—Lister Drive to Smithdown Road, £30,306; Lister Drive to Lark Lane, £32,493; Lister Drive to Beaumaris Street, £37,082.

London.—HACKNEY.—The Electricity Committee has submitted a report to the Borough Council on extensions to the electricity undertaking to be carried out during the periods 1927-28 and 1929-30. For the period 1927-28 an expenditure of £131,400 is proposed, which would include the substitution of one 10,000-kW turbo-alternator for the 5,000-kW set at present in use, and the installation of additional plant and equipment at six sub-stations. During 1929-30 extensions are recommended involving an estimated expenditure of £199,890. This would include further additions to existing, and the erection of new, sub-stations, and the laying of e.h.p. feeders. The Committee has recommended that application be made to the London and Home Counties Joint Electricity Authority and the Electricity Commissioners for sanction to the scheme and necessary loans.

WIMBLEDON.—The Corporation Electricity Committee has received sanction to the borrowing of £80,000 for mains and services, and £4,000 for sub-stations and equipment.

SOUTHWARK.—The Electricity Committee has approved an estimate prepared by the borough electrical engineer for new mains and services during the financial year amounting to £7,190.

Lytham-St. Annes.—LOAN SANCTIONED.—Sanction has been received by the Town Council to the borrowing of £33,000 for mains, meters, and services.

Mexico.—HYDRO-ELECTRIC DEVELOPMENT.—A new hydro-electric power plant with a capacity of 100,000 h.p. is to be established on the River Lerma by the Mexican Light and Power Co., Ltd.

Northern Ireland.—WARRENPOINT (Co. ANTRIM).—At the last meeting of the Urban District Council it was decided to offer no objection to either the Warrenpoint Gas Consumers' Co., Ltd., or Mr. J. U. Finney, Banbridge, applying to the Electricity Commissioners for Northern Ireland for powers to supply electricity in the town.

Nottingham.—ELECTRICITY ACCOUNT.—A report of the Electricity Committee, which has been presented to the City Council, states that whilst a profit of £22,000 was made during the past year, it is undesirable to allocate any portion of it to the relief of rates, in view of the fact that it is hoped shortly to reduce the charges for electricity.

Peterhead.—PROPOSED NEW POWER STATION.—The Town Council has agreed to give the Electric Supply Corporation, Ltd., a site in Ugie Street for the erection of a generating station. The consent of the Electricity Commissioners has not yet been obtained to the scheme.

Preston.—ELECTRICAL DEVELOPMENT.—Rapid progress is now being made with the various extensions of the electrical distribution system from Ribble power station. The Blackburn-Preston cable is now practically completed, and a commencement has been made with the Blackpool overhead cable.

Price Reductions.—Reduction in the charges for electricity have been made or recommended in the following districts:—

WIMBLEDON.—General lighting: From 4½d. to 4d. per kWh. Basement and cellar lighting (business premises): From 3½d. to 3d. per kWh. Shop window lighting (time switch): From 2d. to 1d. per kWh. Outside advertising signs: From 4½d. and 2d. to 4d. and 1d. per kWh. Maximum demand system (rental wiring): The rental of 2d. per point per week throughout the year reduced to 1½d. during the summer quarters. Water heaters (continuously in circuit): From ¾d. per kWh during the summer and 1d. during the winter to ½d. per kWh by separate meter all the year round. Reductions have also been made in the kinema and industrial power supplies.

SOUTHPORT.—Power (maximum demand system): First 90 kWh per kVA of maximum demand, 2d. per kWh; next 30 kWh, 1½d.; beyond 120 kWh, 1d. per kWh.

ALDERSHOT.—Ordinary lighting: From 8d. to 7d. per kWh. Factory and outside lighting: From 6d. to 5d. per kWh. Power: Existing rates up to 10,000 kWh to continue; from 10,000 to 15,000 kWh, from 2¾d. to 2½d.; 15,000 to 20,000, from 2½d. to 2¼d. per kWh; all energy in excess of this amount,

from 2¾d. to 2d. per kWh. Kinemas, &c.: First 100 kWh per week, from 8d. to 7d. per kWh; beyond, from 4½d. to 3½d. per kWh.

Shaldon.—Inauguration of Supply.—An electricity supply for the district was recently formally inaugurated. Electricity is obtained from the Newton Abbot generating station and is being conveyed to Shaldon by an 11,000-V cable laid in the bed of the river.

Sheffield.—Electricity Supply.—In connection with the recommendation of the Electric Supply Committee to obtain authority to incur the expenditure necessary to proceed with the installation of an additional 20,000-kW set at Blackburn Meadows, the general manager states that he has been in communication with the Electricity Commissioners to ascertain if such proposals agree with the arrangements which they are contemplating for the development of electricity supply in this area. The Commissioners have replied that they are now making a survey of an area which includes Sheffield and anticipate that they will be in a position to publish the scheme during the autumn. They are therefore of opinion that the position of Sheffield will not be prejudiced by delaying a decision until after the scheme for that area has been formulated. The Committee has decided to inform the Commissioners that further generating plant is urgently required to meet the increased demand anticipated in the near future, and that it is therefore imperative that it should be informed at an early date of the Commissioners' contemplated arrangements.

Loans Sanctioned.—The Committee has received sanction to the borrowing of £1,122 for the Roach Road sub-station, £12,150 for mains, £4,300 for converting plant, £3,918 for switchgear and building work, £31,782 for mains, and £75,000 for sub-station equipment.

South Africa.—Cape Town.—According to the *South African Engineer*, the Corporation's programme of electrical development for the years 1927, 1928, and 1929, involves a total estimated expenditure of £500,000, made up as follows:—Land and buildings for 18 static transformer sub-stations 11,000-380-200 V, £30,000; equipment of new and extensions of equipment in a total of 40 sub-stations, £88,400; extensions of and additions to generating plant and equipment, £87,750; provision of new d.c. feeders and further instalment of reconstruction of l.p. distribution network, £83,000; additional street lighting, £12,500; extensions of mains, £30,000; provision for altering network in central city area from overhead to underground, £10,000; new 11,000-V, 3-phase feeders, £32,850; new l.p. feeders, £40,000; provision for respective portions of cost of tie feeders and other cables for joint operation of Council's and Electricity Supply Commission's generating stations, £25,500; share of supervisory control and telephone communication throughout combined E.S.C. and Council's systems, £10,000; extension of mains outside municipal area, £50,000. The plant extensions include an additional 7,500-kW turbo-alternator and two 50,000-lb. water-tube boilers with auxiliary equipment, practically all of which is already on order, and will be installed within the next few months.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Cumberland Waste Heat Owners Co., Ltd., authorising it to supply electricity within part of the rural district of Whitehaven, and the Urban District Council of Wivenhoe to supply electricity in the urban district.

Watford.—Power Station Extension.—The Corporation Electricity Committee has approved the expenditure of £65,500 for the extension of the power station, the Committee not being in favour of a bulk supply from the North Metropolitan Electric Power Supply Co., Ltd.

Loan.—The Committee is applying for sanction to borrow £7,000 in respect of underground mains and sub-station buildings and equipment at King's Langley.

Extension of Supply.—An application from the Berkhampsted Rural District Council for a supply of electricity to Bourne End is under consideration.

West Ham.—Loans Sanctioned.—The Town Council has received sanction to loans of £35,486 for electricity purposes, and £45,000 for the provision of additional offices, &c., in Romford Road, for the Electricity Department.

York.—Extension of Supply.—The City Council has decided to extend its area of electricity supply to the villages of Stockton-on-Forest, Shipton, Naburn, and Acaster. The laying of the necessary cables will cost £7,630.

Tramway and Railway Notes.

Australia.—Sydney Suburban Railways.—The *Industrial Australian and Mining Standard* reports that the New South Wales Minister for Works and Railways (Mr. Flannery), has supplied the following information regarding the electrification of the various sections of the Sydney suburban system:—Bankstown line.—Electric service commenced, October 10th, 1926; electric service to be completed, July 1st, 1927. Milson's Point to Hornsby.—Service to commence July 1st, 1927; complete service, December 31st, 1927. Main suburban line to Homebush.—Service to commence, December 1st, 1927; complete service, January 1st, 1929. Liverpool and Bankstown to Regents Park.—Service to commence, January 1st, 1929; complete service, April 1st, 1929. Homebush to Parramatta.—Service to commence April 1st, 1929; complete service, November 1st, 1929. Granville to Cabramatta.—Service to commence, November 1st, 1929; complete service, March 1st, 1930. Strathfield to Hornsby.—Service to commence, March 1st, 1930; complete service, November 1st, 1930. Mr. Flannery states that this programme is subject to the necessary funds being made available as required. When the whole city and suburban electric system is completed there will be in the city proper 22 miles of track and nine stations, and a total of 221 miles of track is to be electrified in the suburban zone. For the electrified system about 1,200 cars will be required. During the year ended June 30th last, more than 100,000,000 passengers were carried on the suburban railways. The direct result of the completion of the electrification of the first section of the suburban lines (from St. James to National Park, a distance of 19 miles) has been an increase in revenue on that section of 20 per cent., although the work has been completed for only a little more than four months. The total cost of the works at present in hand and chargeable to railway capital are:—Sydney Harbour Bridge (two-thirds debitable to railway capital), £4,000,000; city railway, £6,950,000; electrification and widening of suburban lines, immediately necessary, £8,981,000; new rolling stock, £5,805,000; total £25,736,000.

Continental.—Austria.—The Austrian State Railway authorities are preparing two new railway electrification schemes. The first scheme, which will occupy a period of five years, includes the electrification of about 380 miles of track and comprises the Vienna-Salzburg and Vienna-Gratz-Nauer lines. The second plan provides for the electrification of about 475 miles.

France.—New electric local railways have lately been completed and opened for traffic between Champagnole and Boujailles and between Champagnole and Froncine-le-Haut in the Department of Jura, the total length of the lines being about 32 miles.

Irish Free State.—Proposed Railway Reconstruction.—English visitors, believed to be members of a British syndicate, recently visited Portumna, Co. Galway, and inspected the disused railway from that town to Birr, in King's County, a distance of nearly 20 miles. The inspection was carried out with a view to the possibility of reconstructing the railway to carry on the service with power obtained from the Shannon scheme later. The visitors were satisfied that the reconstruction of the line would present very little difficulty, and in connection with the Shannon scheme, might easily become a paying proposition.

Japan.—Railway Schemes.—The Tokio suburban electric railway lines are being extended in all directions. The Nanbu Railway line from Kawasaki station on the Government Keihin line to Noborido, crossing the Tokio-Yokohama Railway line, was opened for traffic on March 10th. This railway is to eventually join the Tamagawa Railway and the Odawara Rapid Transit Railway. The Odawara Rapid Transit Railway with a length of 50 miles, from Shinjuku (Tokio) to Odawara, was to be opened in April. The Seibu Railway's new line from Takata-no-Baba Station on the Government Yamate line to the Higashim-Urayama station on the Government Kokubunji line will be opened shortly. Other railways to be opened are the Meguro-Kamata Railway Co.'s Oi-Shibuya line, and an extension of the Ikegami Railway.

On March 7th the inaugural meeting of the Nikko Mountaineering Railway Co., Ltd., was held. The company will construct an electric railway from Myowaga-hara to Chugu Temple.

The I.G.R. has decided to complete the electrification of the Hachioji-Kofu line during the next five years at an outlay of 8,906,000 yen. Four sub-stations will be erected between Hachioji and Kofu. The system will be 1,500 V. The Hachioji-Otsuki section will be completed by the fiscal year of 1929-1930, and the Otsuki-Kofu section between the fiscal years 1929-1930 and 1930-1931.

London.—L.C.C. Tramways.—The estimates for the year 1927-28 in connection with the L.C.C. tramway undertaking show that the revised estimated deficiency for the year 1926-27 is £302,114. It was originally estimated that there would be a net deficiency of £127,330. The revised estimated surplus on working is £178,575, as compared with the original estimate of £407,795. The financial loss during the general strike is estimated at £74,000, and the additional cost of fuel due to the coal dispute at £152,000. Apart from these two factors, therefore, the original estimated gross surplus would have been practically maintained in the revised figures.

Manchester.—Loan.—The City Council has approved a recommendation of the Finance Committee that application be made for sanction to a loan of £155,000 for reconstruction of the Middleton Light Railway and the erection of a garage in Queen's Road. The light railway was recently purchased from the Middleton Electric Traction Co., Ltd.

Nottingham.—Year's Working.—Although results were marred by the coal strike, the working of the Corporation tramway system during the past year was satisfactory. Total receipts, including rent of leased lines, amounted to £423,092, this being a decrease of £19,813, as compared with the pre-

vious year, and the working expenses were £317,550, an increase of £2,461. After meeting capital charges and making contributions to the reserve and renewals funds, a sum of £20,000 was transferred to the borough fund. The Corporation now owns 200 tramcars, 45 motor omnibuses, and 10 railless cars. During the year 74 million passengers were carried by the combined services.

Stretford.—EXTENSION OF TIME.—The Urban District Council has given notice of its intention to apply to the Ministry of Transport for permission to extend by one year the time for the completion of the railways authorised by the Stretford Light Railways Order, 1906, and of Railway No. 10 authorised by the West Manchester Light Railways (New Lines, &c.) Order, 1906.

United States.—PHILADELPHIA.—Delivery of equipment for the Philadelphia subway has commenced. The cars are being constructed by the J. G. Brill Co., and the motors, control and other equipment for the first 150 cars have been delivered by the Westinghouse Electric and Manufacturing Co. According to *Electric Traction*, each car will carry two motors, the motor rating being 200 h.p. The control is the ABF type for rapid transit service, having a special automatic feature that allows the controller handle to be turned to the full " on " position at once and the car will then automatically accelerate. The cars will be 67 ft. long, 10 ft. wide, and 12 ft. 3 in. from rail to roof. The construction includes longitudinal seats for 25 passengers and transverse seats for 50 passengers. Each car is equipped with six double doors, three on each side. The total weight, completely equipped, will be 105,000 lb. These cars will embody every conceivable safety device, including automatic stop control, and when completed will constitute the most perfect group of this kind of rolling stock. The Westinghouse Co. is also manufacturing 750 specially-designed electric fans for the ventilation of the new cars. The total cost of the subway is estimated at $100,000,000.

Telegraph and Telephone Notes.

Continental Telephony.—HOLLAND-SWITZERLAND SERVICE.—The Postal and Telegraph Administration announces that on and after May 16th direct telephone communication will be opened between all offices in Holland and Switzerland.—*Reuter* (Amsterdam).

Germany.—SHIP-SHORE TELEPHONY.—It is reported from Hamburg that experiments are in progress with the object of connecting steamships and other vessels, when in port, with the local telephone system.

Guatemala.—WIRELESS TELEGRAPHY.—An arrangement with the Tropical Radiotelegraph Company (a subsidiary of the United Fruit Company organised to handle the radio business of its steamships and stations in the United States) has been concluded by the Government for the connection of the State radio station with the Fruit Company's system in Central America. The Tegucigalpa (Honduras) station has been decided upon as the connecting link with the other five States, and the Company's station in New Orleans will connect with the rest of the world and transmit Press messages at a discount of 50 per cent. on the actual rates. By special arrangement with the Minister of Promotion, messages of general interest up to 300 words from the Press of Guatemala City to that of San Salvador will be sent free of charge.—*Reuter's Trade Service* (Guatemala City).

Italy.—REPORTED WIRELESS DISCOVERY.—Signor Majorana, Professor of Physics at the University of Bologna, has written to the Reale Accademia dei Lincei at Rome, claiming to have discovered a system of wireless telephony in which ultra-violet rays are employed. In experiments made between Bologna and a place 16 kilometres distant conversations were, it is said, carried on with great clearness and in secrecy.—*Reuter* (Rome).

The Telephone Service.—" TANDEM " EXCHANGE.—The new " Tandem " exchange, which, by means of junction lines, will enable any London exchange to be accessible to all the others during the transference of the system from manual to automatic switching, has been completed, and is being tested by means of artificial traffic.

LARGE PRIVATE EXCHANGE.—A new automatic telephone exchange, the largest private installation in Scotland, has been opened by the Glasgow Corporation. The exchange is built on the expanding bookcase system, and is fitted with duplicate ringing machines; while the central switching apparatus has a capacity for 500 lines, the total number of lines now working is 321 of all classes, including 41 external lines connecting outside departments with the City Chambers. The automatic equipment was installed by the Relay Automatic Telephone Co., Ltd.

Wireless at Sea.—SHIPS' " AUTO-ALARMS."—At the annual meeting of the Marconi International Marine Communication Co., Ltd., its managing director (Mr. F. G. Kelleway) announced that the authorities in this country were on the point of issuing rules governing the installation on merchant ships of the " auto alarm," actuated by a special signal which, in time of distress, would give audible warning of the need for help, and summon to the wireless apparatus on the ship where the alarm was received the telegraphist who at the time might be off duty.

Radio Notes.

Atmospherics.—AN INVESTIGATION.—The Royal Meteorological Society recently issued a report on an attempt to ascertain the range of atmospherics; that is, how far away are the storms that produce the X's which interfere with reception in England. The Society, with the co-operation of the B.B.C., appointed observers in various parts of Europe, equipped with broadcast receivers and advance copies of certain talks transmitted simultaneously by B.B.C. stations, to which they listened. Whenever they heard a strong atmospheric they put a mark on the manuscript through the syllable on which it occurred. At the same time automatic direction finders in Aberdeen, London and Egypt, recorded the directions of atmospherics which occurred when the talks were taking place. When the papers were gathered and compared with the records made by the direction finders, the results were remarkable, says the *Evening News*, which explains that in several cases atmospherics were observed at identically the same moment by listeners in Madeira, Ireland, Germany and Norway, and the direction finders showed that the thunderstorm responsible at the moment was situated somewhere in the West Atlantic. The results show that atmospherics may be due to storms taking place perhaps 4,000 or 5,000 miles away. Instructive observations of a similar nature are contained in I.E.E. papers (Vol. 63, No. 346, and Vol. 64, No. 353), by Capt. H. J. Round and Mr. R. A. Watson Watt, respectively.

Lithuania.—NEW LICENCE FEES.—The Lithuanian Parliament (Seimas) has adopted a new radio tariff which is already being provisionally put into operation by the institutions concerned. According to *World Radio* the monthly charge for a receiving set installed in private dwellings, State and Municipal institutions, by cultural and charitable organisations and in newspaper offices, if special taxes are already being levied, is as follows:—In towns: (*a*) crystal detector, tenpence; (*b*) valve receiver, 2s. 1d. In villages and other localities: (*a*) crystal set, fivepence; (*b*) valve set, 1s. 3d. For a receiving set in restaurants, clubs, shops, kinemas, and similar public places, the monthly fee is to be: (1) in Kaunas and Klaipeda, one pound sterling; (2) in district towns, 12s. 6d.; and in other places, 4s.

United States.—100-kW VALVE.—For the past few weeks the high-powered transmitter of WGY, at Schenectady, N.Y., has been using a 100-kW vacuum power tube, which takes the place of eight 20-kW tubes. It is a development of the General Electric Co., and engineers are now securing data on its performance; with its water jacket, the tube stands 7½ ft. high and weighs 100 lb., or 1 lb. per kilowatt, and it is used as a radio amplifier, fulfilling in the transmitter a function comparable with the radio-frequency stages in receivers. Outside its water jacket the tube is 5 ft. high, and two-thirds of this height consists of the copper envelope, 4 in. in diameter; the upper third is made of glass through which the filament leads and the grid lead find insulated entrance. The glass bulb is 22 in. long and 4 in. in diameter, and it is sealed to the spun-out end of the anode cylinder, or copper envelope, by a machine process in such a way as to make the junction of glass and copper mechanically strong and vacuum tight. Two copper cables capable of carrying several hundred amperes are connected to tungsten rods which, in turn, pass through a pinch seal terminating at the filament ends; three lengths of tungsten wire, each 16 in. long, connect to each of the inner leads, forming six parallel filament spans, which pass within the grid and meet at a common point at the filament spring suspension in the lower end of the tube. The grid, within the copper envelope, is cylindrical and has an over-all length of 3 ft. 5 in. The grid frame is a most ingenious structure of molybdenum and tungsten; bracing, such as is common in steel bridges and tower construction, provides strength with a minimum of metal; rigidity is necessary to prevent short-circuiting from swaying or sagging, and minimum metal in the grid structure facilitates exhaust and minimises the possibilities of gas evolution. The grid connection is brought out through an arm part way up the high-voltage glass bushing to a flexible outside grid terminal. To guard against failure due to pressure increase in the tube, an ionisation gauge is used which takes the form of a special three-element vacuum tube, in appearance much like an ordinary receiving tube; it is sealed to the large tube, connections to filament, grid and plate are made from the pressure-indicating device at the operating panel, and the gauge operates on the principle of the ratio of ionisation by collision with electrons to the pressure, or amount of gas present.—*T. & T. Age.*

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Aberdare.—June 2nd. Electricity Department. E.h.p. overhead and underground main and branch transmission lines. (See this issue.)

Armagh.—June 1st. Urban District Council. Heavy oil engine generating plant, underground and overhead mains. (See this issue.)

Australia.—Melbourne.—June 1st. Victorian Government Railways. Electric time-releasing mechanisms. (B.X. 3431.)*

July 5th. State Electricity Commission. One 15,000-kW steam turbo-generator and accessories. (B.X. 3369.)*

July 4th. 66,000-V and 22,000-V insulators for the Yallourn brown coal scheme. (May 6th.)

June 28th. Postmaster-General's Department. Jacks, switchboard instruments, &c. (B.X. 3474.)*

Sydney.—June 22nd. New South Wales Government Railways. Remote-control switchgear. (B.X. 3442.)*

June 20th. Municipal Council. Turbo-alternators for Bunnerong power station. (B.X. 3443.)*

Brisbane.—May 18th. City Electric Light Co., Ltd. Outdoor switchgear. (B.X. 3456).*

Basingstoke.—June 7th. Corporation. Electrical installations at the Council's housing estate (approx. 1,015 wiring points). (See this issue.)

Belgium.—Antwerp.—June 20th. Municipal Council. 32 portal travelling electric cranes. (A.X. 4653.)*

Chile.—Santiago.—July 18th. Chilean State Railways. Materials for electric lighting and power (Group 30). Materials for electric lighting of locomotives and coaches (Group 32). August 22nd. Signalling, telegraph and telephone supplies (Group 36). (C.X. 2271.)*

Dartford.—May 21st. Urban District Council. 1,062 yd. l.p. cable. (See this issue.)

Darton.—May 17th. West Riding Education Committee. Electric lighting installation at Darton Kexborough new school. Specifications from Education Department, County Hall, Wakefield.

Darlington.—May 23rd. Electricity Committee. One 500-kW rotary convertor, with transformer. (May 6th.)

Dublin.—May 23rd. Electricity Department. Pipework for the 5,000-kW turbo-alternator. (May 6th.)

Dundee.—May 19th. Electricity Department. 2-core and 4-core l.p. cable. D.c. and a.c. house-service meters. (May 6th.)

Edinburgh.—May 16th. East Lothian Education Authority. Works, including electric lighting installation, for the extensions, &c., at Macmerry Public School. Schedules from the surveyors, Messrs. R. & A. K. Smith, 44, Queen Street, Edinburgh.

Egypt.—Cairo.—June 4th. Egyptian State Railways, Telegraphs and Telephones, Chief Inspecting Engineer, Queen Anne's Chambers, S.W. Underground cables (approx. £E12,000 to £E13,000).

May 28th. Ministry of Education. Electrical equipment for Beni Suef Trades School. (B.X. 3488.)*

Epsom.—Electricity Department. E.h.p. cable. (May 6th.)

Glasgow.—May 16th. Corporation. Electric light installations at a number of housing schemes. Mr. R. B. Mitchell, engineer, 75, Waterloo Street, Glasgow.

May 18th. Electricity Department. Materials for 12 months, including l.p. and e.h.p. cable, i.r. insulated cables and flexibles, meters, carbons, cast-iron boxes, section pillars. Mr. R. B. Mitchell, engineer, 75, Waterloo Street, Glasgow.

Glentanar, Aberdeenshire.—May 16th. Work in connection with the hydro-electric scheme, intake works on the River Tanar. Specifications from Messrs. Tawse & Allan, civil engineers and architects, 10, Bon Accord Square, Aberdeen.

Grimsby.—June 4th. Electricity Department. Sub-station equipment. (See this issue.)

Guildford.—May 16th. Town Council. Wiring 60 flats for electric light. Mr. J. W. Hipwood, borough surveyor, Tuns Gate.

India.—June 14th. India Stores Department, Simla. Generating sets for Fyzabad power station. (B.X. 3486.)*

London.—St. Marylebone.—May 18th. Electricity Department. L.p. and e.h.p. cables for 12 months. (April 15th.)

Islington.—June 1st. Electricity Department. Steel-tube lamp columns, 2,200-V feeder switchgear, rotary and/or static power factor correctors. (April 22nd.)

Metropolitan Asylums Board.—May 18th. Installation of a multiple roller ironing machine; new steam boiler, &c.; steam main; electric power in laundry, &c., at Darenth Tramway Colony; conversion of mechanical stokers to hand firing at North-Eastern Fever Hospital. (April 29th.)

London County Council.—May 17th. Electrical installation at the Albion Road, Stoke Newington, Central School (approx. 133 points). (May 6th.)

Manchester.—May 30th. Electricity Department. L.p. valves for circulating water system, two electrically-driven and one steam-driven boiler feed pumps. (See this issue.)

New Zealand.—Wellington.—June 21st. Public Works Department. Sub-station switchgear and metering equipment for Arapuni. (B.X. 3398.)*

Auckland.—July 4th. Auckland Electric Power Board. Switchgear. (B.X. 3471.)*

Richmond-on-Thames.—May 23rd. Municipal Water Department. Electrically-driven centrifugal pump, with motor, &c. Mr. H. P. Williamson, engineer, Riverside.

Scarborough.—June 3rd. Corporation. Installation of electrical pumping plant in duplicate for the new Irton water scheme No. 2. Specifications (£5) from Dr. H. Lapworth, engineer, 25, Victoria Street, S.W.

Sleaford.—May 17th. Electricity Department. Cables, boxes, &c. (April 29th.)

Stirling.—May 27th. Corporation. Electrical work at 96 houses. Specifications from Mr. Andrew H. Goudie, burgh surveyor.

Thorne.—May 17th. West Riding Education Committee. Electric lighting installation at new boys' school. Specifications, &c., from Education Department, County Hall, Wakefield.

Tynemouth.—June 11th. Electricity Department. One voltage regulating transformer. (See this issue.)

Whitley.—Electricity Department. One 1,000-kW turbo-alternator, with condenser, pumps, air filter, &c.; one 200-kW semi-Diesel or heavy-oil engine alternator. (May 6th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—Melbourne.—Electricity Supply Committee. Accepted :—

D.c. switchgear (£4,246).—Johnson & Phillips, Ltd.

H.p. armour-clad switchgear (£5,277).—A. Reyrolle & Co., Ltd.

Electrically-driven pump (£1,425).—Kelly & Lewis.

7,400 yd. triple braided cables (£932).—British Insulated Cables, Ltd.

Postmaster-General's Department.—Primary battery material (£977).—Siemens Aust. Pty., Ltd.; (£26,862) Widdis Diamond Dry Cells, Ltd.

Accumulator plates and separators (£645).—T. K. Steanes and Son; (£924), Chloride Elec. Storage Co., Ltd.; (£1,341), Tudor Accumulator Co., Ltd.

Motor-generator sets (£232).—Crompton & Co., Ltd.

Automatic exchange equipment for Brisbane Central and Paddington Exchanges, Queensland (£161,105).—Siemens (Aust.), Ltd.

State Electricity Commission of Victoria.—555-kVA transformers (£971).—Weymouth's, Ltd.

V.I.R. control cables (£1,278).—British Insulated Cables, Ltd.

SYDNEY.—New South Wales Railways.
H.p. cable (£17,903).—Enfield Cable Works (Aust.), Ltd.

Electricity Supply Committee. Recommended :—
Copper busbars (£450), two 2-ton electrically-operated jib cranes (£754 each), one 3-ton ditto (£937), one 5-ton ditto (£1,577).—Noyes Bros. (Sydney), Ltd.
14½ tons corrosion-resisting bars and fittings for Bunnerong (£406).—Armco Australian Agency.
3½ tons bare copper cable (£390).—W. T. Henley's Telegraph Works Co., Ltd.

Finance Committee. Accepted :—
5,000 metal filament lamps (£312).—Condor Lamps (Aust.), Ltd.

Tenders.

Ayrshire.—Education Authority. Accepted:—
Electric lighting work at new primary school at Irvine (£107).—C. Banks (Irvine).

Belgium.—International competition was again experienced at Schaerbeek, Belgium, on April 29th, when the municipal authorities opened tenders for the supply of 11,000 metres of h. and l.p. armoured cable. Offers were received from Belgian, German, Dutch, French, Czecho-Slovakian, and British firms. The quotations ranged from 429,670 fr. to 616,885 fr., the lowest being that of the Land-und-See Kabelwerk Gesellschaft, of Cologne, this being 3,650 fr. under the lowest Belgian quotation. The British competing firms were Callender's Cable and Construction Co., Ltd., who quoted 564,800 fr., and British Insulated Cables, Ltd., whose price was 585,882 fr.

Canterbury.—Town Council. Accepted:—
Equipment for a central sub-station :—
E.h.p. cables, control, telephone and pilot wires (£2,322).—Standard Telephones & Cables, Ltd.
Switchgear (£460).—Ferguson, Pailin, Ltd.
Overhead travelling crane (£164).—Herbert Morris, Ltd.

Dartford.—Urban Council. Accepted:—
Supplying and laying cables from the electricity works to Park Road (£1,952).—Power Lines Construction Co., Ltd.

Doncaster.—Town Council. Accepted:—
Two 500-kVA transformers (£700).—Bruce Peebles & Co., Ltd.
E.h.p. switchgear (£500).—Ferguson, Pailin, Ltd.

Hitchin.—Rural Council. Accepted:—
Installing electric light at 26 houses at Knebworth (£7 10s. each).—Stevenage Electric Light and Power Co.

Hull.—Education Committee. Accepted:—
Electric light installation Park Avenue Special School (£376).—Alexander Shaw & Sons.

Tramways Committee.
Renewal of tram track in Newland Avenue (£5,598).—Sangwin, Ltd. (Recommended.)

Telephones Committee.
Instruments.—Automatic Telephone Manufacturing Co., Ltd. (£475), W. F. Dennis & Co. (foreign) (£337). (Accepted.)

Liverpool. — Electricity and Tramways Committee. Accepted :—
70 tons tiebars (£700), 20 tons fishbolts (£220).—Société Anonyme Usines & Aciéries.
20 miles e.h.p. cable (£44,320).—British Insulated Cables, Ltd.
10 miles e.h.p. cable (£21,780).—W. T. Henley's Telegraph Works Co., Ltd.
Maintenance of electric lifts at electricity and tramways offices for three years.—Express Lift Co., Ltd.

London. — LONDON COUNTY COUNCIL. — Highways Committee. Accepted :—
Tramway stores :—
Controller segments, fingers, tips, &c.—Dyer & Young, Ltd.; Higgs & Hill, Ltd.; E. Showell & Sons, Ltd.; Yorkshire Switchgear and Engineering Co., Ltd.
Gear wheels and pinions.—Metropolitan-Vickers Electrical Co., Ltd.; Cammell, Laird & Co., Ltd.; Power Plant Co., Ltd.
Rheostats.—Rheostatic Co., Ltd.

WIMBLEDON.—Electricity Committee. Accepted :—
Twelve 100-kVA transformers (£1,026).—Hackbridge Electric Construction Co., Ltd.

SOUTHWARK.—Electricity Committee. Accepted :—
Meters.—Chamberlain & Hookham, Ltd.
Brush holders.—J. Child & Co., Ltd.
Steel pipes.—Millwall Engineering Co., Ltd.
Stoneware ducts.—Sutton & Co., Ltd.

GENERAL POST OFFICE.
Telephone switchboard lamps.—Edison Swan Electric Co., Ltd.

Maidenhead.—Town Council. Accepted:—
Wiring houses at Cox Green for electric lighting (£4 17s. 3d. each).—W. H. Arundell & Co.

Oldham.—Electricity Committee. Accepted:—
Earthenware cable ducts.—Albion Clay Co., Ltd.
Overhead electric travelling crane for new power station.—Clyde Crane & Engineering Co.

Manchester.—Tramways Committee. Accepted:—
Trolley wire.—Messrs. Richard Johnson & Nephew, Ltd.
Two Millars concrete mixers.—Millars Machinery Co., Ltd.
Block tin.—French & Smith, Ltd.

Paving Committee. Accepted :—
Electrical work at new depot.—Meta Manufacturing Co., Ltd.
Motor and starter frame for driving machinery at depot.—Metropolitan-Vickers Electrical Co., Ltd.

Electricity Committee. Accepted :—
Static transformers.—Bruce Peebles & Co., Ltd.
Feeder cables.—Callender's Cable & Construction Co., Ltd.

Education Committee. Accepted :—
Electric cooker at Cheetham Central School.—R. H. Clampnett & Co.

Ross-shire.—LOCH LUICHART.—Ross-shire Electric Supply Co., Ltd.
Supply and erection of pipes, water turbines, and electrical plant for the station at the outlet of Loch Luichart.—James Gordon & Co.

The plant will consist of two 750-h.p. Francis turbines, coupled to two 500-kW generators, with switchgear, transformers and about 40 miles of transmission line.

South Africa. — CAPETOWN. — South African Milling Co.
Wiring contract, the new flour mills.—Gearings, Ltd., of Cape Town. The contract comprises wiring for 20 motors (4 being of 130 h.p. each) and for over 500 lighting points.

Electricity Supply Commission. Accepted :—
Wiring the new power station at Salt River Mouth, near Cape Town (£2,550).—Edward A. Shaw & Co., Cape Town.

Walsall.—Town Council. Accepted:—
Modification of the existing switchgear at the station, including the provision of 10 new switches (£5,866).—A. Reyrolle & Co., Ltd.

Warwick.—Board of Guardians. Accepted:—
Installing electric light in the new children's block, &c. (£242).—Ellis & Ward, Ltd.

Watford.—Electricity Committee. Accepted:—
Cable.—W. T. Henley's Telegraph Works Co., Ltd.

Worthing.—Town Council. Accepted:—
L.p. distribution cables (£6,498).—Enfield Cable Works, Ltd.

Forthcoming Events.

Physical Society.—Friday, May 13th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, May 14th. South Wales Institute of Engineers, Cardiff. 6 p.m. Annual meeting.

(North of England Branch).—Saturday, May 21st. Annual general meeting.

Röntgen Society.—Tuesday, May 17th. 32, Welbeck Street, W.1. 8.15 p.m. Ordinary meeting.

Institution of Electrical Engineers (Wireless Section).—Wednesday, May 18th. London. 6 p.m. "A Wireless Works Laboratory." Mr. P. K. Turner.

Royal Society of Arts.—Wednesday, May 18th. 8 p.m. "Industrial Welfare in Great Britain and the United States." Mr. R. R. Hyde.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the name and address of makers of the following :—

SILOVAC vacuum cleaner.
ROBERTSHAW vacuum cleaner.
MARVEL electric curling iron.

Notes.

Sir Charles Soame, Bt., and Co-Directors Charged.

At the Mansion House, before Ald. Sir G. Truscott, on May 10th, Sir Charles Buckworth Herne Soame, Bt., Edward Warden, Robert George Harley, and Col. Edmund Octavius Eaton were summoned at the instance of the City Police on charges of conspiracy to defraud such persons as might receive prospectuses, &c., relating to the Chalk Fuel Power Gas and By-Products Corporation, Ltd.; to obtain money from them by representing that the statements made regarding the fuel were genuine reports; and to commit offences against the Larceny Act, 1861 (Section 84). A letter from Sir Charles Soame was read, explaining that he was unable to attend by reason of an accident, in 1924, which had crippled him. It was also stated that Col. Eaton was too ill to appear. The hearing was accordingly adjourned for six weeks.

Irish Free State Electricity Supply.

At a meeting of the Irish Centre of the Institution of Electrical Engineers on April 28th, in Dublin, a paper was read by Mr. MacEntee on the subject of "Rural Distribution of Electricity in the Irish Free State," in the course of which he said that the comparative scarcity of the rural population, coupled with the fact that it lived more or less in isolated homesteads, would considerably influence the rural distribution system of electricity. The network in connection with the hydro-electric development of the Shannon would be so extensive and so close-knit that a considerable number of towns within a distance of from 10 to 15 miles of each other would become the terminal points of 10,000-volt lines. In Ireland they had embarked upon an undertaking very large in proportion to their resources—one which might cripple the State if it failed, but, if it succeeded, would bring returns in prosperity and in social amelioration more than commensurate with the risk. One of the essentials was the successful application of electricity to the conditions of rural life, and experimental rural lines should be immediately constructed, so that fundamental data necessary for a sound scheme for electrification of rural areas might be secured.

The Free State Government's Bill for the absorption of local electrical undertakings under the Board of Control in connection with the Shannon hydro-electric scheme is now before the Senate at last, and passed second reading after an amendment proposed by Sir John Keane in favour of delay had been rejected. This amendment urged that the House should refuse a second reading to the Bill until "it is satisfied that the Executive Council (Cabinet) is unable to lease the Shannon works at a rent to cover interest and sinking fund on the capital cost." Several Senators complained that, in view of the dissolution of the Dail (Lower House) this month and the approach of a General Election for members of that Chamber, it would be impossible to have a definite discussion in Committee, whereupon Mr. McGilligan, Minister of Industry and Commerce, announced that, if necessary, the election could be postponed, as the Government was determined to get the Bill through without delay. The policy of the Government is the subject of keen hostile criticism by various speakers in the election campaign throughout the country, but Ministers and their friends continue to defend it and to plead that a Bill for the control of the whole electricity supply of the State is essential to the success of the Shannon scheme and the distribution of cheap power through an efficient service. A party of members of the Institution of Civil Engineers in Ireland was this week to have paid a visit of inspection to the Shannon works.

Electric Threshing Demonstration.

To demonstrate the possibilities of electricity on the farm, the Chester Corporation Electricity Department, in conjunction with Messrs. Ransomes, Sims & Jefferies, Ltd., arranged a demonstration of threshing machinery at Deeside Farm, Sealand, recently. The experiment was witnessed by farmers from various parts of the country. Threshing was done under the direction of Mr. F. Ayton. The Class "AM" medium threshing machine and a 25-b.h.p. electric motor, mounted on a portable carriage for removal from place to place by a horse, were employed.

The British Association.

Preliminary details of the 97th annual meeting of the British Association for the Advancement of Science have been issued. The meeting is to be held at Leeds from August 31st to September 7th under the presidency of Prof. Sir Arthur Keith, M.D., LL.D., F.R.S. Prof. Sir J. B. Henderson is to be president of the Engineering Section, Prof. D. H. MacGregor president of the Economics Section, and Prof. E. T. Whittaker, F.R.S., president of the Mathematical and Physical Science Section.

Electric Ship Propulsion.

The Peninsular and Oriental Steam Navigation Co. has placed a contract with Messrs. Alexander Stephen & Sons, Ltd., Linthouse, Glasgow, for a passenger liner of 19,000 tons, which will be the largest vessel of the liner type fitted with electrical gear; she will be over 600 feet in length and the turbines will obtain steam from Yarrow water-tube boilers working at a pressure of 375 lb. per square inch. The transmission of power from the turbines to the propeller shaft will be electrical and the speed of the ship will be 19 knots. Accommodation will be provided for 400 first-class and 300 second-class passengers. Another "electric" ship is being built at Scott's Yard, Greenock, for the Holt line.

Electric Vehicles in Italy.

It is reported from Rome that among the efforts that are being made to render Italy less dependent on imported motor fuel is a campaign by the Italian Automobile Club to popularise the greater use of electric vehicles. In this connection it is reported that a new type of secondary battery has been developed by Count Gallenga, which is considerably lighter than those at present available.

River Water—or Cooling Towers?

In a recent communication to the Société des Ingénieurs Civils, Mr. T. J. Guéritte touched upon the above question, and in the *Génie Civil* of April 9th he developed the subject with reference to the article by Mr. J. N. Waite, M.I.E.E., published in the Electrical Review of January 14th, and the correspondence which ensued. Accepting Mr. Waite's figure of 4 per cent. for the relative advantage of using river water, in place of the 7 per cent. formerly claimed, the author further points out that the peak load only lasts a few hours, and at other times the average temperature of the circulating water is lower. Where cooling towers are installed, if the ponds are designed so as to profit by the lowering of temperature and the reduction of load during the night, the increased consumption of steam due to the use of towers instead of river water takes place only during a very short time. In addition, the cost of screening the river water and pumping it to the station, and the high cost of foundations for a station built on the bank of a river, tend to annul the economy due to using river water. Recently some important stations which could have been sited on rivers have been built on land nearer the centres of distribution. On the other hand, the necessity of softening make-up water for cooling towers must often be allowed for, though this is partially off-set by the cleaner and more efficient condition of the condensers.

Unless highly efficient cooling towers are employed, however, the 4 per cent. loss may rise to 10 per cent. or more. Recent developments are in the direction of hyperbolic towers, especially in England, as at Liverpool. The Corporation of Birmingham is going to build 20 enormous towers, each having an output of 21,000 tons of water per hour, the power station being projected for an ultimate capacity of 840,000 kW.

In his communication to the Society, Mr. Guéritte examined the efficiency of natural-draught coolers, and showed that a wide range of cooling was not essential. On the contrary, it was desirable to have a rapid circulation of water, between relatively narrow temperature limits, but ensuring as low a temperature as possible at the condenser inlet. He explained why wood and steel construction had been dropped, and why the circular form had been adopted, and stated that large coolers were the most economical; a cooler 40 m. in diameter was as effective as four of 20 m. diameter, and far cheaper, but in very large cylinders it was difficult to ventilate the central portion. Hence the hyperbolic type of Messrs. Van Iterson and Kuypers was invented, which had no projections from the shell, so that the air circulated freely and uniform temperature was obtained over the whole surface of any horizontal section.

Appointments Vacant.

Head of the Electrical Engineering Department (£500) for the Robert Gordon's Colleges, Aberdeen. Showroom attendant (70s.) for the Borough of Stoke Newington Electricity Department. Junior scientific assistant for the Admiralty Research Department. Electrical engineer and general manager (£1,500) for the Corporation of Belfast. Lecturer in electrical engineering for the Borough Road Polytechnic. Salesman (84s.) for the Farnworth Urban District Council electricity undertaking. Junior mains records assistant for the Croydon Corporation Electricity Department. Mains engineer for the Corporation of Lowestoft. Plumber-jointer for the Eccles Corporation Electricity Works. Telegraph foreman (£400) for the Government of Nigeria. Assistant telephone engineer for the Oriental Telephone and Electric Co., Ltd. (See our advertisement pages to-day.)

H.P. Electrode Steam Generators.

In a recently-issued bulletin of Messrs. Oerlikon, Ltd., a description is given of electric steam generators which have been introduced. They are designed for working pressures from 3,000 to 8,000 V and for outputs ranging from 300 to 5,000 kW. These h.p. electrode steam generators, like the l.p. Oerlikon equipments, are provided with fixed electrodes, the output being regulated by varying the level of water. The electrodes are separated by insulated bodies arranged in an iron frame fitted in the boiler; they are secured to the cover and can be removed by raising the latter. Tests on a 1,200-kW electrode boiler for 6,400 volts have shown, it is claimed, that the efficiency of this plant can reach 98 per cent. An equipment of this capacity has been in service for some time at one of the

hospitals of the city of Basle; it is designed for 1,200 kW at 6,000 V. The plant works in conjunction with a steam accumulator with a storage capacity of 2,500 kW-hours, which can feed the different parts of the hospital when the electrode boiler is not in operation. The hot water also required is heated in a separate counter-flow apparatus by means of the steam generated in the electrode boiler and stored in large tanks. The generators were built by the Oerlikon Co. in conjunction with Messrs. Escher, Wyss & Co., of Zurich.

The First European 380-kV Transmission Line.

What is stated to be the first 380-kV electricity transmission line in Europe has recently been completed between Neuenahr and Rheinau by the Rhenish-Westphalian Electric Power Works Co., to connect its steam-operated and hydro-electric power stations. Actually there are two lines about 125 miles in length, each consisting of three hollow copper cables 42 mm. in diameter, supported on masts about 110 ft. high and spaced at intervals of approximately 328 yards. A noteworthy feature is the section of the line across the River Rhine near Coblenz, a single span of 547 yards. Fig. 1 illustrates the construction of the hollow cable, which was developed by the Allgemeine Elektricitäts Gesellschaft, of Berlin, in conjunction with the R.W.E.; it has a cross section equivalent to 400 sq. mm., as against 1,000 sq. mm. for a solid conductor, and it consists of a large number of flat wires arranged in two layers over a central support. The latter, which the A.E.G. has patented, consists of a spiral-shaped flat-copper band wound edgeways on a mandril, which is removed when the spiral is completed; the two layers over the spiral, which run in opposite directions and are wound in the usual manner on a tandem stranding machine, consist of flat hard-drawn copper wires of segmental section, *i.e.*, in the form of a trapezium, by which means the various wires are forcibly supported in their relative positions; the latter effect is augmented by increasing the thickness of the wires of the inner layer, the principal function of the weaker outer layer being to keep the structure together. For the erection of the line new methods and special equipment were necessary in order to protect the cable from undue stresses during the stretching and erection operations. Fig. 2 represents one of the towers with the platforms temporarily fitted up for the cable-erection operations and the wheels over which the cables were pulled by means of a winch. During the erection the cable was maintained taut by means of a tension-regulating device specially constructed for the purpose. It is claimed that the manufacture of hollow cables does not present any difficulties, provided the material is good and the dimensions of the spiral and layer wires are appropriately chosen.

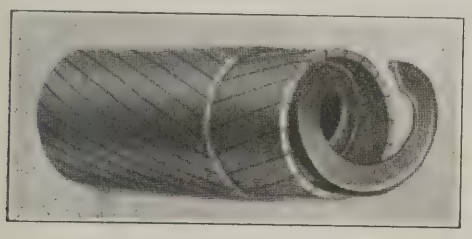


Fig. 1.—A.E.G. Hollow Copper Cable.

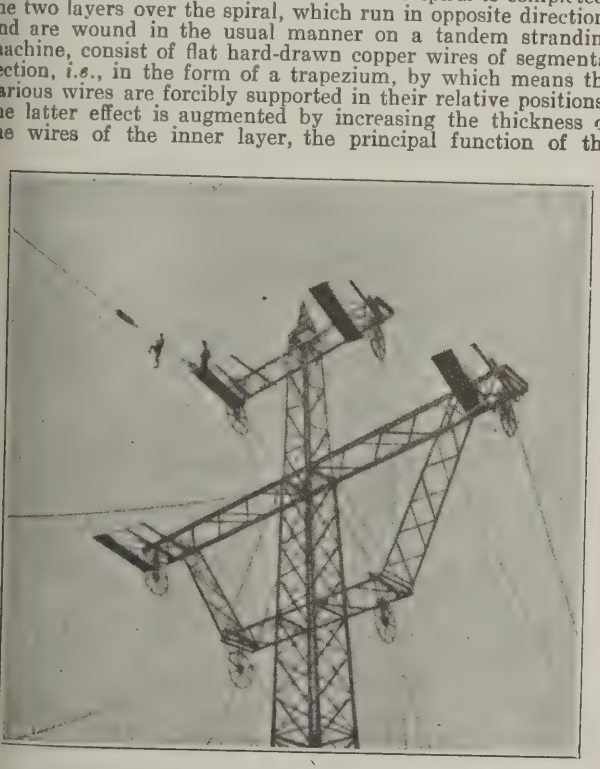


Fig. 2.—Tower with Erection Platforms and Wheels.

How to Reduce Electricity Prices.

The *Daily Express* reports that taxpayers at Grasse on the Riviera seized the town hall as a protest against the high cost of electricity, gas, and funerals.

Street Accidents Caused by Vehicles.

The returns for 1926 show that in Great Britain there were 96,742 accidents caused by mechanically propelled vehicles, of which 7,426 were due to omnibuses and motor coaches, and 5,697 due to tramcars and railless trolley vehicles. The total number of accidents was 124,287; 4,886 persons were killed and 133,888 injured. In the Metropolitan Police District there were 43,507 accidents, and 1,003 persons were killed.

Association of Supervising Electrical Engineers.

The results of the fifth annual competition for the W. E. Highfield Shield, 1927, have been announced. The winner of the shield and first prize, value 4 guineas, presented by the Board of Control, is Mr. G. H. Conway, for a paper on "Electrically-heated Glasshouses"; second prize, value 2 guineas, presented by Messrs. V. G. Middleton & Co., Ltd., Mr. B. C. Garman, for some "Notes on Electric Cooking Apparatus"; and third prize, value 1 guinea, presented by Messrs. Johnson & Phillips, Ltd., Mr. E. J. Davies, for a paper on "Electricity as Applied to the Asphalte Industry." The winning Associate competitors are:—First prize, value 2 guineas, Messrs. Hogan & Wardrop, Mr. T. V. Harding, "Electric Crane Control"; and second prize, value 1 guinea, editor of *Electricity*, Mr. F. Anderson, for a paper on the "Testing of Electrical Machines."

Educational.

RESEARCH SCHOLARSHIPS.—A limited number of research scholarships in technology (each of a value not exceeding £100) will be awarded in July, 1927, tenable during the academic year 1927-28 in the Manchester Municipal College of Technology (Faculty of Technology in the University of Manchester). The subjects include electrical engineering and electro-chemistry. Applications must be received on or before July 6th, 1927; forms of application may be obtained by written application to the Registrar of the College.

The Armourers and Brasiers Company has arranged for lectures to be delivered at the Sir John Cass Technical Institute, 31, Jewry Street, Aldgate, E., at 6.30 p.m., on May 17th and 31st, and June 14th, by Dr. W. H. Hatfield, on "Special Steels and their Application in Engineering," and at the Royal School of Mines, Prince Consort Road, South Kensington, S.W., on May 18th and 25th and June 1st, by Mr. U. R. Evans, on "Oxidation, Corrosion, and Passivity of Metals." Admission is free, without ticket. The company has also founded Industrial Bursaries to assist honours graduates and students to pursue their studies. (See our advertisement pages to-day.)

Rating Electricity Undertakings.

The Local Government Committee of the L.C.C. recommends in connection with the report of the Advisory Committee on Domestic Supplies appointed by the Electricity Commissioners, that representations should be made by the Council on the subject of the recommendation of the Advisory Committee dealing with assessment for rating, which is as follows:—"With regard to assessment for local rating, the Committee are of opinion that the present method of assessing electricity supply undertakings requires immediate amendment. The Committee recommend that electricity undertakings should be assessed on the basis of the profits of the undertakings, with a rebate of such a sum as would represent 75 per cent. of the sum payable on account of the general district rate in respect of underground cables and works." The Local Government Committee points out that no arguments are adduced in the report in justification of the proposed rebate, but that it is probably based on the precedent of section 211 (1) (b) of the Public Health Act, 1875, which provides that certain classes of property shall be assessed to the general district rate at one-fourth only of their net annual value. By the Rating and Valuation Act, 1925, the general district rate is abolished as a separate rate, but the effect of the exemption is continued by reducing the value on which rates will be levied by an amount representing the average amount of the relief from the general district rate over the period from 1914-1924. There is, however, very little, if any, analogy between underground cables and the classes of property dealt with. On the other hand, there is a close analogy between electric cables and water and gas mains. The assessments of water and gas undertakings are based on profits in the same way as electricity undertakings, no exemption being allowed in respect of their mains. There is frequently active competition between gas and electricity undertakings, and it would be manifestly unfair to impose on gas undertakings additional rates in order to relieve their competitors. If partial exemption were granted to electric cables, it would be difficult to refuse it to gas mains or other similar classes of property. During the committee stage of the Rating and Valuation Bill an amendment was moved to grant an exemption (similar to that enjoyed by railways) in respect of the underground mains and pipes of gas, water and electricity undertakings, and of the rails, tracks, &c., of tramways. This amendment was, however, withdrawn, on the representation of the Minister of Health. The Royal Commission on Local Taxation reported in 1901 against the extension of exemptions. In this connection the Council passed a resolution to the effect that no further exemptions from rating should be allowed, and that existing exemptions should be abolished as opportunity offered. It is true that the recommendation of the Advisory Committee relates only to general district rate purposes and does not affect London; but if the rebate were conceded outside London, it might be difficult to resist the application for a similar rebate in London.

The Thury D.C. System in France.

For the past twenty years a power transmission line on the Thury high-voltage, direct-current, variable-voltage system has been in operation between Moutiers and Lyons, France, for the supply of power for the tramway system in the last-named city. The system has worked well, the only difficulty encountered having been that of the supervision of the line between Chambery and Novalaise, a distance of nearly 20 miles, where an altitude of 3,290 ft. is attained and the weather is very severe, especially in winter. To overcome this drawback the Société Générale de Force et Lumière recently decided to install a new underground cable on this section of the line, placing a contract with the Compagnie Générale des Cables, of Paris, for a d.c. cable capable of working at 150,000 volts and of attaining 300,000 volts between the positive and negative wires with the central point earthed. It is claimed that this constitutes a new step forward in cable manufacture, the highest d.c. voltage transmission hitherto attained in France being 60,000 V.

Chief Technical Assistants' Association.

On May 7th a party of members of this Association paid a visit to the Ilford Electricity Department's sub-stations. At Gant's Hill sub-station the automatic gear was inspected and operated for the benefit of the visitors. The next stop was the Goodmayes sub-station, where some more automatic equipment was seen in operation. Mr. G. F. Gregory (Ilford) presided at tea at the sub-station, supported by Mr. A. Murdoch (Fulham), the chairman of the Association. The party is seen in the accompanying illustration. After inspecting the showroom a number of the members visited the Stepney Electrical Exhibition.



The C.T.A.A. at Ilford.

Carnegie Grant for X-Ray Martyr.

An allowance of £120 per year has been made by the trustees of the Carnegie Hero Fund to Dr. G. C. W. Williams in recognition of his X-ray work. Dr. Williams has been compelled to give up his professional work as the result of the loss of his right hand and part of his left. He had carried on X-ray work since 1895, and much of it was of a valuable nature.

Electro-Farming Discussed in Paris.

Last week the Société Française des Electriciens devoted a long evening to the subject of the "Applications of Electricity to Agriculture." Papers illustrated by kinematograph films were presented by Mr. R. Borlase Matthews, who dealt with the British point of view; Dr. A. Ekström, who illustrated Swedish practice; and M. Bitouzet, who referred to the electric ploughing work now being carried out in the rural districts within a radius of 40 miles of Paris. A part of the film shown by Mr. Matthews was entirely new, and has not yet been exhibited in England; it demonstrated the application of electric light and heat for the treatment of bees, showing the results of experiments conducted during the past three years at East Grinstead. The result of such treatment is that the bees are kept free from disease and produce considerably more honey per hive per annum. The feature of Dr. Ekström's paper was the fact that in Sweden it was now more profitable to supply a rural area than an urban one. M. Bitouzet's film was a revelation as to the serious progress that was being made in electric ploughing in France.

Radiation.

Mr. John B. Kramer, of the General Electric Co., Ltd., who has been investigating phenomena associated with radio-active energy, described some of the interesting results he has achieved in a lecture on "Radiation" before the Birmingham Electric Club recently. He showed how it is possible to harness, in a small way, the energy of certain radio-active materials, which exist in quantities in various parts of the world. In his early experiments, Mr. Kramer had used monazite sand from India as a source of radiation, and batteries were made by placing the sand between plates of carbon and zinc; the sand remained radio-active for years, but it was eventually found to be unsuitable owing to changes in the atmosphere setting up an electrolytic action. Other materials, notably thorium, had since been used. Mr. Kramer demonstrated various experiments, and claimed that they had brought him nearer to the practical utilisation of the energy stored in radio-active minerals. He showed a method of using radiation energy to work a small electronic balance, and also an electronic cell; the radio-active substance was placed upon a carbon plate, above which, with an air space between, was a zinc plate. He was engaged in examining such cells with a view to developing a battery which would produce sufficient energy for useful work, even if only in a small way for a start. He pointed out that, up to a certain point, the determination of the air gap in an electronic cell, a very important matter, was contrary to Ohm's law, in that the charge increased as the gap was made larger; this was probably explained by the fact that a certain volume of air was required for maximum ionisation.

Boiler Explosion Report.

A report has been issued of the preliminary inquiry into the cause of an explosion which occurred from a water-tube boiler at the Lister Drive power station, Liverpool. One of the tubes failed longitudinally over a length of 7 in., and at each end of the opening it ruptured circumferentially, creating an aperture 7¾ in. wide. The explosion was caused by overheating due to excessive scale deposit on the inside surface of the tube. There appears to have been no thinning of the tube as in ordinary cases of over-heating.

The Electro-Deposition of Rubber.

According to *Science*, the electric rubber moulding process was worked out by two groups of research workers, one in America and one in Hungary, neither of which knew that the other was engaged in the problem. The American workers were S. E. Sheppard and L. W. Eberlin, of the Eastman Kodak Company, and the Hungarian group was led by Paul Klein and A. Szegvari. Both groups knew that when solid dried crude rubber was worked upon a mixing mill in the rubber factory the rubber substance was made softer and weaker. They knew that the less rubber was heated or worked, the better was its quality; they also knew that research in recent years had shown how vulcanisation might be carried on at lower temperatures than formerly and the necessary sulphur combined with rubber with the minimum loss of quality. Certain substances known as "accelerators" possess the property of permitting vulcanisation to be accomplished at relatively low temperatures. However, if these accelerators were incorporated on the usual mixing mill, the temperature would be sufficiently high to cause vulcanisation during mixing and to spoil the goods.

These men conceived the plan of so depositing rubber on forms, from latex, that the rubber particle itself was not altered, and made the discovery that electro-deposited rubber had the highest quality ever observed. There were many problems to be solved before this was made practical. It was necessary for other substances to be deposited simultaneously, such as sulphur, zinc oxide, and carbon black; the last two substances are required to give toughness. A long investigation was carried out to find means to disperse them in water, mixed with the latex particles, without coagulating the latex. A noteworthy achievement was the discovery of means by which the rubber layers might be free from bubbles —by surrounding the anode with a porous clay diaphragm. The anode is therefore immersed in electrolyte inside a porous clay cell or dish, and the rubber particles, together with those of zinc oxide, sulphur, &c., are deposited upon this porous diaphragm. The rubber as it collects forms a continuous homogeneous tough covering of uniform thickness. Any thickness up to an inch or more is practicable. Rubber thus formed is stronger than rubber prepared by the old methods, and is free from gas or air holes. Industrial development is already well advanced. The continuous, automatic production of certain kinds of articles is feasible. Insulation for wires and other things electrical is another application. No high temperatures are used. Previous reference to the subject was made in the Electrical Review of January 28th, p. 155.

Electrical Association for Women.

On March 24th some members of the Electrical Association for Women, Birmingham and Midlands Branch, paid a visit to the General Post Office, Birmingham, where they viewed the engine room, rotaries and generators, and had explained to them the intricacies of the telephone, telegraph, and postal sections. On April 14th three American films, brought over by Mrs. C. Frederick and kindly loaned by Mr. J. W. Beauchamp, director E.D.A., were shown to the Association by the Gaumont Co. in its private theatre. These were much appreciated, as they gave the English woman an idea of how the American woman achieves her leisure by means of electricity. On Thursday, April 28th, a demonstration of the Hoover suction cleaner and heater was given by the manager of the Birmingham Branch of the Hoover Co. at Ridgway's Café, Birmingham.

A sixth branch, North-East Coast, has been added to the Association; the inauguration meeting was held at the Lighting Service Bureau, Dial House, Newcastle, on April 28th. Viscountess Grey of Fallodon was elected president, and Miss A. Holm hon. secretary and treasurer.

Service Note.

The eighth Royal Air Force Display will take place on Saturday, July 2nd, at Hendon Aerodrome. The programme has been arranged to demonstrate the efficiency and airmanship of service squadrons, and new features are being introduced which will enable the public to appreciate the developments that are constantly taking place in the air arm. Arrangements have been made to improve accommodation and traffic facilities at the aerodrome. The proceeds will be devoted to Royal Air Force charities.

Institution of Railway Signal Engineers.

The proceedings, 1926-27, of the above Institution, are now available (7s. 6d. to non-members). The papers read during the session, together with the discussions and authors' replies, are included in the contents, among which are: "A Comparative Survey of American and British Signalling," by J. Parsons; "Fundamentals of Automatic Telephone Switching," by H. H. Harrison; "Electrical Power for Railway Signalling Communications," by M. G. Tweedie; and "Railway Signalling in Germany," by T. S. Lacelles. It is hoped that it will be possible to view at least three large recent signalling installations in France during the summer meeting this year, which is expected to be held from June 17th to 21st.

Institution Notes.

Institution of Electrical Engineers.

WESTERN CENTRE.—The following officers have been nominated for the 1927-28 session:—*Chairman*: C. G. Morley New; *second vice-chairman*: S. B. Haslam; *new members of committee, south of the Bristol Channel (four vacancies)*: R. D. Archibald, A. F. Coates, L. A. Hards, F. G. Jones, and J. W. Spark; *north of the Bristol Channel (one vacancy)*: G. D. Arden, J. M. Bowman, H. O. Davies, and P. J. Plevin.

LONDON STUDENTS' SECTION.—During the 1926-27 session 11 meetings have been held, the average attendance being 63, as against 104 last year. The record attendance was 160 at the joint meeting of the London Students' Sections of the Institutions of Civil, Mechanical and Electrical Engineers. The Committee is, however, not satisfied with this low average attendance of 4.1 per cent., the number of members attending the discussion being nearly always less than those present when the paper is read, and the quality of papers was not up to the usual standard. The number of visits during the session was 13, the average attendance being 86. The social functions held during the year have been fewer than last year. The summer meeting of the Students' Sections was held in Belgium and Luxemburg.

Royal Institution.

The annual meeting of the members was held on May 2nd, Sir Arthur Keith, treasurer and vice-president in the chair. The annual report of the Committee of Visitors was read and adopted, and the report of the Davy-Faraday Research Laboratory Committee was also read. Sixty-four new members were elected in 1926, and 78 lectures and 19 evening discourses were delivered. The following members were unanimously elected as officers for the ensuing year:—*President*: The Duke of Northumberland. *Treasurer*: Sir Arthur Keith. *Secretary*: Sir Robert Robertson.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. J. W. BURLEIGH, chief electrical engineer at Newton's Dynamo Works, Taunton, has resigned in consequence of ill-health, and sails with his family on May 21st for California. His association with the Dynamo Works dates from 1900. The staff on May 4th presented Mr. Burleigh with a silver cigarette casket as a farewell gift.

We learn that Mr. JOHNSTONE WRIGHT'S appointment is under the Central Electricity Board, not the Electricity Commission of Great Britain as stated in our last issue.

We regret to learn that Mr. STANLEY J. HARDING is resigning his position as managing editor of the *British Engineers' Export Journal* owing to the deterioration of his eyesight consequent upon ill-health. Mr. Harding was with the *Electrical Times* for many years, and he has edited the *Export Journal* for the past eight years. He hopes to be able to resume his activities after a period of rest.

Capt. H. LEIGH MOSSLEY has been appointed chairman of the Willesden Electricity Committee.

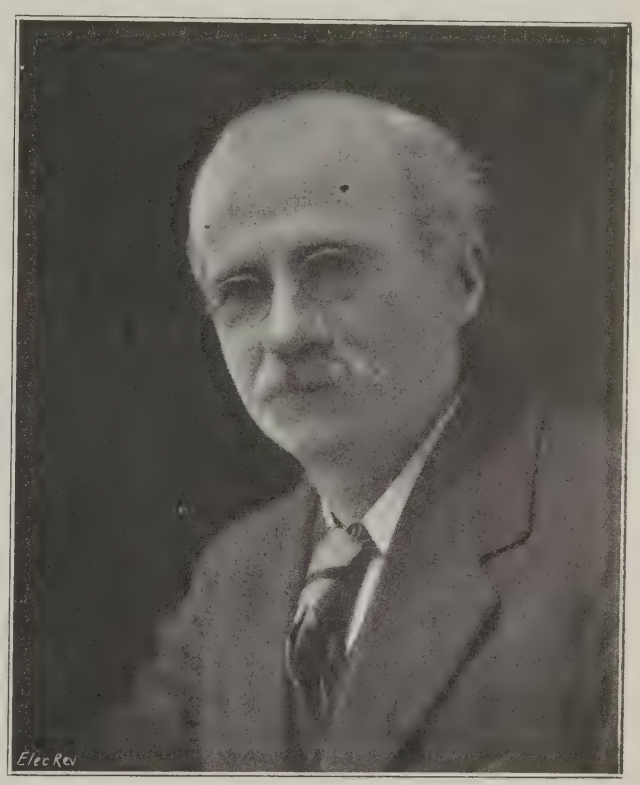
Mr. A. W. MAKOVSKI (Messrs. Tamplin & Makovski, Ltd.) has been re-elected president of the Reigate and Redhill Chamber of Commerce.

M. MARS, general secretary of the Compagnie Française pour l'Exploitation des Procédés Thomson-Houston, Paris, has been appointed a Chevalier of the Legion of Honour.

On May 4th, Mr. H. A. RATCLIFF, who has relinquished the position of deputy chief engineer to the Manchester Corporation Electricity Department to become chief electrical engineer to the London Power Co. (under the engineer-in-chief, Dr. S. L. Pearce), was presented by his colleagues with a set of silver-ware. Mr. Ratcliff has also received a gold cigarette case from his colleagues at the Polygon testing station.

Mr. A. L. LUNN, who is the hon. secretary of the North-Western Centre of the I.E.E., succeeds Mr. Ratcliff as deputy chief engineer at Manchester, and the following new appointments have been made:—Mr. T. BAXENDALE, superintendent of power stations; Mr. W. DUNDAS, resident engineer, Barton station; Mr. F. P. SEAGER, resident engineer, City station; Mr. J. L. CARR, B.Sc., chief electrotechnical engineer; Mr. J. D. PEATTIE, B.Sc., electrotechnical engineer; Mr. A. PHILIP, B.Sc., assistant superintendent of testing section.

Mr. W. A. SHAW, of Stockport, the president-elect of the E.C.A. Allied Associations, whose portrait appears herewith, commenced business as an electrical contractor in 1886, and was joined two years later by his brother, who was his partner for 10 years, afterwards going to Capetown, where he is still in business as an electrical contractor. In the early years of his business career the work carried out by Mr. Shaw was principally private lighting installations in mills, &c., with a large amount of business in private telephone installations,



Elliott & Fry] [*London.*

Mr. W. A. Shaw,
President-elect of the E.C.A. Allied Associations.

for public authorities such as the Lancashire County Police, Liverpool Corporation (Vyrnwy and Rivington Waterworks), and others. The firm were pioneers in street fire alarm work, and put in the system for Stockport and many other towns in Lancashire and Cheshire. Of late years the work has principally been lighting and power, and the maintenance of the telephone systems before mentioned. Mr. Shaw has been a member of the E.C.A. since the earliest days of the Association, and has taken an active part in its work, principally in development. He was elected first chairman of the Development Committee, and still holds that office.

The *Manchester Guardian* reports the retirement of Mr. HENRY ELLIOTT from the position of Post Office telephone contract manager for the Manchester district. Mr. Elliott joined the National Telephone Co. in 1891. He has been presented with a gold cigarette case by his colleagues.

Mr. J. H. BUTTERS, who relinquished the position of chief engineer to the Tasmanian Government Hydro-Electric Department to become chief commissioner at Canberra, was knighted upon the occasion of the inauguration of the new Federal Parliament at Canberra.

The Accrington Town Council has referred back a proposed increase in the salary of the electrical engineer (Mr. A. W. CLEGG). His remuneration is: Salary £700, bonus £166. The energy sold last year amounted to 15,500,000 kWh. The Electricity Committee now asks the Council to agree to a remuneration of £700, bonus £213, and to institute a sliding scale for increased sales of energy to bring the salary and bonus to £991 when 20 million kWh is sold.

To-morrow, May 14th, Mr. H. Topley, A.M.I.E.E., is leaving the position of charge engineer at Doncaster Corporation electricity works, to take up a similar appointment at the power station of the United Alkali Co., Ltd., Widnes.

Alderman A. G. Ellaway (Birmingham) has been elected chairman of District Joint Industrial Council No. 5 for the Electricity Supply Industry (West Midlands Area). Mr. R. F. Dempster (A.E.U.) is vice-chairman. Mr. E. J. Jennings, who has been secretary and treasurer since the formation of the Council, has been re-elected to the position.

Mr. W. A. Rhind, late of the English Electric Co., Ltd., and Messrs. Siemens Bros. & Co., Ltd., has joined the Empire Rubber Co., of 25, Victoria Street, S.W.1, where he will deal with business in rubber as applied to the electrical industry.

We regret to note from our contemporary, the *South African Mining and Engineering Journal* for April 16th, that Mr. John Roberts, the Durban borough electrical engineer, was seriously indisposed. He was expected to leave Durban for a time for complete rest and change. "His second in command, Mr. E. Poole, will be acting borough electrical engineer in the meantime."

Obituary.—Mr. H. Hartnell.—We record with regret the death of Mr. Henry Hartnell, A.M.I.E.E., a retired staff engineer to the General Post Office, which occurred on May 3rd, at Wellington, Somerset, at the age of 81 years. In the course of his lengthy service at the Post Office he was for many years examiner in technology. He possessed a special knowledge of electric cable matters, including loaded submarine and underground cable, and his committee work included duties as a member of the Committee on Copper Conductors, and as a member of the Engineering Standards Sub-Committee on Telegraphs and Telephones. For some years he was joint editor of the *Journal* of the Institution of Post Office Electrical Engineers, and he was an accomplished translator of technical and scientific matter from many languages. He had a considerable knowledge of languages, both ancient and modern. Mr. Hartnell was in many respects a remarkable man; of great technical ability, he was at an early period selected for transference from the telegraph staff at the Nottingham Post Office to the engineer-in-chief's office in London under Sir W. H. Preece, where he had many opportunities of showing his sterling worth in every branch of the service. Those who had the privilege of his acquaintance were warmly attached to him and delighted to renew their acquaintance on every opportunity. As a worker he was indefatigable, and kept in harness almost to the last.

Mr. A. V. Burtonshaw.—The death took place on March 29th of Mr. Arthur V. Burtonshaw, who was for 16 years electrical engineer to the late Mr. Albert Brassey, at Heythrop, Oxon.

Mr. W. E. Beer.—We have great regret in recording the sudden death of Mr. W. E. Beer, B.Sc., D.I.C., at the very early age of 28 years. Mr. Beer, who was an assistant in the Electricity Department of the National Physical Laboratory, where he was held in high esteem, was on his way to the laboratory on the morning of April 27th when he succumbed to an attack of hæmorrhage. He had published several original scientific papers, and was a member of B.E.S.A. and other committees.

Will.—Mr E. Bremner Smith, chairman of the Oswestry Electric Lighting and Power Co., Ltd., left £13,848 gross and £8,464 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Peters & Co., Ltd.—Private company. Registered May 2nd. Capital, £1,500 in £1 shares. Objects: To acquire the business of an electrical factor now carried on by Amy L. Peters, at 5, York Road, Colwyn Bay, as "Peters & Co.," and to carry on the business of electrical engineers, manufacturers of and dealers in all electrical appliances and apparatus and wireless instruments and accessories, &c. The subscribers (each with one share) are:—H. Peters, Hill Croft, Church Road, Rhos-on-Sea, electrical factor; H. V. Lee, Hazelhurst, Church Road, Rhos-on-Sea, commercial traveller. H. Peters shall be permanent governing director and chairman, so long as he holds £250 shares. Qualification of directors: £25 shares. Secretary: R. Roberts, 13, Erskine Road, Colwyn Bay. Solicitor: D. Thomas, Post Office Chambers, Colwyn Bay.

Sherrin-Goodridge Patents, Ltd.—Private company. Registered, May 5th. Capital, £100 in 1s. shares. Objects: To adopt an agreement with P. Sherrin and H. C. Goodridge, and to carry on the business of electrical and mechanical engineers, manufacturers, and repairers of thermionic devices and parts, and instruments for the production of alternating currents, vacuum measuring instruments, vessels and lamps, scientific glass blowers, manufacturers of and dealers in electrical, mechanical, telegraphic, telephonic, television, and other appliances and apparatus, &c. The subscribers (each with one share) are:—E. C. Goman, 44, Leghorn Road, Harlesden, electrical engineer; A. Secretan, 44, Montgomery Road, W.4, clerk. Secretary: F. B. Weller. Registered office: 64, Mill Hill Road, Acton, W.3.

Buell Combustion Co., Ltd.—Public company. Registered, May 4th. Nominal capital: £250,000 in £1 shares. Objects: To acquire (1) from the Buell Pulverised Coal Syndicate, Ltd., and Bolton & Partners, Ltd., certain inventions relating to the systems of combustion or burning of pulverised fuel known as the "Buell System," (2) from United Water Softeners, Ltd., and Kek, Ltd., certain inventions relating to systems of grinding and crushing or disintegrating known as the "Kek Mill," and (3) from the British Columbia and West Canadian Agency, Ltd., and W.A.C. Pulverisers, Ltd., certain inventions relating to the systems of pulverisation and disintegrating known as the W.A.C. Pulverisers, and to carry on the business of iron and brass founders, mechanical and electrical engineers, &c. The directors are:—C. A. Bolton, Littleworth Lodge, Esher (director, G. T. Holloway & Co., Ltd.); W. I. Anderson, British Empire Club, St. James', S.W. (director, British Columbia and West Canadian Agency, Ltd.); L. A. Neel, 38, Drayton Court, Drayton Gardens, S. Kensington, S.W. (director, United Water Softeners, Ltd.); H. A. Procter, 48, Queen's Drive, West Derby, Liverpool (director, Buell Pulverised Coal Syndicate, Ltd.); N. Liversidge, Oxley, Woodhouse, Huddersfield (director, Jas. Watkinson & Son, Ltd.); J. G. Robertson, Drayton Gardens, S. Kensington, S.W.10 (engineer, Babcock & Wilcox, Ltd.). Qualification: £500 shares or stock. Solicitors: Herbert Smith & Co., 62, London Wall, E.C.2.

Official Returns of Electrical Companies.

Mann, Egerton & Co., Ltd.—Equitable mortgage dated April 12th, 1927, to secure £10,000, charged on certain properties in Marylebone. Holders: Armstrong Siddeley Motors, Ltd., Parkside, Coventry. Collateral mortgage dated December 2nd, 1912, securing £3,000, being part of a sum not exceeding £10,000 secured by debenture dated October 3rd, 1912, was satisfied to the extent of the first-named sum on January 28th, 1920. (Notice filed April 26th, 1927.)

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Acknowledgement of further indebtedness dated April 8th, 1927 (supplemental to trust deed dated October 16th, 1913), to secure £430,000 additional second mortgage debenture stock, ranking *pari passu* with £1,546,000 like debenture stock. Trustees: Law Debenture Corporation, Ltd., 24, Old Broad Street, E.C.

C.A.C. Valve Distributing Co., Ltd.—Debenture dated April 7th, 1927, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: V. J. Woolley, Sherrington School of Physiology, St. Thomas's Hospital, S.E.

Charles Mickleburgh, Ltd.—Particulars filed on April 17th of £1,000 debentures authorised February 17th, 1927, charged on the company's undertaking and property, present and future, the whole amount being now issued.

North-Western Wireless Company and Wallasey Motor Exchange, Ltd.—Debenture dated April 12th, 1927, to secure £500, charged on the company's property, present and future, including uncalled capital. Holder: D. Greenwood, 5, Ashburton Road, Wallasey.

Electrical and Allied Instrument Manufacturing Co., Ltd.—G. C. McEwen, of 35, Copthall Avenue, E.C.2, and S. R. McDonald, of "Elstan," The Mall, Surbiton, ceased to act as receivers or managers on February 28th, 1927. (Notice filed April 25th.)

Acme Production Co., Ltd.—T. G. Weavers, of 4, Drapers Gardens, E.C.2, ceased to act as receiver or manager on April 20th, 1927.

India Rubber, Gutta Percha and Telegraph Works Co., Ltd.—Capital, £1,250,000 in 750,000 ordinary, 250,000 preferred, and 250,000 unissued shares of £1 each. Return dated December 9th, 1926. 750,000 ordinary and 250,000 preferred shares taken up. £1,000,000 paid. Mortages and charges: £400,000.

South Metropolitan Electric Tramways and Lighting Co., Ltd.—Capital, £400,000 in 200,000 ordinary and 200,000 preferred shares of £1 each. Return dated March 16th, 1927. All shares taken up. £365,110 paid on 165,110 ordinary and 200,000 preferred shares. £34,890 considered as paid on 34,890 ordinary shares. Mortgages and charges: £128,791.

Rhayader Electric Light and Power Co., Ltd.—Capital, £2,000 in £5 shares. Return dated November 4th, 1926. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Electric Light Insurance and Maintenance Co., Ltd.—Capital, £5,000 in £1 shares. Return dated October 1st (filed December 24th), 1926. 1,255 shares taken up. £1,257 10s. paid (including £2 10s. paid on 50 shares forfeited.) Mortgages and charges: £1,567 14s.

Poynter, Griffiths & Co., Ltd.—Return dated December 31st, 1926 (filed February 2nd, 1927). Capital at date of return, £6,000 in £1 shares (increased March 4th, 1927, to £20,000 in £1 shares). 6,000 shares taken up. £4,500 paid. £1,500 considered as paid. Mortages and charges: £1,746.

Baynton's Wholesale Wireless, Ltd.—Capital, £2,500 in £1 shares. Return dated March 12th, 1926 (filed March 25th, 1927). All shares taken up. £2 paid, £2,498 considered as paid. Mortgages and charges, nil.

John Lewis (Wireless), Ltd.—Capital, £100 in £1 shares. Return dated March 7th, 1927. All shares taken up. £100 paid. Mortgages and charges, nil.

Wholesale Electric Lamp Co., Ltd.—Capital, £1,500 in £1 shares. Return dated December 31st, 1926 (filed March 11th, 1927). 425 shares taken up. £425 paid. Mortgages and charges, nil.

City Notes.

Johnson & Phillips, Ltd.

The annual meeting was held on May 8th, Sir Philip Dawson presiding in the absence of the chairman (Mr. C. Johnson). In moving the adoption of the report (ELEC. REV., April 29th, p. 691), the chairman read a statement prepared by Mr. Johnson, in which he said that the profit for the year, after making provision for bad and doubtful debts, and after charging to revenue some £15,000 odd for maintenance of buildings, plant, &c., amounted to £115,114. Referring to the balance sheet, the chairman said that a further £94,000 had been expended on additions to the property. It was always necessary in a business like theirs to keep on spending money on capital account in order to keep pace with the latest developments. The total assets exceeded the liabilities by just over £1,000,000. Investments at £136,649 were somewhat less than appeared in the last balance sheet, and included a £50,000 8 per cent. mortgage debenture in Burndept Wireless, Ltd. The directors were of opinion that the debenture was amply covered by the assets of that company. Burndept's were very good customers of the company, which in the past had done a profitable business with them. The falling-off in the profits as compared with the previous year was caused entirely by the general strike and the prolonged coal stoppage. The value of the orders booked from the beginning of May until the end of October was rather less than 50 per cent. of the amount booked during the corresponding six months of 1925. As a matter of fact, the disastrous month of May was so bad that they only booked one-third the value of orders compared with the corresponding month in the previous year. Due to the same unfortunate industrial conditions, they experienced considerable difficulty in obtaining certain raw materials, and the general conditions which prevailed rendered the task of maintaining output very costly. The results obtained, therefore, must be considered satisfactory in the circumstances, and reflected the highest credit on the management, staff, and workers. Notwithstanding the industrial upheavals which occurred during the past year, the relations between their workpeople and the management continued to be of the most cordial nature. During the last few days of November, after the settlement of the coal dispute, they booked so much work that the total value of orders taken that month created a record—exceeding the previous record by nearly 100 per cent. Among the more important orders in hand at the present time was the large extension order for the Southern Railway Company, comprising some 78 miles of h.p. cable. Having the benefit of the large additions made to the factory during the last year or so, they were able to undertake the manufacture of the whole of that cable themselves, whereas of the previous order, which was for 125 miles, they had to sublet part of the actual cable manufacture to other cable makers. The success of this great railway electrification scheme, as indicated by the rapid extension of which this repeat order formed part, was an encouraging augury for the electrical industry as a whole. With regard to their own position, he might fairly summarise it by saying that they had weathered a peculiarly difficult year without having sustained too serious a setback. He did not wish to underrate the difficulties which might lie ahead of them. Competition was still very keen, both at home and abroad, and the British manufacturer had to stand up to it everywhere unsheltered. But they had tremendous assets in their thoroughly up-to-date equipment, their world-wide selling organisation, their skilled personnel, and, above all, their reputation, extending over half a century, for manufactures of the very highest quality. They were engaged in an industry for whose products the world's needs were enormous, incalculable, and cumulative, so that no question of a saturation limit could arise. Our own country's electrical under-development was such as to constitute a vast reserve of demand. The Electricity Act was now on the Statute Book with the express object of remedying that under-development. The transition stage must involve some delays, perhaps even a temporary lull in demand, but as to the ultimate effect all round, there could be no doubt, and as the products of the company, cables, transmission lines, transformers and switchgear, formed the very spearhead of electrical progress, the lines along which all electrical advance must be made, concerns such as theirs must be the first to feel the benefit of the new impetus to the industry. Mr. J. MacGregor, the managing director, in seconding the motion, remarked that they had started the new year very well, and it looked as if labour had settled down to an earnest desire to work steadily and get back their losses. Replying to questions, Mr. Macgregor said that they were members of the Cable Makers' Association, and as far as it had worked, it was a very fair system indeed, both to those who were in it and to their customers. Shareholders need have no anxiety about the £50,000 debenture which the company held in the Burndept Company. It was fully secured, and their monthly accounts from that company were being paid promptly. The report was adopted.

Shropshire, Worcestershire and Staffordshire Electric Power Co.

The accounts of this company for 1926 were reviewed in our issue of April 29th, p. 690. The annual meeting was held on May 3rd, when Mr. E. Garcke, who presided, pointed to the satisfactory improvement in the revenue in face of the industrial dislocation last year. He said that although the great industries in the Midlands had not yet fully recovered, applications from new customers of all classes were being received in considerable numbers. Dealing with the development of business, the chairman repeated the statements in the report relating to the Avon Valley Order and the acquisition of the Ludlow undertaking, and also said that arrangements had been made to take over the electricity supply assets of the Bishop's Castle Electric Light and Power Co. and the Fladbury Electric Light and Power Co., two unauthorised undertakings working in the company's area. The Stourport station had been completed, and during the current year would probably be able to carry a large proportion of the Smethwick load and some part of the Redditch load. The linking-up of the company's system with that of Birmingham was almost finished; by that means the undertakings could furnish reciprocal supplies. The company had pursued its policy of providing electricity in some of the less densely populated districts, and an encouraging demand had been received from some of the smaller towns and villages on the route of the power lines. During the past year 85 miles of mains had been installed and extensions of the distribution network had been carried out in such places as Bromsgrove, Evesham, Astwood Bank, and Stourport, which were formerly considered rural but were becoming industrial. Mr. Garcke expressed the company's confidence in the Central Electricity Board, and concluded with a statement regarding a change in the company's name. The directors had proposed "The Severn Electric Power Company," but were open to other suggestions.

Calcutta Electric Supply Corporation, Ltd.

The annual meeting was held on May 4th, Lord Meston (chairman) presiding. In presenting the report (which we reviewed in our last issue, p. 730), the chairman said that the issue of 150,000 ordinary and 150,000 preference shares during the year had enabled them to add £97,500 to the capital reserve. The redemption of the first mortgage debentures had been completed and the balance of the sinking fund had been transferred to general reserve, and the result was a very healthy balance-sheet. The work done on the new station at

the Calcutta Docks had added nearly half-a-million sterling to their fixed assets. One generator at the station was working before the end of the year and two others had since been brought into use, and the company now had an ample reserve of plant. Riots and industrial disturbances had adversely affected the company's business during the year, but the economy effected in running costs had caused a slight improvement in the net profit. The past year had been marked by a good deal of activity: the duties of the staff were reorganised; the distribution system was improved; plans for replacing overhead cables by underground mains were matured; an efficient a.c. fan was designed; they took over the electricity supply of Dum-Dum; and the company's licence for operating in Howrah was renewed on satisfactory terms. The new station now had three 6,000-kW sets, and another similar set was being installed; the station was planned for eventual extension to 100,000 kW. The company had decided to decrease its charges and hoped that the extended use of electricity would compensate them. The unfailing support of the shareholders had enabled the company to build up large reserves, and the directors accordingly proposed to capitalise a part of those reserves and distribute it as ordinary shares in the proportion of one to each ten held at present; that would mean the creation of 136,000 shares. The prospects appeared to be encouraging. Maj.-Gen. R. H. Mahon seconded the adoption of the report, and it was approved. Subsequently a resolution providing for the capitalisation of part of the reserve was passed.

Cornwall Power Co., Ltd.

Mr. P. D. Tuckett (chairman) presided at the annual meeting on May 5th. In presenting the report, the chairman said that the company was formed last year to facilitate the financing of the Cornwall Electric Power Co. (the Parliamentary Company). The accounts were therefore very simple, consisting substantially of two items: A holding of shares and debenture stock of the Parliamentary Company on one side against the issued shares of the limited company on the other; at the date of the balance-sheet those items stood at £221,322 and £250,000 respectively. Their holding in the Parliamentary Company represented the whole of its issued share capital and all but £5,960 of its issued debenture stock. Their own capital consisted of 150,000 partly-paid convertible preference shares and 212,500 fully-paid ordinary shares held by the Urban Electric Supply Co. There was a balance of £12,367, from which they proposed to pay the 7 per cent. preference dividend and 5 per cent. on the ordinary shares. When the preference shares were fully paid, the holding in the Parliamentary Company, and consequently the income, would be increased. Referring to the operations of the Parliamentary Company, Mr. Tuckett said that, in spite of the industrial position, its gross profit had increased. £17,000 was put to the reserve, raising it to £121,000—over 60 per cent. of the issued capital. The power station was being extended to meet the demands from the tin mines.

Marconi International Marine Communication Co., Ltd.

Mr. F. G. Kellaway (deputy-chairman and managing director) presided at the annual meeting on May 5th, and at the commencement of his speech said that since the date of the report Col. Simpson had resigned from the board. Dealing with the report and accounts (Elec. Rev., April 29th, p. 690), the chairman said that the progress of profits in the past four years must give the shareholders a sense of security. The sum of £230,316 in the balance-sheet, representing investments in subsidiary companies, included the cost of acquiring a majority of the shares in the Radio Communication Co., Ltd., and the whole of the shares in the Brazilian Marconi Co. The sum of £24,051 for shares in associated companies included the amount involved in the purchase of shares in the Canadian Marconi Co. and Amalgamated Wireless (Australasia), Ltd. The company was in a strong financial position, and at December 31st last the gilt-edged securities stood at £511,795, and £66,000 of War Loan had since been purchased. The company's prospects had been considerably enhanced by the acquisition of a controlling interest in the Radio Communication Co., the company's principal competitor. Dealing with the improvement in the shipbuilding industry, Mr. Kellaway said that in the first three months of the current year the company had done 66 per cent. of the total amount of new business for the whole of last year.

New Issues.

County of London Electric Supply Co., Ltd.—The company's offer of £4,250,000 of 5 per cent. debenture stock at £96 per cent. was several times over-subscribed by 11 a.m. on the day of issue (May 4th).

Buenos Aires Lacroze Light and Power Co., Ltd.—On Monday last the public were offered £300,000 of 6½ per cent. redeemable mortgage debenture stock of this company at 96½ per cent. The principal and interest are guaranteed by the Buenos Aires Central Railway. The company was formed *inter alia* for the supply of electricity to this railway company and the Buenos Aires Lacroze Tramways Co., and these two undertakings have agreed to purchase from the company an annual minimum of 30 million kWh each while any portion of the debenture stock is outstanding. The proceeds of the issue will be mainly employed in the erection of an 18,000-h.p. generating station and an agreement for the execution of this work has been entered into with Balfour, Beatty & Co., Ltd. The list was closed, for London, at 10.45 a.m. on the day of issue.

Electrical Finance and Securities Co., Ltd.—This company has a controlling interest in the Colne Valley Electric Supply Co., Ltd., the Northwood Electric Light and Power Co., Ltd., the Foots Cray Electricity Supply Co., Ltd., the Lothians Electric Power Co., and the Boston and District Electric Supply Co., Ltd. It was formed for the purpose of financing electricity undertakings, the securing of provisional orders for supply, &c. This week an issue was made of £100,000 5½ per cent. debenture stock, at £92 10s. per cent., and 100,000 7 per cent. preference shares of £1 each at par. The 1926 profits were sufficient to cover the service of the debentures more than three times, and to twice cover the preference dividend after deducting debenture interest, &c. The proceeds of the issue are to be used for the redemption of the existing debentures (£20,000), and loans (£154,000), and for the general purposes of the company. The issue was quickly over-subscribed.

Electric Supply Corporation, Ltd.—The directors have offered to existing shareholders 50,000 £1 ordinary shares at 30s. each to provide funds for the further development of the company's business.

Calcutta Tramways Co., Ltd.

Mr. J. G. B. Stone (chairman) presided at the annual meeting on May 3rd. After reviewing the financial results of the past year (*vide* Electrical Review, April 29th, p. 691), he said that the period had been a troubled one on account of the communal riots, but they could now look forward to more normal conditions. Although they still had to meet a considerable amount of omnibus competition, there had been a material reduction in the number of their competitors. They had added to their own fleet of 'buses, and further additions were projected, to act mainly as feeders to the tramways. Fares had been reduced, with a resultant benefit in increased traffic; the company was endeavouring to attract the poorer class in Calcutta which did not at present use the cars. He (the chairman) was convinced that tramways were the best means of dealing with the transport of the mass of the population of Calcutta. The board was proceeding with the appointment of a traffic advisory committee consisting of representatives of the company, the Calcutta Corporation, the Commissioner of Police, the Calcutta Improvement Trust, and the Howrah Municipality. The report and accounts were adopted.

Ever-Ready Co. (Great Britain), Ltd.

The report for the year ended March 31st last shows a profit of £174,588, to which is added £23,864 brought forward, making £198,452. The reserve accounts receive £29,514, and after allowing for the interim dividends, there is a balance of £129,058, with which it is proposed to deal as follows:—Final preference dividend; final dividend of 25 per cent. on the old ordinary shares, making 35 per cent. for the year; dividend of 25 per cent. on the new ordinary shares; carried forward, £26,558. The directors again report a considerable expansion in the company's business; this was contributed to by the subsidiary undertakings and overseas branches. The profit shows an increase of £35,100. During the year, plant and works extensions involved an expenditure of £66,000, and since the close of the year a further expenditure of £20,000 has been undertaken. The 71,200 ordinary shares offered to the shareholders at 50s. each in November last were fully taken up, and the premium of £106,800 has been transferred to general reserve. Meeting: May 31st.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted:—

Atlas Light and Power Company.—1,500,000 ordinary shares of £1 each, fully paid, Nos. 925,212 to 2,425,211; and 1,000,000 seven per cent. preference shares (cumulative) of £1 each, fully paid, Nos. 1,000,001 to 2,000,000.

Midland Electric Corporation for Power Distribution.—70,000 ordinary shares of £1 each, fully paid, Nos. 280,001 to 350,000.

North Metropolitan Power Station Company.—£850,000 five per cent. guaranteed debenture stock, 1957.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Baird Television Development Co.—100,000 10 per cent. preferred participating ordinary shares of £1 each, partly paid and fully paid, Nos. 1 to 100,000; 100,000 deferred ordinary shares of 1s. each, fully paid, Nos. 1 to 100,000.

County of London Electric Supply Co.—£4,250,000 5 per cent. debenture stock, issued at 96 per cent., partly paid and fully paid.

Craigpark Cable Co., Ltd.

As reported in our last issue, the ordinary dividend for 1926 is 7½ per cent., as against 12½ per cent. for the previous year. The directors state that the company's business was seriously affected by the coal stoppage, and the relatively unsatisfactory results were caused by this to a considerable extent. In addition, the company has spent money in necessary alterations and improvements in the workshops and increasing its selling organisation, which has brought no results so far on account of the prevailing industrial conditions.

Scottish General Transport Co., Ltd.

The revenue for 1926 was about £2,000 higher at £30,793. The balance brought forward is £11,345, making £42,138. After meeting all expenses and allocating £22,847 to renewals, it is proposed to carry forward the balance (£4,789). No dividends were received on the company's holding of ordinary shares in the Greenock and Port Glasgow Tramways Co. and the Rothesay Tramways Co. This and the effects of the coal stoppage combined to reduce the company's available balance.

Stratford-on-Avon Electricity Co., Ltd.

At the recent annual meeting, the directors reported a net profit of £2,727, to which was added £409 brought forward, making £3,136. A dividend of 5 per cent. was declared on the ordinary shares, £1,500 put to general reserve, and £665 carried forward.

Ross Electric Light and Power Co., Ltd.

The gross profit for 1926 was £959, and the net loss has been reduced to £6,657. Arrangements have been made for an a.c. supply from Hereford in place of the d.c. supply; this is expected to reduce costs.

Fairbairn Lawson Combe Barbour, Ltd.

The directors report a net loss of £123,571 for 1926. Against this is set a balance of £87,739 brought forward, reducing the loss to £35,832. No dividend is paid on the preference or ordinary shares.

Pernambuco Tramways and Power Co., Ltd.

From the profits of the past year the directors propose to place £8,000 to reserve (against £7,000), to pay the dividend on the 7 per cent. participating preference shares, and to carry forward £5,644.

Mexican Light and Power Co., Ltd.

A meeting of the holders of the company's 5 per cent. second mortgage bonds is to be held on May 24th, to give approval to the scheme for dealing with arrears of interest and dividends outlined in our last issue.

Brush Electrical Engineering Co., Ltd.

The dividend on the ordinary shares for 1926 is again 10 per cent. Under the company's co-partnership scheme £7,354 is to be distributed among the staff and employés.

Glenfield & Kennedy, Ltd.

The directors have declared a final dividend of 6 per cent., making 10 per cent. for the year as for 1925-26.

Melbourne Electric Supply Co., Ltd.

An interim dividend of 10 per cent., free of tax, has been declared on the ordinary shares, as in 1926.

Radio Corporation of America.

The gross income for the quarter ended March 31st was $10,572,490, and the surplus profit amounted to $126,788.

Coventry Chain Co., Ltd.

The directors have declared an interim dividend of 2 per cent., as against 3 per cent. last year.

French Companies.

The *Société des Accumulateurs du Nord* reports a net profit of 260,000 fr. for 1926, which has been placed to the reserve fund.

The *Société Gramme* proposes to repeat the dividend of 60 fr. per share out of net profits of 623,000 fr. for 1926.

The *Compagnie des Locations Electriques* records net profits of 799,000 fr. for 1926, as compared with 743,000 fr. in the previous year, when a dividend at the rate of 7 fr. per share was declared.

The *Compagnie Générale Electrique* has decided to carry forward the net profit of 463,000 fr.

The *Compagnie Electro-Mécanique* reports an available surplus of 4,944,000 fr., of which 4,610,00 fr. has been devoted to depreciation and the balance carried forward.

The *Compagnie d'Entreprises Electro-Mécanique* reports orders for the construction of sub-stations for the Orleans Railway Company, a dam above the Coindre station for the utilisation of the Upper Dordogne and two hydro-electric works in the province of Segovia, Spain. The accounts show a net profit of 579,000 fr., which sum has been applied to depreciation.

Norwegian Company.

The report of the *A.S. Elektrisk Bureau* states that 1926 was a still more difficult year than 1925, as a result of the appreciation of the krone and the stagnation in business, while the level of wages did not keep pace with the declining prices of manufactures. The turnover amounted to 4,700,000 kr.; the sales of telephone material reached 1,790,000 kr., or 700,000 kr. less than in 1925. The accounts show a deficiency of 300,000 kr., which is extinguished by appropriations from the reserve funds.

North Metropolitan Electric Power Supply Co.

The company offers the holders of its 8 per cent. second preference stock (which is under notice of redemption) the right to exchange their holdings, on July 1st, into 6 per cent. cumulative preference shares at par.

Swedish Company.

The *Svenska Accumulator A.B. Jungner* reports net profits and balance forward, amounting to 230,000 kr. for 1926, permitting of the payment of 8 per cent. on the ordinary shares, as compared with 7 per cent.

Belgian Company.

The *Société Internationale d'Energie Hydro-Electrique*, Brussels, has made an issue of 50,000 preference shares in Amsterdam at the price of 196 guilders per share.

Siemens Bros. & Co., Ltd.

The directors have declared a final ordinary dividend of 5 per cent., making 7½ per cent. for 1926, as for 1924 and 1925.

Stocks and Shares.

MONDAY EVENING.

INVESTMENT has taken the bit between its teeth, now that money conditions are regarded as being favourable to all sound stocks and shares. Prices are rising in nearly every section of the more serious markets, leaving speculation behind in the matter of public popularity. The prompt closing of the County of London Electric Supply Company's subscription lists for so large an amount of stock as 4½ million pounds of 5 per cent. debenture at 96 is clear illustration of the general appetite for a first-class security offered at a reasonable figure. Reduction in the Bank rate to 4 per cent. is considered to be sufficiently probable as to justify advance discounting of the anticipated change. The cable group shows a number of rises. The chief gain in our lists to-day is one of 8 points in British Electric Traction preference. Mexican Light and Power preferred follows with an advance of 7.

Immediate success attended upon the offer by the Electrical Finance and Securities Company of £100,000 5½ per cent. debenture stock at 92½ and 100,000 7 per cent. cumulative preference shares of £1 each at par. Originally, in 1914, a few weeks before the outbreak of war, the company was incorporated with an authorised capital of £50,000 in £1 ordinary shares. Later, an issue was made of £20,000 in 10 per cent. debentures. These are to be repaid in July this year. The company's assets comprise interests in the Colne Valley Electric Supply, the Northwood Electric Light and Power, Foot's Cray Electricity Supply, Lothian Electric Power, and the Boston and District Electric Supply Companies. Two of the three directors are also on the board of British Insulated Cables, Ltd. The 5½ per cent. debenture stock has a reasonable margin of cover, and should prove a good investment. The preference shares carry an element of speculation. For both issues the public promptly oversubscribed.

Another new issue that went very well is £300,000 Buenos Aires Lacroze Light and Power 7½ per cent. sterling redeemable mortgage debenture stock at 96½. The company was formed for constructing, equipping, and operating an electricity generating station in Buenos Aires to supply, primarily, the B.A. Central and the B.A. Lacroze Tramways, these two companies undertaking to purchase sufficient energy annually to ensure the interest and sinking fund of the debenture issue now offered. The principal, sinking fund and interest are guaranteed unconditionally by the B.A. Central Railway, and the security is very fair. The County of London Electric Supply allotments will be dealt in this week. A premium was an assured certainty from the day that the lists closed so promptly.

In the demand for investment stocks of all kinds, it seems reasonable to expect that the London electricity supply shares are not likely to remain unmoved. Reference to our table will show that from 5¼ to over 5½ per cent. is obtainable from the ordinary shares of the Brompton, Charing Cross, Chelsea, Kensington, London, St. James', South London, and Westminster shares, the calculations being based on the 7 per cent. dividends that will come into force at the end of 1931. Meanwhile, the return on the money is higher, in consequence of reasons too often mentioned here to require reiteration. People are on the look out for good shares that pay anything like 6 per cent. on the money, and, in spite of the objection which attaches to a fall in dividend in four years' time, the knowledge that the 7 per cent. laid down by Act of Parliament can be maintained with ease, and that there is a possibility of this being exceeded, will serve to bring into prominence such purely investment shares as those mentioned. When money rates are high, the attraction becomes less noticeable, but, seeing that the Government recognises the national importance of reducing money rates in order that interest and other charges can be lowered in successive Budgets, it is justifiable to look for money conditions to be easy over a period of years. There will be spasms of tightness, no doubt, but, looking at the matter broadly, the investor who is content to take 5¼ or 5¾ per cent. on his money need have no qualms about keeping his present holding

of London electricity supply shares, or of adding to it when opportunity serves.

The Home Railway market is quiet, and there is nothing fresh to report in any of the Underground issues, all of which hold the gains which they secured last week. Current traffics now run against those of the strike, a year ago. It must be repeated that the public show little inclination to buy Home Railway stocks, but the Undergrounds are in a different position from that occupied by the steam railways, and the prospects of the District are hopeful enough to warrant appreciation from a present price which still pays over 5½ per cent. on the money.

The Electric Supply Corporation offers its proprietors 50,000 shares at 30s. each. As the existing shares stand at 32s., and as the company is likely to continue its 10 per cent. dividend payments, shareholders may be advised to take advantage of this offer for increasing their interests. In the manufacturing group, the tendency is somewhat dull. Johnson & Phillips are unchanged at 47s. 6d. Sir Philip Dawson read an optimistic speech by the chairman, Mr. Claude Johnson, at the recent meeting, Mr. Johnson being unfortunately indisposed and unable, by his doctor's orders, to take the chair. The managing director stated that "the only financial interest of Johnson and Phillips in Burndept Wireless is a mortgage debenture for £50,000 and a current account for supplies that is paid month by month." He referred to the drop in the Stock Exchange price of the shares as being a purely market phenomenon over which the company had no control.

Mexican utility issues are very much to the fore, in consequence of the publication of the scheme for dealing with the Mexican Light & Power arrears. The overdue dividend on the 7 per cent. cumulative preference shares is to be funded by the allotment as fully-paid, to the registered holders of the shares, of a new 4 per cent. cumulative redeemable second preference share. It is proposed to convert the ordinary share capital into shares of no par value. The directors are of opinion that, should no unforeseen events occur, the company's earnings will be sufficient to pay the dividends on the 7 per cent. preferred, the new 4 per cent. second preference, and to leave something over. This has had a marked effect upon prices. Mexican Light & Power preferred at 115 are 10 points up. The 5 per cent. first bonds at 72½ have gained 4 points. Mexico Trams rose 3 to 30½, and the 5 per cent. first bonds at 79½ are 4½ up on the week. Mexican Electric Light fives advanced to 67½, and the whole of the group shows pronounced strength, due primarily to the Mexican Light & Power statement, which comes up to the most optimistic expectations that had been formed in advance.

The cable group is good, thanks to the investment enquiries which are going on all round the markets. Rises have occurred in Easterns, Globes, Westerns, Anglo-Americans, Great Northerns, and Indo-Europeans, amongst others. United River Plates keep firm at 9. Venezuela Telephones are a little better at 34s. 3d.

Marconis are quiet, the ordinary shares at 17s. 6d. and Marines at 23s. 9d. The Marconi Company has secured an important contract in Bolivia whereby the company will undertake the control and operation of the entire postal, telegraph and wireless service of that country. This is an arrangement somewhat similar to that already in force between Marconi's and the Peruvian Government. Canadian Marconi's gave way a little to 4s. sellers. We understand that a meeting is to be held in the near future, possibly this week, at which information will be given of the progress which the Canadian company is now making. Automatic Telephones remain a dull market at 46s. 3d. Three new automatic telephone exchanges are expected to be ready towards the end of this year, and it is said that the first will be opened in five months' time.

Calcutta Electric Trams are £2 ex rights, which, making allowance for deduction of the value of the new shares, is a little better on balance. At last week's meeting, the Chairman referred to the loss of traffic occasioned by last year's communal riots in India. A complete absence of pilgrims and of the usual influx of holiday-makers into Calcutta, during the Punjab holidays in October, was due to the same cause. Anglo-Argentine Tramways are again a little higher. There has been a noticeable demand for the company's 5 per cent. debenture stock. British Columbia Railways remain firm. Fewer fireworks have been seen in Brazilian Traction, Barcelona, and Sidro shares, but no reactions have occurred in the advanced range of prices.

British Electric Traction preference rose 8 points on the assumption that the proposed scheme will be adopted whereby the stock is to receive 8 per cent. dividend for last year. The directors proposed, it may be recalled, to convert the present ordinary stock into an 8 per cent. non-cumulative preferred ordinary, and to distribute new deferred ordinary stock by way of bonus. The distribution of the latter will be 10 per cent. on the present ordinary, the price of which now stands at 150. It may not be considered wholly uncharitable to infer that the recent material rise in the price of the ordinary stock was due to intelligent anticipation that some kind of bonus distribution might be made.

Ever-Ready shares recovered to 4⅜, after being 4¼, on the issue of a good report. Iron and steel descriptions hold their recent gains, and Armstrong debentures attract buyers. Advances of several points have occurred in the junior issues. The rubber market is a trifle better. Business in most industrial sections is tolerably active.

Share List of Electrical Companies.

	Nom. £	Dividend. 1925.	1926.	Price May 9, 1927.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	14	14	57/-	—	4 18 3
Brompton Ordinary	1	10	8⅜	25/6	—	5 11 6
Charing Cross Ordinary	1	15	8½	25/-	—	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	12	8⅝	25/-	—	5 12 0
City of London	1	15	10	13⅜	—	5 1 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	31/-	—	5 3 3
County of London	1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/6	—	5 19 2
Elec. Supply Corporation	1	10	10	32/-	—	6 5 0
Kensington Ordinary	1	15	8	25/-	—	5 12 0
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	8½	24/-	—	5 16 8
do. do. 6% Pref.	5	6	6	5½	—	5 9 1
Metropolitan	1	11	8	28/6	—	4 18 3
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary	1	7	5	23/6	—	4 5 1
do. 5% Pref.	1	5	5	17/6		5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	25/6	—	5 9 10
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1¼	—	6 3 0
Urban Ordinary	1	4	7	26/3	—9d.	5 6 5
do. 6% Pref.	1	6	6	1 1/16	—	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/8	—	7 8 2
Yorkshire Elec.	1	8	8	29/6	—	5 8 4
Home Rails.						
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	,,	5	3	64	—	4 13 9
do. District	,,	3½	3½	63	—	5 11 0
Underground Electric	£1	Nil	1½	18/6	—	1 12 5
do. do. Income	Bonds	6	6	102	—	*5 17 8
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 19 0
do. Def.	,,	1½	1½	24⅛	—	6 3 9
Automatic Telephone	1	3	10	46/3	—	4 6 7
Chili Telephone	5	5	6	6 7/8	—	4 18 2
Eastern Extension	10	10	10	17⅞	+⅛	*5 12 0
Eastern Tel. Ord.	Stock	10	10	180	+4½	*5 11 1
Globe Tel. and T. Ord.	10	10	10	18⅞	+⅛	*5 6 0
do. do. Pref.	10	6	6	11	+⅛	5 8 1
Great Northern Tel.	10	20	20	28½	+¾	7 0 4
Indo-European	25	8½	10	47½	+1	*5 5 3
Marconi	1	Nil	Nil	17/6	—	... ...
Marconi-Marine	1	7½	8¾	23/9	—	7 7 4
Oriental Telephone Ord.	1	12	12	52/6	—	*4 11 5
United R. Plate Tel.	5	8	8	9	+3/8	*4 9 0
Western Telegraph	10	10	10	17⅜	+⅛	*5 15 1
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	8½	+1/16	7 17 2
do. do. 2nd Pref.	5	6	6	8 1/16	—	8 2 8
do. do. 5% Deb.	Stock	5	5	71½	—	7 0 0
British Electric Traction Ord.	,,	8	—	150	—1	5 6 8
do. do. 6% Pref.	,,	6	8	120	+8	6 13 4
Brazil Traction	100	5	6	144	+1	4 3 4
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	89½	—	5 11 9
do. do. Preferred		6¾	6¾	118½	+1	5 5 6
do. do. Deferred	,,	8	—	158	—	*5 1 3
do. do. Deb.	,,	4¼	4¼	80½	—	5 5 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	7/9	—	Nil
London United Tram. Deb.	Stock	4	4	51	—	7 16 10
Mexico Trams, 5% Bonds	—	5	5	79½	+4½	6 5 9
Mexican Light Common	100	Nil	Nil	45		Nil
do. Pref.	100	Nil	Nil	115	+7	Nil
do. 1st Bonds	—	5	5	72½	+4	6 17 11
Yorkshire (West Riding)	1	5	—	8/9	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	1	13	13	55/-xd	—	4 14 6
British Aluminium Ord.	1	12½	10	43/9	—9d.	4 11 4
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 6
British Insulated Ord.	1	15	15	68/9	—1/3	4 7 3
Brush Ord.	1	10	—	28/3	—	7 1 7
Callenders	1	15	—	3½	—	4 5 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	10	28/9	— 1/3	6 19 2
Enfield Cable Pref.	1	7½	7½	1¾	—	6 6 4
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	3	—	12/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	1	20	—	90/-	—	4 8 11
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1⅜	—	*4 9 0
Johnson & Phillips	1	17½	12½	2⅜	—	5 5 3
Met.-Vickers Ord.	1	8	8	27/6	—	5 11 4
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	7½	—	26/9	—	5 12 2
Telegraph Construction	12	10	10	28½	—	*4 4 2

* Dividends paid free of Income Tax.

The Electrical Imports of India.

Principal Sources of Supply.

FULL details of India's import trade in 1925-26 in electrical goods, showing the principal countries of supply, have recently been issued. From these the following particulars have been extracted. The corresponding figures for 1924-25 have been added for purposes of comparison and a note of increases or decreases given :—

	1924-25. Rs. (Thous.)	1925-26. Rs. (Thous.)	Inc. or dec. Rs. (Thous.)
ntrol and switchgear—			
Total	3,647	3,640	− 7
om United Kingdom	3,410	3,253	− 157
,, United States	94	139	+ 45
nerators, alternators and dynamos—			
Total	3,185	4,193	+1,008
om United Kingdom	2,948	3,684	+ 736
,, United States	87	196	+ 109
,, Switzerland	38	47	+ 9
,, Germany	69	175	+ 106
,, Italy	8	17	+ 9
otors—			
Total	3,972	3,459	− 513
om United Kingdom ...	3,345	2,747	− 598
,, United States	343	330	− 13
,, Sweden	51	65	+ 14
,, Germany	127	166	+ 39
,, Switzerland	37	21	− 16
,, Italy	12	37	+ 25
ansformers—			
Total	1,322	1,849	+ 527
om United Kingdom ...	1,096	1,339	+ 243
,, United States	182	384	+ 202
,, Germany	11	101	+ 90
,, Italy	6	3	− 3
,, Holland	25	12	− 13
rbo-generator sets—			
Total	407	2,760	+2,353
om United Kingdom ...	252	2,564	+2,312
,, Germany	—	119	+ 119
,, United States	139	52	− 87
her electrical machinery—			
Total	7,693	6,333	−1,360
om United Kingdom ...	6,606	4,807	−1,799
,, United States	673	872	+ 199
,, Switzerland	3	6	+ 3
,, Germany	143	231	+ 88
,, France	21	4	− 17
,, Italy	28	28	—
,, Belgium	14	30	+ 16
,, Czecho-Slovakia	14	—	− 14
ctric fans and parts—			
Total	2,553	2,825	+ 272
om United Kingdom ...	1,315	1,617	+ 302
,, Italy	482	635	+ 153
,, United States	178	205	+ 27
,, Germany	558	350	− 208
res and cables, rubber insulated—			
Total	2,902	3,715	+ 813
om United Kingdom ...	2,681	3,379	+ 698
,, United States	33	24	− 9
,, Germany	139	202	+ 63
to, other insulation—			
Total	1,966	2,286	+ 320
om United Kingdom ...	1,837	2,109	+ 272
,, United States	10	5	− 5
,, Germany	92	80	− 12
,, Holland	17	54	+ 37
,, Belgium	4	11	+ 7
egraph and telephone wires and cables—			
Total	212	163	− 49
om United Kingdom ...	180	162	− 18
,, Germany	18	—	− 18
,, Japan	12	—	− 12
re copper wire, electrolytic, other than telegraph and telephone wire—			
Total	1,584	1,538	− 46
om United Kingdom	1,430	1,158	− 272
,, Germany	25	193	+ 168
,, Holland	96	83	− 13
,, Japan	25	51	+ 26
Telegraph and telephone instruments and apparatus—			
Total	865	770	− 95
From United Kingdom	760	702	+ 58
,, United States	66	20	− 46
,, Sweden	7	27	+ 20
,, Germany	8	16	+ 8
Electric glow lamps—			
Total	1,232	2,001	+ 769
From United Kingdom	407	791	+ 384
,, Holland	531	565	+ 34
,, Germany	163	147	− 16
,, Austria	77	182	+ 105
,, United States	18	54	+ 36
Electric lamps, other sorts—			
Total	275	474	+ 199
From United Kingdom	47	46	− 1
,, Germany	46	52	+ 6
,, United States	152	349	+ 197
Batteries—			
Total	729	889	+ 160
From United Kingdom	371	430	+ 59
,, United States	203	216	+ 13
,, Germany	150	241	+ 91
Electric carbons—			
Total	89	63	− 26
From United Kingdom	75	41	− 34
Accumulators—			
Total	1,206	1,216	+ 10
From United Kingdom	987	902	− 85
,, United States	176	89	− 87
Electric condensers (nearly all from U.K.)—			
Total	29	26	− 3
Electric bell apparatus—			
Total	13	18	+ 5
From United Kingdom	2	7	+ 5
,, Germany	6	10	+ 4
,, United States	4	1	− 3
Lighting accessories and fittings, including switches—			
Total	1,392	1,613	+ 221
From United Kingdom	861	941	+ 80
,, Germany	157	197	+ 40
,, United States	332	428	+ 96
Meters—			
Total	645	630	− 15
From United Kingdom	437	462	+ 25
,, Germany	161	93	− 68
,, Switzerland	8	49	+ 41
,, United States	35	15	− 20
Electro-medical apparatus—			
Total	106	284	+ 278
From United Kingdom	46	112	+ 66
,, United States	27	117	+ 90
,, Denmark	15	—	− 15
,, Germany	8	14	+ 6
,, France	—	32	+ 32
Switchboards (other than telegraph and telephone)—			
Total	408	321	− 87
From United Kingdom	389	305	− 84
,, United States	10	4	− 6
,, Germany	5	8	+ 3
Electrical goods and apparatus, unenumerated—			
Total	3,219	2,966	− 253
From United Kingdom	2,154	1,810	− 344
,, Germany	599	489	− 110
,, United States	285	376	+ 91
,, Japan	101	163	+ 62

The Electrical Trade of Holland.

THE following statement, showing the imports and exports of electrical and similar goods into and from Holland during the year 1926 is compiled from the recently-issued statistics. The figures for 1925 are added for purposes of comparison and notes of any increases or decreases are given :—

Imports.

	1925. Florins. Thous.	1926. Florins. Thous.	Inc. or dec. Florins. Thous.
Electric generators, motors, transformers and rotary convertors—			
Total	5,739	7,763	+2,024
From Germany	3,701	4,488	+ 787
,, Great Britain	734	1,008	+ 274
,, Switzerland	436	1,016	+ 580
,, Belgium	239	393	+ 154
,, United States	156	175	+ 19
,, France	193	336	+ 143
Electric locomotives—			
Total	3	60	+ 57
Wireless apparatus—			
Total	2,472	3,434	+ 962
From Germany	811	1,234	+ 423
,, Great Britain	767	827	+ 60
,, France	347	600	+ 253
,, United States	305	444	+ 139
Telegraph and telephone apparatus—			
Total	3,689	4,263	+ 574
From Germany	2,218	2,682	+ 464
,, Belgium	184	536	+ 352
,, Sweden	622	411	− 211
,, Great Britain	426	274	− 152
Other electrical apparatus and instruments—			
Total	5,695	6,554	+ 859
From Germany	4,571	4,719	+ 148
,, Sweden	46	69	+ 23
,, Great Britain	396	578	+ 182
,, United States	163	171	+ 8
,, Switzerland	361	714	+ 353
Steam boilers—			
Total	4,782	5,754	+ 972
From Germany	1,943	2,219	+ 276
,, Great Britain	2,171	2,683	+ 512
,, Belgium	284	538	+ 254
,, France	226	225	− 1
Electric cable, insulated—			
Total	9,030	8,013	−1,017
From Germany	8,090	7,004	−1,086
,, Belgium	374	549	+ 175
,, Great Britain	263	158	− 105
Steam engines and turbines—			
Total	2,154	2,867	+ 713
From Germany	869	1,232	+ 363
,, Great Britain	610	776	+ 166
,, Belgium	136	175	+ 39
,, Sweden	121	72	− 49
,, Switzerland	249	369	+ 120

Exports.

	1925. Florins. Thous.	1926. Florins. Thous.	Inc. or dec. Florins. Thous.
Electric locomotives—			
Total	232	23	− 209
Wireless apparatus—			
Total	879	3,343	+2,464
To Germany	70	403	+ 333
,, Great Britain	537	747	+ 210
,, Dutch East Indies	139	285	+ 146
Electric generators, motors, transformers and rotary convertors—			
Total	2,856	2,682	− 174
To Germany	470	695	+ 225
,, Belgium	529	420	− 109
,, Dutch East Indies	398	489	− 99
,, Spain	204	148	− 56
,, South Africa	213	261	+ 48
,, Australia	154	83	− 71
Telegraph and telephone apparatus—			
Total	531	594	+ 63
To Great Britain	194	301	+ 107
,, Dutch East Indies	43	51	+ 8
,, Germany	78	109	+ 31
,, Italy	138	*	−
Other electrical apparatus and instruments—			
Total	1,597	1,526	− 71
Steam boilers—			
Total	2,214	2,313	+ 99
To Dutch East Indies	890	1,389	+ 499
,, Egypt	249	*	—
,, South Africa	387	186	− 201
,, Curaçao	135	302	+ 167
Insulated copper wire and cable—			
Total	3,276	3,277	+ 1
Metal filament lamps—			
Total	21,996	17,806	−4,190
To Belgium	1,767	1,299	− 468
,, Great Britain	1,632	1,112	− 520
,, France	3,507	2,092	−1,415
,, Italy	2,001	2,181	+ 180
,, Spain	813	880	+ 67
,, Argentina	968	1,217	+ 249
,, Brazil	802	373	− 429
,, Canada	472	*	—
,, Australia	1,456	1,567	+ 111
,, Dutch East Indies	716	572	− 144
,, Russia in Europe	891	*	—
Steam engines and turbines—			
Total	1,841	1,910	+ 69
To Germany	138	217	+ 79
,, Belgium	85	169	+ 84
,, Dutch East Indies	882	895	+ 13
,, Switzerland	96	*	—

(Florin or Guilder=about 1s. 8d.)

* Not separately distinguished.

British Goods in Argentina.

The subject of conditions in the Argentine market, particularly as they affect British goods, is again dealt with by the Buenos Aires correspondent of the *Chamber of Commerce Journal*. He says that certain recent events have created an atmosphere favourable to British goods and unfavourable to American wares. "Happily there appears to be a better realisation of market needs, as well as of the difficulties which those who sell goods here have to face. The agency question, in one or two cases which have come under the writer's knowledge, is being studied in a more liberal spirit, though it must be added that there is still a disposition to try and find men who are willing to work on what, for want of a better phrase, may be termed old-fashioned conditions. Contrasted with the American agency agreements, those of most English houses are illiberal and impractical in many clauses. American firms pay cables, costs on samples—which remain their property, and are re-shipped or sold when of no further utility, as they may direct—and all advertising outlay, the latter on a very liberal scale, while expenses of office and transport are matters of arrangement."

The Argentine trader's point of view is forcibly put in the March *Journal* of the British Chamber of Commerce in the Argentine Republic. In the course of a leading article the following appears :—"When we find London newspapers referring to the 'lack of energy and enterprise of British merchants' we are entitled to presume that the writer of the article is well primed with ideas as to how the British merchant in Argentina can redouble his energies and enliven his enterprise. But is he aware of the fact that this market is perhaps the most keenly competitive market in the world to-day, that the condition of the rural industries is so momentarily unsatisfactory that the price factor is even more impressive to the purchaser than it has ever been before, and that the agents and representatives of British firms are, in the majority of cases, working on a narrower margin of commission and with less support in respect of publicity expenses than competitors serving the interests of other nations. The fact that British trade in Argentina has not suffered even more severely than has been the case, really speaks volumes for the energy and enterprise of British merchants in this country, for . . . in addition to the difficulties created in the sphere of production by such factors as strikes and continuous unemployment, there are others of an equally harassing quality which manifest themselves at the merchandising end of the trade channel. However, a more earnest interest is being taken in the potentialities of this market, while the mere fact that the ordeal of direct comparisons with other countries have not been shirked, is a very good sign and should lead, eventually, to a reasonably accurate distribution of responsibilities for anything that may be lacking in the scheme of British trade reconstruction in Argentina."

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Weatherproof Bell.

A recent introduction of the MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, London, W.1, is a Sterling loud-ringing weatherproof bell of novel design for a.c. working, fig. 1. It is primarily a loud-ringing magneto extension bell and eliminates the use of relays and local bell circuits; it is claimed to be suitable for factory alarms. It is designed for continuous working at 220 V, but the pressure may be considerably increased for intermittent working. The operating movement, which has a resistance of 1,000 ohms for standard use, is of the polarised type with no contact breaker, and is thus suitable for use in gas-laden atmospheres. The signal is

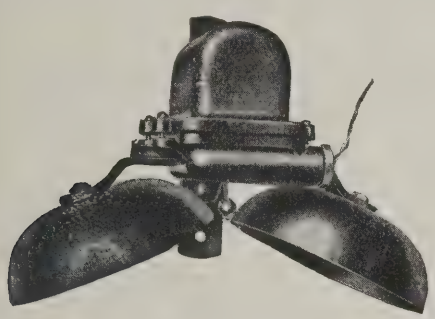


Fig. 1.—Loud Magneto Bell.

said to be of a very distinctive character, capable of being easily heard above other signals and over a considerable area. The bell is enclosed in a robust cast-metal case finished with black enamel. The hammer protrudes through an aperture underneath, and is well protected by the gongs. Access to the terminals and working parts is easily obtained by removing the cover, which is held on with four screws and clamps down on to some packing in the base, making a watertight joint. A watertight cable gland fitted to the side takes the incoming cable, and a wrought-iron fixing strap is fitted to eliminate the risk of the casting breaking, due to strain when fixing. The gongs are mounted eccentrically to allow of ample adjustment. An earthing terminal is fitted near the cable gland.

A Kettle Protective Device.

A recent development of MESSRS. CREDENDA CONDUITS CO., LTD., Oldbury, Birmingham, is the "Creda" protector kettle, which is equipped with a cut-off device of very simple design. Figs. 2 and 3 depict the automatic arrangement. Excessive



Fig. 2.—Automatic Device Closed.



Fig. 3.—After Operation.

heat melts a tiny fuse, which releases the spring-controlled movable portion of a protective switch, throwing it into the "off" position. When the device has operated the words "Boiled Dry" appear in a small window in the base of the kettle. The kettle is made in six sizes with capacities ranging from 2 to 8 pints and loadings from 650 to 1,300 W respectively.

A Novel Cable Gland.

An interesting design of cable gland has recently been introduced by the WALSALL HARDWARE MANUFACTURING CO., LTD., Hatherton Works, Ablewell Street, Walsall. It consists essentially of four parts, and the arrangement is shown in figs. 4 and 5. A suitable screwed nipple is provided for the necessary connection to the box. A gland through which the lead-sheathed cable is passed serves for the bonding of the sheath, and is provided with a suitable collar by means of which a nut screws it right home to the nipple. Hinged to this nut is a clamp which, when in position and tightened up, clamps

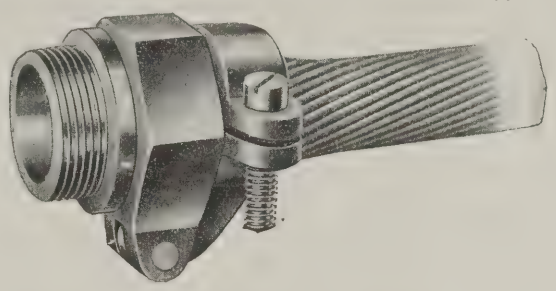


Fig. 4.—Cable Gland in Position.

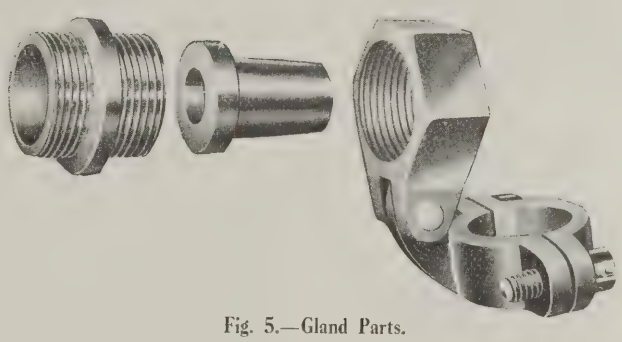


Fig. 5.—Gland Parts.

the armouring to the gland. It is claimed that the metallic connection between the box and the cable is watertight and that a perfect joint can be made in less than half the time required by the old method.

A New Change-over Switch.

We have received from the MIDLAND ELECTRIC MANFG. CO., LTD., Barford Street, Birmingham, some particulars of its most recent production, the "Memlock" change-over switch, fig. 6.

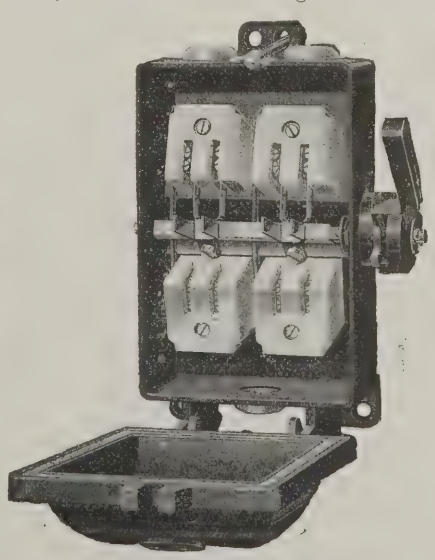


Fig. 6.—Ironclad Change-over Switch.

This is made in three sizes, 15-, 30-, and 60-A capacities, for both double- and triple-pole types, and is suitable for pressures up to 500 V. The smallest size is particularly suitable for shop-window lighting under special tariffs. The contacts are completely shrouded in porcelain and the positive quick-make-and-break action is independent of the springs. The apparatus is contained in a cast-iron case with a jet-black enamelled finish. The lead-in and-out holes are of standard clearance size for conduit, and bushes are also provided.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

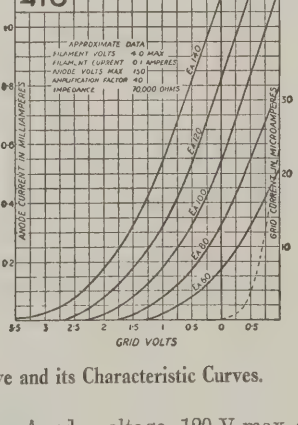
New " Steep-Slope " Valves.

The interest created by the recent introduction of the 2-volt DEP.215 power valve has encouraged the Marconiphone Co., Ltd., and the General Electric Co., Ltd., to add to the series. The three new patterns, of which we have had samples, are of the 4-volt filament type, each having a current consumption of only one-tenth of an ampere.

The DEH.410 is a valve specially designed to have a very high amplification factor, while at the same time to keep its internal impedance down to moderate limits. Thus when the now very popular method of resistance-capacity coupling is used, the magnification with one of these valves and suitable resistance should be equal to transformer coupling; in addition, when worked at a lower anode voltage the sharp bend of the characteristic curve permits this type to be employed as an " anode-bend " detector: its characteristics are:—Anode voltage, 140 V max.; amplification factor, 40; impedance, 70,000 ohms; normal slope, 0.57 mA per volt.

The DEL.410 valve may be used in almost any position, having features which conduce to marked economy in the running of the set, and is preferable to the " Osram " DE.3, which is designed primarily for operating off dry batteries; it being rated 3.8 to 4 volts, there is far less danger of over-running the new one, and no special filament resistance is





Figs. 1 and 2.—" Steep-Slope " Valve and its Characteristic Curves.

required. Its characteristics are:—Anode voltage, 120 V max.; amplification factor, 13; impedance, 14,000 ohms; normal slope, 0.93 mA per volt.

The DEP.410 power valve falls into line, as a factor in economy, with its companions, for by means of the new " electronised " filament an increased surface is available for electron emission, and, in conjunction with the disposition of the electrodes, gives the valve its distinguishing " steep-slope " characteristic. Moreover, by the adoption of separate filament resistances as a precaution against over-running, it is now possible to use a real power valve in conjunction with the DE.3 type—a power valve which will work off dry filament batteries, if desired. The characteristics of the DEP.410 are:—Anode voltage, 120 V max.; amplification factor, 6.25; impedance, 6,250 ohms; normal slope, 1.0 mA per volt.

New Marconiphone Products.

A decidedly useful and neat component has been added to the range of accessories marketed by the Marconiphone Co., Ltd., in the form of a novel switch for cutting out the last stage of a receiver; it breaks the filament circuit of the last valve and then connects its anode socket to the corresponding socket of the previous valve holder, it being, of course, essential that both valves should operate at the same anode voltage.

Another new product is a valve holder the shock-absorbing material in which is a selected grade of soft rubber, which supports the valve and also insulates it entirely from any vibration that may be imparted to the set, tending to damp any movement of the valve itself. Unlike metal springing systems, resilient rubber does not introduce a period of its own.

New Siemens Batteries.

With 50 years' experience of battery manufacture, Messrs. Siemens Brothers & Co., Ltd., recently placed on the market two new types of dry batteries which are intended to be employed for energising the anode circuit of broadcast receiving sets. Known as the " 60 "- and " 100 "-volt patterns, they have been specially priced in order to compete with the cheap imported article, and preference given to the British product will not be regretted. The new batteries are tapped at convenient stages, and appear to be of standard construction, though a bituminous compound is used for insulating purposes instead of the usual wax.

Resistance Amplification.

The distinctive feature of the new method of resistance amplification due to Von Ardenne and Heinert is the employment of anode resistance of much greater magnitude than hitherto considered suitable: instead of the customary value of from 50,000 to 100,000 ohms, the use of megohms is advocated. This is a drastic departure from current practice, for it is usually assumed, as is pointed out in *Experimental Wireless and the Wireless Engineer*, that the anode resistance should be such that the fall of potential therein will still leave sufficient voltage at the anode to ensure that the valve will operate in the straight-line region of its characteristic curve, even with a negative grid voltage. If from 1 to 3 megohms are used with anode-battery voltages of, say, 50-100 volts, as recommended, practically the whole voltage will be absorbed in the resistance, leaving only about 10 to 20 volts on the anode, and it might therefore be anticipated that the anode current-grid voltage characteristic with the resistance in circuit would show pronounced curvature, which would cause partial rectification and distortion. Actually, however, the working characteristics obtained under these conditions are remarkably straight over quite useful ranges of grid voltage. The method appears to have all the well-known advantages of resistance-capacity amplification combined with a higher degree of amplification per stage than has hitherto been conveniently obtainable, at the same time avoiding the necessity for high anode battery voltages, but the claims made originally and the estimate of the possibilities of further development are a little over-enthusiastic, says Mr. F. M. Colebrook, who carefully examined the subject in a recent issue of the above-mentioned journal. He reaches the conclusion that low-frequency amplification by the new method can be stated to have the following characteristics:—

1. Amplification per stage amounting to from 80 to 90 per cent. of the voltage factor of the valve used; in the case of small amplitudes (up to about one volt) amplification of at least twenty per stage can be obtained by means of high voltage factor triodes: these results can be obtained with anode battery voltages of, say, seventy to one hundred volts.

2. Valves used in this way require in most cases considerably less than normal filament current.

3. Low-frequency amplification by this method will be practically free from amplitude or frequency distortion, if the component magnitudes are suitably chosen: the following are suggested:—Anode resistances: 1 to 2 megohms, for normal h.f. valves; 2 to 3 megohms for high voltage factor valves. Grid-leaks: 3 to 5 megohms. Coupling condensers: 1,000 to 2,000$\mu\mu$F. The following precautions must be observed: sufficient negative grid bias must be applied to each valve following a resistance stage to ensure that the grid voltage does not at any time rise above about two volts negative. The insulation resistance of all components used must be as high as possible. The wiring and valve sockets must be such as to reduce to a minimum the stray capacities of the system. The resistances used must also have small self-capacity, ordinary grid leaks of standard make appear to be satisfactory.

New B.T.-H. Valves.

A series of 2-volt 0.1-amp. filament, 100-volt anode, valves is being produced by the British Thomson-Houston Co., Ltd. The B.21 high-frequency and detector has an amplification factor of 16, an anode a.c. resistance of 32,000 ohms, and a mutual a.c. conductance of 0.5 mA per V. The B.22 general purpose type has an amplification factor of 7.5, an anode a.c. resistance of 14,000 ohms, and a mutual a.c. conductance of 0.53 mA per V. The B.23 power amplifier (the filament current of which is 0.2 A) has an amplification factor of 6, an anode a.c. resistance of 8,000 ohms, and a mutual conductance of 0.75 mA per V, being a last-stage companion to the B.8 valve and approaching the performance of the B.4 type.

The Institution of Electrical Engineers.

The Council's Annual Report and Accounts for 1926-27.

DR. W. H. ECCLES, F.R.S., president, occupied the chair at the annual general meeting on May 5th, and announced that the Council had made the following awards of premiums for papers during the 1926-27 session:—Institution premium to Messrs. J. R. Beard and T. G. N. Haldane. Ayrton premium to Lt.-Col. K. Edgcumbe and Mr. F. E. J. Ockenden. Fahie premium to Mr. G. F. O'dell. John Hopkinson premium to Mr. P. Dunsheath. Kelvin premium to Mr. J. W. T. Walsh. Paris premium to Mr. A. R. Cooper. Webber premium to Mr. W. McClelland. Extra premiums to Mr. A. H. M. Arnold; Mr. F. W. Carter; Mr. A. Rosen. Wireless premiums to Mr. T. L. Eckersley; Messrs. R. V. Hansford and H. Faulkner. The awards for papers read before Students' Sections will be announced later.

Dr. Eccles then moved the adoption of the Council's report, which is summarised below.

Annual Report.—(*Abstract.*)

The Institution has continued to progress and prosper; the net increase in membership is the satisfactory figure of 505, and it is a matter for congratulation that the 12,647 members include no less than 3,625 students, who will in time provide the largest recruiting ground for the class of corporate members. Senatore Guglielmo Marconi, G.C.V.O., LL.D., D.Sc., was elected an honorary member. The sixth award of the Faraday Medal was made to Elihu Thomson, D.Sc., honorary member. In April, 1924, the Société Française des Électriciens founded the Mascart Medal of Honour in memory of that eminent French scientist, to be awarded triennially to scientists or engineers distinguished for their work in pure and applied electricity, whatever their nationality. The first award of the medal was made in 1924 to Monsieur A. Blondel, Hon. M.I.E.E., and the second (1927) award has recently been made to Sir J. J. Thomson, O.M., M.A., F.R.S., Hon. M.I.E.E. Ten other honours and distinctions have been conferred on members. The Council records the death of 62 members during the year.

At the meeting on December 2nd, 1926, oil portraits of Faraday and Kelvin were formally installed in the lecture theatre, that of Faraday having been presented to the Institution by Mr. Sydney Evershed; the portraits are the work of Mr. George Harcourt, R.A. The Council has since accepted offers of portraits of Clerk Maxwell and of Wheatstone from Mr. Ll. B. Atkinson and Sir George Sutton, Bart., respectively, and also an offer by the Cable Makers' Association of a portrait in oils of Mr. Ll. B. Atkinson, which will be placed in the Council Chamber, where there are already oil paintings of former presidents.

During the past twelve months 358 meetings have been held in London and at the local Centres by the members, the Council, and the various committees. The attendances and proceedings at the meetings of the local Centres and Sub-Centres have well maintained the high standard of the past. Eight Wireless Section meetings have been held, at which six papers were read, and there were two informal discussions. A Local Wireless Section, of which three meetings have been held, has been formed at the South Midland Centre (Birmingham), and papers on wireless subjects have also been read and discussed at Manchester and Liverpool. Eleven informal meetings have been held during the session, the average attendance being 59, against 65 last year, and the eight Students' Sections carried out a very full programme of meetings, visits to works, and social functions, and a summer meeting was held in Belgium and Luxemburg.

The Faraday lecture, by Prof. W. M. Thornton, O.B.E., D.Sc., who took for his subject "What is Electricity?," was delivered at London, Birmingham, Bristol, Dublin, Glasgow, Leeds, Liverpool, Manchester, and twice at Newcastle-on-Tyne. The total attendance was approximately 6,000, and the presence of over 4,000 non-members indicates that the lecture achieved the object in view, *viz.*, the bringing of electricity to the attention of the public.

Under the scheme approved by the Council in 1925 for the publication in the *Journal* of periodical reviews of progress in electrical engineering, four reviews were published during 1926 and seven in 1927, and arrangements are being made for reviews of the three remaining sections to be published in 1928, together with further reviews of research and electrical standardisation. The Council will be glad if members will forward to the secretary of the Institution criticisms of the present reviews, and also suggestions as to the ground to be covered by those to be published in the future.

Two David Hughes scholarships and two Salomons scholarships (value £50 each, tenable for one year) were awarded. That part of the trust deed of the War Thanksgiving Education and Research Fund which provided for the education and technical training of men who served overseas in H.M. Forces during the great war has come to an end, as there are no longer any students at educational establishments who fulfil the condition of war service. A scheme has therefore been prepared which will permit of grants being made each year to one or more post-graduate research students, to assist them in carrying out approved researches of an electrical nature; the first of such grants will be made this year.

The Council appointed Mr. C. P. Sparks, C.B.E., Lieut.-Col. K. Edgcumbe, R.E. (T.A.), Mr. S. W. Melsom, and the secretary delegates of the Institution to attend the meeting of the International Electrotechnical Commission in New York from April 13th to 22nd, 1926; the meeting was attended by 116 delegates, representing 17 countries. At the annual conversazione in 1926 there was a record attendance of over 1,800 members and guests. At the annual dinner in 1927 the Prince of Wales was principal guest; there were present 618 members and guests, and the function was the largest of the kind held by the Institution.

The two sets of Conditions for Export Contracts B1 (delivery f.o.b.) and B2 (including complete erection or supervision of erection) are under revision.

During the year 128 books and pamphlets were presented to the reference library, and 58 volumes have been purchased. The total number of readers for the year was 4,666, of whom 139 were non-members, against 3,537 and 114 respectively in 1924-25. The circulation of books from the lending library has been well maintained; 71 new volumes were added, and 2,401 books were issued to 933 borrowers, the corresponding numbers for the previous year being 1,938 and 857 respectively. A new edition of the lending library catalogue, with a subject index, is available.

The net cost of printing and posting the *Journal* in 1926 was £4,447, compared with £4,166 in 1925. The increase was due partly to the greater size of the volume (1,230 pages, compared with 1,180 in the previous volume), and partly to the larger number of copies printed (12,800, against 12,500).

The Physics volume of *Science Abstracts* for 1926 contained 896 pages of abstracts, compared with 904 pages in 1925. The Electrical Engineering volume contained 584 pages of abstracts, compared with 616 pages in the previous year. Mr. H. G. Solomon has been appointed to the Institution staff and is charged with the editorial duties.

The Joint Committee set up by the Council of the Institution and the National Gas Council, "to consider whether in the national interest an inquiry might advantageously be held into the possibility of closer co-operation between gas and electricity undertakings in promoting capital and fuel economy in the supply to the public of energy derived from coal," held six meetings, and two sub-committees have been set up by it. Among the first matters which have engaged its attention are the utilisation of waste heat in gasworks and the consequent release of solid fuel for other uses, and also the utilisation of surplus coke or coke breeze from gasworks as fuel for steam-raising at electric power stations.

For the final examinations of 1926 the Joint Standing Committee representing the Board of Education and the Institution examined at various schools and colleges students from 58 approved courses for the award of ordinary certificates in electrical engineering, 23 courses for higher certificates (including 1 post higher certificate course), 4 courses for ordinary diplomas, and 1 course for higher diplomas; the number awarded was as follows:—245 ordinary certificates; 116 higher certificates (including 4 post-higher certificates); 8 ordinary diplomas; and 6 higher diplomas.

A further list of urgent amendments to the eighth edition of the Regulations for the Electrical Equipment of Buildings was approved by the Council last September for publication in the form of an alterations leaflet; in addition, alterations have been agreed upon as a result of suggestions received since the eighth edition was published, and it has therefore been considered advisable to issue immediately a revised edition (ninth) containing all the alterations referred to above. The Committee proposes, however, to proceed at once with a more comprehensive revision.

The Council has set up a Committee of representatives of the Institution and of bodies closely associated with electricity supply to consider and report on (*a*) the practicability and cost of raising or lowering to 230 the declared lighting

voltage of the general supply networks of all systems in Great Britain; (*b*) the ways in which the Electricity Commissioners may be able to assist voltage standardisation; (*c*) any other matters affecting the standardisation of low-voltage distribution systems.

The Council has adopted the following rule: "Any corporate member who has reached the age of 65 and has retired from the practice of his profession or business, may apply to the Council to remit or reduce his future annual subscriptions, provided that his membership of the Institution has been continuous for at least 25 years. If his request be granted, he may, nevertheless, be required to pay, at a rate to be determined by the Council from time to time, for such publications of the Institution as he may wish to receive."

On December 31st, 1926, the capital account of the I.E.E. Benevolent Fund stood at £12,003, and the accumulated income at £882. The donations and subscriptions to the fund in 1926 amounted to £1,484. In 1926, 87 grants were made to 32 persons, amounting to a total of £1,497. The accounts of the I.E.E. show a balance to the good on the revenue account for 1926 of £3,882, which compares with £1,196 in 1926. The income amounted to £38,179, compared with £35,620 in 1925. The assets amount to £152,906, an improvement of £8,279 on the 1925 figure.

Annual Meeting.

Mr. F. GILL seconded the motion to adopt the report.

Mr. D. G. HURLBATT suggested that the I.E.E. Electrical Appointments Board should be made better known, so that employers who found it necessary to increase their staffs could make use of the facilities offered.

Mr. F. W. PURSE expressed full satisfaction at the work done during the year. He compared the rate of increase of corporate and student membership, and counselled the encouragement of Students to "follow on" into higher grades so as to give the Institution the benefit of higher subscriptions as some compensation for the money it spent for their benefit in the earlier stages.

Mr. F. W. PHILLIPS again advocated the re-admission of late "enemy" members. The president explained that the Council had already approved of the change being made and in due course a meeting would be called to alter the by-laws accordingly.

The report was adopted.

The hon. treasurer, Lieut.-Col. F. A. CORTEZ LEIGH, moved the adoption of the accounts and balance sheet. Mr. ROGER T. SMITH seconded, and Mr. W. RAWLINGS offered congratulations on the extraordinary results of the year. The anticipated further increase in the assets next year, he said, showed that there was money to spend, and he accordingly advised that the I.E.E. grant of £500 to the British Engineering Standards Association should be increased to £1,000, which suggestion was supported by Mr. LL. B. ATKINSON.

The accounts having been adopted, a vote of thanks to the officers of the Institution was carried, and Messrs. Allen, Attfield & Co. were re-elected auditors.

Mr. D. J. BOLTON proposed a resolution to the effect that no paper should be rejected without some reason being given to the author. The motion was seconded, but it was opposed by several members for diverse reasons and the president suggested that it be withdrawn on his promise to bring the matter before the Council.

The withdrawal of the resolution terminated the meeting.

H.P. Transmission.

The Design of Towers for Overhead Lines, with Particular Reference to American Practice.

IN a paper read recently before the Institution of Structural Engineers, the author, Mr. H. R. White, outlined the general considerations necessary for designing overhead electrical transmission lines, and reviewed what has been done up to the present time, particularly in the United States and Canada.

Wooden and tubular poles and structural masts with wire guys were objectionable, he said, both electrically and as regarded the cost of maintenance. The tendency in America and Canada was to use structural steel towers, square in plan, of the self-supporting type, or, for very light or auxiliary lines, structural steel lattice poles of the self-supporting type. The mileage of transmission lines on the North American Continent and the consequent demand for these steel towers was such that leading makers formed entirely separate engineering departments and laid out independent shops to deal with this work.

The two most usual sets of loading in use in the United States were class A, 15 lb. per sq. ft. on the bare wire and 25 lb. on the structures, for districts where the temperature did not fall below freezing point, where it was found that in these districts a somewhat higher range of wind pressures was encountered than in winter time in the cold districts; class B, 8 lb. per sq. ft. on the cable covered with ice ½ in. radial thickness, and 13 lb. on the structures, for districts which were subject to low temperatures in winter. Where winter conditions were very severe a third loading, C, was used, in which case 11 lb. per sq. ft. was allowed on cables covered with ¾ in. thickness of ice. The wind load on the structure was taken on one and a-half times the exposed area of one side. It was customary to calculate the wind on the ice-covered wire at zero F.

The weight of the tower was a question of either experience or trial. Considerable experience was necessary to forecast weights accurately, it having been found absolutely impossible to standardise towers, no two lines being exactly alike.

The load due to the breaking of wires was usually taken at or near the elastic limit. It was the item of loading that chiefly accounted for the difference in design between various types of towers in a line.

The clearance between conductors and the nearest tower member for pin-type insulators was 12 in. for 22,000 V or less, and up to 19 in. for 44,000 V. In the case of suspension insulators swung 45 deg. from the vertical, the figures were the same, and ranged up to 61 in. for 165,000 V. In the case of suspension insulators swung 60 deg., due to an angle in the line, the figures were the same, but if due to wind load the clearances might be about 10 per cent. less due to the fact that the angle of 60 deg. was less likely to be maintained.

The clearance between one conductor and another for pin-type insulators was given for 44,000 V as 49 in. for 200-ft. spans, ranging to 82 in. for 800 ft. For suspension insulators at this voltage the clearances would be 56 in. and 100 in. respectively, while for 144,000 V the figures were 110 in. and 144 in. In the case of conductors swung 60 deg. it was necessary to use either a specially long insulator or to drop the point of suspension below the cross arm by means of a bracket in order to provide the necessary clearance between the wire when swung and the cross arm above it. The determination of the general outline would be based on the above figures, and it was here that the experience of a designer might effect considerable economy.

Open-hearth steel was used in the manufacture of these towers; the dead load was not a serious factor, and in a number of members the slenderness ratio governed. The loads and stresses were small by comparison with those in bridge and building work, and it was, therefore, necessary to use small sections. In some towers the legs were as small as 3½ in. by 3½ in. by ¼ in., and this was about as small as could be used consistent with economic detailing. Many towers contained web members 1½ in. by 1½ in. by ⅛ in. Makers' specifications recommended a minimum thickness of 3/16 in. in an endeavour to advocate the use of more substantial towers, and due to the fact that some structures built in the early days were lighter than they should have been.

The American Bridge Co. and the United States Steel Products Co.'s tower shops were quite apart with separate organisation. All the work was punched, but the machines were designed and arranged to ensure exact duplication. Protection by galvanising was coming to be more and more generally used. It cost more than painting in the first place, but in the extra thickness of the members required for painting, and the cost of subsequent painting, the extra cost of galvanising disappeared. Galvanised structures should have a much heavier coating than was applied to ordinary materials.

Discussion.

Prof. J. HUSBAND pointed out that the towers used in France had a smaller base than similar towers in the United States because most of the lines in France ran over cultivated country and it was desired to create as little inconvenience as possible to the farmers.

Mr. J. C. TELFORD regarded the French method of casing the base of the column in concrete as better than putting it into bare earth. A feature of tower failures in America was that they were given prominence so that other people might learn from them. He asked if any experiments had been conducted on sherardising the whole of a tower.

Mr. S. BYLANDER said that for the railway electrification scheme from Gothenburg to Stockholm, in Sweden, the posts were made of two-channel lattice. The foundations for the towers were concrete, and one type of tower used near Stockholm had three legs and not four. This was the most modern and clever design he had seen, and made the tower cheaper. For towers not of too great a height it was the best type.

Prof. HUSBAND said the usual practice in France was to galvanise the upper parts of the towers which were near the live wires. The lower portions could be painted with safety whilst the current was on.

The author, replying to the discussion, said that the cost of timber varied very much in different parts of the world. In England it was very much more expensive than in America. It might be possible to get a lattice pole which cost double as much as a timber pole, but it would be of very much greater strength, not only as a pole, but in its ability to take up torsional stresses. The stresses recommended by the various manufacturing companies were such that, under test, members with punched holes and bolted connections gave 10 per cent. increase in strength at the joints, compared with what they gave in the member. Towers built in this way which had been tested to destruction did not fail at the joints but through buckling of the struts. He did not know what was the objection to sherardising, but people in America who had had sherardised poles would not have them any more. Triangular towers had not been found cheaper when tried for high radio towers. No allowance was made for rust when the towers were galvanised, and galvanising, if properly done, would last as long as 20 years.

The Trade Disputes Bill.

Debate on the Second Reading.

ON May 2nd the Government's Trade Disputes and Trade Unions Bill, which was dealt with in our issue of April 22nd, p. 633, came before the House of Commons, and four days were allotted for the debate.

In moving the second reading, the Attorney-General (Sir Douglas Hogg) said that the Government believed that the Bill was well drafted, and, while it would be glad to accept amendments to remove any ambiguities, it would resist to the utmost any amendments designed to defeat the objects of the measure. The first five clauses, which were, perhaps, of the most general importance, could be stated in the form of four propositions:—(1) That a general strike was illegal, and no man could be penalised for not taking part in it; (2) That intimidation was illegal; (3) That no man should be compelled to subscribe to the funds of any political party; and (4) That Civil Servants must give their undivided allegiance to the State. The right of workmen to strike was preserved, although many legitimate industrial strikes affected large bodies of the community. To be illegal a strike had to be one which was not purely industrial, and was intended to coerce the Government or intimidate the community, or a substantial part thereof. The Government did not think that the inclusion of lock-outs in the Bill was possible. A general lock-out directed against the Government had never been suggested; any attempt would be met by the Government stepping in and running the undertakings, as it already had power to do. If, however, a case could be made out for the inclusion of lock-outs, the Government had no objection to including them. Employers, equally with workmen, were included in Clause 3, dealing with intimidation, and Clause 4, dealing with the political levy. Clause 2, which provided that no one should be penalised for refusing to take part in an illegal strike, definitely applied only to strikes declared by the Bill to be illegal; Sub-Section 3 of the clause made it retrospective to cover the general strike of last year. Clause 3 dealt with intimidation; peaceful picketing was not prohibited. Clause 4 altered the status of the political levy. The change from contracting-out to contracting-in should not injure those unions which had been loyal to the Act of 1913. Clause 5 dealt with the position of Civil Servants; Clause 6 prohibited public authorities from making trade union membership a condition of employment; and Clause 7 empowered the Attorney-General to apply for an injunction restraining a union from using its funds in contravention of the Bill. He asked the moderate Labour men to co-operate with the Government in improving the measure and making it workable.

Mr. Clynes (Labour) moved the rejection of the Bill, saying that the fight against it would not end when it was on the Statute Book. The Bill would make it almost impossible for trade unions to enter into effective contracts with the Government or employers of labour. It would be the duty of his party to repeal the measure when it came into office. The Bill did not debar a group of men from striking, but it prevented their strike from being successful. As regarded intimidation, there had been a great deal of exaggeration. There was more on the other side: no weapon was so potent as the power of dismissal. The Civil Servants had taken no part in the general strike and, in addition to their obligations as Civil Servants, were entitled to the privileges of wage-earners. The political levy clause brushed aside an agreement come to between all parties in 1913, and it was an attempt to deprive the working classes of representation. Mr. Harney (Liberal) considered that the Bill was directed against all strikes by means of its "intimidation" clause, but Sir W. Greaves Lord (Conservative) said that the clause was rendered necessary by the events of last year. Sir H. Slesser (Labour) said that in the case of a strike being declared illegal it would be criminal for men to leave their employment even after giving notice; the Government was thus reducing workmen to a state of servitude. The Bill went far beyond a general strike; any strike which "intimidated the community" was illegal, and the word "intimidate" was not defined. The matter was purposely left vague for any interpretation to be put upon it and thus make any strike illegal.

Mr. Hurst (Conservative) spoke in favour of the Bill, and Capt. MacMillan (Conservative) said that if the Government had not proceeded with the Bill it would have been interpreted as a sign of weakness. He and other Unionists would support the Government, hoping, however, that it was not the beginning of a reactionary policy. Mr. G. Spencer (Labour) said that unless something upon the lines of the Bill were done, the unions would be captured by the revolutionary element. The Bill would do more good to the Labour Party than to any other. The movement against the Bill had not sprung spontaneously from the working man. Mr. Spencer continued his speech on May 3rd, and related his experiences during the coal dispute. He concluded by saying that the unions devoted more time to political than to trade union matters. Mr. A. Henderson (Labour) described the Bill as an invasion of the established rights and legal powers of the trade unions. It prevented combinations of workers, while capital was allowed to enter into any combination thought desirable. What was the position of such a body as the Transport and General Workers' Union which embraced men in a number of industries?

Sir L. Worthington Evans (Secretary for War) said that Mr. Justice Astbury had decided that the general strike was illegal, and the Bill made the matter definite. Labour leaders had condemned the strike, but that did not preclude the possibility of another. Contrary to Opposition opinions, the Bill was designed to protect the working class, which was the greatest sufferer in a general strike. Sir R. Horne (Conservative) considered that the Bill should include lock-outs, and said that that was the opinion of the bulk of the Conservative Party. If the political levy was really voluntary, the unions should not be injured in any way. The great mass of trade unionists would be grateful for the Bill. Mr. Walsh (Labour) said that under the Bill any strike could be made illegal, and the trade union movement would be rendered impotent.

On May 4th, Sir John Simon made a long speech, in the course of which he said that the objects of the Bill as expressed by the Attorney-General were unexceptionable. The real objection to the Bill was the method in which it was drawn up. He expressed doubt regarding the wisdom and necessity of the political levy clause, but agreed that if it was necessary no harm should be done. Clause 1 might lead to complications, and lock-outs should certainly have been included. He considered that a general strike was already illegal, and a simple declaration to that effect would have been sufficient, and he concluded by saying that all members should endeavour to make the Bill fulfil the declarations of the Attorney-General—neither more nor less. The Prime Minister said that the Trade Disputes Act, 1906, took a far more extreme form than was originally intended, and the ground covered by trade unions had since then moved from industrial to political action, and in some unions the power was getting into the hands of the "minority movement," such as in the Miners' Federation. The Government had refrained from introducing legislation, and had decided not to proceed with Mr. Macquisten's Bill to deal with the political levy in 1925, but its hands were forced by the general strike; that was the Government's mandate for the Bill. He concluded by inviting the co-operation of the House in giving effect to the propositions enunciated by the Attorney-General. Mr. T. Shaw (Labour) said that the Bill aimed at the destruction of the Government's political opponents, and was so drafted as to provide endless work for the lawyers. It did not touch the employers, who were left to do as they pleased. Capt O'Connor (Conservative) said that although it was incorrect to describe the Bill as "industrial conscription," it went a long way in that direction. It should be the aim in committee to prune the Bill and remove the ambiguities. Mr. Dixey (Conservative) said that the measure should have been introduced two years ago. He also urged the Government to include lock-outs in it.

On May 5th, Mr. Townend (Labour) said that no attempt had been made in the Bill in dealing with sympathetic strikes to define a line of demarcation between trades. Mr. Snowden (Labour) said that if general strikes and intimidation were already illegal, the repealing of the Act by a Labour Government would leave things exactly as they were. Under modern conditions it was impossible to confine all disputes to the industries in which they arose, and the banning of sympathetic strikes rendered all strikes useless. The Government was constantly being coerced by all parties, including its own, and to merely refuse to work was a very peaceful form of coercion. No amount of legislation would stop a general strike if the workers intended to have one. The Bill said nothing about taking the leaders first; could they put 5,000,000 men in prison? He agreed that the inclusion of the employers would be useless for they had a thousand means of coercion at their disposal of which no legislation could deprive them. He ridiculed the attempt to expand the meaning of "intimidation," and with regard to the political levy said that improvements in conditions were mainly brought about by political means, and trade union members should be prepared to pay for them. He wished that the Government had devoted itself to the setting up of machinery to settle industrial disputes by reason and not force. Sir R. Sanders (Conservative) claimed that the demand for the Bill had come from the working classes, not the employers.

Mr. Lloyd George (Lib.) challenged the wisdom of introducing the Bill at such a time. The Bill, instead of clarifying trade union law, created new obscurities. It was dangerous to leave the interpretation of its terms to magistrates who might unconsciously be prejudiced in favour of the employing class. The first clause rendered sympathetic strikes and all strikes in vital industries possible. With regard to Clause 4, the Mineowners' Association had used its funds freely for political purposes—would that be impossible in future unless a special fund were set up to which individuals would have to agree to subscribe? He did not believe that the general strike could be repeated, but how would the Bill stop one? No important industrial group of any kind wanted the Bill; it was dictated entirely by political expediency. Conditions were improving, and the Bill would set them back. Mr. Jephcott (Conservative), speaking as a former trade unionist, said that a large number of unionists would be grateful for the measure if it separated industrial from political matters. Mr. Wheatley (Labour) claimed that whether a sympathetic strike was right was a question to be decided by the men concerned. The workers would find means of evading the Bill if it became law. Mr. Hilton Young (Conservative) said that any attempt to substitute the rule of the Trade Union Congress for that of Parliament must be made impossible. Mr. J. H. Thomas said that in his union 55,000 members were exempt from the political levy; among the shipwrights in Sunderland there were more exempted members than members paying the levy, and that also applied to the boilermakers. After preaching industrial peace, Mr. Baldwin had given his support to an attack upon the trade unions and his political opponents. After quoting examples of what he described as intimidation by employers, Mr. Thomas said that the unions were being deprived of the only weapon that they possessed. The bulk of the magistracy was of the employing class, and he had no doubt as to what their opinions of the legality of a strike would be. The Government had struck a serious blow at those who were desirous of peace in industry. The Solicitor-General (Sir T. Inskip) said that Clause 1 did not prohibit a strike for the improvement of conditions in an industry even if it was a national one and might possibly bring pressure to bear on the Government and compel the community to submit. The word "sympathetic" was one of no very exact meaning, but the word "intimidate" was perfectly plain. Regarding Mr. Snowden's suggestion that the Government might have to imprison five million workers, the speaker said that Acts of Parliament were not administered by the police, but by the law-abiding character of the English race. The employer was prevented from intimidating his men by Clause 3, just as much as the worker was prevented from the use of intimidation. If a man was compelled to join a union, he should be protected from compulsory contribution to a political fund. The Bill was wanted by the community which had suffered from the general strike. The closure was then moved and carried, and on a division the Bill was read a second time, the Government majority being 220. It was then decided to commit the Bill to a committee of the whole House.

Powdered Lignite in America.

Some notes on an electricity works in the United States which is said to be the largest user of powdered lignite for steam-raising purposes.

THE largest steam turbo-generator between the Mississippi River and the Pacific Coast of America has been installed in a Rocky Mountains generating station which at present claims to be the largest single consumer of powdered lignite fuel in the world. The turbine, a 25,000-kW set, being added to the Public Service Company's Valmont station wherein a 20,000-kW set is already in operation, was built by the General Electric Company of America. While the Valmont plant is at present said to be the largest consumer of lignite fuel, a larger plant is being installed in Texas to utilise lignite from that State; 80 per cent. of the powdered lignite tonnage is converted into utilised heat, the balance including 5 per cent. ash and 15 per cent. radiation and chimney gases.

Electricity is generated at 13,000 volts, stepped up to 100,000 volts, for transmission to Denver, and to 44,000 volts for the transmission system distributing throughout Northern Colorado. Lake Valmont, upon whose shore the plant is located, and which furnishes the condensing water for the steam turbines, has an area of 127 acres, or enough to care for four sets similar to the present ones. Land is owned and a dam site has been laid out to increase this area to 600 acres, which will care for the ten sets that are contemplated in the ultimate scheme.

The first step of economy in the use of powdered lignite, according to the practice at the Valmont plant, is the utilisation of a grade of fuel heretofore largely waste, consisting of the dust and slack from the mines. Before the fuel is powdered, the discharged hot fumes from the boilers are passed through it to extract the moisture; it is then ground in centrifugal mills of the Chilean type and lifted by air pressure created by fans to the distributing storage bins above the boilers. Its distribution to the combustion chambers of the boilers is by screw conveyor and air pressure, the air furnishing the necessary oxygen. A stream of powdered lignite one foot in diameter is fed into the boilers at the rate of eight feet per second. Within three feet after entering the combustion chamber the powdered fuel becomes entirely incandescent and burns like a gas, at a temperature of from 2,500 to 2,800 deg.

The ash falls in the form of a fine dust through the grates, which are internally water-cooled to prevent the ash from vitrifying. As this incombustible waste represents only 5 per cent. of the original volume of coal, its disposal is negligible. The lignite used is obtained from mines only a short distance away, and the present consumption is 1½ lb. per horse-power-hour, representing from 400 to 500 tons daily.

Steam enters the turbines at a pressure of 375 lb. per sq. in. and a temperature of 680 deg. F., being exhausted into a 24-in. vacuum. The feed water to the boilers is preheated to 260 deg. under pressure, and all free oxygen is removed from the water to prevent corrosion in the boilers. The condenser cooling water enters at a temperature of 70 deg. during the summer and discharges at from 78 to 80 deg. Each unit uses 40,000 gallons per minute, supplied by two 20,000-gallon pumps.

Two independent transmission lines furnish outlets from the Valmont plant to Denver, Boulder, Fort Collins, and Greeley, which arrangement ensures against interruption of service.

Parliamentary News.

(By Our Special Parliamentary Reporter.)

The Trade Disputes Bill.

After a four-days' debate, the House of Commons, on May 5th, carried the second reading of the Trade Disputes and Trade Unions Bill by 386 votes to 171. A report of the debate appears on p. 779.

Wednesday and Thursday of this week were to be devoted to the Committee stage, and the Government had prepared amendments providing for the inclusion of lock-outs in the Bill and substituting the words "inflicting hardship upon the community" for "intimidating the community or any substantial portion of the community" in the definition of an illegal strike.

The Southern Railway Contract.

On May 4th Mr. Dennison asked the Minister of Labour whether the recent contract given by the Southern Railway Company to a Swedish electrical company would involve the introduction into this country of Swedish artisans; and if he was prepared to give permits to such foreign workpeople to take part in the erection of plant and machinery manufactured abroad while large numbers of British skilled engineers were still unemployed.

Sir A. Steel-Maitland said that no application for permits in that connection had so far been received. He could not say what decision he should come to unless and until such an application was made.

Mr. Hannon asked the Financial Secretary to the Treasury if, having in view the guarantees given by the Trade Facilities Committee for the electrification of the Southern Railway, any condition was imposed on the railway company that, as far as possible, contracts should be placed in this country.

Mr. McNeill said that the South-Eastern and Chatham Construction and Equipment Co. did not avail itself of the guarantee, which was subsequently withdrawn.

Railway Electrification.

On May 3rd Mr. Hannon asked the Minister of Transport whether the Electricity Commissioners had been consulted on the extension of the electrification schemes of the Southern Railway Company; and if such extension schemes had had their approval.

Colonel Ashley said that the approval of schemes for extensions of railway electrification was not a matter in which the Electricity Commissioners were directly concerned.

On May 5th Lt.-Commander Kenworthy asked the Minister of Transport how many miles of main railway line had been electrified in Great Britain, and whether plans had been prepared for the electrification of other portions of the main line railway system.

Colonel Ashley said that at December 31st, 1926, 946 track miles of the railway lines of the four amalgamated companies were worked either wholly or partly by electric traction. In addition, 295 track miles of railways belonging to other companies, mainly operating in London, were worked by electric traction on that date. He understood that the principal railway companies had the question of railway electrification constantly before them.

Oil from Coal.

On May 5th, in reply to Mr. Thurtle, who asked for information as to whether the process of extracting oil from coal was now being carried out on a commercial basis in Germany, the Duchess of ATHOLL said that low-temperature carbonisation processes had long been employed for the extraction of oil from brown coals in Germany. It was understood that oil was now also being produced on a commercial scale in Germany by the hydrogenation of brown coal.

Private Bills.

The London and Home Counties Joint Electricity Authority (No. 2) Bill has been read a second time in the House of Commons. The Yorkshire Electric Power Bill and the Farnham Gas and Electricity Bill have been read a third time and passed in the Lords.

A Select Committee of the House of Commons this week commenced the consideration of the County of London Electric Supply Co. Bill, the principal object of which is the extension of the company's powers in relation to the supply of electricity in Essex.

Correspondence.

Correspondents should forward their communications* as early as possible.** ***No letter can be published unless we have the writer's name and address in our possession.

Electroculture.

I note in your issue of April 29th that your Paisley correspondent would like to have particulars of experiments in the culture of tomatoes by means of electricity.

This is a method of treatment which has been tried in several forms by a number of people from time to time. In tomato growing, electricity can be used in the following five ways:—

(1) *Seed treatment.* Mr. A. Carr Bennett, of Fairfield, New South Wales, has reduced the electric treatment of seeds to a commercial proposition, and particulars of his results are contained in a book published by Messrs. Angus & Robertson, Ltd., 89, Castlereagh Street, Sydney, entitled "Electro-Culture, the Application of Electricity to Seeds in Vegetable Growing." Mr. Carr Bennett reports phenomenal yields from crops of treated seeds and considers that such treatment so strengthens the seed, that weeds have little chance of making way in their neighbourhood. Not only is the yield increased, but the quality of the tomatoes is enhanced.

The Wolfryn process of seed treatment, which has been developed in England, does not seem to have been tried on the tomato seed, but there is no reason why it should not be as successful as with other seeds.

(2) *High-tension treatment* by means of positively charged wires placed close above the plants (about 1,000 volts).

(3) *Local electric heating.* By placing a heating cable in the soil, under the roots of the plants.

(4) *Intensive illumination.* Intensive electric light can be applied (*a*) to seedlings immediately after transplanting in order to prevent wilting, and (*b*) to plants, in order to speed up the flowering. The time of maturity can to a certain extent be regulated, *i.e.*, the grower could be sure of having fruit available in time for the best markets.

(5) *Sterilisation of soil,* by means of a portable electric steam boiler.

As far as the bibliography of this subject is concerned, little has been written dealing with the electrical side, but I suggest that your correspondent in addition to the above booklet should refer to "The A.B.C. of Tomato Growing," by W. Dyke (The Lockwood Press), post free 3s. 9d. Two books on the general subject which might also interest him are "Growing Crops and Plants by Electricity," by E. C. Dudgeon (Rentell), and "Electricity in Agriculture and Horticulture," by K. S. Lemström (Benn Bros.), although neither of these deals specifically with tomatoes.

By the way, in an article that you asked me to write for your Jubilee issue on the future of electro-farming, I suggested that probably concrete beds would be employed in which to grow crops. It is of interest to note that to-day this is an accomplished fact for tomato and water-cress growing.

R. Borlase Matthews.

Greater Felcourt, East Grinstead, *May 2nd*, 1927.

The Ideal Wiring System.

Mr. H. R. Taunton, in Part 1 of his article in your current issue, rightly states that no wiring system can be safe unless properly fitted by a careful workman. With this I heartily agree, and I would add that the careful workman can best be evolved by apprenticeship with a registered contractor who is also a member of the E.C.A. or the E.C.A. of Scotland.

I observe that Mr. Taunton places h.g. screwed conduit at the top of his list, but says: "It is rare to meet an installation in which the logic of the system does not lapse at a wooden fuseboard or a ceiling block or the like." Surely he has been unfortunate in his district. Speaking from my experience all over Scotland, and Edinburgh in particular, it is the exception to come across any recent installation work done by qualified contractors on which iron boxes behind fuseboards and ceiling blocks are omitted.

There is no system for domestic work so lasting, safe, reliable, and so well adapted for extension or replacement of cables as a properly installed screwed-conduit installation. No other building item in the modern house gives such a useful return as the electrical installation if it is well fitted in the first instance, and the price of a reliable system is a small—too small—item in general building costs.

It is not the place of anyone interested in the welfare of the electrical industry to belittle the importance of a sound wiring job, and flexible surface systems for the most part should only be adopted as temporary expedients until the opportunity arises for fitting a concealed and continuous safe and lasting steel conduit system.

J. Johnston Foggo, N.R.E.I.C.

Edinburgh, *May 2nd*, 1927.

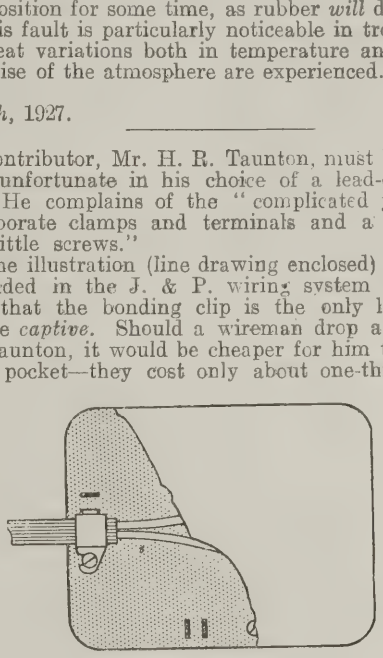
With reference to Mr. Taunton's article on "The Ideal Wiring System," he appears to consider that the cab-tire sheathed system most nearly approaches the ideal. He does not, however, mention one fault of this system, namely, that the rubber sheathing is apt to crack on the outside of bends after it has been in position for some time, as rubber *will* do when in tension. This fault is particularly noticeable in tropical climates, where great variations both in temperature and in dampness or otherwise of the atmosphere are experienced.

C. T.

May 7th, 1927.

Your contributor, Mr. H. R. Taunton, must have been particularly unfortunate in his choice of a lead-covered wiring system. He complains of the "complicated junction boxes, with elaborate clamps and terminals and a multiplicity of fiddling little screws."

From the illustration (line drawing enclosed) of the junction box included in the J. & P. wiring system fittings it will be seen that the bonding clip is the only loose part; the screws are *captive.* Should a wireman drop a clip, as feared by Mr. Taunton, it would be cheaper for him to take another from his pocket—they cost only about one-third of a penny



J. & P. Junction Box.

each—than to waste time getting down from a ladder to pick it up. To bond the sheathing of a cable firmly and permanently the tail of a clip is inserted in one of the slots in the back plate, the notched end is slipped over the cable and under the head of the captive screw, and the latter is tightened. No complexity, no elaborate clamps, no fiddling screws.

Mr. Taunton deplores the lack of a simple joint box for use with C.T.S. cable. We would refer him to our list C.T.S.W., where he will find particulars of a totally-enclosed universal joint box which is inexpensive, easily wired, and has no loose screws.

Johnson & Phillips, Ltd.

(CHARLES STEWART, *Director.*)

London, *May 7th*, 1927.

I have read Mr. Taunton's excellent article with considerable interest, as it confirms my opinion as regards C.T.S. which you published some years ago. My long experience, however, in the use of C.T.S. compels me to differ from him in the following points:—

(*a*) On page 710 he refers to cab-tire as being neither metal-sheathed *nor protected.* Cab-tire is well protected mechanically. It is astonishing what rough treatment it will stand during erection. Anyone who has used C.T.S. flexible in engine rooms and similar situations where it is subject to extremely rough treatment will appreciate this.

(*b*) On the same page he refers to potential danger through carelessness in stripping the sheathing, and states that such risk is greater with cab-tire than with lead-covered. Surely the reverse is the case, because of the close proximity to "earth" with lead-covered. This risk with C.T.S. is to my mind negligible.

(*c*) Further on he again refers to mechanical protection and the possible attack of nails, &c. This risk is certainly no greater than with lead-covered or light-gauge tubing. I have seen many a nail and screw driven through both lead-covered and conduit, with the result that the fuse usually blows and repairs are at once necessary. The wires cannot always then be drawn out of tubing as tube enthusiasts would have us believe.

Incidentally, a neat cement covering in chases is a much more effective protection than metal.

(*d*) As regards Mr. Taunton's statement as to cost, C.T.S. certainly costs less than lead-covered or tubing, because C.T.S. is more rapidly erected, and therefore the labour cost is less. Also, contractors can be certain of a high insulation test and need not allow for the possibility of paying the supply authority a fee for a second test, frequently necessary through moisture.

One can dismiss the remaining unimportant shortcomings —no wiring system is perfect—some risks must be taken, and after giving all the other systems a prolonged and thorough trial, not only for house wiring but for works wiring in the most difficult situations, I still prefer the small mechanical risks with C.T.S. to the much greater electrical and chemical risks of other systems.

C.T.S.

May 7th, 1927.

Off-Peak Supplies.

An article on "Electric Water Heating," in a recent issue of your journal by Mr. J. W. Meares, draws attention to some interesting possibilities of "selective" supplies.

The most effective method of controlling peak supplies, or of ensuring that certain supplies shall be "off-peak," is by means of the time switch, for this purpose not used here to the same extent as in certain foreign countries.

Mr. Meares perhaps attaches too much importance to the first cost of the time switch; the best appliances, of British make, are so satisfactory in action and have such low maintenance costs that their employment for supplies of any reasonable magnitude is easily possible.

The time has arrived when more attention should be given to storage methods; the possibility of storing electrical energy in the form of heat over long periods and with little loss is of immense value to the supply authority, allowing peak control without inconvenience to the user of the supply; moreover, it allows the time selection to take place at any period of the twenty-four hours, which is important, as it does not follow that the peak period will continue in the position on the clock which it generally occupies to-day.

The work already done in storage water heating and in warming rooms by heat accumulation, is sufficient to show how valuable this business can be in improving load factor. It would be worth while to revive interest in time-switch metering methods, in the "Dispensible" circuit proposals by Mr. Wilkinson, and even in methods of meter and switch control from a central source as carried out with the "Ripple" impulse appliances, to a limited extent already adopted for switching on and off street lighting.

Running motor appliances, as suggested by Mr. Meares, may be difficult to control, although it should not be beyond the capacity of the designer to produce a motor drive with speed to a great extent independent of pressure variation.

It may be too much to suggest "direct" switch control from a central point for all consumers; the distributing engineer will hardly welcome a proposal to run with every service a third wire for that purpose, but already in certain places the ordinary distributors carry a switch wire, permitting street lights and signs to be controlled from central points.

Some day perhaps electricity supply undertakings may be willing to provide a standard time service which could be linked in with peak control, or might even be able to work in conjunction with the telephone or radio service, those organisations, for a consideration, communicating to every one of their clients some periodic impulse adapted for operating meters or switch gear for the "selective" use of electrical energy.

We have not heard recently of "Wired Wireless," a proposal whereby central stations were to add to the attractions of their service a supply of music or news which could be picked up from any lighting installation; possibly the "Broadcasting" provisions of the world are too complete for anything of the kind to be attempted, but the existence of a "conductor" link between the power stations and each building in our cities and towns offers a tempting prospect to those inventors who study the more abstruse applications of electricity.

J. W. B.

May 2nd, 1927.

Bad Business Methods.

It may interest your readers to know exactly what goes on in the selling organisations for marketing certain domestic appliances. On April 28th we received an order for a Hoover sweeper for a new client. On April 28th we rang up the Hoover Co. and gave them the order over the telephone, and confirmed it the same evening, enclosing with our order a cheque in settlement. The machine was delivered on the 29th, and we invoiced our client on May 2nd. On May 6th we received a cheque from our client in settlement, and on the same morning, by first post, our client received an invoice from the electricity supply company, Edgware, for this same machine.

We do not know what impression our client now has of us, but we think possibly he may not trouble us again.

Jacob, White & Co., Ltd.

London, *May 6th*, 1927.

A Commutation Problem.

The letter in your issue of May 6th by Mr. A. O. Griffith is of considerable interest. My opinion is that the solution lies, not in the design of the machine, but in a purely mechanical point.

It is noted that turning the commutator cures the trouble whereas apparently no alteration in brush position, kind of brushes, or recessing the mica does so. Furthermore, the machine runs sparkless for a period of weeks after turning the commutator; clearly this eliminates all possibility of faulty design causing sparking.

On the other hand, it is noted that the speed is high. I suggest therefore that the trouble is in the design or assembly of the commutator, resulting in the possibility of one or more segments moving outwards slightly under centrifugal force, thus lifting the brush at each revolution.

When one realises that if a high bar gives the brush sufficient impetus to remain out of contact with the commutator for one hundredth of a second nine or ten bars will fail to establish direct contact with it at each revolution, it is not difficult to see that considerable arcing must inevitably take place.

The remedy is to put a wire band round the segments and re-turn the vees to fit the vee-rings accurately, then reassemble and tighten up hot, and finally, of course, skim up.

One other possibility, but a less likely one, is that in cutting down the micas a thin film is left adhering to adjacent segments at the commutator face. No doubt your correspondent is familiar with this pitfall. Perhaps he would like to communicate with me direct.

The Midland Electric Power Installation Co.

H. Joseph, *Proprietor.*

Wolverhampton, *May 9th*, 1927.

Legal.

Claim for Electricity Consumed.

In the Mayor's and City of London Court, recently, before Mr. Registrar Dell, a claim was made by Daniels Agency, 94, Cannon Street, inquiry agents, against Mr. J. Waterhouse, formerly trading as Waterhouse & Co., Tothill Street, S.W., for £2 15s. in respect of electrical energy used. Mr. H. Daniels, partner in the plaintiff firm, said when moving to their present offices in April last they received a bill from the electric light company, and they made a complaint. As a consequence of inquiries which were made, it was discovered that the defendant, who was the tenant occupying the floor below them, was using the same meter. He called upon the defendant several times, and afterwards came to an arrangement, after going into the figures, by which it was thought that £2 15s. was a fair amount to be paid by the defendant. He had promised to pay the amount, but had not done so. The defendant did not appear, and judgment was entered for the plaintiffs for the amount claimed, an order being made for payment on May 12th.

Impex Electrical, Ltd., v. Norton Wireless Co.

Mr. Justice Tomlin, in the Chancery Division, on May 4th, had before him an action by Impex Electrical, Ltd., of 538, High Road, Leytonstone, for an injunction restraining the alleged infringement by the Norton Wireless Co., 17, Norton Folgate, E.C., of their trade mark, "Dario," for wireless valves. The defendants denied infringement, and said they had never sold any valves bearing the word "Dario."

Mr. Courtney Terrell, for the plaintiff company, said that his clients dealt in various kinds of electrical apparatus, and especially in wireless valves. A French company, La Radiotechnique, supplied the plaintiff company with valves unmarked, and the trade mark "Dario" was attached to them by the plaintiff company. The latter was formed in 1925 by M. Auguste Fevre, who originally represented the French company in England. The valves supplied to the plaintiff company were made to a special specification, and they came from France in a carton worded in French. Last summer M. Fevre, hearing that defendants were applying his company's trade mark to their valves, sent a man, who saw in their shop window cartons similar to those containing the plaintiff company's "Dario" valves, and in the following October, after the defendants had been warned by letter, M. Fevre caused a purchase of a valve to be made. This bore the plaintiff company's trade mark. When an interim injunction was applied for, Mr. Thomas Kelly, of the defendant company, said it was true that a valve was sold to the plaintiff company's representative, but that the valve in question was not the one sold. The salesmen said not only was the valve not sold, but they never had in their possession valves marked "Dario," nor had they any cartons bearing French words. Evidence was called to prove the purchase of the alleged infringing valve.

For the defence, Mr. THOMAS KELLY, the principal member of the defendant firm, said he had never had any cartons in the shop bearing French wording, nor had he seen the plaintiff company's valve until it was produced in court. Mr. MELVILLE, K.C., for the defendants, said the utmost that could be proved against them was that they sold one article in regard to which there might be a complaint, and he asked his Lordship to hold that there was no threat to infringe the plaintiff company's rights. While there was an innocent offence, there was no case for the granting of an injunction.

Mr. Terrell did not proceed with his final speech, but asked that Mr. Kelly be recalled for further cross-examination in view of certain information that had just come into the possession of the plaintiff company.

The case was adjourned until a time to be fixed for further cross-examination and, if necessary, further evidence.

Bosville v. Wood.

HENRY WOOD, motor engineer, Leyburn, was sued at York County Court, recently, for £43, for alleged defective electric wiring, the plaintiff being Thomas Bosville, Leyburn. According to the evidence the defendant was engaged to re-wire the house, plaintiff thinking he was a qualified electrical engineer, and he was paid £175 for the work. Examination by an expert revealed many defects and he refused to pass the house for insurance as the wiring was unsafe. The defence was that there was no contract for Wood to do the work, and that what he did was according to Mr. Bosville's instructions. The Judge remarked that a good many of the mysterious fires which had occurred were probably due to causes such as had been revealed in that case. He gave judgment for plaintiff for the full amount claimed with costs.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

26,333. "Television and apparatus for use in transmitting views, scenes, images, pictures, and other objects of an animated or inanimated nature to a distance" J. L. Baird. October 21st, 1925. (269,219.)

26,384. "Receiving apparatus for wireless telegraphy and telephony." G. B. Ellis (Sachsenwerk Licht-und Kraft Akt. Ges.). September 2nd, 1926. (Convention date not granted.) (255,013.)

31,678. "Dry cells, and method of producing same." Twin Dry Cell Battery Co. December 15th, 1924. (244,494.)

31,710. "Means for improving the factor in alternating-current circuits." G. Bauer. December 15th, 1925. (269,225.)

31,952. "Manufacture of electrical resistances." Morgan Crucible Co., Ltd., and C. C. Gow. December 17th, 1925. (269,227.)

1926.

111. "Means for testing electric incandescent lamps." A. Kelly. January 2nd, 1926. (269,231.)

436. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and R. Taylor. January 6th, 1926. (269,233.)

557. "Automatic and semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (G. Deakin). January 7th, 1926. (269,236.)

1,007. "Electrically-driven cranes." British Thomson-Houston Co., Ltd., and C. J. H. Trutch. January 13th, 1926. (269,245.)

1,113. "Thermionic valves for wireless telegraphy and telephony." J. K. Im Thurn and H. Morris-Airey. January 14th, 1926. (269,250.)

1,146. "Modulated carrier-wave signalling systems." Standard Telephones and Cables, Ltd. (Western Electric Co. Inc.). January 14th, 1926. (269,251.)

1,240. "Contact banks for telephone switches." Standard Telephones and Cables, Ltd., M. S. Snell, and R. St. G. Terry. January 15th, 1926. (269,257.)

1,241. "System for producing electrical oscillations." Standard Telephones and Cables, Ltd. (Western Electric Co. Inc.). January 15th, 1926. (269,258.)

1,299. "Electric measuring instruments." British Thomson-Houston Co., Ltd., R. C. Clinker, and L. J. Clark. January 16th, 1926. (Addition to 175,052.) (269,259.)

2,130. "Inductance coils." E. E. Rooke. January 25th, 1926. (269,266.)

3,545. "Adjustment means for wireless receiving apparatus." L. Q. Slocumb. March 27th, 1925. (249,824.)

5,027. "Switchboards for motor vehicles and the like." British Thomson-Houston Co., Ltd., A. G. Salisbury, and T. H. Wood-Field. February 22nd, 1926. (269,285.)

5,700. "Wireless receiving apparatus." J. J. Dowling and D. O. T. McAteer. March 1st, 1926. (269,291.)

6,285. "Electric rectifiers and transformers." M. H. Goldstone and H. O. Farrell. March 6th, 1926. (269,296.)

6,328. "Electrolytic refining of copper." Siemens & Halske Akt. Ges. January 6th, 1926. (264,116.)

7,818. "Electric switches." J. B. Tucker. March 22nd, 1926. (269,309.)

8,290. "Magneto ignition systems." British Thomson Houston Co., Ltd., A. P. Young, and E. G. Parrott. March 26th, 1926. (269,313.)

8,291. "Electric ignition systems." British Thomson-Houston Co., Ltd., and L. Griffiths. March 26th, 1926. (269,314.)

9,505. "Three-phase wired carrier-wave receiving circuits." Wired Radio Inc. June 5th, 1925. (253,079.)

9,751. "Electric ignition systems." British Thomson-Houston Co., Ltd. and A. P. Young. April 13th, 1926. (269,327.)

10,805. "Electric wiring system fittings." J. C. White. April 24th, 1926. (269,338.)

11,391. "Manufacture of oxide cathodes for discharge tubes." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). April 30th, 1926. (269,341.)

11,713. "Motor control systems using time-lag electroresponsive devices." British Thomson-Houston Co., Ltd. May 4th, 1925. (251,671.)

12,337. "Four-wheeled tramcar side-frames and the location of springs on same." C. Lewis. May 13th, 1926. (269,347.)

12,960. "Wireless receiving apparatus." J. W. Galloway. May 20th, 1926. (269,349.)

13,960. "Electric switches." International General Electric Co. Inc. June 9th, 1925. (253,512.)

14,009. "Space-discharge tube systems having variable condensers." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). June 3rd, 1926. (269,355.)

17,226. "Device for indicating the correct working of sparking-plugs and magnetos of explosion motors." J. Barnett, jun., and E. Salisbury. July 9th, 1926. (269,370.)

17,233. "High frequency induction heating apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). July 9th, 1926. (269,371.)

17,572. "Ignition magnetos for internal-combustion engines." M. M. Cardellino. July 13th, 1926. (269,374.)

18,504. "Electrolytic cells." Automatic Telephone Manufacturing Co., Ltd., and R. W. Tarrant. July 24th, 1926. (269,378.)

18,865. "Secondary electric batteries." Hart Accumulator Co., Ltd., and C. R. Hardy. July 28th, 1926. (269,380.)

20,387. "Device for electrically coupling two or more electric motors." A. Blondel and G. T. Guy. August 18th, 1926. (269,386.)

20,740. "Mountings for thermionic valves or the like." E. H. Fleming. August 23rd, 1926. (269,388.)

21,527. "Electric contact apparatus, more particularly for railway signalling purposes." Siemens & General Electric Railway Signal Co., Ltd., F. Downes and W. D. Rogers. September 1st, 1926. (269,391.)

21,548. "Selective relays for the protection of electric distribution systems." Compagnie pour la Fabrication des Compteurs et Materiel d'Usines à Gaz. September 19th, 1925. (258,570.)

24,057. "Electric safety fuses." E Maurich. October 8th, 1925. (259,556.)

24,093. "Electrical tube-welding devices." P. Gedien and K. Schwade. September 29th, 1926. (269,402.)

24,186. "Wireless telegraphy and telephony." Telefunken Ges. für Drahtlose Telegraphie. October 1st, 1925. (259,226.)

24,575. "Electric hand lamps." E. C. R. Marks (National Carbon Co. Inc.). October 4th, 1926. (269,405.)

25,078. "Electric advertising devices." O. Wawra. August 3rd, 1926. (269,410.)

25,200. High-frequency amplification system." Hazeltine Corporation. October 10th. 1925. (259,613.)

25,528. "Accumulators." Dr. E. Seig. October 22nd, 1925. (260,244.)

25,723. "Methods of and apparatus for electroplating." British Thomson-Houston Co., Ltd. October 15th, 1925. (259,983.)

26,075. "Ignition apparatus for internal-combustion engines." International General Electric Co. Inc. October 20th, 1925. (260,258.)

27,120. "Electric incandescent lamps for projection purposes." British Thomson-Houston Co., Ltd. October 29th, 1925. (260,615.)

27,731. "Quick-action rotary electric switches." Therma Fabrik fur Electrische Heizung Akt. Ges. vorm. S. Blumer. March 30th, 1926. (268,724.)

27,732. "Barrel electric switches." Therma Fabrik fur Electrische Heizung Akt. Ges. vorm. S. Blumer. March 31st, 1926. (268,725.)

27,805. "Multiple-filament electric lamps." British Thomson-Houston Co., Ltd. November 5th, 1925. (261,020.)

27,852. "Headlights, specially for motor-driven vehicles." F. Singer and Fenag Akt. Ges. November 5th, 1926. (269,422.)

28,790. "Cone-type loud speaker." Hopkins Corporation. June 1st, 1925. Divided application on 252,685.) (261,426.)

30,279. "Sparking plugs." P. D. Peterson and H. T. Tillquist. April 26th, 1926. (269,093.)

30,427. "Electrical distribution systems." British Thomson-Houston Co., Ltd. December 1st, 1925. (262,431.)

31,147. "Incandescent electric lamps." British Thomson-Houston Co., Ltd. December 8th, 1925. (262,788.)

31,469. "Electric condensers." British Thomson-Houston Co., Ltd. July 19th, 1926. (269,101.)

32,646. "Electric arc lamp for photographing." H. Traut, Munchen Ges. December 28th, 1925. (263,823.)

1927.

767. "System for the protection of electrical installations against excessive voltages." G. Campos. January 9th, 1926. (264,187.)

1,162. "Spark plugs." British Thomson-Houston Co., Ltd. January 14th, 1926. (264,518.)

1,418. "Accumulators." Dr. F. Aletter and Dr. L. Strasser. January 16th, 1926. (264,539.)

1,486. "Rods or tubes of insulating material, more particularly for suspension or strain insulators." International General Electric Co. Inc. January 18th, 1926. (264,540.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 4th :—

Jupiter. No. 475,348. Class 8. Electric lamps for projection purposes.—Juperlicht Gesellschaft Kersten Brasch, Berlin. (British representatives: Chatwin & Co., 253, Gray's Inn Road, W.C.1.)

P.P.P.P. (lettering and design). No. 476,960. Class 8. Radio-telephonic sets, telephone instruments, and electrical control apparatus.—Plessey Co. (1925), Ltd., Vicarage Lane, Ilford.

R. & B. (lettering and design). No. 477,928. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Reynolds & Branson, Ltd., 13, Briggate, Leeds.

Britex. No. 478,150. All goods in Class 8.—C. S. Pyser, 50, Bank Chambers, 329, High Holborn, W.C.1.

Noctovisor. No. 478,271. Class 8. Apparatus for use in transmitting views, scenes, or images to a distance by telegraphy.—Television Ltd., Motograph House, Upper St. Martin's Lane, W.C.2.

Inadequate Distribution Mains.

In a letter recently sent to the Incorporated Municipal Electrical Association and the Provincial Electrical Supply Committee of the United Kingdom, the Electricity Commissioners urged authorised supply undertakers to adopt the policy of anticipating the future demands on their mains by the provision of distributors of adequate section. The Commissioners have noted that the practice prevails in some cases of laying distributors of so small a sectional area as to tend to restrict or preclude the use of such distributors for dealing with any development of the domestic load. It has also been observed in a number of cases that the cost of excavation, reinstatement and jointing has exceeded the cost of the cable itself; and that by a comparatively small additional expenditure on cable of a larger size provision could have been made for dealing with a load at least twice as great as that possible with the cable actually laid. It is suggested that, except in special cases, distributors having a cross section of not less than 0.05 sq. in. should, as a general rule, be provided.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AUDENSHAW.—Adaptation of Westernlea as clinic; Lancashire Education Committee.

AYR.—Alterations to Mansion House (electric lighting) for Corporation; burgh surveyor.

BASFORD.—Secondary school for Notts Education Committee; H. James, Mansfield.

BIDDULPH (Staffs.).—Additional 50 houses, for the U.D.C.; Mr. Gibson, surveyor.

BILSTHORPE.—Elementary school for Notts Education Committee; Greenwoods (Mansfield), Ltd.

BIRKENHEAD.—Fire station and firemen's houses, for the T.C.; Charles Brownridge, borough engineer.

BIRMINGHAM.—Elementary school, Billesley; Education Committee.

BOLTON.—Extensions, Dove Mill, Deane Church Lane; Dove Spinning Co. Pattern stores, Bark Street; Ryder Bros. Conversion of school in Fern Street to cinema; F. Moorhouse. Alterations cinema, Rumworth; Bolton Cinema Co. Bank, Derby Street; Manchester and County Bank, Ltd.

BRAINTREE.—Housing scheme (56), for the U.D.C. Ward block, &c., Cressing Road hospital, for the Joint Hospital Board; D. G. Armstrong, architect, Great Square.

BROWNHILLS (Staffs.).—Houses (54), for the U.D.C.; J. W. Edwards, builder, Birmingham.

BULKINGTON.—Cinema, Rieton, for Frank Voce, Nuneaton.

CLOWNE (Derbyshire).—Additional 50 houses, for the R.D.C.; surveyor.

COATBRIDGE.—Re-erection of premises, Main Street, for D. M. Stark, Ltd. (£3,500).

COVENTRY.—School (1,250 places), Radford, for the borough E.C.; director of education.

DARTMOUTH.—100 houses for the T.C.; borough surveyor.

DARTON.—Ex-Service men's club, Station Road; W. Wrigley, architect, 2, King Street, Wakefield.

DUNBAR.—Additions to secondary school (£6,812); clerk School Management Committee.

DUNCHURCH.—School (£8,000), for Warwickshire E.C.; director of education, Warwick.

DUNDEE.—School at Lochee; Bishop Toner. Maternity hospital for directors of Royal Infirmary; the secretary.

EASINGTON (Co. Durham).—Additional 50 houses, for the R.D.C.; surveyor.

EASTBOURNE.—Masters' quarters, &c., Eastbourne College; Tatchell & Wilson, architects.

EAST GRINSTEAD.—Offices (£6,258), for the U.D.C.; J. Bodle, builder.

EDINBURGH.—Reconstruction of Empire Palace Theatre; manager, Moss Empires, Ltd.

EXETER.—Joint mental institution; City Council and Devon and Cornwall County Councils.

GLOSSOP.—Works, J. Hadfield & Sons, Derby Street.

GRANTHAM.—Rebuilding church schools, for the managers; Messrs. Parks, builders.

HARLESCOTT.—School, for Salop E.C.; director of education, Shrewsbury.

HEANOR.—Clinic, for Derbyshire E.C.; G. H. Widdows, education architect, St. Mary's Gate, Derby.

HERTFORD.—Hospital extensions, for the Joint Hospital Board (£3,000); G. H. Gisby, clerk.

HUDDERSFIELD.—Roman Catholic schools (£6,000); Joseph Berry & Sons, architects, Market Place; James Horkin and Son, builders, Liversedge.

HULL.—Extensions, Royal Infirmary (£150,000); governors.

KIRKBY-IN-ASHFIELD.—Sewage scheme (£19,000); U.D.C. surveyor.

KIRKINTILLOCH.—Baptist church; Rev. Jas. Scott.

LEEDS.—Extensions, Meanwood mental colony; J. Kirkland, architect of the Board of Control, Corporation assessor.

LEWIS.—Sanatorium extensions (£13,180), for Ross and Cromarty C.C.; the clerk, Dingwall.

LLANBISTER.—School, for Radnorshire E.C.; T. W. Wishlade, county surveyor, Llandrindod Wells.

LONDON (Ilford, E.).—104 houses, Lonsdale Gardens, &c.; Suburban Developments, Ltd. School, Benton Road (£5,721), for the borough E.C.; the clerk. Extensions to Roman Catholic schools, High Road, for the managers; P. Palmer, correspondent.

(St. Marylebone, N.W.).—Blocks of flats, Carlisle Street area; Ashley & Newman, architects for Borough Council. Flats, Abbey Lodge estate, Park Road; J. Murray.

(Greenwich, S.E.).—Nurses' quarters, &c., for the B.G.; A. Roberts, architect, 92, London Street, S.E.

(S.W.).—Re-wiring Southern Hospital; Metropolitan Asylums Board.

MAIDSTONE.—Offices, King Street, for the B.G.; the clerk. Offices, Palace Avenue, for the T.C. (£3,000); borough surveyor.

MANCHESTER.—Houses for staff, Partington gasworks; city engineer. School, Dover Street; managers, Holy Name Roman Catholic School.

MANSFIELD.—Technical college for Notts Education Committee; Greenwoods (Mansfield), Ltd.

MIDDLESEX.—Bath Road widening (£145,000); county engineer.

MIDDLETON (Lancs.).—Electric light installation, Rhodes School, for the borough E.C.; the clerk.

NEWCASTLE.—29 houses, White Brickfield estate, for Corporation; J. S. Hetherington.

NORMANTON.—School, for Derbyshire E.C.; H. W. Skinner, clerk, County Offices, Derby.

NORTHAMPTON.—Hall, Brunswick Street (£8,000), for the Salvation Army.

NORTHCHURCH.—Offices, High Street; Berkhampstead R.D.C. surveyor.

NOTTINGHAM.—Office extensions, St. Mary's Gate; county surveyor.

OXFORD.—Library extensions; city engineer.

POOLSBROOK (Staveley).—School (300 places), for Derbyshire E.C.; H. W. Skinner, clerk, County Offices, Derby.

PURLEY (Surrey).—Additional 50 houses, Coulsdon, for the U.D.C.; surveyor.

RETFORD.—Theatre, Coronation Street; C. Getliffe. Cinema, Regent Picture Palace Co.

SEAHAM (Co. Durham).—Houses (100), for the Londonderry Collieries, Ltd.

SHEFFIELD.—Church, Manor estate; trustees, Roman Catholic Diocese of Leeds. Adaptation of Redmires Camp as infectious diseases hospital; medical officer of health. Sewage plant (£53,000), for the Corporation; city engineer. 172 houses, Ridgway estate; city architect.

SHOTTON.—Central school (450 places), for Flintshire E.C.; J. Bevan Edwards, secretary, Flint.

SCHOOL AYCLIFFE.—Mental colony, Durham County Council.

SMETHWICK.—64 houses, Alexander Road, for Corporation; G. Stubbings, Birmingham. Church, Church Lane, Spiritualist Community. Extensions, Soho Foundry; W. & T. Avery, Ltd. Extensions, North Works Foundry; Midland Motor Cylinder Co., Ltd.

STOKE-ON-TRENT.—Additional housing schemes (3,056), for the T.C.; A. Burton, city surveyor.

TRANENT.—School (£15,474); clerk, School Management Committee.

TWICKENHAM.—Shops, workshops and 47 garages, Richmond Road; Brewer, Smith & Brewer, architects, Richmond-on-Thames.

UPMINSTER (Essex).—Extensions, St. Laurence Church (£8,000); Sir Charles Nicholson, architect.

WEST STANLEY.—Training centre, for Durham County E.C.; education architect, Durham.

WHIXLEY.—Extensions, mental institution; Mid-Yorkshire Joint Board.

WINNINGTON (Cheshire).—Electric light installation, St. Helen's Church, Witton; Rev. A. W. M. Wood, M.A., vicar.

WINTERTON.—Infirmary; Durham county architect.

WORTHING.—Extensions, Christ Church (£4,322); Sandell and Sons, builders.

YORK.—Handicraft and science centre, Knavesmire School; Education Committee. Conversion old library, Clifford Street, into technical school; Education Committee. Elementary school, Tang Hall; William Bellerby, Ltd.

The

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Contents:

	PAGE
Electricity Supply Tariffs	785
The Central Scotland Electricity Scheme	786
Electricity in the Irish Free State	786
Electro-Farming, by R. Borlase Matthews (*illus.*)	787
Electrical Aids for the Deaf, by C. M. R. Balbi (*illus.*)	789
The Royal Society's Soiree	792
Modern Stage Lighting (*illus.*)	793
Business and Industrial Notes	795
Lighting and Power Notes	800
Tramway and Railway Notes	802
Telegraph and Telephone Notes	802
Radio Notes	803
Contract Information	803
Forthcoming Events	805
Notes	805
Institution Notes	807
Our Personal Column	807
Financial Section—	
New Companies Registered	808
Official Returns of Electrical Companies	809
Financial Section—*continued.*	
City Notes	809
Stocks and Shares	811
Our Foreign Electrical Trade	813
Conditions in Poland	813
United States Electrical Production	814
Electrical Association for Women	814
New Electrical Devices, Fittings and Plant (*illus.*)	815
A Remote-Control Public Lighting Scheme (*illus.*)	816
Electrothermics	817
Trolley 'Bus Operation (*illus.*)	818
Parliamentary News	819
Correspondence—	
The Ordinary Engineer and the Beama	821
The Bogy of 40	821
Sheath Losses in Cables	822
Cheap Electricity	822
The Ideal Wiring System	822
Electro-Culture	822
Legal	823
Published Specifications	823
New Work for Contractors	824

Electricity Supply Tariffs.

THE question of tariffs is one that we have always with us; it will only be finally solved when the load curve becomes a horizontal line and electricity can be sold for all purposes at the same price—a flat rate of less than a halfpenny per kilowatt-hour. In the meantime no plan by which we can make a nearer approach to that desirable consummation should be neglected. In many respects the two-part tariff which we have consistently advocated, and which has been adopted in principle in the Act of 1926, is the most suitable for general application; it inherently tends to improve the shape of the load curve, and cheapens the supply of electricity to those consumers whose demands are very economically met—namely, those who make a low maximum demand and yet consume a large quantity of energy. Such consumers' loads have a high load factor of their own.

As we have pointed out, there is a still more desirable class of consumer—the one whose demand falls entirely within the "off-peak" hours, and thus improves the general load factor by helping to fill up the valleys in the load curve. A consumer of this type may reasonably be relieved of the kilowatt charge and be supplied at the net kilowatt-hour rate, for no appreciable proportion of the standing charges can be debited to his account. But an arrangement of this kind usually involves the provision of a time switch, restricting the use of the supply to certain specified hours; the objection is not so much to the switch as to the time, which is usually a fixed period or periods, the supply being cut off at other hours. A modified system which lessens this inconvenience is that which employs a two-way switch, enabling, say, the cooker to be used when the water-heater is cut off, and *vice-versa*, but never both together. Incidentally, it may be observed that any domestic load which is to be moulded into a desirable form must necessarily include some long-hour application such as the heating of water, or thermal storage cooking such as Dr. A. Ekström has reported to be widely used in Sweden. And this brings us to the point of this article, for it is to Dr. Ekström that we are indebted for particulars of a system of charging for

electricity for home use which also is in vogue in Sweden, but which appears to be entirely new to this country. It partakes of the nature of a two-part tariff, a contract tariff, and an alternative-use tariff, and attains its end by simple means—a watt-hour meter combined with a switch.

The basis of the system is the division of the domestic load into two parts—an optional or declared kilowatt "basis" demand, for which a fixed annual charge is made (per kilowatt-year), no matter how many hours' use the consumer makes of it; and a "supplementary" load comprising all energy consumed at a higher demand rate than the "basis" wattage, for which a charge is made per kilowatt-hour. For example, a consumer may declare his demand at 500 watts, for which an annual charge of £7 may be made; he may, if he likes, take 500 watts for 8,760 hours a year without further payment, but experience in Stockholm shows that a longer period of use than 7,000 hours is never reached, and in that case the charge corresponds to a price of ½d. per kWh. But if the consumer switches on a device consuming, say, 1,000 watts, he is charged for all energy used above the 500-watt line at a much higher price per kWh—say, 1½d. Assuming that a water-heater or thermal-storage cooker forms part of the load, the function of the switch is periodically to cut off the heater when the demand exceeds the "basis" wattage until the excess energy used above the line is compensated for—partially, if not wholly—by a corresponding deficiency below the line.

The exact mode of operation of this system will be explained more fully on a later occasion; in the meantime we would once more extend to Dr. Ekström our thanks for his disinterested efforts to hasten the development of electricity supply in this country as in his own. Recently he has lectured on the uses of electricity before the North-Eastern Centre of the Institution of Electrical Engineers, and the Farmers' Club; he is now, we believe, fulfilling lecture engagements at Berlin and Rome, and he read a paper before the Société Française des Electriciens in Paris not long ago. As an apostle of electrical development he takes high rank, and there can be no doubt that his instructive addresses will do much to increase the adoption of electricity in the home and on the farm.

The Central Scotland Electricity Scheme.

Much interest has been aroused north of the Border by the publication of the Central Scotland Electricity Scheme by the Central Electricity Board, which affects 42 authorised undertakers in the area, and involves eventually the closing of 30 generating stations. By this time next year it is estimated that nearly a quarter of a million sterling will have been expended on the standardisation of frequency, out of the total of three millions allocated to this purpose during the next six years. Our Glasgow correspondent informs us that Bailie J. D. Higgins, Convener of the Glasgow Corporation Electricity Department, says there may be an immediate increase in efficiency and a large expansion of electrical service as a result of the scheme, and it may prove of great advantage to the agricultural community. He is of opinion, however, that it will not result in lower rates to electricity consumers for some considerable time. Even a great increase in consumption, he says, may not give reduced rates to consumers in the near future, as increased capital expenditure will first require to be met. Electricity will perhaps be cheaper after that is done, but the immediate tendency may be to increase the price to the consumer.

Dr. S. Parker Smith, Professor of Electrical Engineering at the Royal Technical College, Glasgow, supports the scheme, but cautions the public against expecting too much from it. He points out that much pioneer work has to be done in putting the scheme into operation, and it will be a number of years before it can be completed. Its benefits in the way of reduced tariffs will be least felt in the big manufacturing centres, for there the rates are already low. The advantage will be experienced chiefly in the areas at present without electricity supply, or with a supply from small stations.

Lord Provost High, of Dundee, says that one effect of the scheme will be to relieve the Council of the cost of further extensions of the electricity station. The Convener of the Corporation Electricity Committee says that the Department has been invited to put forward any observations it has to make on the subject. In the meantime, he says, much doubt has been expressed as to the city's position, but it will be a long time before the scheme affects Dundee at all.

In Dunfermline, the site of one of the generating stations that will be retained temporarily in service—that of the Fife Electrical Power Co., Ltd.—the scheme has aroused much interest. Mr. George A. Nicolson, secretary of the company, states that his directors have not yet fully analysed the scope of the new scheme, but, broadly speaking, he thinks that under it electricity will eventually be cheaper.

Sir Andrew Duncan, chairman of the Central Electricity Board, and Mr. A. Page, chief engineer, were in Scotland last week, and called informally upon Councillor Shaw, Convener of the Edinburgh Corporation Electricity Committee, and Mr. E. Seddon, chief engineer of the Electricity Department, with whom they discussed the new scheme in private. Sir Andrew also visited Dundee. It is pointed out that Edinburgh is in a much better position with regard to the scheme than are the stations in the west, where changes of frequency and voltage will have to be made in order to procure standardisation. Edinburgh is the largest "exporter" of electrical power in Scotland, and it is owing to the large turnover which will be made as a result of this bulk supply that it is expected consumers in Edinburgh will ultimately benefit by reduced charges made possible by increased production.

Electricity in the Irish Free State.

The Irish Free State Government's Electricity Supply Bill has now passed through committee stage in the Senate, and the report and third reading stages are being taken this week. It is expected that the Bill will receive the Royal Assent forthwith. No change of outstanding importance was made by the Senate except that it was agreed that the date for the Board of Control to show a balance of revenue and costs should occur in 1932, and that the actual date should be fixed by the Minister for Industry and Commerce, in consultation with the Board. The Minister (Mr. McGilligan) stated that in 1929 the Board would be in a position to reduce the charges for electricity all over the country and to get revenue that would make the Shannon scheme a paying proposition in 1932.

Cork Chamber of Commerce recorded approval of the Government's action in taking over municipal and other undertakings to work in connection with the Shannon scheme, provided that fair market values were paid. There is, however, no hope that the Government will now accept any suggestion of this sort, nor is there any prospect of an amending Bill being introduced later. The question of confiscation is being freely discussed at meetings of various parties in preparation for the General Election for the Dail (Lower House) next month. Business people appear to be more amenable than they were a few weeks ago, and the view is generally held that the Government's proposal for absorbing the local undertakings must be accepted as a vital part of the Shannon enterprise.

Of course, the original differences of opinion remain among those directly concerned in the electricity industry, and probably more will be heard about the confiscation policy when the election is over and the position of the present Executive Council (Cabinet) is made clearer. The constitution of the Board of Control is much discussed, but no definite step is likely to be taken just now in the selection of members. The Board, it may be recalled, will have plenary powers, and will not be subject to Parliamentary control or criticism.

Electro-Farming.

The ultra-violet ray treatment of live-stock on a commercial scale; some particulars of the apparatus available for the purpose, and of the results obtained.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

A STABLE tip, direct from the horse's mouth (for those persons who have not made a mathematical investigation of betting—as those who have done so will not bet), is to back an animal that gets the benefits of a summer seaside holiday in the midst of winter, through the medium of ultra-violet rays. This treatment is now being applied by several enterprising racing stables. The method is being kept as secret as possible, since it is considered that horses thus irradiated are brought into better condition during the winter racing season, and thus stand a better chance of winning. Very little information is, however, available concerning the manner of application, as the present users do not wish competing race-stables to follow their example—which is in itself excellent evidence as to the good results that they must be obtaining. The fact that the practice of utilising ultra-violet rays is being adopted for this and other purposes is of considerable interest to electricity supply undertakings as a new development calling for the use of still more current.

Recognition has always been given to the sun as the great life-giver and healer. Sun worship has been practised in many countries for centuries; it has also been stated that the cradle of the human race was in some tropical country, so it is claimed that mankind was evolved in the sun and largely by its agency. During the past few years a great deal of interest has been taken in heliotherapy, owing, no doubt, to the discovery that, of the sun's rays, the most beneficial are the short invisible ones, and that these can be reproduced by artificial means. As natural sunshine varies in its intensity and is not obtainable at will, the artificial sources are far more satisfactory, especially during the winter months in Northern climes. The artificial sunlight work carried out in many of the hospitals and doctors' consulting rooms of this country shows that the medical profession is awake to the immense potentialities of this treatment, and the results obtained prove that the practice is now an accepted therapeutic process, which is playing an important *rôle* in medical science. While a great deal of publicity has been given to the treatment of human beings by this means, little is heard of the use of these rays for the treatment of birds and animals, though a considerable amount of research work has already been done and some very definite results obtained. Some particularly valuable work has been done at the Rowett Research Institute, Aberdeen, the Kansas State Agricultural College, and the Wisconsin College of Agriculture, where it has been demonstrated that irradiation is as effective in the case of birds and animals as it is in its application to human beings.

Commercial experimental work has been carried out on the writer's all-electric farm at East Grinstead with both the mercury-vapour and the arc types of lamps. During the past two years he has had a large number of inquiries from pig and poultry farmers on the subject. Several of these enterprising farmers have purchased and are using ultra-violet lamps commercially.

Units of Measurement.

In this article, the wave-length measurements are given in Angström (Å) units, though other terms are sometimes used; those commonly employed are:—

Unit.	Millimetres.	Relative length.	Symbol.
Angstrom.	One ten-millionth.	1	Å
Milli-micron.	One millionth.	10	$m\mu$
Micron.	One thousandth.	100	μ

So that a measurement could be given as 2,700 Å, or 270 $m\mu$.

The visible spectrum of sunlight consists of wave-lengths from 3,900 Å to 7,700 Å. Above this range come, of course, the heat rays (8,000 Å to 20,000 Å). The actual wavelengths of ultra-violet rays used for artificial irradiation range from 3,900 Å down to 1,850 Å. Ultra-violet rays fall to 120 Å where the X-ray region begins; however, air absorption commences at 1,850 Å, hence the part below is of no practical value (fig. 1). Owing to absorption by dust and suspended moisture, the rays of the sun are not as effective for many purposes as the artificially-produced rays. The ultra-violet rays of greatest therapeutic power appear to be those between 2,300 Å and 2,900 Å. The ultra-violet part of the solar radiation, after passing through the atmosphere, is chiefly between 2,900 Å and 4,000 Å. Thus it is not so effective.

Lamps.

There are three principal methods of providing ultra-violet rays artificially:—

(1) By means of a vacuum or gasfilled incandescent filament lamp made of glass which is transparent to the rays.

(2) Arc lamps, with (*a*) carbon, or (*b*) impregnated carbon, or (*c*) tungsten electrodes.

(3) The quartz mercury-vapour lamps: (*a*) atmospheric type; (*b*) vacuum type.

The ultra-violet rays of the sun can also be obtained indoors by using a special window glass containing a large proportion of quartz, which permits rays down to 2,700 Å to pass through. Rays below 3,000 Å cannot pass through ordinary glass, and it is these rays that are intimately associated with metabolism and growth. It is very important to keep the surfaces of this glass scrupulously clean on both sides by the aid of spirits of wine, for the slightest deposit will screen the rays.

There is a difference of opinion, at the present time, as to the best type of lamp, for the mercury-vapour lamp is deficient in the biologically active wave-lengths, but has a number of isolated bands of very short wavelengths near the region of atmospheric absorption. The spectrum of the tungsten lamp falls short at 3,500 Å; and the carbon arc is poor in the shorter of the short wavelengths. The tungsten arc is probably the most satisfactory, as it gives a more nearly continuous spectrum band to 2,130 Å. Tungsten positive and tungsten-cored negative carbons give excellent results. The longer wavelengths are more penetrating, hence are probably of more value for treating the thicker and hair-covered skins of animals, though the therapeutical effect of the shorter wavelengths is the greater. The

choice of a reflector needs a little care, as the silvered type reflects only 30 per cent., the nickel reflector 45 per cent., and the silicon reflector 75 per cent., of the ultra-violet rays.

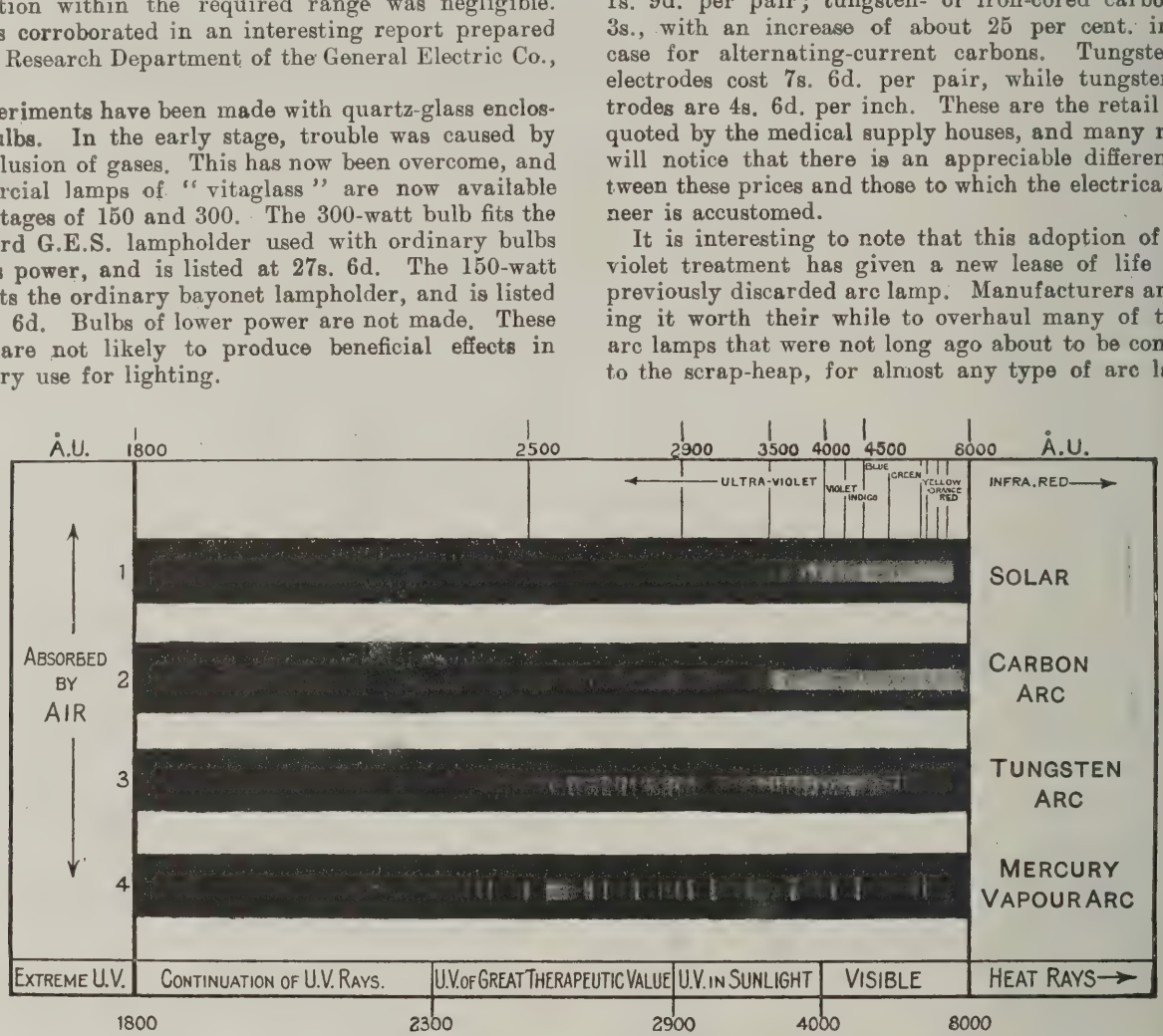
1.—*Incandescent Filament Lamps.*—A test with the spectroscope, made by the writer, upon a standard gasfilled lamp indicated that the ultra-violet ray emanation within the required range was negligible. This is corroborated in an interesting report prepared by the Research Department of the General Electric Co., Ltd.

Experiments have been made with quartz-glass enclosing bulbs. In the early stage, trouble was caused by the occlusion of gases. This has now been overcome, and commercial lamps of "vitaglass" are now available in wattages of 150 and 300. The 300-watt bulb fits the standard G.E.S. lampholder used with ordinary bulbs of this power, and is listed at 27s. 6d. The 150-watt bulb fits the ordinary bayonet lampholder, and is listed at 15s. 6d. Bulbs of lower power are not made. These bulbs are not likely to produce beneficial effects in ordinary use for lighting.

The first grade is used when a long exposure and weak intensity of ultra-violet radiation is required, while the second is stronger in ultra-violet radiation and more effective for a shorter exposure. The third gives a strong ultra-violet radiation of a more penetrating power than either A or B.

Impregnated carbon electrodes for arc lamps cost 1s. 9d. per pair; tungsten- or iron-cored carbons are 3s., with an increase of about 25 per cent. in each case for alternating-current carbons. Tungsten-steel electrodes cost 7s. 6d. per pair, while tungsten electrodes are 4s. 6d. per inch. These are the retail prices quoted by the medical supply houses, and many readers will notice that there is an appreciable difference between these prices and those to which the electrical engineer is accustomed.

It is interesting to note that this adoption of ultra-violet treatment has given a new lease of life to the previously discarded arc lamp. Manufacturers are finding it worth their while to overhaul many of the old arc lamps that were not long ago about to be consigned to the scrap-heap, for almost any type of arc lamp is



(1) Continuous spectrum of sunlight. (2) Spectrum of a carbon arc. (3) Spectrum of a tungsten arc. (4) Spectrum of a mercury-vapour arc.

Fig. 1.—A Comparison of the Spectra of Different Sources of Light.

The writer has not yet had an opportunity of either testing these lamps or seeing their characteristic spectrum, though he has seen them in operation. If the spectrum is satisfactory, this is probably the most practical form of lamp for the farmer—if he keeps the exterior scrupulously clean, by wiping the glass with spirits of wine before using. The very short rays are not emitted by these bulbs, so that the use of goggles for the protection of the eyes is not essential. The ultra-violet radiation is, however, rather weak, necessitating long exposure at a short distance.

2.—*Arc Lamps.*—When a single arc is used, a series resistance has, of course, to be employed in the circuit, with a consequent wastage of energy. However, one firm of manufacturers now produces a series four-carbon arc lamp for 220-volt circuits, which can be operated without a large resistance, the current being used to produce an increase in the quantity of radiation.

The current consumption of the arc lamps employed to produce ultra-violet rays varies from 5 to 45 amps., according to size of carbons and whether they are impregnated or not.

The impregnated carbons are often graded according to their wavelengths; the three usual grades are:—

Grade A	...	2,950 to 3,100 Å.
Grade B	...	2,900 to 3,500 Å.
Grade C	...	2,400 to 3,575 Å.

suitable, if provision is made for preventing the particles of hot carbon from falling on to the treated subject. An effective method of doing this is to provide a glass cup fixed at the bottom of the lamp. It is essential that this cup be manufactured of the special glass, transparent to the rays, or the vital rays will not pass through. Alternatively, sheets of special glass, transparent to the rays, may be placed underneath.

When the lamps are only required for the treatment of live-stock, the hand-feed or non-automatic type can be employed, as they are only required for periods of ten to fifteen minutes at a time.

A new appliance for the treatment of chickens has lately been developed. A hand-fed arc lamp is fixed on a portable frame, which can be placed over the feeding space of the chickens. A piece of the special glass, transparent to the rays, is placed between the lamp and the floor, so as to catch any sparks falling from the arc and yet permit the full action of the ultra-violet rays. In order to prevent fracture of this valuable glass, it is cut in strips, as is done with the protecting front glass of searchlight projectors.

Enclosed-type arc lamps would not be practicable unless the enclosing glasses were made of a substance transparent to the rays, and even then it is doubtful whether a deposit would not form on the inside of the glass and prevent the passage of the rays.

(To be continued.)

Electrical Aids for the Deaf.

The Application of Radio Apparatus to the Relief of Deafness.

By C. M. R. BALBI, A.M.I.E.E., A.C.G.I.

THE subject of "acoustics" is one in which our knowledge has not yet been co-ordinated; hence, those whose professions require them to deal with this branch of physics are apt to judge matters from their own standpoint. Thus the "telephone engineer" states that he is satisfied if he can enable two subscribers to converse without misunderstanding, or, to put it in his own terms, "set up a standard of 100 per cent. intelligibility."

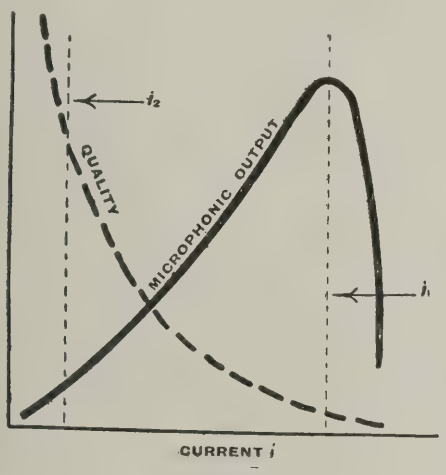


Fig. 1.—Microphone Characteristics.

This ideal can easily be said to have been reached, yet the "radio engineer" will tell you that broadcasting, which is of far better quality than ordinary telephony, has not nearly reached perfection yet. I specially point out this diversity of views as I want to emphasise that for natural reproduction something more than intelligibility is necessary. This fact has been particularly brought to my attention in the case of "electrical apparatus for the deaf." Quite a number of deaf people, who ordinarily wear an electrical aid to increase their range of hearing, have told me that they notice a great difference between their own instruments and broadcast speech and music supplied to them through a wireless receiver and amplifier.

A person who was deaf once expressed the matter to me in the following way: "I can hear so much better on the wireless, and although I can understand everything that is said with the help of my electrical aid, there are distracting buzzing noises which are absent in the wireless."

Now this strikes at the root of the matter, and I will therefore explain why an "electrical aid"* has this inherent defect, and will later discuss a means by which it may be overcome, albeit with limitations.

The question largely depends on the microphone. It is known that a microphone usually consists of a variable resistance made of carbon which can be acted upon by variations of pressure due to sound waves. By passing a small current through the microphone a small microphonic output is obtained, and as the current is increased the microphonic output is increased also. Theoretically modulation is obtainable to any degree of intensity by simply increasing the current, but a limit is soon reached when the modulation attains a maximum and if pushed further it begins to diminish rapidly. The relation is illustrated in fig. 1.

Naturally the microphonic output is greatest when the current is i_1,† but so far I have said nothing about quality; this falls off rapidly as the current is increased. Therefore, there is a choice of great intensity or high quality. The two do not go together.

Now, as the apparatus for the deaf needs to be powerful, it seems to be the general practice among manufacturers of electrical aids for the deaf to operate their microphones at the current i_1, but for broadcasting, where great attention has to be paid to quality, the microphone is operated at the far smaller current i_2, which is later amplified by suitable valve amplifiers.

There is no doubt that manufacturers of electrical aids for the deaf are right in abandoning quality (such as is understood by the radio engineer), and availing themselves of the greatest microphone output that can be obtained, as by so doing they are able to construct a set which is both light and powerful, and it is wonderful what an effective aid can be constructed from parts that only weigh a few ounces complete.

This is what the vast majority of users require—something light and inconspicuous that they can carry about with them, and so long as they are able to hear and understand well, they are willing to waive the matter of quality.

The only alternative is to do as the radio engineer does, and operate the microphone at i_2 and then amplify; but, of course, this greatly complicates matters and adds to both the bulk and expense of the

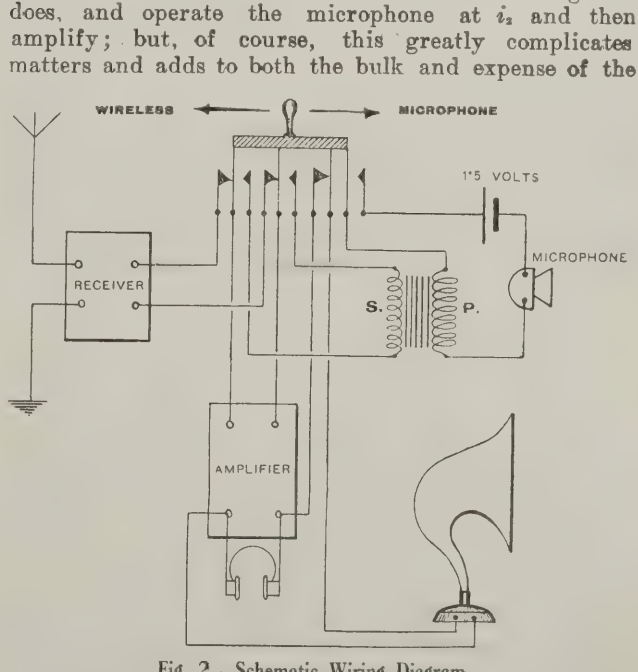


Fig. 2.—Schematic Wiring Diagram.

apparatus. It would be of no use operating a microphone at i_2 without amplification, as the intensity would be too weak for the deaf to benefit by it.

* It is now generally understood that an "electrical aid" refers to an electrical appliance for the deaf, consisting of a small battery, microphone, and receiver.

† i_1 differs considerably for various types of microphones, but in many cases is about 100 milliamperes.

Hitherto it has not usually been thought desirable to construct an aid for the deaf on the lines of the broadcasting studio microphone, on account of the expense of the apparatus and its bulkiness; but now that the radio experimenter has proved his ability in the construction of telephonic apparatus to such a marked degree, and the valve amplifier (the most expensive item required) usually forms part of his equipment, an apparatus of this description could be made up for very little outlay. It is therefore only a question whether in such cases the circumstances are such that the disadvantage of bulkiness might be outweighed by the improved quality of reproduction and the pleasure given thereby.

The circumstance I have in mind is that of a wireless amateur who has in his possession a wireless

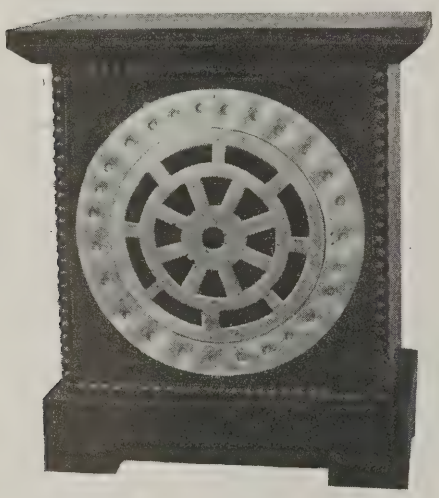


Fig. 3.—Microphone Case.

receiver and a powerful amplifier with which he operates a loud-speaker. He has a deaf relative staying in the same house as himself, who spends much of her time in an armchair by the fireside and who is too deaf to hear the loud-speaker or general conversation.

To make life more tolerable, a pair of headphones have been connected to the output terminals of the amplifier in parallel with the loud-speaker; in this way enjoyment is brought to the sufferer in the form of broadcast reception, but for general conversation an electrical aid is used concerning which an opinion has already been expressed.

My object is to show how, with the aid of a suitably-constructed microphone and the existing amplifier system, quality comparable with that of the broadcast reception may be obtained. For this reason I will pass on to describe the operation of a system which will enable such a patient to listen at will either to general conversation, with the advantage of more natural

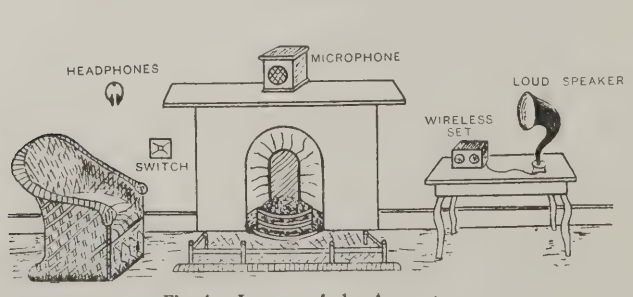


Fig. 4.—Lay-out of the Apparatus.

reception, or to ordinary broadcast reception. The details of the system are illustrated in fig. 2. It will be seen that when the switch is thrown over to "wireless," the circuit is such that the headphones are connected to the wireless set and the patient is able to hear broadcast reception over the same circuit as she did before. The loud-speaker is also connected so that it can be heard by any other members who wish to listen. However, when the switch is thrown over to the other direction (*i.e.*, to "microphone"), the wireless set is cut out and the special microphone which is coupled through a transformer is now connected in at the input of the amplifier.*

The sounds that reach the microphone are conveyed through the amplifier to the same pair of headphones that were previously being used for "listening in," so that the only action that the patient has to perform to change over from "wireless" to "general conversation" is to throw this switch.

It will be observed that when the headphones are connected for general conversation, the loud-speaker is disconnected. This is absolutely necessary—otherwise there would be what is termed a "howl," which is really an acoustic reaction between the loud-speaker and the microphone.

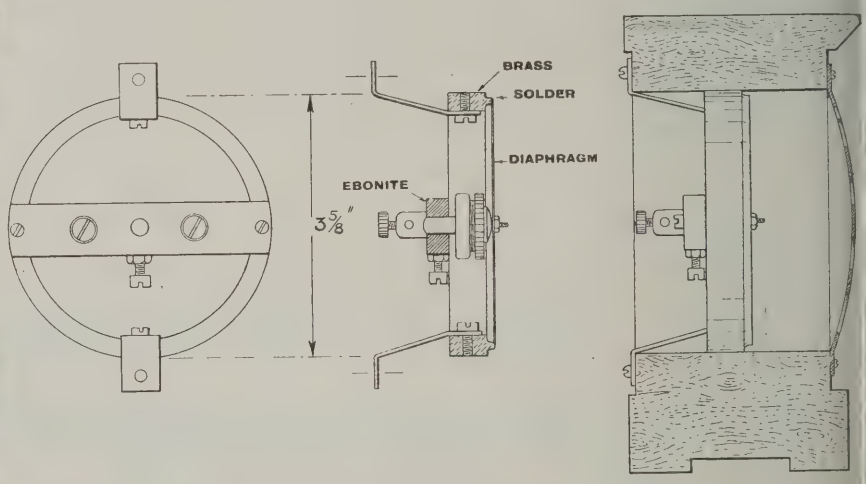


Fig. 5.—Details of Microphone.

A little reflection will show that there is no objection to cutting out the loud-speaker when general conversation is taking place; in fact, in most cases it is found to be more pleasant to do so.

So far as can be seen, there is no advantage in making such a system portable. As has been previously suggested, the patient will spend most of her time in a chair by the fireplace in the living-room where she is wont to "listen in." For any other occasions her electrical aid is available and should be sufficient.

I have, therefore, come to a point where I shall have to consider where to install the various pieces of apparatus in question in the living-room of an ordinary house. I will commence with the microphone.

For acoustic reasons it is found desirable to locate the microphone on the mantleshelf and, therefore some appropriate mounting is required. A very suitable form is a wooden clock case, as shown in fig. An ornamental front has been fitted to finish off the design, the bore, 3⅝ in., is a standard, and into the the microphone can be fitted.

The only other item that requires remark is the location of the multi-point switch which is needed for the purpose of changing-over from broadcast reception to the reception of general conversation; it should be within easy reach of the patient's chair.

A suitable way of laying out the rest of the apparatus is shown in fig. 4, which may be taken as a general guide.

I have now to consider the microphone itself. It is the only part that is likely to present any difficulty to those who may attempt to build up a system for themselves on these lines. Any kind of microphone will produce results, but I have laid down a claim that this microphone must provide natural reproduction. Special precautions, besides the most important

* It was the practice two or three years ago to build the receiver and amplifier separately, but nowadays the set is usually made up as a complete unit. However, the task of opening a circuit at the point where the l.f. amplification begins should offer no difficulty to a person who understands the circuit.

one of working at low microphone current, have to be taken in order that this object shall be attained. If the current through the microphone is of a small enough order, then the variations of current will closely correspond to the variations of pressure that are put on the carbon elements. Now all would be well if it were not for the question of resonance. In almost every form of microphone it is arranged that the sound waves shall exert their minute variations of pressures through the medium of a diaphragm. It is essential that this diaphragm should be non-resonant, otherwise the resonance will be communicated to the microphonic elements and the ill effects revealed in the quality of the reception.

There are two practical ways of overcoming resonance: one is to make the part very heavy in comparison with the forces acting upon it, and the other is to employ damping.

As the diaphragm itself should be as light as possible, I should employ the latter method, but in order that no other part should be acted upon by the sound waves and produce resonance, they should be made as heavy as possible. For this reason it will be found that a light metal diaphragm (afterwards suitably damped) secured about its periphery to a heavy annular ring of brass, makes a very suitable arrangement to which to fix the microphone capsule as illustrated in fig. 5.

The microphone capsule that has been shown is of the type employed by the British Post Office for its standard telephone transmitters, but as these are rather difficult to procure, a slightly different type which will be found equally satisfactory and more easily obtainable is the "Skindeveken."

The diaphragm should be made of hard-drawn brass about 5/1,000th of an inch thick, which is about the thickness of writing paper. It will be noticed that the section of the heavy brass annular ring is pointed; this has been specially arranged so as to facilitate the securing of the diaphragm, which has to be soldered. The diaphragm should be stretched as tightly as possible while it is being soldered, so that it is tight like a drum when it is finished. A light piece of metal with a hole through it should be sweated to the centre where the diaphragm is to be secured to the capsule by its locking nut.

The annular ring, which will require turning, should be of $3\frac{5}{8}$ in. outside diameter, so that it just fits the case,

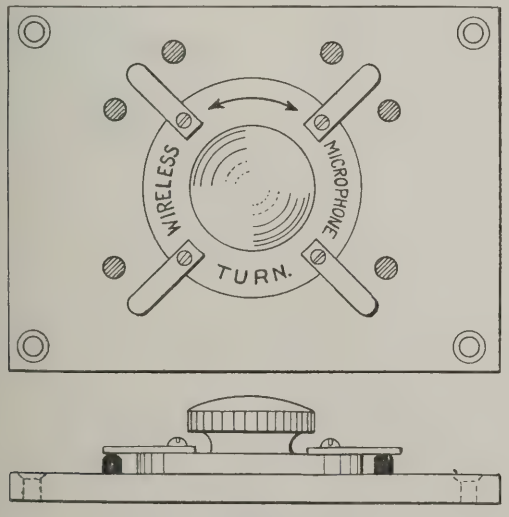


Fig. 6.—A Multi-point Switch.

the bore of which should be also $3\frac{5}{8}$ in., which is a standard for clock cases. The case should be of solid wood as shown.

The ebonite cross-bar fixing for the microphone capsule and terminals will easily be understood from the diagram; the capsule should be fitted so that there is no pull on the diaphragm when the fixing screw is tightened up.

When the model has been completed up to this stage, it will be found to be very resonant for the reasons that have already been given, and the next process is to "damp" the diaphragm, as it is termed, to overcome this effect.

The method of damping to be employed is very important; the best arrangement is to cover the diaphragm with some plastic substance. In certain experimental laboratories ordinary vaseline is used, but this is not suitable in this instance, as in hot weather the vaseline is apt to run. As an alternative to this, I have employed Chatterton's compound, which, I believe, is a mixture of rubber and bitumen, to cover the diaphragm. The amount that should be employed is most critical; if too thick, the action of the diaphragm will be greatly impeded, while if too thin the action will, of course, be insufficient to prevent the occurrence of resonance.

When the damping has been nicely adjusted, one should be able to hear faint, but very clear, reproduction of any sound produced many feet from the microphone. When this is amplified, the same clarity should be obtained, but instead of the faint sound it should be very great in volume. Usually two stages of low-frequency amplification are sufficient to produce the required volume, but less than two stages is not recommended.

There is only one more remark to make with regard to the microphone, and this is that the acoustics of the room should be suited to it. In a room that is very bare of draperies, the echoes about the room have an unpleasant effect when sound is amplified to a considerable extent, even when the listener is deaf. The remedy is to hang more draperies, such as heavy curtains, about the room and spread a thick carpet. This soon reduces the echo. It is for this reason that broadcast studios are so heavily draped. In the early days of broadcasting it is possible that the effect was rather overdone, but it shows the necessity for such a step where the acoustics of a room are not good.

With regard to the multi-point switch, something is required that can be conveniently fixed to the wall. I therefore outline the details of such a switch, which can be mounted on a piece of ebonite, as shown in fig. 6.

The rest of the apparatus required can be seen by referring to fig. 2, in which are shown the circuit connections. This comprises a transformer and a battery (a $1\frac{1}{2}$-V dry cell). The resistance of the primary of the transformer should be between 120 ohms and 200 ohms, and that of the secondary between 1,000 and 5,000 ohms. This type of transformer is sometimes spoken of as a modulation transformer.

Although most of the apparatus described may be obtained from any suitable dealer, I have made arrangements with the Thames Electric Co., Kingston-on-Thames, to supply any of the required parts, including a clock case as shown in fig. 2. I have also arranged for a demonstration model to be fixed up at that address. It will be shown to anyone who is interested or would like to try it.

Electric Mine Locomotives.

The Baldwin-Westinghouse mine locomotives exhibited at the American Mining Congress represented modern trends in the development of haulage and gathering types. The four-ton gathering locomotive was claimed to be the lowest and slowest of its type ever built, and meets the demand for motive power for working thin seams, having an overall height of $23\frac{1}{4}$ in. and speeds of $2\frac{1}{4}$ miles an hour when operating from conductor cable and 6 miles an hour when operating from the trolley. Its features include semi-magnetic control, bar-steel frames, self-equalising coil springs, spacious accommodation for the driver, ball-bearing motors, vertical type cable reel, and a new type of resistor. One of these locomotives with drum-type control is now used by the Erskine Coal Company, of Staunton, Virginia.

The Royal Society's Soirée.

Annual Exhibition and Demonstrations.

THE first of the Royal Society's two annual conversaziones was held at Burlington House, London, on May 11th. Sir Ernest Rutherford, O.M., president, welcomed Fellows and guests for whose inspection the customary display of scientific apparatus, specimens, and demonstrations had been arranged. The total number of exhibitors was 30; several showed two or three items, but electrical exhibits were not so numerous as in previous years, and some of them had previously been exhibited elsewhere.

The National Physical Laboratory's several exhibits included specimens of metals of high purity, the impurities in which were only detectable spectrographically, prepared in its Metallurgy Department: amongst them were iron prepared electrolytically from a chloride electrolyte, melted in a high-frequency induction furnace, and deoxidised by means of pure dried hydrogen; manganese made by vacuum distillation in a high-frequency furnace; chromium obtained by electro-deposition and subsequently freed from hydrogen and deoxidised; and beryllium of 99.8 per cent. purity prepared by fusion-electrolysis.

For gas analysis by utilising high-frequency vibrations (Dr. Ezer Griffiths, F.R.S., and Mr. J. H. Awbery), a quartz crystal, maintained in vibration piezo-electrically, was used to set up a stationary wave system in the gas mixture; the positions of the nodes were identified by the reaction on the crystal in the manner described by Pierce; by moving the reflector from node to node, the wave-length was determined, affording a measure of the composition of the gas mixture.

The Cambridge Instrument Co., Ltd., had a portable magnetometer of the null type on view, which was designed by Dr. F. E. Smith, F.R.S., for measuring the horizontal component of the earth's magnetic force. The magnet system is supported by floats and is practically free from friction effects. The earth's horizontal magnetic force is nearly balanced by an opposing force due to a current in the coils, the two forces being inclined at an angle of a few degrees; the magnet sets in the direction of the resultant force, and the angle is varied until the resultant field is at right angles to the force due to the coils. The angle is observed by means of a telescope, and measurements may be made with an error not exceeding 1 gamma (0.00001 c.g.s. unit).

A beautifully made improved form of Paschen galvanometer was shown, the moving system of which consists of two groups of cobalt steel magnets so made as to ensure uniformity of physical condition and size, thus ensuring almost perfect astaticism. The system is protected from external magnetic fields by a shield of "mumetal" as suggested by Prof. A. V. Hill, F.R.S., and Mr. A. C. Downing, surrounded by a mild-steel tube and by an outer gun-metal shield. A model (ten times full size) illustrated the method of mounting the magnets and mirror, and a group of magnets shown under the microscope demonstrated the accuracy of dimensions which can be obtained.

The Company's apparatus for recording radiation from the sky makes use of a photoelectric cell so connected in an electrical circuit containing capacity that the frequency of discharge depends on the intensity of the radiation falling upon the cell. The total discharge is recorded on a standard thread recorder without the use of an auxiliary relay, the curve obtained being a record of the intensity of radiation.

Prof. O. W. Richardson, F.R.S., and Mr. F. S. Robertson demonstrated apparatus for comparing the yield of soft X-rays from different substances. They employed a small X-ray tube of transparent silica with an incandescent cathode; its target was a vertical hexagonal prism, whose faces consisted of six plates of the substances to be tested, which could be turned about its central axis and put into any one of six set positions by means of an external magnet. Thus each substance could be used in turn as target and the rays generated compared by the photoelectric effect they produced in another part of the tube. With this apparatus the exhibitors have been able to show that the generation of soft X-rays is a periodic function of the atomic number of the elements concerned.

The International Standard Electric Corporation showed apparatus for precision measurements of circuit efficiencies as used on the Anglo-American transatlantic telephone service, that is, transmission levels and losses and repeater gains at telephone frequencies of from 35 to 5,000 cycles. The oscillator used with the equipment had a frequency range from 35 to 50,000 cycles, the higher range being used for carrier-current telephony. The working of the instruments was demonstrated by making measurements on artificial cable.

Mr. H. Dewhurst demonstrated how the rapidity of response to radiant heat of bolometers has been much enhanced by an entirely new method of constructing them. By means of a press flat annular disks of wax containing two inlaid metal contact pieces are stamped out, and thin collodion films are stretched across the disks by floating the latter on mercury. A narrow strip of bismuth (10^{-6} cm. thick) is next deposited on each disk by electrical evaporation, or "sputtering," across the film from contact to contact, the whole being then blackened.

The British Thomson-Houston Co., Ltd., showed a new type of electric discharge, the phenomena having been discovered by Dr. I. Langmuir (see Elec. Rev., November 21st, 1924). An arc was produced in a hot cathode discharge tube 3 cm. in diameter and 50 cm. long, containing argon. Before the injection of a dose of tungsten vapour the arc did not possess unusual characteristics, but after the liberation of tungsten vapour from the filamentary cathode, the arc exhibited phenomena of interest and beauty.

Lt.-Commander F. J. Campbell Allen and Mr. A. E. Salisbury exhibited a new thermostat for use in conjunction with electric circuits, which depends upon the fact that magnetic metals lose their magnetism at certain given temperatures, and alloys of these metals can be made to vary the temperature apart from doing so by means of radiators. In the "on" position an armature was held up by attraction to a controlling arm in a suitable position to be affected by heat, the arm being partly or wholly made of magnetisable material; on a given temperature being reached, the armature was released and fell on a switch, thereby cutting off the current, and the temperature of the apparatus was reduced, when the armature was again lifted and the current switched on.

(To be concluded.)

Modern Stage Lighting.

A brief review of the apparatus developed by the General Electric Co., Ltd., for the production of effects on the stage, with particular reference to the Schwabe-Hasait system.

THE development of electrical methods of lighting has placed at the disposal of stage managers the means of vivid and accurate mimicry of nature. A recent demonstration by the General Electric Co., Ltd., at its new stage-lighting showrooms (ELEC. REV., November 5th, 1926, p. 758) of some examples from the wide range of stage-lighting equipment produced by it, gave some indication of the progress that has been made in this direction. The apparatus includes that specially designed for the Schwabe-Hasait system, first described in our issue of March 16th, 1923, the sole rights of which have been acquired by the G.E.C. for the United Kingdom and the Colonies.



Fig. 1.—Magazine Stage-lighting Batten.

There are two principal considerations in general modern stage lighting, the illumination of the acting area and also of the "artificial horizon." While still retaining the use of footlights and battens where required, the latest methods of lighting the acting area rely to a great extent upon the use of specially designed floodlights, projectors and spot-lights. Fig. 1 shows a magazine-type batten. It consists of a series of compartments, each fitted with a lampholder and reflector.

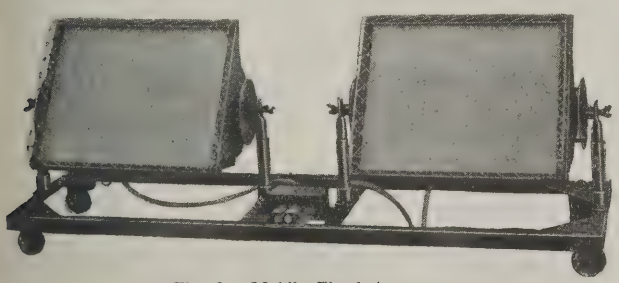


Fig. 3.—Mobile Flood Apparatus.

The reflectors may be of highly polished aluminium, silvered glass, or stainless steel. The lamps are spaced at from 6- to 7½-in. centres, and are of sizes up to 150 W.

A very wide range of flood-lighting apparatus is produced, only a few examples of which can be dealt with here. Fig. 2 shows the "Horizon" flood, which is primarily intended for the illumination of the cyclorama or "artificial sky." The special feature in the design lies in the shape of the colour filter; this is semi-cylindrical in shape, and allows a spread of light covering about 180 deg. Each fitting is designed to take one 1,000-W tubular theatre horizon-type lamp, and is equipped with an aluminium reflector. A particularly useful piece of apparatus is the mobile ground flood, fig. 3. It consists of two 1,000-W floods carried on a light metal trolley which can be easily moved to any required position with a minimum amount of trouble. The floods are mounted on uprights, and are hinged so that each one may be tilted at any desired angle. Glass colour slides in metal frames are supplied in varying colours. A proscenium floodlight apparatus is shown in fig. 4. It is of the magazine type, and is specially adaptable for use on the small stage as a substitute for battens, and in the case of large stages it may be used as an auxiliary to the battens. The special feature is a magazine equipped with a set of four glass colour slides. These are operated by steel tracker wires running over pulleys to a four-lever control gear in a convenient position.



Fig. 2. Horizon Flood.

A large variety of apparatus for spot lighting made by the company includes a small 100-W hand spotlight lamp and a large bracketed apparatus designed to take a 1,500-W horizontal burning projector type lamp. The latter is fitted with a universal joint enabling the light to be thrown at almost any angle in any direction. Fig. 5 shows a proscenium spotlight apparatus suitable for a 1,000-W lamp. For the correct illumination of the artificial horizon, very strong light, variable at will both in colour and intensity, is required, and the ideal source is the gasfilled lamp. A number of special fittings of the type shown in fig. 2 are used, depending upon the size of the "horizon" or the dimensions of the stage itself. They are built up in three or four tiers, forming a homogeneous unit, and are supported in a rigid metal frame

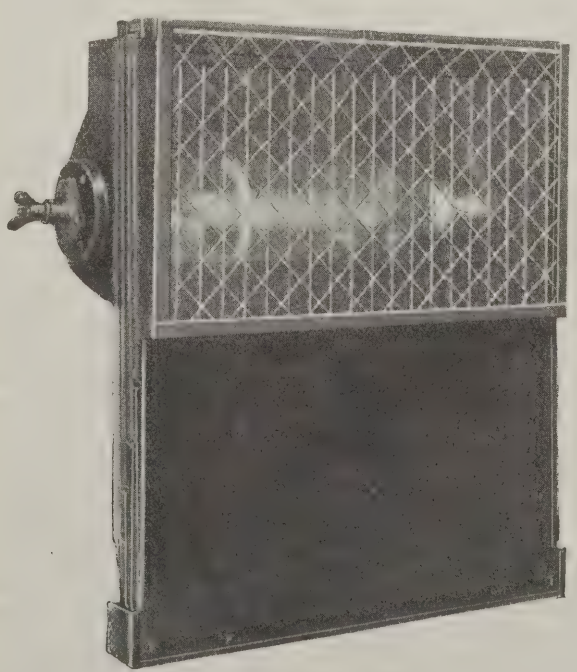


Fig. 4.—Proscenium Floodlamp.

suspended from the roof. The representation of natural effects—such as dawn, sunrise, and so on—is possible, with innumerable shades and intermediate gradations, by the use of the "artificial horizon," and the scientific combinations of colour necessary for these charming sky-pictures have been studied exhaustively and worked out to a nicety. By suitable combinations of the basic colours it will be seen that a very wide series of tones is available by which any natural sky phenomena may be produced.

Complete and flexible control of the lighting of the "artificial horizon" is obtained by a master control apparatus which operates a series of resistances in circuit with the individual lamps. This is designed in such a way that dimming or raising the light takes place smoothly and easily. As the source of light is at a high level, the lower part of the horizon does not receive from it the same intensity of illumination as the upper portion. To remedy this a number of horizon lamps are placed at the level of the stage. These are contained in movable trolleys, spaced round the bottom of the screen, and are supplied with colour slides and

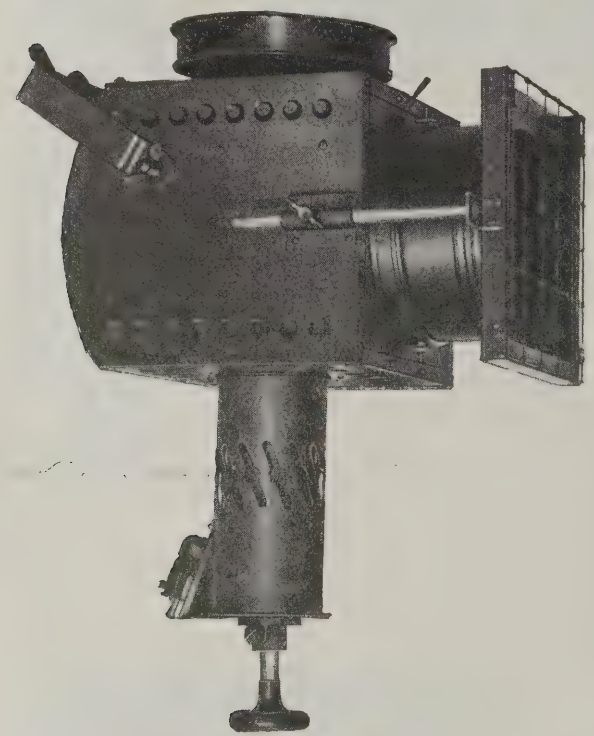


Fig. 5.—Proscenium Spotlamp.

arranged so that they can be tilted at any angle. Ample provision is made for the adequate ventilation of the lamps, each of which is protected by wire guards from accidental breakage.

A far wider range of sky effects than is possible with any of the other apparatus is obtainable by means of the cloud apparatus, used in conjunction with the "artificial horizon," which offers an ideal setting for the reproduction of moving clouds. Fig. 6 shows a unit of this description. It consists of two essential portions: one which is stationary carries the main driving motor, the collector rings, and a 3,000-W gasfilled lamp; the other, which rotates round the first, carries a system of cloud-pictures, lenses and reflectors, and two small motors for driving two lines of shafting through special gearing. The shafts give motion to a series of eccentrics which cause a number of reflectors to rotate through a definite angle, thus causing the cloud-images to rise or fall as desired. The moving system has its cloud slides arranged in two tiers. Immediately behind each slide a condenser transmits the rays from the lamp through the slide on to a fixed glass reflector; this in turn transmits the picture through an objective lens on to a movable glass reflector actuated by one of the eccentrics, the reflector throwing the picture on the horizon screen.

The slow motion of clouds across the sky is simulated by the rotation of the two tiers, which are driven by the main motor through reducing gears; the motor is reversible, so that the clouds can move from right to left, or *vice versa*, and by combining the horizontal with the vertical movements, diagonally travelling and thickening clouds may be produced. One particularly interest-

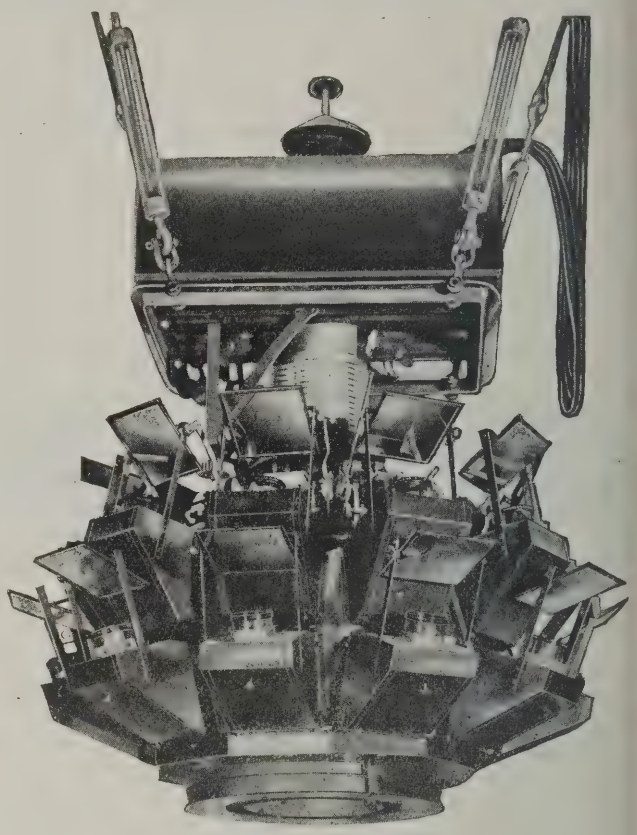


Fig. 6.—Cloud Apparatus.

ing effect obtainable by the combination of these movements is that of two separate banks of cloud travelling independently one above the other, a phenomenon frequently observed in nature. The success of the cloud apparatus is greatly influenced by the manipulation of the horizon lighting, which creates the illusion of the sky itself.

The effect of the cloud apparatus may be intensified by the addition of the panorama projection apparatus, fig. 7, which projects a series of cloud pictures or landscapes on the artificial horizon. It consists essentially of three projectors mounted on a tubular steel frame,

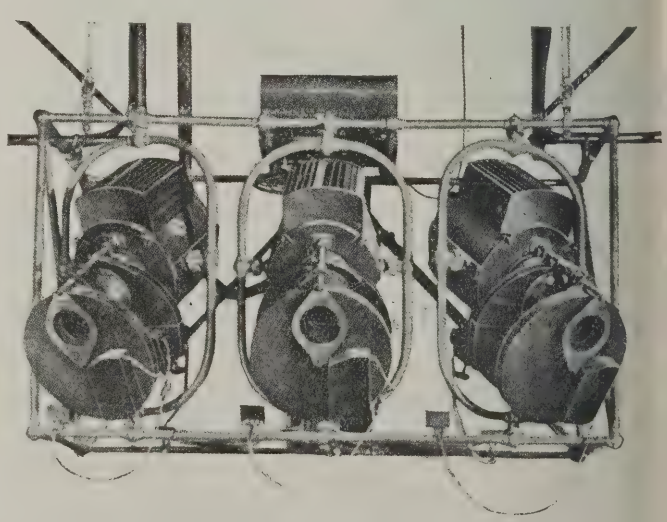


Fig. 7.—Panorama Projection Set.

capable of being tilted in an upward or downward direction, and with each lamp mounted in such a manner that it can swing on its horizontal axis and be locked in the desired position by a set-screw. The raising and lowering movement is obtained by a small motor driving a screwed spindle, the rotation of which operates wires attached to the projectors. Each pro-

jector, in addition to its 3,000-W lamp, adjustable by means of a handwheel operated from the exterior, is equipped with an adjustable reflector which enables the focus of the beam of light to be readily corrected. Two disks are fitted to each lamp, one being a colour-screen, the other containing several dia-positives, so that it is possible, to take one illustration, to obtain three entirely different panoramas without the necessity of changing slides. In front of the projector lens a circular motor-driven colour-screen is fitted by which the operator can control various special colour effects.

In addition to the foregoing, many pieces of apparatus are produced which would not come under the heading of general stage-lighting apparatus, being specially designed to meet particular requirements and conditions. For instance, lightning is produced by an electrical discharge. Special arc lamps with impregnated flame-carbons are used; as soon as the current is switched on an arc is struck, only to be broken immediately by the rapid raising of the upper carbon by means of a coil; the sudden flash is projected through a shutter having a suitable aperture, thus giving a vivid momentary glare. The carbon is retained in its raised position until the switch is opened.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

South America the Battleground: A Berlin Report.

In view of recent statements regarding hopes of foreign electrical interests concerning an organised attempt to dominate the electrical market here and elsewhere to our own exclusion, the following report received from the British United Press in Berlin, under date May 11th and published in the *Financial Times*, will probably be found both interesting and amusing. The "remarkable statement," as it is described, is attributed to the *Deutsche Bergwerks Zeitung*, the organ of the Ruhr industrialists:—"The British electrical industry suspects the existence of a secret agreement between French and German electrical producers for the domination of the European market. Because of this, Britain has launched a policy of reprisal in South America."

International Trust Rumours.

According to various reports circulated in some Continental newspapers, discussions have just taken place at Uschy between representatives of the electrical industries of the leading countries. It is, however, stated to be incorrect that these conversations are connected with proposed arrangements concerning the division of the production and sales. In this respect a Cologne newspaper states that the matter solely concerns the negotiations taking place before the world economic conference at Geneva in so far as applies to the countries participating in the conference; and, moreover, the discussions have only been of a general nature.

Results from Propaganda.

The desire of our kith and kin in New Zealand to deal with electrical manufacturers and traders in this country rather than make their purchases from American or other foreign sources is very marked, but it is essential that British concerns should keep themselves and their product well in evidence there. We have lately had brought to our notice an experience which shows the reward that suitable publicity, even of a most general kind, may bring. A New Zealand paper reported a statement on the all-electric house, made at a meeting of the Walsall Rotary Club by Mr. H. G. Truman, of the Truman Electrical Co., electrical contractors, of Walsall. This attracted the attention of the secretary of the Wellington Golf Club, who deduced from it that the Truman Company manufactured electric ranges, and wrote: "We are considering installing a cooking range at this club. There is no English range on the market here, but any number of American ones. We should naturally prefer to buy one from England if possible." A quotation was asked for. We quote this as an example of the way in which electrical propaganda works round and brings business in quite unthought-of ways.

Wages in the Engineering Industry.

Referring to the engineering trade unions' request for an advance of wages, which is under consideration by the employers, the May *Journal* of the Amalgamated Engineering Union deals with the future of the industry. It is suggested that a joint committee should be formed to examine trade conditions at least half-yearly with a view to making recommendations regarding wages; it is considered that a minimum should be fixed below which wages could not fall.

United States Radio Patent Litigation.

The *Telegraph and Telephone Age* reports that the "big three" of the American radio industry, the Radio Corporation of America, the American Telephone and Telegraph Co., and the General Electric Co., have commenced a legal campaign against infringers of their patents, which, it is said, may "tie up" most, if not all, of the sets in use in the United States and elsewhere. The campaign follows a recent decision of the Canadian Courts in favour of the Canadian General Electric Co., Ltd., against the Fada Radio Co., Ltd., in relation to the alleged infringement of a radio-frequency tuning patent. The General Electric Co. is taking action upon an alleged infringement of the United States patent on the same subject granted to Dr. E. F. W. Alexander and others. This is said to affect every type of receiving set employing tuned radio-frequency amplification. The General Electric Co. owns the Alexanderson patent, but the Radio Corporation of America controls the licence in the United States. The Radio Corporation has already taken action against the Atwater Kent Radio Manufacturing Co., of Philadelphia, for alleged infringement of the Alexanderson patent.

A B.T.-H. Lighting Scheme.

In the reconstruction of their general offices and the provision of a staff restaurant, Messrs. John Player & Sons, Nottingham, have adopted B.T.-H. lighting fittings according to a scheme prepared by their engineer, Mr. Wardle, and the British Thomson-Houston Co., Ltd. The new offices and restaurant occupy two floors each 240 ft. long by 38 ft. wide. On the lower floor, which is now one large general office, the installation comprises 40 "Trojan" totally-enclosed fittings (ceiling type), fitted with 200-W "Mazda" gasfilled lamps. The top floor is partly divided into a number of small offices, necessitating a larger number of fittings. On this floor there are 61 ceiling-type "Trojan" fittings each equipped with a 150-W gasfilled lamp. The installation provides a uniform illumination of about 6 ft.-candles.

The Irish Radio Import Duty.

A motion for the repeal of the duty upon imported radio apparatus was defeated in Dail Eireann on May 11th. The Minister of Posts and Telegraphs said that the duty was essential to cover the difference between the expenditure upon broadcasting and the receipts from licence fees. He mentioned that it was proposed to erect a high-power station at Athlone, and also stated that the number of licence holders was expected to be 100,000 in four years' time.

German Lamp Production.

The *E.T.Z.*, Berlin, has recently published some figures showing the production of electric lamps in Germany in 1925. The output of metal filament and Nernst lamps is returned at 78 millions, as compared with 71½ millions in 1924. Of this total 29 million lamps were exported as against 29.8 million in the preceding twelve months. The production of mercury vapour lamps declined from 4,200 to 1,900. On the other hand the output of arc-lamp carbons increased from 715.8 tons to 777.4 tons.

Indian Tariff Revision.

The *Board of Trade Journal* of May 12th contained the first part of a reprint of the revised Indian tariffs. Among the classes of goods dealt with is electrical control and transmission gear, comprising switches, fuses, and current-breaking devices of all descriptions, designed for use in circuits of less than 10 A at a pressure not exceeding 250 V, and regulators for use with motors designed to consume less than 187 W; bare or insulated copper wires and cables, any one core of which has a sectional area of less than one-eightieth of a square inch, and wires and cables of other metals of not more than equivalent conductivity; and line insulators, including cleats, connectors, leading-in tubes and the like, of types and sizes such as are ordinarily used in connection with the transmission of power for other than industrial purposes, and the fittings thereof. All the above are subject to an import duty of 15 per cent. *ad valorem*.

Modern Floodlighting.

We illustrate two widely-different examples of the employment of floodlighting which have recently come to our notice. The first illustration is the exterior of the People's Palace, Mile End Road, which was illuminated by means of ten



The People's Palace, E.

B.T.-H. 500-W projectors. It was in this building that the Stepney Electricity Department recently ran a successful exhibition.

The other example comes from the "Underground" group. The picture shows the results obtained in the floodlighting of the corridors at Finsbury Park station leading to the Piccadilly Tube. Inner walls have been built, and



Corridor Lighting at Finsbury Park Station.

from behind cornices concealed projectors throw their rays upwards on to the white roof. In this way diffused adequate illumination is obtained. Floodlighting has also been used upon the station front.

Electrical Power in Industry.

Preliminary Report No. 11 upon the 1924 Census of Production (published with the *Board of Trade Journal* dated May 12th), deals with further branches of industry. The section relating to the silk and artificial silk trades shows that the capacity of electrical generating plant in use rose from 1,660 kW in 1907 to 16,910 kW in 1924. This supplied power for 14,391 h.p. of electric motors, while in addition power was purchased for 17,732 h.p. The elastic webbing trade reported 258 kW of generating plant and 1,993 h.p. of electric motors (power for 1,758 h.p. purchased). In the pen, pencil, and artists' materials trades there was 314 kW of generating plant and 3,126 h.p. of motors (power for 2,859 h.p. purchased). The generating plant employed by the ink, gum and sealing wax trades aggregated 314 kW, and there was 4,584 h.p. of electric motors (power purchased for 4,425 h.p.).

Our Electrical Machinery Exports.

We give below the distribution of the electrical machinery exports shown in our monthly table on p. 813. The figures are compared with those of April, 1926 :—

Destination.	April, 1926. £	April, 1927. £	Inc. or dec. £
European countries	81,783	89,655	+ 7,872
Japan	23,021	3,889	−19,132
South American countries ...	22,652	35,505	+12,853
South Africa	48,806	69,431	+20,625
British India	99,488	94,818	− 4,670
Australia	62,426	109,267	+46,841
New Zealand	10,704	14,569	+ 3,865
Canada	16,765	9,887	− 6,878
Other countries	47,217	43,960	− 3,257
Totals ...	£412,862	£470,981	+£58,119

A Kent Electrical Retailer's Enterprise.

An example of aggressive electrical propaganda by an electrical retailer has been brought to our notice. Mr. C. O. Clark, of Deal and Dover, recently organised exhibitions in these two towns and attracted a great deal of attention and business. The first show was held at Dover on May 3rd and 4th, and was opened by Sir Edwin Farley, president of



Domestic Section of the Exhibition.

the Dover branch of the Wireless League. In addition to a wide range of radio apparatus, there were examples of the latest lighting, heating and cooking apparatus of leading makes. The whole exhibition was moved to the Winter Gardens, Deal, on May 5th, and was opened by the Mayor



Radio Display at the Exhibition.

of Deal, who considered that he was not exceeding his duty in supporting the enterprise of one of the citizens; the exhibition, he said, would not merely secure business for Mr. Clark, but would show what electricity could do. The exhibition remained open until the following day, and during its run lectures and demonstrations were given. Two of the stands are shown in the illustrations herewith. The attendance at the two shows was over 3,500.

Unemployment.

The total number of registered unemployed declined further during the week ended May 2nd. At that date the number was 1,021,700, as compared with 1,044,750 on April 25th, and 1,105,916 on May 3rd, 1926.

New Italian Companies.

Among the companies recently formed in connection with the electrical engineering industry in Italy are the Società Fabbrica Articoli Isolanti, F.A.I., Pianezza, capital 240,000 lire; La Società Italiana Construcioni Elettromeccaniche, Turin, capital 700,000 lire; and La Società per la Fabbricazione di Isolanti Elettrici, Milan, capital 50,000 lire.

Social Events.

The G.E.C. Social and Athletic Club cricket season is now in full swing. An auspicious start was made on April 30th, when three elevens were fielded. The batting augured well for a successful season. Most of last season's players are available, with much promising new talent. Twelve tennis courts are available, and a "Beginners' Evening" once weekly provides a welcome "nursery" where advice and instruction is given to novices. A Swimming Club has also been formed and is attached to the Holborn Municipal Baths. The football season just ended was one of the most successful in the history of the club. The first and second elevens won the championships of their sections of Divisions I and II of the London West End Amateur Football Association.

In its first season in the "Beatty" League of the Sheffield and District Works Sports Association, the football club of the Metropolitan-Vickers Electrical Co., Ltd., was successful



The Metro-Vick Football Team.

in winning the championship. The team won 13 out of 19 matches, and only lost two. Our illustration shows the team with the handsome shield presented to the Association by Admiral Earl Beatty.

The Macintosh Cable Co.'s team, in First Division Association football, has won the Derby Amateur Cup.

Registered Contractors.

The following applications were accepted by the Executive Committee of the National Register of Electrical Installation Contractors on May 13th:—

Lambert & Vallack, South Shields.
Wilkins Electrical Works, Ltd., W.12.
Brice, W. V., W.C.1.
Taylor, F. W., & Son, Milnsbridge, near Huddersfield.
Bacchus, H., Ltd., Bedford.
Headen & Brennand, Halifax.
Holt, W. P., & Co., Bradford.
Thomson, D., & Sons, Carlisle.
France's, Darlaston.
Penty & Margetts, Bradford.

At the same meeting four applications were declined.

The Timber Trade.

Our Timber Trade correspondent writes:—"Whilst there is a better consumption of building woods, including poles, than at this time last year, stocks are not so large. Fresh supplies, however, are likely to be heavier than those of the corresponding period of 1926 now that navigation has been reopened, for there has been large forward buying. Prices keep very firm for the better qualities, whilst values for inferior grades are steady. The Mississippi disaster has had the effect of steadying the market on this side for the American hardwood varieties, and values are firmer, although not on such a large scale as might be anticipated by the more optimistic operators. Stocks, however, are ample, and should spot prices show any great increase, consumption is sure to be affected. The better market for the American woods also has an influence on values of other descriptions. The hard and fancy woods, including the better grades of mahogany, teak, ebony, and rosewood, are strong in value, but the demand for these is not active."

New French Companies.

A company has lately been formed in Paris (1, Rue de Metz) with a capital of 500,000 fr. and the title La Société de la Lampe Microlux, to manufacture electric lamps.

La Société d'Amenagements Hydro-Electriques is the name of a new company which has been formed in Paris (10, Rue Rossini) with a capital of 500,000 fr., to develop hydro-electric undertakings.

New Municipal Showrooms and Offices.

The East Ham Corporation has appointed a committee to select a site for the erection of electricity showrooms.

The Scarborough Corporation has adopted a recommendation of the Electricity Committee to purchase 89, Westborough, at a cost of £6,875 as showrooms for the electricity undertaking.

Trade Announcements.

Mr. Berl Wober, late manager in Scotland for the Lunar Electrical Co., Ltd., has been appointed managing director of the Bryterlite Electrical Co., Ltd., at 10, West Campbell Street, Glasgow, from which address a wholesale electric lamp and accessory business will be carried on.

The address of Messrs. Robert Blackwell & Co., Ltd., is now Mitcham Road, Croydon. Telephone: Thornton Heath 2410-11-12; telegrams: "Kurkee, Croydon."

Messrs. J. V. Brittain & Co., Ltd., have removed to larger premises at Kingsway, Stoke-on-Trent, with a trade counter in Back Glebe Street. The company has a varied stock of wiring and colliery supplies, and runs a wholesale radio department.

Mr. F. Sandler, wholesale electrical and wireless factor, has removed to larger premises at 2, Mayes Street, Shudehill, Manchester.

Mr. Leonard J. Ive, electrical and wireless engineer, of 7, Clarendon Corner, Watford, has opened new showroom premises at 11, The Parade.

A new company registered recently under the designation of Fiat British Auxiliaries, Ltd., with its head office at 133, Helen Street, Govan, Glasgow, is to start at an early date the manufacture of marine Diesel engines of the Italian Fiat type. The initial capital is £125,000. The subscribers are Messrs. James Caird, shipowners, London; Mr. J. Howden Hume, engineer, Glasgow; and Mr. E. W. Harvey, engineer, London. Operations will be started as soon as the necessary plant and equipment are installed.

An arrangement has been entered into between Messrs. Carlo Brivio, of Milan, and Automatic & Electric Furnaces, Ltd., for the manufacture and sale of "Wild-Barfield" electro-magnetic furnaces in Italy.

The address of the Boston & District Electric Supply Co., Ltd., for all correspondence is Mount Bridge Power Station, Boston, Lincs. Manufacturers and others who have been in the habit of sending correspondence to the Dolphin Lane showrooms are asked to note that no office business is transacted there.

New Catalogues and Lists.

Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, London, W.C.2.—A series of illustrated descriptive pamphlets: Leaflet No. 1,069, type 201, 1.5-kW telegraph-telephone transmitter for submarines, gunboats, and other small craft. Leaflet No. 1,068, type 20Y, Marconi-Newton constant-speed propeller for wind-driven aircraft generators. Sheet A12/2, 30-watt transmitting valve. Sheet A19/2, 40-watt dull-emitter transmitting valve. Sheet A20, 1-kW modulating valve. Sheet A21, 1-kW transmitting valve with shield outside bulb for short-wave work. Sheet A22, 400-watt transmitting valve with shield outside bulb for short-wave work. Sheet C20, two-electrode 15 mA dull-emitter half-wave rectifying valve. Sheet C21, double-electrode full-wave 50 mA rectifying valve. Sheet D1, cooled-anode 10-kW transmitting valve. Sheet D2, cooled-anode 12.5-kW transmitting valve. Sheet D3, cooled-anode 5-kW modulating valve. Sheet D4, cooled-anode 5-kW absorber valve. Sheet E1, cooled-anode low-impedance transmitting valve.

The British Aluminium Co., Ltd., Adelaide House, E.C.4.—An illustrated pamphlet dealing with aluminium for special advertising van bodies.

Messrs. Robert McGregor & Co., Alpine Steelworks, East Molesey, Surrey.—List No. 124, giving illustrations, sizes, and prices of mild-steel cable hangers and racks.

The Beko Lamp Co., Ltd., 5, Finsbury Square, E.C.2.—A pamphlet describing the "Beko" 10-gal. electric boiler. Illustrated and priced.

The Metropolitan Electric Cable & Construction Co., Ltd., Fuller Works, Chadwell Heath, Essex.—Price List No. 20, containing prices of v.i.r. taped, braided, and compounded cables and lead-covered cables.

Automatic & Electric Furnaces, Ltd., 173-175, Farringdon Road, E.C.1.—A priced and illustrated pamphlet describing the "Wild-Barfield" electric solder bolt heater.

The Standard Resistance Co., Broomfield, Chelmsford.—List No. 6, containing illustrations, particulars, and dimensions of wire resistance grids.

Messrs. Courtney, Russell & Co., 65a, Holborn Viaduct, E.C.1.—A leaflet illustrating five examples of crystal electric lighting fittings.

The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, E.C.4.—This company has sent us a complete set of its catalogue sections in a neat binder. The sections are well illustrated and priced and cover lamps, lighting fittings, fans, heating and cooking apparatus, instruments and meters, batteries, accessories, d.c. and a.c. motors, and radio apparatus.

Graham Amplion, Ltd., 25-26, Savile Row, W.1.—A black and white wall sheet advertising the "Amplion" cone loud speaker and illustrated and priced folders dealing with loud speakers, gramophone attachments, &c.

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The Saxonia Electrical Wire Co., Ltd., Roan Works, Greenwich, S.E.10.—A net trade price list of magnet wires, flexibles, v.i.r. cables, &c.

Messrs. Isenthal & Co., Ltd., Ducon Works, Victoria Road, North Acton, W.3.—A preliminary list dealing with the "N.C." automatic rapid action voltage regulator which the company is commencing to manufacture.

Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow.—Pamphlet No. 21/1, dealing with knife switches for pressures up to 660 V, and Pamphlet No. 31/1, describing medium-pressure, heavy-duty fusible cut-outs. Illustrated and priced.

Messrs. S. G. Brown, Ltd., North Acton, W.3.—The "Brown Budget" for May containing articles and notes on "Brown" loud speakers in various parts of the world.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—May calendar-blotter advertising the "No. 154" electric wash-boiler.

Messrs. H. Clarke & Co. (Manchester), Ltd., Atlas Works, Old Trafford, Manchester.—A catalogue dealing with the company's "Neutrofour" radio receiver, containing details, illustrations and prices of the necessary components and accessories.

Berry's Electric, Ltd., 85 and 86, Newman Street, Oxford Street, W.1.—Two pamphlets giving particulars and prices of the "Wilton" fire and the "Fleur-de-lis" basket and dogs. The illustrations show these to be handsome additions to the "Magicoal" series.

The Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, E.15.—A coloured showcard advertising "Hart" automobile lighting and starting batteries.

Messrs. Charlesworth Peebles & Co., 5, Eden Street, Hampstead Road, N.W.1.—Pamphlets advertising the "Protos" vacuum cleaner.

Mr. Alan Wright, 124, Chancery Lane, W.C.2.—A booklet containing illustrations, particulars and prices of "Inventum" electric water-heating appliances.

The Weston Electrical Instrument Co., Ltd., 15, Great Saffron Hill, E.C.1.—A priced and illustrated booklet dealing with the company's voltmeters, milliammeters, galvanometers, &c., for radio measurements.

Bankruptcy Proceedings.

Francis Husband, "The Hollies," Sandpit Lane, St. Albans, engineer.—The first meeting of creditors was held recently at 29, Russell Square, W.C.1. The statement of affairs showed liabilities expected to rank at £4,074, against gross assets of £35, which amount was absorbed by preferential claims. Debtor attributed his failure to liability under guarantees on behalf of a limited company, judgments obtained against him under a building contract entered into with his wife, and expenses of his wife's illness, bad debts, and unemployment. In 1915 debtor and another formed a limited company as F. Husband, Ltd., with £1,000 nominal capital, to carry on business as electrical engineers. He was allotted 700 £1 shares partly for cash and partly as consideration for services in introducing business, and was appointed managing director. The company went into voluntary liquidation in 1920, and as guarantor on behalf of the company he was liable for debts of £3,134. From February to September, 1924, he was engaged on a contract for the supply of switchboards. In July, 1926, judgment was obtained against him for the balance of the purchase price of a house which had since been taken over by the mortgagees. Debtor admitted having been aware of his position since February, 1920. The case was left in the hands of the Official Receiver as trustee of the estate. The following are creditors:—

	£		£
Allied National Corpn., Ltd.	51	General Wireless, Ltd. ...	35
Davis & Ball	53	North Metropolitan E.P.S. Co.	21
Ducat, Dr. A.	75	Record Elecl. Co., Ltd....	71
Electrical Contracts and Maintenance Co. ...	70	Braby & Waller	45
General Electric Co., Ltd.	91	Universal Housing Co. ...	317
		West, L. C.	44

J. Atkins, trading as Atkins & Co., Tewkesbury, Northleach and Winchcombe, Gloucestershire, electrical engineer. The following are creditors herein:—

	£		£
Atkins, E. M. (Mrs.) ...	153	Electrical Components, Ltd.	30
Atkins, J.	32	General Electric Co., Ltd.	46
British Petroleum Co. Ltd.	40	Moss, A. E.	125
Callender's Cable & Construction Co., Ltd. ...	40	Siemens Bros. & Co., Ltd.	44
		Whitworth Electric Lamp Co., Ltd.	61

H. Nutter, electrical engineer, 246, Yorkshire Street, Rochdale.—First meeting, May 24th, at the Official Receiver's offices, Byrom Street, Manchester; public examination, June 17th, at the County Police Court, Rochdale.

J. L. R. Jensen (Jensen & McNicol), wireless accessories factor, 149a, Seabank Road, Wallasey.—Trustee, Mr. E. D. Symond, Official Receiver, 11, Dale Street, Liverpool, released May 5th.

S. Holmes, electrical engineer, 5, Gibson Street, Burmantofts, Leeds.—Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds, released May 5th.

G. Youll and A. Fraser (Youll, Fraser & Co.), electric lamp and wireless factors, 6, Hunter Street, Liverpool.—Trustee, Mr. E. D. Symond, Official Receiver, 11, Dale Street, Liverpool, released May 9th.

B. Uttley, electrician, 212, Central Drive, Blackpool, late of Tower Street, Bacup.—Trustee, Mr. J. G. Gibson, Senior Official Receiver, Byrom Street, Manchester, released May 3rd.

H. Tidswell (H. Tidswell & Co.), electrical engineer, 11, Bazaar Street, Pendleton.—Trustee, Mr. J. G. Gibson, Senior Official Receiver, Byrom Street, Manchester, released May 3rd.

C. J. Nichols (C. J. Nichols & Co.), electrical engineer, 7, Park Street, Bridgend, Glam.—Last day for proofs for dividend, May 27th. Trustee, Mr. G. G. Poppleton, 26, Corporation Street, Birmingham.

C. Hubbard, electrician, 13, Magdalen Street, Norwich.—Last day for proofs for dividend, May 28th. Trustee, Mr. C. B. L. Prior, Official Receiver, 9, Queen Street Chambers, Norwich.

G. Mason and G. E. Tinsley (Mason & Tinsley), electrical engineers, 6, Alberta Terrace, Sherwood Rise, Nottingham; and late of 94, Upper Parliament Street, Nottingham.—First and final dividend of 1s. in the £, payable May 23rd, at the Official Receiver's offices, 4, Castle Place, Nottingham.

G. Mason (separate estate).—First and final dividend of 10s. in the £, payable May 23rd, at the Official Receiver's offices, 4, Castle Place, Nottingham.

A. L. Weekes, electrical engineer, 13, Crescent Road, Luton.—First meeting held May 17th, at the Official Receiver's office, The Parade, Northampton; public examination, May 27th, at the Court House, Luton.

P. Cheshire (P. Cheshire & Co.), electrical engineer and contractor, Water Street Works, Middleton, Lancaster.—First meeting held May 19th, at the Official Receiver's offices, Byrom Street, Manchester; public examination, June 15th, at the Court House, Church Lane, Oldham.

H. Bebbington, electrical engineer, 14, Cestrian Street, Bolton.—Last day for proofs for dividend, May 25th. Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester.

E. F. Woodgate, electrical engineer, 7, St. John's Terrace, and Brunswick Cottage, Weymouth.—Last day for proofs for dividend, May 24th. Trustee, Mr. T. Barton, Official Receiver, Catherine Street, Salisbury.

Company Liquidations.

Southern Counties Electric Light & Power Supply, Ltd., 121, Cheapside, E.C.—Under a compulsory winding-up order, made last March, on the petition of a creditor, the statutory first meetings of the creditors and shareholders were held on May 12th at Carey Street, W.C., before Mr. H. E. Burgess, senior Official Receiver. The company was incorporated in November, 1924, with a nominal capital of £11,000, subsequently increased to £21,000, and was promoted by Mr. Edmund Octavius Eaton for the purpose of acquiring, developing, and carrying on electric light and power undertakings in the southern and western counties in Great Britain and elsewhere. The immediate object, however, was to take over the benefit of certain contracts entered into by the Electricity Finance & Distribution Corporation, Ltd. (another of Mr. Eaton's companies) for the supply of electric power in certain areas. Agreements were entered into in December, 1923, with the Rural District Council of Sturminster Newton, Dorset, for the establishment by the company of an electrical generating station, and laying of mains for the supply of electricity in the district of Sturminster Newton. In October, 1924, the directors entered into an agreement for the purchase of electric light undertakings at Battle, Sussex, and in March, 1925, they entered into a further undertaking for the laying of cables and the extension of mains between Chagford and Moretonhampstead, Devon, also for the supply of electricity at the rate of 5d. per kWh for 20,000 kWh per annum and 4d. per kWh in excess of that amount. The company also had an interest in the exploitation of Reid's patent process for the generation of electricity at a cheaper rate than any known process other than by water-power. This process was stated to be for the conversion of a non-combustible gas, obtained from the burning of chalk and coke, into a combustible gas. In the event of that process being a success the company was to have a licence to use the process in all its areas. The company applied for Special Electricity Orders for all its areas, but failed to obtain them, and the work at Battle involved it in a heavy loss. The Sturminster Newton scheme was partially completed at a cost of £3,000, but owing to insufficient funds the company was unable to continue the proposed extensions, and in August, 1926, the company's installation was taken over for £2,000 in shares by the Dorset and Devon Electricity Supply, Ltd., whilst at Moretonhampstead no work was done by the company. In order to obtain the finance necessary to carry out its schemes the directors, on December 12th, 1924, resolved to create first mortgage debentures, carrying 7 per cent. interest per annum, for £25,000. A prospectus was issued on March 23rd, 1925, offering for subscription 20,000 8½ per cent. participating preference shares of £1 each at par, and £15,000 first mortgage 7 per cent. debentures of £10 each at £9 16s. 0d. The issue of the prospectus was carried out by the Electricity Finance and Distribution Corporation, Ltd., at a cost of £8 per £1,000, plus petty cash and out-of-pocket expenses, and was supervised by Mr. Eaton at a fee of £100, plus travelling expenses. Owing to the poor response by the public to the first issue,

the prospectus was reprinted, and further issues made in May, 1925; a new prospectus was issued in the following October; and further prospectuses were sent out in February and June, 1926. The statements contained in the various prospectuses as to the position of the company and its undertakings will be the subject of further investigation by the Official Receiver. In September, 1925, some of the debtors and shareholders brought actions against the company and its directors for the return of moneys subscribed on the ground of fraudulent misrepresentations contained in its prospectus. The total amount subscribed by the public was £32,326. The failure of the company is attributed by the directors to insufficient capital at any one time to carry out its undertakings; the failure to obtain Special Orders for the supply of electricity in its areas; and excessive cost of obtaining capital. No statement of affairs had been lodged at the date of the meetings, but it appeared that the assets were valued at £7,421, and the liabilities were estimated at £19,142, including the debenture debt of £16,700. In consequence there is no possibility of any surplus becoming available for the unsecured creditors or of any return being made to the shareholders. The liquidation was left in the hands of the Senior Official Receiver.

NADIN & DELL ELECTRIC, LTD.—A meeting of members is called for June 13th, at 5, Bold Street, Warrington, to hear an account of the winding up from the Liquidator, Mr. L. A. Voisey.

ELECTRICAL & RADIO DISTRIBUTORS, LTD.—Winding up voluntarily. Liquidator, Mr. F. E. Anderson, 50, Bedford Row, W.C.1. Meeting of creditors, May 25th, at the liquidator's offices.

MAGNETIC SIGNS & CARRIERS, LTD.—A meeting of members is called for June 10th, at 18-19, Ironmonger Lane, to hear an account of the winding up from the liquidator, Mr. J. C. Sherrott.

Private Arrangements.

S. S. JURY, trading as Jury's Electric Service, 128, Far Gosford Street, Coventry, electrical and wireless dealer.—In response to a circular letter issued by Mr. J. W. B. Allen, Barbican Chambers, Earl Street, Coventry, a meeting of creditors was held recently at Birmingham, when a statement of affairs was submitted which disclosed liabilities of £2,914 and net assets of £1,322, leaving a deficiency of £1,592. It was reported that the debtor commenced trading in 1923, and at the outset was successful. Subsequently he acquired other premises, and in consequence of heavier overhead expenses he traded with a very fine margin of profit. He drew from the business about £4 weekly. It was intimated that the debtor had already executed a deed of assignment with a view to protecting the assets. Recently creditors had pressed. The debtor was unable to make any offer, but he hoped that friends would assist him to retain the business. A resolution was passed confirming the deed already executed, and a committee of the principal creditors was appointed. It was arranged that the trustee and committee should deal with any offer that was received.

S. L. STREETER, Petworth, electrical and wireless engineer and kinema proprietor.—A meeting of creditors was held on May 11th at the offices of the Palatine Trade Protection Office, Kimberley House, Holborn Viaduct, E.C., when Mr. P. S. Booth presented a statement of affairs which showed liabilities of £467 and net assets of £432, leaving a deficiency of £35. The debtor commenced business as a wireless and electrical dealer in April, 1925. In January of this year the debtor took over the "Picturedrome," Petworth. The turnover of the wireless business averaged about £400 a year. The debtor had interviewed friends to see if an offer could be made, but so far without success, and he left the matter entirely with the creditors. As there were suing creditors, Mr. Booth said that, in order to protect the assets, a deed of assignment had been executed by the debtor to him (Mr. Booth) as trustee. It was decided that the deed of assignment should be confirmed, and a committee of inspection, consisting of three of the creditors, was appointed. The following are the principal creditors:—

	£		£
Houghton-Butcher (G. B.), Ltd.	91	Radio Communication Co., Ltd.	29
Roneo, Ltd.	47	A. J. Stevens & Co. (1914), Ltd.	44
Woods, Ernest	31		

Dissolutions of Partnership.

GREYCOAT IGNITION CO., electrical engineers, 27, Charles Street, Notting Hill, W.—Mr. R. Tricker and Mr. C. P. Holt have dissolved partnership. Debts will be attended to by Mr. Tricker.

BIRMINGHAM & MIDLAND ELECTRIC WELDING CO., electric welders and boiler repairers, Grove Works, Grove Lane, Smethwick.—Messrs. Frank Parkin, G. Price, Fred Parkin, J. W. Parkin, and H. Jones have dissolved partnership. Debts will be attended to by Messrs. Frank Parkin, G. Price, J. W. Parkin, and H. Jones, who will continue the business under the same style.

GOODMAN BROS., electrical and general engineers, Moretonhampstead, Devon.—Messrs. K. I. and W. R. Goodman have dissolved partnership. Mr. K. I. Goodman will attend to debts and continue the business in his own name.

WYCOMBE ELECTRICAL SUPPLIES, 51, Oxford Street, High Wycombe.—Mr. R. C. Gilbert, Mr. G. H. Turner, and Mr. D. Holt have dissolved partnership. Mr. Gilbert will attend to debts and continue the business.

Local Exhibitions.

STEPNEY.—The exhibition organised by the Borough Council was visited by about 20,000 people, and all the exhibitors received a gratifying number of inquiries which are confidently expected to result in a considerable amount of business in the near future. At the Council's own inquiry bureau over 300 inquiries were recorded for all types of domestic apparatus. No fewer than 191 of these were for cookers. A hiring and hire-purchase scheme is in operation which, together with the attractive rates in force for heating and cooking, place the ratepayers of Stepney in a favourable position.

BERMONDSEY.—Reporting on the all-electric house on the Salisbury Street estate, which was arranged by the Electricity Department, the Electricity Committee states that a total of 11,360 people visited the house—an average of 630 per day. Fifty-eight applications for lighting installations were received from residents where the mains are already laid, and many inquiries were made for lighting in streets where there are no mains. Applications were received for the following apparatus: 20 cookers, 15 irons, 20 radiators, 5 geysers, 3 washing machines, 1 refrigerator, 1 fan, and 1 bedwarmer. Various shades and fittings were sold as a result of the consumers seeing them actually in use.

ABERDEEN.—A Brighter Homes Exhibition is to be held in the Music Hall from September 30th to October 11th. The exhibits will embrace heating, cooking, lighting, and labour-saving devices.

MANCHESTER.—The Power Efficiency Exhibition, which was to be held from June 22nd until July 2nd, has been abandoned on account of lack of support.

For Sale.

Rushden and District Electric Supply Co., Ltd., has for disposal three 240-kW Willans Diesel engine generating sets, with oil tanks, pumps, &c., also one Garrett locomobile-type power plant, boiler, superheater and condenser, direct coupled to a 115-kW Phœnix dynamo, complete with steel chimney, &c. By order of Mr. James White and the Beecham Trust, Ltd., Messrs. Toplis and Harding & Russell, in conjunction with Messrs. Knight, Frank & Rutley, will sell by auction on June 2nd and 3rd, at the British Empire Exhibition, Wembley, electrical and fire equipment, office furniture, miscellaneous effects, &c. (See our advertisement pages to-day.)

Book Notices.

"Towards Industrial Recovery," by Hugh Quigley. London: Methuen & Co. 4s. 6d. net.—Many of our readers who are familiar with the statistical and other writings of Mr. Quigley will no doubt read this book with interest. It comprises eight chapters, the earlier of which consider the changes that have taken place since the war in organisation for production in Britain, Germany, and France, and the main factors determining industrial recovery in Germany, France, and Belgium. Later pages deal with certain developments of international significance and the grouping of forces within industry, and the closing chapters discuss the control of industrial fluctuations and the basis of industrial revival. In this last connection the writer refers to the importance of management, the need of essential statistics, financial obstacles to reorganisation, trustification and central control, and the future of industry.

"*Journal* of the Institution of Electrical Engineers." Vol. LXV. No. 365. May, 1927. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

The HART ACCUMULATOR CO., LTD., has produced for the help of present users of its lighting and power batteries a brochure describing the construction of the batteries and instructions for correct charging, care and maintenance, &c. The book is illustrated, and should be of great service to those for whom it is intended.

New Australian Company.

Stromberg-Carlson (Australasia), Ltd., has been formed in Sydney, with a capital of £50,000, to manufacture, import and export electrical and mechanical engineering goods.

Uruguayan Electrical Import Duties.

The section of the Uruguayan customs tariff relating to "articles for electricity" has recently been revised. Particulars of the revision are available from the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

Proposed Compulsory Safety Measures.

The Home Office has issued a circular to factory employers' associations in which it is said that progress in the development of safety-first arrangements is too slow. An Order requiring the institution of special safety arrangements has been provisionally approved, but is being held up pending representations on the subject from the employers. This Order would apply to all those industries in which accidents are frequent, with the exception of docks, for which, it is understood, voluntary arrangements are being made. Among the industries specially mentioned are dynamo, motor and cable manufacture. One part of the Order requires the employment of a competent safety supervisor, but with the Chief Inspector's approval an alternative arrangement can be made.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	Price May 17th.	Fortnight's inc. or dec.
CHEMICALS, &c.		
a Acid, Oxalic ... per lb.	5¾d.	...
a Ammoniac, Sal ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ,,	...	...
a Borax ... ,,	£25	...
a Copper Sulphate ... ,,	£25 10s.	...
a Potash, Chlorate ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ,,	5½d.	...
a Shellac ... per cwt.	£13 10s.	...
a Sulphur, Commercial ... ,,	£9 10s.	...
a ,, Roll ... ,,	£9 10s.	...
a Soda, Chlorate ... per lb.	8¼d to 8½d.	...
a ,, Crystals ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots... ... per ton	£107 to £112	...
b ,, Wire ... per lb.	1/6 to 2/-	...
b ,, Sheet ... ,,	1/8 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... per ton net.	£256	£5 dec.
Grade II ... ,, ,,	£178	£4 dec.
Grade III... ,, ,,	£93	£1 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	9⅝d.	...
c ,, Tubes (solid drawn) ... ,,	11½d. to 11⅝d.	...
c ,, Wire, basis ... ... ,,	9⅝d.	...
c Copper Tubes (solid drawn) ... ,,	1/0½	...
c ,, Bars (best selected) ... per ton.	£86	...
c ,, Sheet ... ,,	£86	...
c ,, Rod ... ,,	£86	...
d ,, (Electrolytic) Bars ... ,,	£61 12s 6d.	2/6 inc.
d ,, ,, Sheets ... ,,	£143 10s	...
d ,, ,, Wire Rods ,,	£71 12s 6d.	2/6 inc.
d ,, ,, H.C. Wire per lb.	9⅛d.	...
f Ebonite Rod ... ... ,,	2/3 to 2/6	...
f ,, Sheet ... ... ,,	2/3 to 2/6	...
n German Silver Wire ... ... ,,	2/2	...
h Gutta-percha, fine ... ... ,,	8/-	...
h India-rubber, Para fine ... ... ,,	1/5	...
l Iron Pig (Cleveland No. 3.) ... per ton.	75/-	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English pig ... ... ,,	£25 5s.	20/- dec.
g Mercury ... ... per bot.	£22 15s. to £23	...
e Mica (in original cases) small ... per lb.	3d. to 8/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	...
p ,, ,, rolled strip & sheet ,,	1/2¾	...
p ,, ,, wire... ... ,,	1/3½	...
o Platinum ... ... per oz.	£23	...
d Silicium Bronze Wire ... ... per lb.	10½d.	...
r Steel, Magnet, in bars ... ... ,,	7½d.	...
n Tin, Block (English) ... ... per ton.	£288 5s. to £288 15s.	£5 15s. to £6 5s. dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co,. Ltd
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
W. F. Dennis & Co.

Reporting under date May 14th, Messrs. James Forster and Co. state that lead arrivals this month "are light, and it is to be hoped that this is the forerunner of smaller imports in future, in order to give the market a breathing space in which to absorb the warehouse stocks, and so get on to a healthier basis. It seems more probable that relief will come from a decrease in supplies rather than from an increase in consumption." Board of Trade returns for April, 1927:—Imports, 28,169 tons; exports, 1,682 tons; leaving for home absorption, 26,487 tons.

Lighting and Power Notes.

Alderley Edge.—PURCHASE OF UNDERTAKING.—The Urban District Council has decided to join with the Wilmslow Urban District Council in negotiations for the purchase of the undertaking of the Alderley and Wilmslow Electric Supply, Ltd. Subject to an agreement to purchase being arrived at a Special Order providing for joint working will be applied for, together with powers to supply electricity in the two towns, and also to portions of the rural districts of Bucklow and Macclesfield and the urban district of Handforth.

Argentina.—ELECTRICAL DEVELOPMENT.—The output of the power stations in Buenos Aires of the Compania Hispano-Americana de Electricidad (Chade) during the past year amounted to 534,002,536 kWh, an increase of 37,304,144 kWh over 1925. The number of consumers increased by 23,346, bringing the total up to 229,666, representing a load of 624,282 kW. At the main Dock-Sud power station the extensions are approaching completion. The fourth, fifth and sixth 25,000-kW turbo-generators are now in operation, and a seventh set of the same capacity will be ready for work by the opening of the next Argentine winter season. In order to meet the prospective increase in demand, orders have been placed for two new 40,000-kW sets, which, it is hoped, will be ready for working by the winter of 1928. Preparatory work on the new super-power station which is to be established by the company in Buenos Aires is now in progress, cementing operations in connection with the foundations having lately been commenced.

In the Buenos Aires suburb of Avellaneda the company is now supplying electricity to 21,444 consumers, as against 18,400 a year ago, the sales during 1926 having totalled 33,566,647 kWh, as compared with 30,305,626 kWh in 1925.

The Compania Empresa de Luz y Fuerza of Mendoza increased its output facilities during the past year by the inauguration in May of its hydro-electric plant at Cachenta. The company is now supplying energy to 12,993 consumers, the sales last year having amounted to 11,040,102 kWh, an increase of 2,049,509 kWh over 1925.

Australia.—BUNNERONG POWER STATION.—According to the *Industrial Australian and Mining Standard*, considerable progress is being made in the erection of the power house at Bunnerong, which is being undertaken by the Sydney City Council. The total cost will be about £6,000,000. A feature of the work is the construction of twin tunnels, each three-quarters of a mile in length to provide 100,000,000 gallons of water an hour for condensing purposes. The drive is almost completed. On top, steam navvies, pneumatic drills, and a giant sluicing plant are transferring 140 cubic yards of rock and soil an hour into 26 acres reclaimed from the sea. Foundations for the boiler house, and the ashpits for the 18 boilers in the first section of the undertaking, are rapidly nearing completion. Erection of the steel framework of the building has commenced. It is stated that the work is well up to schedule time.

FORBES (N.S.W.).—Mr. R. T. Hole, supervising engineer for the Department of Public Works, Bathurst, held an inquiry recently into the Municipal Council's proposal to borrow £14,600 for the purpose of establishing an electricity undertaking. The total cost of the proposed work is to be £32,000.

Barnsley.—SUPPLY FOR HOUSING ESTATE.—The Corporation Electricity Committee has recommended that the mains be extended to the Cundy Cross No. 2 housing scheme (139 houses), and provision made for public lighting, at an estimated cost of £1,342.

Bedford.—LOAN.—The Town Council has applied for sanction to a loan of £8,700 for the supply of electricity in the Ampthill district. Subject to the consent of the Ministry of Transport, overhead cables will be used.

Bradford.—NEW TRANSFORMER CHAMBER.—The Corporation Electricity Committee has prepared a scheme for the provision and equipment of a district transformer chamber on the Low Well estate in Bolton Road district, at a total estimated cost, including land and the laying of distributing mains, of £7,538.

Brentwood.—INSTITUTION SUPPLY.—The Essex Asylums Committee has adopted an electricity scheme for Brentwood Asylum, at an estimated cost of £22,700. The Committee proposes to install its own plant and to substitute electricity for gas for lighting purposes.

Bristol.—EXTENSION OF SUPPLY.—In connection with the Corporation's application for an Order extending its area of electricity supply so as to include areas immediately outside the existing area, the Electricity Commissioners required an undertaking from the Corporation that mains would be laid in part of the area applied for within a period of two years from the date of the Order, if granted. The Electricity Committee has recommended the Council to give the required undertaking so far as it relates to mains in the parishes of Almondsbury, Tockington, and Olveston in the rural district of Thornbury. The estimated cost of laying mains in these parishes is £21,995, and the Committee is satisfied that the return upon the capital outlay involved will be satisfactory.

Burton-on-Trent.—BOILER PLANT EXTENSIONS.—At an Electricity Committee meeting the electrical engineer submitted a report regarding extensions to the boiler house, and recommended that two additional 40,000-lb. boilers, complete with stokers, &c., be installed, that the old Lancashire boilers be removed, the old boiler house roof be raised to take one boiler, and that the new boiler house be extended for the second boiler. The bunkers would be extended, together with the coal handling plant. The total cost of these extensions would be approximately £40,000. The Committee has approved the report.

Canada.—NEW E.H.P. LINE.—Permission has recently been granted by the Public Service Commission of Quebec to the Shawinigan Water and Power Co. to connect up the Anglo-Canadian Pulp and Paper Co.'s plant at Limoilu, near Quebec, with a 154,000-V transmission line. Power is being taken from the Duke-Price development on the Saguenay River at Ile Maligne, over 100 miles way, where the addition of two units last year brought the capacity up to 450,000 h.p.

ONTARIO.—A preliminary statement relating to the past year's working of the Hydro-Electric Power Commission of

Ontario shows that the combined revenue of the municipal undertakings served was $22,677,999, as compared with $20,419,115 in 1925, while the expenditure rose from $19,338,837 to $21,500,911. The net surplus thus increased from $1,080,278 to $1,177,811. Only 25 municipalities showed net deficits as compared with 42 in 1925. The percentage of net debt to total assets was reduced from 57.2 to 55.5.

Carlisle.—ELECTRICITY IN BULK.—The Electricity Committee has received an application from the Gretna and District Electric Supply Co., Ltd., to supply electricity in bulk, and intimating that the company had been in communication with the Electricity Commissioners with a view to an application being made for a Special Order. The Committee is to confer with the directors of the company as to the terms and conditions upon which a supply could be afforded.

Colne.—YEAR'S WORKING.—Mr. J. H. Thompson, borough electrical engineer, informs us that for the year ended March 31st last the revenue from the electricity undertaking amounted to £38,014, as compared with £33,676 in the previous year. Working costs increased from £19,510 to £24,385, leaving a gross profit of £13,629 (£14,166). After providing for capital charges, there was a net profit of £1,685, as compared with £3,173 in the preceding year. The maximum supply demanded decreased from 1,858 kW to 1,692 kW. The results of the year have been materially affected by the prolonged coal stoppage, but nevertheless the sales of electricity increased by 249,061 kWh to 3,420,164 kWh.

Continental.—POLAND.—La Société des Reseaux Electriques, which holds the concession for the supply of electricity in the towns of Sosnowice, Zabkowice, Zawiercie, Mijskow, Lodz, and the suburbs of Czenstochowa has nearly completed its distribution system, and hopes to be able to commence supply in the latter half of the current year. The company has entered into an arrangement to draw its electricity supply from the power station of the Société Centrale Electrique du Bassin de Dombrowa, the capacity of which is being increased from 10,000 to 22,000 kW.

PORTUGAL.—The Sociedad Union Electrica Portugesa has recently completed a steam-operated power plant with a capacity of 10,000 h.p., as a reserve for the Lima hydro-electric power station.

FRANCE.—The Paris City Council will have under consideration in June a report relating to the extension of the production and distribution of electricity in view of the growing demands. A special report has been presented to the City Council by the Prefect of the Seine, pointing out the necessity for a decision on the matter being arrived at in the immediate future. As under the most favourable circumstances it is impossible to envisage the practical execution of the scheme referring to the transport of energy from the Massif Central to Paris before 1933 or 1934, it is suggested that provision should now be made for the addition of a new steam power station of 100,000 kW. One solution would lie in the construction of a city works at Orby at a cost of 225 million fr., and a second would be the establishment of one at Vitry. The second solution would be less onerous, as it would involve an expenditure of 175 million fr., and it is this latter which is recommended by the Prefect to the Council.

GERMANY.—It is reported that the great Klingenberg power station of the Berlin Electricity Works has now been completed and put into service. The station comprises three main turbines, with a maximum capacity of 80,000 kW each, three other turbines of 10,000 kW each, and 16 boilers. There are six coal pulverisers. The City of Berlin has already invested some £3,500,000 in the station, and further sums will be required in the autumn to commence extensions, as the station in its present stage can only supply the demands of Berlin until 1930.

Craven (Yorks.).—ELECTRICITY SUPPLY.—The Electricity Commissioners have announced their decision with regard to the applications made last autumn for Electricity Orders in the Craven area of Yorkshire. That of the Electrical Distribution of Yorkshire, Ltd., with regard to Barnoldswick, Earby, Silsden, and 26 parishes in the Skipton rural area is refused, as also is that of the Keighley Corporation with regard to Silsden, Cowling, Farnhill, Glusburn, and Kildwick, while those of the Barnoldswick and Earby Urban District Councils for powers in their own townships are granted. The Silsden Council's application for its own area will be decided later. The Commissioners have intimated that they are prepared to proceed with the consideration of the application by the Electrical Distribution of Yorkshire, Ltd., regarding the remaining part of the area in the Skipton rural district.

Gainsborough.—ELECTRICITY SCHEME.—All the preliminary work in connection with the Council's electricity scheme has been completed, and a supply will be shortly available. The Council has decided to extend the mains to the new housing site at a cost of £3,000. The cost of wiring the new houses will be about £3 per house. The following scale of charges for the hire-purchase of fittings has been adopted:—Two points, 1s. 3d. per month for 120 months, 2d. per month being added for each light up to five and 3d. per month for each light from five to 20.

Hazel Grove and Bramhall.—LOANS SANCTIONED.—The Urban District Council has received sanction to loans of £8,000 for e.h.p. mains and £12,000 for l.p. mains, being part of an application for £35,000.

Kendal.—ELECTRICITY SUPPLY.—The Town Council has decided to engage an expert to advise on further extensions to the electricity works. As a bulk supply will not be available for at least five years, the Electricity Commissioners have recommended the Council to install two 335-kW crude oil engine sets which will meet the town's requirements for the next five years, one of the sets to be a spare.

Kirkcaldy.—ELECTRICITY EXTENSIONS.—The Town Council on May 9th approved a report on the extension of the Corporation electricity undertaking, involving an expenditure of £123,500, and agreed to carry out immediately the first part of the scheme at a cost of £87,200. The second stage, estimated to cost £36,300, has been postponed until it is found to be necessary. It was also agreed to apply for sanction to borrow £87,200 to meet the cost of the first part of the scheme. The report by Messrs. Kennedy & Donkin recommended that the Corporation should change its l.p. distribution system from d.c. to a.c. in two stages. The first stage would affect the outlying areas to the north and south and would necessitate the laying of a new distributing network and mains and the erection of static transformer substations. The second stage would be carried through during the next five to seven years. It affected the centre area, and therefore the change-over should be progressive. It should start with the completion of the first stage on the fringes of the central d.c. area, and should progress inwards as the load increased and as conditions arose. The capacity of the transforming plant in the new sub-stations proposed would meet the demand for the next ten years, but at a later date it would be necessary to build additional sub-stations interposed between the others. It is considered that, as far as possible, the Corporation should discontinue taking the load of factories on its l.p., d.c. network, and that these factories should be supplied from its other mains. It would be impracticable to change over all of them at once. It is expected that the work will begin in August, and that certain parts will be completed by the end of next winter.

Leicester.—ELECTRICITY EXTENSIONS.—The Electricity Committee has submitted to the City Council a report prepared by the engineer and manager (Mr. T. R. Smith) on proposed extensions to the electricity undertaking, involving an estimated expenditure of £640,000, and the provision of additional mains, services and meters to meet requirements during the next two years, at an estimated cost of £183,000. The extensions include new buildings, cooling towers, coal and ash-handling plant (£194,000), two 25,000-kW turbo-alternators with condensing plant, and four boilers (£446,000), mains and services (£163,000), and meters (£20,000). The engineer estimates that when these extensions have been completed the cost of generation and distribution, including the additional charges for interest and sinking fund, will be reduced by about 13 per cent., and that the needs of the city will be met for the next seven years. The Council has adopted the report, and application is to be made to the Electricity Commissioners for sanction to the scheme.

Lincoln.—LOAN.—The Town Council has applied for sanction to a loan of £39,600 to cover the cost of a scheme for the supply of electricity in the south-west part of the city, and for extensions.

London.—CHISWICK.—The Conference of Local Authorities Owning Electricity Undertakings in Greater London has considered the scheme which is being promoted by the London and Home Counties Joint Electricity Authority for the purpose of enabling the Authority to acquire a site at Chiswick for the erection of a principal power station to deal with the demand for electricity in the west and north-west electricity district. The Conference agrees in principle with the proposal, it being considered highly desirable that the station should be owned and operated by the Joint Authority. The Conference is also of opinion that the erection of the station should be expedited.

Manchester.—PROGRESS DURING MARCH.—During the month of March the Corporation electricity undertaking showed an increase in connections of 12,170 kW, bringing the total to 316,638 kW; and the number of applications received for supply, including consumers for additional supplies, was 1,138, representing a total of 3,305 kW. The number of hired cookers connected increased by 112, bringing the total actually on circuit to 3,029. Applications for the hire of cookers totalled 166. Two new sub-stations were put into commission at Burnage and Droylsden (West), and additional plant installed at three existing sub-stations.

Malvern.—NEW CABLE.—The Urban Dsitrict Council is to lay a duplicate h.p. feeder cable from the electricity works to Malvern Links in order to provide an alternative supply for the West Malvern and Malvern Links areas, at an estimated cost of £1,284.

Peterborough.—NEW ELECTRICITY CHARGE.—The Town Council has adopted a new two-part domestic tariff, the basis of which is 12½ per cent. on the ratable value of the premises, plus £1 per annum service charges, and 1d. per kWh for electricity consumed

Portsmouth.—Loan.—The Corporation Electricity Committee is applying for sanction to a loan of £125,000 for mains and services.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Newmarket.—*The Newmarket Electric Light Co., Ltd.*—Lighting: Reduced to 10d. per kWh. Power and heating: Reduced to 6d. per kWh.

Stroud (Glos.).—*The Stroud Electric Supply Co., Ltd.*—An all-round reduction of 1d. per kWh.

Pembroke (Dublin).—Lighting: A reduction of 1d. Cooking, heating, and power: A reduction of ½d. per kWh.

Shoreditch.—Heating: The addition of 25 per cent., which has been in force since December last, has been withdrawn.

Plympton St. Mary.—Electricity in Bulk.—It was announced at a recent meeting of the Rural District Council that terms have been arranged for a bulk supply of electricity from Plymouth Corporation. The first districts which are to be supplied with electricity are Plympton, Plymstock, Crownhill, and Compton; tenders have been received and the work of linking-up will be commenced as soon as possible.

South Africa.—Simonstown.—The Municipal Council, which has hitherto obtained its electrical supply from the Naval Dockyard, has now completed arrangements for a supply from Cape Town Corporation. The latter authority will also give a supply to the village of Glencairn, near Simonstown.

Special Orders.—Applications have been made to the Electricity Commissioners for a Special Order by the Urban Electric Supply Co., Ltd., to extend its area of electricity supply so as to include certain parishes in the rural districts of Newbury and Kingsclere.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising Gloucester Corporation to supply electricity in the rural district of Gloucester, and the Torquay Corporation to supply within parts of the rural districts of Newton Abbot and Totnes.

Stourport. — Inauguration of Power Station. — The generating station of the Shropshire, Worcestershire and Staffordshire Electric Power Co. is to be formally inaugurated by the Premier and Mrs. Baldwin on June 2nd.

Stretford.—Loans.—The Urban District Council is to apply for sanction to the borrowing of £20,000 for l.p. mains and services, and £8,520 for h.p. mains.

Torquay.—Electricity Extensions.—The Corporation is to erect a sub-station at Thatcher Pines, and lay h.p. and l.p. mains, at an estimated cost of £3,361, in order to provide a supply of electricity to the Ilsham Marine Drive district.

Tunbridge Wells.—Electricity in Bulk.—The Town Council has arranged to give a bulk supply of electricity to the Crowborough District Gas and Electricity Co. for a period of ten years, terminable by 24 months' notice, such notice not to be given without the consent of the Electricity Commissioners. The price is to be £2 5s. per kVA of maximum demand, plus 1d. per kWh.

Wakefield.—Street Lighting.—After considering a report of the electrical engineer, together with a statement by the street lighting superintendent, showing the comparative costs of gas and electricity for street lighting, the Corporation has decided to invite an expert to report on the street lighting system, and outline the best methods of development under local conditions. Data are to be obtained showing the complete costs of gas and electricity for lighting along streets where mains are already laid.

Tramway and Railway Notes.

Bournemouth.—Loan.—The Town Council is to apply for sanction to a loan of £18,000 in connection with the doubling of the tramway track from the Cemetery Junction to the top of Rochmond Hill.

Continental.—Italy.—The newly-electrified line between Pistoia and Bagni-della-Perretta will be opened on May 24th. The plant is practically completed and the rolling stock is on the spot. On October 28th the entire electrified line between Florence and Bologna will be formally inaugurated.—*Reuter's Trade Service* (Milan).

The length of electrified railways in Italy at the end of 1926 was 1,093 km. To this should be added the Pistoia-Perretta line and 132 km. from Bologna to Florence mentioned above. Of the lines constructed, 605 km. are double track and 488 km. single. The traction system is 3-phase, 3,700 V, with two aerial phases, except on the Milan-Varese-Porto Ceresio and the Naples-Pozzuoli lines, which are operated with d.c. at 650 V. Included in the above total is a line of 11 km. in French territory operated on account of the Paris-Lyons-Mediterranée Company.—*Reuter's Trade Service* (Rome).

East Ham.—Doubling of Track.—The Corporation Tramways Committee has had under consideration the report of a conference convened by the L.C.C. relative to the cost of the duplication of the tramway track at the "Bull" Corner, Barking, and recommends that the action taken by the delegates in agreeing to bear a proportion of the annual capital charges of reconstruction be approved, subject to the other authorities concurring with the proposals.

India.—Railway Electrification.—The development of the suburbs of Calcutta and the expansion of the city with a view to relieving congestion and to counteracting soaring house rent has been the concern of the Government of Bengal for nearly a decade. According to *Indian Engineering*, a comprehensive scheme for the electrification of the suburban railway system has been drawn up by the Eastern Bengal Railway and submitted for consideration to the Railway Board. No details of the scheme, however, are at present available. If approved by the Railway Board, the scheme will be submitted to the Secretary of State in Council for sanction.

Japan.—Electric Railway Schemes.—It is reported that the Nügata Electric Co., Ltd., has applied for a charter in connection with a scheme for the construction of an electric railway between Nügat and Yahiko, a distance of 21 miles. The cost of the scheme is estimated at 2,000,000 yen.

The Municipal Council of Tokio has applied to the Government for sanction to commence work on the construction of underground railways in the city, at a cost of 17,000,000 yen.

With regard to the electrification of lines of the South Manchurian Railways, it is understood that it has been finally decided to electrify the Dairen, Fushun, Aansan, and some other lines, commencing the work of construction in the fiscal year of 1928-1929.

Liverpool.—Loan Sanctioned.—The Corporation Tramways Committee has received sanction to the borrowing of £100,000 for the erection of a new car shed, works and offices at Edge Lane.

Wolverhampton.—Transport Development.—According to the *Electric Railway and Tramway Journal*, important developments in connection with the transport facilities between Wolverhampton and the Black Country are foreshadowed in an announcement that the Corporation has come to an agreement with the Wolverhampton and District Electric Tramways Co., Ltd., for the purchase of the company's interests from the borough boundary to Bilston, to the Bull Stake, Darlaston, and also from the Square at Willenhall to the Fighting Cocks, which is the borough boundary on the Dudley route from Wolverhampton. It is proposed to remove the existing tramway track from these roads, to introduce railless cars on the route to Darlaston, and to run motor-omnibuses on the section from Willenhall to the Fighting Cocks. This is in accordance with the policy of the Corporation to scrap the tramway on all routes, and to substitute either railless cars or omnibuses.

Telegraph and Telephone Notes.

Belgium.—Long-distance Telephony.—At the annual meeting at Charleroi of the Société des Ateliers de Constructions Electriques, the chairman reported that good progress was being made with the new telephone cables for the Belgian Post and Telegraph Authorities. That between Brussels and La Panne was completed some time ago and had successfully passed all the tests. The Brussels-Rosendael cable had been laid, and that between Brussels and Lille was well in hand. As a result of the successful carrying through of this contract the company had now been entrusted with the order for the telephone cables between Brussels and Luxemburg, and between Brussels, Charleroi, and Mons.

New Zealand.—Telephone Repeaters.—The increase in telephone traffic and a demand for telephone communication between the two islands comprising the Dominion have resulted in the laying of the first submarine telephone cable across Cook's Strait, which separates the North and South Islands. Siemens Brothers & Co., Ltd., of Woolwich, have supplied a four-core, continuously-loaded, gutta-percha insulated cable, which has been laid between Wellington and Seddon (a small station on the South Island), its length being 45 nautical miles. It will provide three telephone circuits: two physical and one phantom. To enable the cable to be linked with the long trunk land lines on either side, Siemens Brothers also supplied telephone repeater stations, one at Seddon and one at Wellington. They are two-wire cord circuit repeaters, and can be connected to any of the trunk wires radiating from the cable-terminating stations. Although the installation of this equipment is as yet far from complete use was made of it recently in connection with the visit of

the Duke and Duchess of York to the Dominion, when conversations took place between Wellington and Dunedin, over 400 miles to the south, at 36 hours' notice.

Russia.—AUTOMATIC TELEPHONY.—In the latest bulletin issued by the L. M. Ericsson Co., of Stockholm, Sweden, it is stated that the Company is to build and equip a 10,000-line exchange for the city of Rostov in South Russia. At present the Company has under construction no fewer than 18 automatic exchanges, of which three are in Sweden, one in Norway, one in Holland, eleven in Italy, one in Poland, and one in South Africa.

The Telephone Service.—GROWTH IN 13 YEARS.—Figures showing the growth of the telephone service since the Post Office took it over in 1912 have just been issued by the Board of Trade. When the Post Office took charge, there were 730,821 stations (telephone instruments) in use, and 797,000,000 local calls were made. In 1925 and 1926 there were 1,390,156 stations and 1,016,000,000 local calls were made. This figure represents a lower calling rate per telephone than that of 1912. The war caused a heavy decrease in the number of local calls: in 1913 there were 834,000,000 calls, but during the four war years they fell to 776; 701; 700; and 716 millions respectively. In the first year following the war they jumped back to 848 millions. Trunk calls, on the other hand, rose during the war period from 38,200,000 to 46,500,000. The income from the service increased steadily over almost the whole period from 1912 to 1926, and was only slightly affected by the war: in 1911-12 it was £5,847,410, and in 1925-6 it was £16,163,206. The only set-back was a drop of nearly £1,000,000 immediately after the war, which fall was recovered in two years.

NEW ANGLO-BELGIAN CABLE.—The Postmaster-General announces that the laying of the new Anglo-Belgian telephone cable has been completed, and that improved service is now available between this country (both London and the provinces) and all the principal towns in Belgium. On May 15th the then current charges ceased to apply, and new rates and conditions of service came into force.

Transatlantic Radio-telephony.—COMMITTEE'S REPORT.—The report of the Committee on Transatlantic Wireless Telephony (H.M. Stationery Office, Cmd. 2,858, price 2d. net) outlines the history of the service, which was opened for commercial public use on January 7th, 1927. The Committee, which has completed its work, recommends that the improvement of the present partially secret system should be pressed to a conclusion by the British Post Office engineering staff in consultation and co-operation with the American Telephone and Telegraph Co.

United States.—UNUSUAL CABLE FAULT.—On April 3rd, the Alaska cable failing to function, the Government sent the cable ship *Dellwood* out from Seattle to locate the trouble. After several days' effort she located the break off Cape Flattery on April 7th, and the line was picked up in 600 fathoms of water. Attached to the twisted wires of the cable was a twenty-ton whale, which had severed the wires in several places and in some manner caught them fast in its jaws. The cable ship cut the whale loose and cast it adrift, but brought back several sections of the damaged cable to Seattle; the strands were so badly twisted that it was almost impossible to separate them. According to *T. & T. Age*, this is the second recorded case of a whale breaking an ocean cable, the Seattle-Sitka cable having previously been broken in the same manner 22 years ago.

Radio Notes.

Another "Wireless Exchange."—SECOND IN ENGLAND.—The second wireless "exchange" to be licensed in this country has started operations at Southsea. The owner is Mr. J. Tubb, who, with a four-valve receiver, is supplying his neighbours with broadcast programmes from the Daventry station at a charge of 1s. 6d. a week. The other exchange is at Southampton, and has been working for nine months. Would-be subscribers have first to obtain a wireless licence and to pay for a loud-speaker and a switch supplied to them by Mr. Tubb. The house is wired free of charge, and, by an automatic device, the first subscriber to switch on his loud-speaker switches on the valves of the receiver. So successful is the scheme, says the *Morning Post*, that the Southsea Corporation has granted permission for a line to be taken over a street, where it connects with another block of houses. Such schemes are working with success in New York.

Hungary.—LICENCES.—In March, 1927, the number of wireless subscribers in Hungary was 70,899, an increase of 1,868 during the month.—*Reuter's Trade Service* (Budapest).

United States.—RECEIVING SETS ON FARMS.—There are now 1,252,126 farms in the United States equipped with wireless receiving sets, the Radio Service of the Department of Agriculture announces in a report on its past season's work. The estimate was based on returns made by country agricultural agents, and showed a 126 per cent. increase on the estimated 553,008 sets on farms in July, 1925. Iowa led the States with 99,990 farm radio sets, or an increase of 160 per cent. since 1925. Indiana came second with 81,144, but this figure represented an increase of 377 per cent., as compared with the 1925 figures. American farmers are not using wireless merely for entertainment; the day's work is now planned according to the weather forecasts sent out by the Weather Bureau and received by radio much more quickly than was formerly possible; market reports issued by the Federal Bureau of Agricultural Economics are also eagerly followed.—*Reuter's Trade Service* (Washington).

PART-TIME STATIONS.—Twenty-eight of the forty-six broadcasting stations authorised to operate in New York City under temporary permits will be obliged to divide time, according to an announcement of the Federal Radio Commission. Fifty-seven stations were operating in New York City when the Commission took up its duties. Nine failed to apply for temporary permits. All stations in the New York area are now licensed at separation intervals of a minimum of twenty kilocycles, says *World Radio*, and in many cases thirty, forty, and fifty kilocycles' separation between stations has also already been arranged.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Aberdare.—June 2nd. Electricity Department. E.h.p. overhead and underground main and branch transmission lines. (May 13th.)

Armagh.—June 7th. Urban District Council. Heavy oil engine generating plant, underground and overhead mains. (May 13th.)

June 7th. A.c. switchboard and overhead travelling crane. (See this issue.)

Australia.—MELBOURNE.—July 5th. State Electricity Commission. One 15,000-kW steam turbo-generator and accessories. (B.X. 3369.)*

July 4th. 66,000-V and 22,000-V insulators for the Yallourn brown coal scheme. (May 6th.)

June 28th. Postmaster-General's Department. Jacks, switchboard instruments, &c. (B.X. 3474.)*

SYDNEY.—June 20th. Municipal Council. Turbo-alternators for Bunnerong power station. (B.X. 3443.)*

Basingstoke.—June 7th. Corporation. Electrical installations at the Council's housing estate (approx. 1,015 wiring points). (May 13th.)

Chile.—SANTIAGO.—July 18th. Chilean State Railways. Materials for electric lighting and power (Group 30). Materials for electric lighting of locomotives and coaches (Group 32). August 22nd. Signalling, telegraph and telephone supplies (Group 36.) (C.X. 2271.)*

Darlington.—May 23rd. Electricity Committee. One 500-kW rotary convertor, with transformer. (May 6th.)

Dublin.—May 23rd. Electricity Department. Pipework for a 5,000-kW turbo-alternator. (May 6th.)

Dundee.—May 25th. Council Fire Department, 27 cast-iron fire-alarm telephone boxes, the price to include delivery at the Central Fire Station.

Edinburgh.—May 23rd. Education Authority. Electric installation at Abbeyhill (New), Dalry, and Victoria schools. Schedules from the offices of the Authority.

Egypt.—CAIRO.—June 4th. Egyptian State Railways, Telegraphs and Telephones, Chief Inspecting Engineer, Queen Anne's Chambers, S.W. Underground cables (approx. £E12,000 to £E13,000).

May 28th. Ministry of Education. Electrical equipment for Beni Suef Trades School. (B.X. 3488.)*

Epsom.—Electricity Department. E.h.p. cable. (May 6th.)

Glasgow.—May 23rd. Corporation. Electric lighting installation for McNeil Street Rehousing Scheme. Specifications, &c., from Mr. R. B. Mitchell, engineer, 75, Waterloo Street.

Grimsby.—June 4th. Electricity Department. Sub-station equipment. (May 13th.)

Hull.—June 16th. Electricity Department. Steel coal bunker and conveyor housing. (See this issue.)

India.—June 14th. India Stores Department, Simla. Generating sets for Fyzabad power station. (B.X. 3486.)*

Ilford.—June 1st. Electricity Department. E.h.p. and l.p. paper-insulated cables. (See this issue.)

London.—H.M. Office of Works.—May 27th. Incandescent electric lamps. (See this issue.)
June 3rd. 5-ton gantry crane. (See this issue.)
Hammersmith.—June 1st. Electricity Department. Cables, transformers, h.p. switchgear and ironclad feeder switchgear. (See this issue.)

Manchester.—May 30th. Electricity Department. L.p. valves for circulating water system, two electrically-driven and one steam-driven boiler feed pumps. (May 13th.)
June 1st. Education Committee. Electric lighting installation at Levenshulme High School for Girls. Specification, &c., from Education Offices, Deansgate.

Middleton.—May 23rd. Wiring for electric light, Rhodes Council School. Specification from borough electrical engineer, Corporation Street, Middleton.

New Zealand.—Auckland.—July 4th. Auckland Electric Power Board. Switchgear. (B.X. 3471.)*

Pudsey.—June 14th. Electric light installation at the School of Art. Specifications from Education Department, County Hall, Wakefield.

Richmond-on-Thames. — May 23rd. Municipal Water Department. Electrically-driven centrifugal pump, with motor, &c. Mr. H. P. Williamson, engineer, Riverside.

Scarborough.—June 3rd. Corporation. Installation of electrical pumping plant in duplicate for the new Irton water scheme No. 2. Specifications (£5) from Dr. H. Lapworth, engineer, 25, Victoria Street, S.W.

South Africa.—Cape Town.—June 30th. South African Railways and Harbours Board. Gasfilled and vacuum lamps for 12 months. (B.X. 3518.)* Telegraph material (B.X. 3519.)*

Stirling.—May 27th. Corporation. Electrical work at 96 houses. Specifications from Mr. Andrew H. Goudie, burgh surveyor.

Tynemouth.—June 11th. Electricity Department. One voltage regulating transformer. (May 13th.)

Whitley.—Electricity Department. One 1,000-kW turbo-alternator, with condenser, pumps, air filter, &c.; one 200-kW semi-Diesel or heavy-oil engine alternator. (May 6th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Barnes.—Urban Council. Accepted:—
Duplicate 1,000-kW rotary convertor panel (£230).—English Electric Co., Ltd.

Birkenhead.—Electricity Committee. Accepted:—
Panel at Sungleton Avenue sub-station (£117).—Ferguson, Pailin, Ltd.
Cubicle at Heath Road sub-station (£143).—Metropolitan-Vickers Electrical Co., Ltd.

Burton-on-Trent.—Electricity Committee. Accepted:—
Six 25-kVA transformers (£266).—British Electric Transformer Co., Ltd.

Bury St. Edmunds.—Electricity Committee. Accepted:—
Feeder cable (£690).—Callender's Cable & Construction Co., Ltd.

Croydon.—Libraries Committee. Recommended:—
Electric light installation, Ashburton library (£122).—A. E. Cook.
Electricity Committee. Accepted:—
Artesian well (£1,108).—Le Grand Sutcliffe & Gell, Ltd.

Dartford.—Electricity Committee. Recommended:—
Supplying and laying cable at East Hill (£1,953).—Power Lines Construction Co., Ltd.

Douglas (I.O.M.).—Electricity Committee. Accepted:—
Contract for mains (£6,259).—Siemens Bros. & Co., Ltd.

Dundee.—Corporation Cleansing Committee. Accepted:
Installing electric light at Broughty Ferry Cleansing Depôt.—Marshall, Hutton & Co.

East Ham.—Electricity Committee. Recommended:—
Cable (£4,314).—Enfield Cable Works, Ltd.
Four feeder panels (£326).—Bertram Thomas.

Gravesend.—Electricity Committee. Recommended:—
Removing existing 200-kW units from Queen Street to El Teb and providing a 600-kW induction regulator controlled extension at Queen Street (£4,664).—Hewittic Electric Co., Ltd.

Hull.—Education Committee. Accepted:—
Installation of electric light at Park Avenue School (£376).—Alexander Shaw & Sons.

Ilford.—Electricity Committee. Recommended:—
100-kVA transformer (£116).—Foster Engineering Co., Ltd.
500-kW convertor with automatic control and B.E.T. type transformer (£3,441).—Crompton & Co., Ltd.
1,000-kW rotary convertor (£6,608).—Metropolitan-Vickers Electrical Co., Ltd.
Pavement frames and covers.—W. T. Henley's Telegraph Works Co., Ltd.
Meters.—Edison Swan Electric Co., Ltd.; Ferranti, Ltd.; R. Hornby & Co., Ltd.; Landis & Gyr, Ltd.; and Measurement, Ltd.

India.—India Store Department. Accepted:—
26,775 inert dry cells.—Fuller Accumulator Co. (1926), Ltd.

Irish Free State.—Commissioners of Public Works. Accepted:—
Electric lighting installation at the Custom House, Dublin.—Gleeson, O'Dea & Co., Ltd.—*Irish Builder and Engineer.*

Lamp Contracts.—Renfrewshire Combination Hospital has placed a contract for metal filament lamps with Edison Swan Electric Co., Ltd.
The General Electric Co., Ltd., has received contracts from the General Post Office for 75,000 Robertson carbon-filament telephone switchboard lamps, and from Turton Urban District Council for a 12 months' supply of "Osram" metal-filament vacuum lamps.

Leeds.—Tramways Committee. Accepted:—
Electrical sundries.—Electric and General Stores, Ltd.; British Thomson-Houston Co., Ltd.; L. Andrew and Co.; Micanite & Insulators, Ltd.; Insulation Manufactures, Ltd.; and Hammett & Andrew.
Electrodes.—G. D. Peters & Co., Ltd.
Electricity Committee. Accepted:—
Cable (£2,465), Macintosh Cable Co., Ltd.; (£894), Enfield Cable Works, Ltd.
Parks Committee. Accepted:—
Three electric launches (£600).—R. F. Winder, Ltd.

London.—St. Pancras.—Contract and Stores Committee. Recommended:—
L.p. cable (£1,005).—Hackbridge Cable Co., Ltd.
H.p. cable (£224).—Siemens Bros. & Co., Ltd.; (£320) Standard Telephones & Cables, Ltd.
Davison patent flue dust collector (£1,895).—International Combustion Co., Ltd.
London County Council.—Education Committee. Accepted:—
Electric wiring and fittings at Drayton Park school (£290).—Bailey & Incledon, Ltd.
Bermondsey.—Maternity Committee. Accepted:—
Lighting plant at Fairby Grange Institution.—Broadwell Engineering Co.
Westminster.—Housing Committee. Recommended:—
Electric wiring and fittings at Drayton Park school (£290).—Rashleigh Phipps & Co.
Crown Agents for the Colonies. Accepted:—
Tram lighting cells in wood-lined containers.—Fuller Accumulator Co. (1926), Ltd.

Manchester.—Electricity Committee. Accepted:—
Two 250-kVA and three 500-kVA transformers.—Bruce Peebles & Co., Ltd.

Prestwich.—Highways Committee. Accepted:—
Electric lamps.—Edison Swan Electric Co., Ltd.

Swansea.—Education Committee. Accepted:—
Electric wiring, Sketty mixed school (£130), Cole & Day; Sketty infants' school (£135), H. Norman Kirk; Cwmbwrla school (£137), G. L. Ward & Co.
Electricity Committee. Accepted:—
Auxiliaries for 10,000-kW set (£1,805).—Hick, Hargreaves and Co., Ltd.
Steam-driven boiler feed pump (£585).—G. & J. Weir, Ltd.

Torquay.—Electricity Committee. Accepted:—
2,000-kVA transformer (£1,140).—C. A. Parsons & Co., Ltd.
Switchgear (£797).—British Thomson-Houston Co., Ltd.
50-ton travelling crane at Newton Abbot (£2,400).—Royce and Co.

Wakefield.—Electricity Committee. Accepted:—
Renewing battery of electric vehicle (£138).—Chloride Electrical Storage Co.

Wrexham.—Town Council. Accepted:—
Installing electric light at houses at Acton Park at £562.—William Bright.

Forthcoming Events.

Association of Mining Electrical Engineers (North of England Branch).—Saturday, May 21st. Annual general meeting.

Faraday Society.—Wednesday, May 25th. 8 p.m. Annual general meeting.

Institute of Wireless Technology.—Wednesday, May 25th. 71, Kingsway, W.C.2. 7 p.m. Annual general meeting.

Incorporated Radio Society of Great Britain.—Wednesday, May 25th. Institution of Electrical Engineers, London. 6 p.m. "The Hot Wire Microphone and Audio Resonant Selection." Mr. G. G. Blake.

Institution of Production Engineers.—Friday, May 27th. 83, Pall Mall, S.W. 7.30 p.m. "Rate Fixing." Mr. J. Ronald.

Physical Society.—Friday, May 27th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

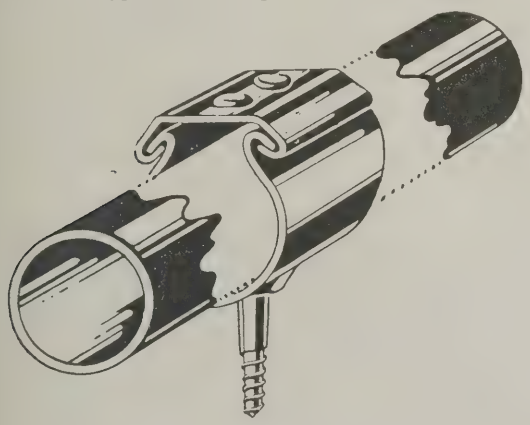
Incorporated Municipal Electrical Association.—May 30th to June 4th. Buxton. Annual Convention.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the name and address of makers of the following:—

A "D" type conduit clip as illustrated below.



Notes.

The First European 380-kV Transmission Line.

With reference to the note under the above heading on page 765 of our May 13th issue, we understand that, while the hollow conductor has been calculated to prevent corona discharge taking place at 380 kV, its operating pressure will not be so high as that. The line will operate at 220 kV.

Fatalities.

Whilst employed at the Bridgend electricity works, Jack Power, a driver, recently came into contact with "live" apparatus and received a fatal electric shock.

Thomas Owen Thomas, assistant crane-driver at the Margam Iron and Steel Works, Port Talbot, received an electric shock which proved fatal.

The L.C.C. Tramways.

At a recent meeting of the London County Council, Mr. C. W. Matthews discussed the estimates of the tramway undertaking showing an estimated net deficiency of £302,114 for the financial year 1926-27, and of £222,439 for 1927-28. *The Times* reports that Mr. H. Morrison maintained that the tramway undertaking could not be regarded simply as a commercial concern. It was a public service, which tended to keep all traffic fares down to a reasonable level. The present estimates were somewhat misleading, because they did not make it sufficiently clear to the public that repayment of debt was included in the deficit. Mr. J. D. Gilbert said that, taking the deficits of the last seven years, he found that, on deducting redemption of debt, there was really a profit on working. Last year's figures would have been much more favourable had it not been for the general strike. Mr. Angus Scott pointed out that the present competition made it impossible for the tramway undertaking to pay its way. It remained to be seen what help the Ministry of Transport would afford, for it was unwise to extend the system unless there was some guarantee of a reasonable return.

Appointments Vacant.

Lady demonstrator (70s.) for the Liverpool Corporation Electricity Supply Department. Junior charge engineer for the Borough of Loughborough Electricity Department. Colliery electrician (£400) for the Government of Nigeria. Deputy borough electrical engineer (£605), for the Corporation of Hastings Electricity Department. Head of Electrical Engineers' Department (£500), for the Rutherford Technical College. (See our advertisement pages to-day.)

I.E.E. Annual Meeting.

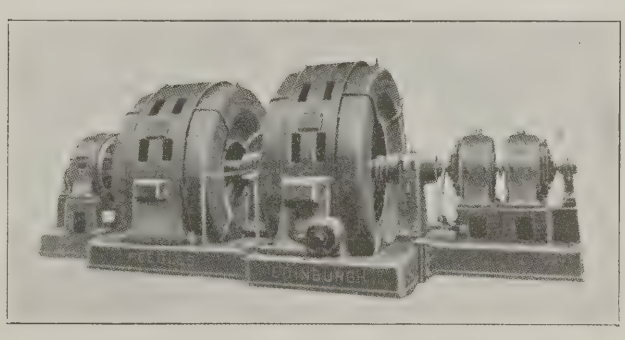
CORRECTION.—In the report of the annual general meeting of the Institution of Electrical Engineers on page 778 of our May 13th issue the remarks of Mr. W. A. Erlebach, B.Sc., M.I.E.E., were ascribed to Mr. Hurlbatt. The error is regretted.

Electrical Equipment for an Airship.

An interesting contract for the complete electrical equipment of a new airship, which will be much larger than any hitherto constructed, has been placed with the Metropolitan-Vickers Electrical Company. The new giant dirigible is the R100, which is being built at North Howden, Yorkshire, by the Airship Guarantee Company, Ltd. It will have a capacity of 5,000,000 cubic feet of gas, and accommodation will be provided for 100 passengers and 50 crew. The electrical equipment is to provide a service for compartment and navigation lighting, compartment heating, cooking and water heating, and wireless signalling. A direct-current system has been adopted, and a special scheme has been worked out by the Metropolitan-Vickers Company to meet the unusual requirements, in which considerations of safety and minimum weight of apparatus are of paramount importance. Two 25-kW generators are to be installed in the machinery cars, where they will be driven by the small petrol engines which will be used for starting the main driving engines of the ship. Casings of apparatus and most of the fittings throughout the ship will be of light alloys, while for the wiring system a cable with conductor and armouring sheath, both of aluminium, specially manufactured by Messrs. Glovers, Ltd., will be used. Safety features include a special protective system which will not only guard against damage to the equipment by overload or short circuit, but also ensure that open sparking cannot be produced by any fault on the line. The special construction of the wiring cable contributes to this protection. The armouring of the cable is strong, yet capable of considerable extension, so that in the event of undue strain the conductor will break first and the armouring will contract round the point of fracture, thus preventing any external spark. Flameproof casings will be used for all apparatus and fittings.

Electricity Supply in South Wales.

In connection with the description of the Upper Boat generating station of the South Wales Electrical Power Distribution Co. in our issue of May 6th, we are informed that Messrs. Bruce Peebles & Co., Ltd., were the manufacturers of the two frequency changers installed to give a 50-cycle supply to the Great Western Railway Docks. Each of the sets is designed to develop 2,000 kW, their speed being 375 r.p.m., and is provided with a starting motor and two exciters, one



Peebles 2,000-kW Frequency Changer.

for each machine. The synchronous motors operate on a 3-phase, 25-cycle, 11,000-V circuit at unity power factor, and the alternators develop 2,500 kVA at 0.8 power factor and generate 3-phase, 50 cycles at 11,000 volts. The alternators are provided with motor-operated stator rocking gear, the motor for operating which can clearly be seen in the accompanying illustration. The starting motor develops 300 b.h.p. and operates on a 3-phase, 25-cycle, 440-volt circuit, its rated speed being 500 r.p.m.

Electrical Engineers' Ball.

A meeting of the General Committee of the Electrical Engineers' Ball was held on May 13th at the Institution of Electrical Engineers. The hon. treasurer, Mr. J. E. Kingsbury, reported that the financial result of the 18th annual ball held on February 11th compared very favourably with the returns of previous years. The Committee decided to vote the sum of £150 to be divided equally between the Institution of Electrical Engineers' Benevolent Fund and the Electrical Trades Benevolent Institution. As on the two previous occasions, the number of tickets issued had to be strictly limited to the capacity of the accommodation, the number of guests present at the Ball being approximately 700.

"Creeping" Cables.

In a short paper recently presented by Mr. F. E. Bentley to the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers, he points out that the creeping of lead-covered telephone and telegraph cables along the underground multiple-way earthenware ducts and iron pipes into which they are drawn for protection has been the cause of damage to many cables. The movement varies over a length of several hundred yards; for instance, 18 in. in some parts and from 3 to 12 in. in others. It is arrested by right-angle bends in the duct track and by the lead-sleeve joints of the cable butting against the mouths of the ducts in manholes; the joints then become faulty owing to the strain imposed on the lead sheathing, which eventually cracks.

In some cases it is possible that the method of connecting loading coils to the cables is responsible for pronounced creep: the cable is divided into sections 1.6 miles in length, and it is probable that less movement would take place if the joints in the loading-coil manholes were straight-through, the sections of cable thus forming one long cable without breaks. Creep may take place both in and against the direction in which traffic normally passes along the road under which the cable is laid; one such case was apparently due to ground subsidence shortening the duct track, the surplus cable being thereby pushed into the manhole. Creeping of the paper-covered copper conductors inside the lead sheath is somewhat unusual; in one case the conductors moved bodily from ½ to ¾ in. into a joint in the lead sleeve, but no movement out of the other end of the joint could be detected, whilst the next joint (160 yards away) was normal and there was no evidence that the pipe or lead sheath had moved.

Covering the ducts with a layer of concrete is an expensive way of overcoming the trouble, but a less costly method is the following:—A lead disk and shoulder of metal are wiped on to the cable sheathing about 8 in. from the mouth of the duct in manholes, and a split hard-wood block is fitted round the cable between the disk and duct mouth, thus forming an anchoring device. A suggested method (not yet proved to be effective) of preventing the copper conductors creeping inside the lead sheath, is to carefully dress the sheathing down on to the conductors all round the cable on each side of the joints.

The following conclusions have been arrived at:—Most creeping appears to be directly due to vibration set up by heavy traffic over the road under which the cable is laid; movement takes place in the direction of the traffic and appears to be independent of gradient, sometimes taking place uphill. Creeping is more pronounced in earthenware ducts than in cast-iron pipes, the latter being more rigid. Less movement may be anticipated in a duct track that follows a winding road, and there is no remedy for that due to ground subsidence.

The Photometric Department of the N.P.L.

On April 26th a visit was paid by members of the Illuminating Engineering Society and friends to the National Physical Laboratory. On arrival the party were received by the director, Sir Joseph Petavel, after which they were conducted by Mr. Walsh and his staff over the Photometric Section of the Laboratory. Much interest was taken in the equipment of the laboratories, the arrangements for testing standard lamps, the new 10-ft. diameter integrating sphere, &c. Visitors had also an opportunity of examining some of the special apparatus used for tests of radium paint, atmospheric absorption, the reflection of light by materials for road surfaces, &c.

After a short interval for refreshments a paper was read by Mr. J. Buckley, reviewing the work of the Photometry Department. Dealing with the methods of overcoming the difficulties of comparing lamps which differed in the colour of their light, he said that, unfortunately, it had not yet been found possible to apply gasfilled lamps as standards, though some progress in that direction had been made. Other refinements in photometry included the use of photo-electric cells, the ingenious application of which, to ensure lamps being operated at the same colour-temperature, was particularly interesting. The routine of lamp-testing was described, and the author referred to a number of special investigations, such as the design of picture galleries to secure adequate daylight illumination of the walls and avoidance of reflections in the glass of pictures; the study of ships' navigation lights for the Board of Trade; and the search for a satisfactory primary standard of light.

Electrical Association for Women.

On May 11th the annual business meeting of the Association was held at the Hotel Cecil, London. The annual report was proposed by Lady Brooks, O.B.E., J.P., president of the Birmingham and Midlands Branch, and seconded by Mr. J. W. Beauchamp, both of whom referred to the wonderful progress made by the Association. Short reports of local activities were given by Miss R. F. Kennedy, hon. secretary of the Glasgow and District Branch; Mrs. A. L. Hayes, hon. secretary of the Birmingham and Midlands Branch; Miss Entwisle, hon. secretary of the Manchester and District Branch; Miss A. A. Stemp, hon. secretary of the Cheltenham Branch; Mrs. J. Tyler, hon. secretary of the South Wales and Monmouth Branch; and Miss Anna Holm, hon. secretary of the North-East Coast Branch.

The annual report stated that the past year had been one of great development and afforded overwhelming justification for the existence of the Association. Its growth had been phenomenal. The branches at Glasgow, Birmingham, and Manchester had added very considerably to their membership, and three new branches had been formed at Cheltenham, Cardiff, and Newcastle. Many lectures had been given and visits paid to electrical shops and factories; requests from various other organisations for lectures on "Electricity in the Home" and similar subjects, had also been complied with, and a liaison had been established with the Association of Teachers of Domestic Science.

In order to cope with the needs of women working in electrical shops and showrooms, a series of evening lectures was held during the winter months, with the co-operation of Mr. Beauchamp, of E.D.A., and Mr. Bush, of E.L.M.A., and a committee was formed to endeavour to evolve a scheme which would help the woman in the electrical industry to become more efficient and useful in her work. With a view primarily to training suitable girls for work in connection with the domestic developments of electricity, a syllabus had been drawn up which had been approved by the Headmistresses' Committee, and which was being introduced into the Chelsea and Battersea Polytechnics.

The Association's journal, *The Electrical Age for Women*, already had a large circulation. Evidence of interest in the work of the Association had reached it from America, Canada, South Africa, Japan, Germany, and Austria, and requests had come from Sweden and Southern Ireland for help in forming similar associations.

Alderman Mrs. Hammer had continued to act as chairman of the Council and the Executive and Finance Committees, and her great knowledge had been invaluable to the Association. Thanks were accorded to Mr. Cramb, of the I.M.E.A., and Miss Lanfear, for the very great assistance which they had given in arranging special meetings of interest to women at their annual Convention.

After the luncheon, reported on p. 814, over 150 members visited Magnet House, by kind permission of the General Electric Company, when a lecture was given by Dr. Porter, medical officer of health for St. Marylebone, on "Public Health Regulations," with special reference to the preservation of food. Mr. W. H. Roberts and Mr. Creasser, of the G.E.C., explained the principles of refrigeration. The members were entertained to tea by the company, and afterwards visited the Electric Bungalow.

On Thursday morning, at the invitation of Mr. H. H. Berry, the members visited Touchbutton House, Newman Street, where they were shown a replica of the new electric grate to be installed in the Piccadilly home of the Duchess of York. The members were also interested in the many beautiful examples of Mr. Berry's art in retaining the charms of antiquity and adding to them the modern comforts of electricity. Mr. Berry's hospitality was very much appreciated.

In the afternoon the members visited the Woolwich works of Standard Telephones & Cables, Ltd., where they were received by Mr. Martin, the works manager, Mr. Eve, and Mr. Goodburn. They were conducted through the works and saw the various processes in the manufacture of telephone cables and large electric cables. Much interest was shown in the 450,000-V testing plant recently installed. Afterwards the members visited the Eltham housing estate of the Woolwich Borough Council, where they were met by Mr. Keats, borough electrical engineer, and a representative of the Housing Committee, and inspected several of the "all-electric" homes. On a Sunday morning the maximum load for cooking purposes alone on this estate amounts to 1,400 kW, and last Sunday the domestic load was greater than the evening lighting peak load for the whole of the 30 years' history of the undertaking.

The Eclipse of the Sun.

A lantern lecture on the total eclipse of the sun on June 29th (the first visible in England for 200 years) will be given by the President of the Royal Astronomical Society (Rev. T. E. R. Phillips), on Friday, May 27th, at 8 p.m., at the Polytechnic, Regent Street, in aid of King Edward's Hospital Fund for London. The price of admission is 1s. 6d.; seats numbered and reserved, 4s.

An Electro-Medical Department at Glasgow.

An electro-medical department is being introduced at Stobhill Hospital by the Parish Council, at a cost of £20,427. The department will embrace the latest developments for the treatment of diseases by means of electricity.

The Paris E.h.p. Electrical Conference.

Good progress is being made with the preliminary arrangements for this meeting, which is to be held at the end of June. The present indications are that over 200 foreign representatives will be present from 28 countries, and 65 papers are to be discussed. The English members at present number just over 20; however, as was the case last year, it is probable that the numbers will be considerably augmented (over 40 were present last year). Applications should be made to the secretary of the Institution of Electrical Engineers, London. The British official delegates are Messrs. W. B. Woodhouse (chief delegate), J. R. Beard, P. V. Hunter, R. Borlase Matthews, and C. Rogers.

Cause and Effect.

I am told of a lady whose illness was diagnosed by her doctor as acute gastritis. She at once declared that she knew the cause of the trouble. She had lately had her meals cooked on a gas range, instead of on the coal one to which she had always been used!—Peter Simple, in the *Morning Post*.

Institution Notes.

Institution of Civil Engineers.

At the annual general meeting, held on May 10th, the result of the ballot for the election of officers was declared. The president-elect is Mr. E. F. C. Trench, C.B.E., M.A., B.A.I. Amongst the vice-presidents are Sir Archibald Denny, Bart., Sir John F. C. Snell, G.B.E., and Mr. G. W. Humphreys, C.B.E.

Royal Institution.

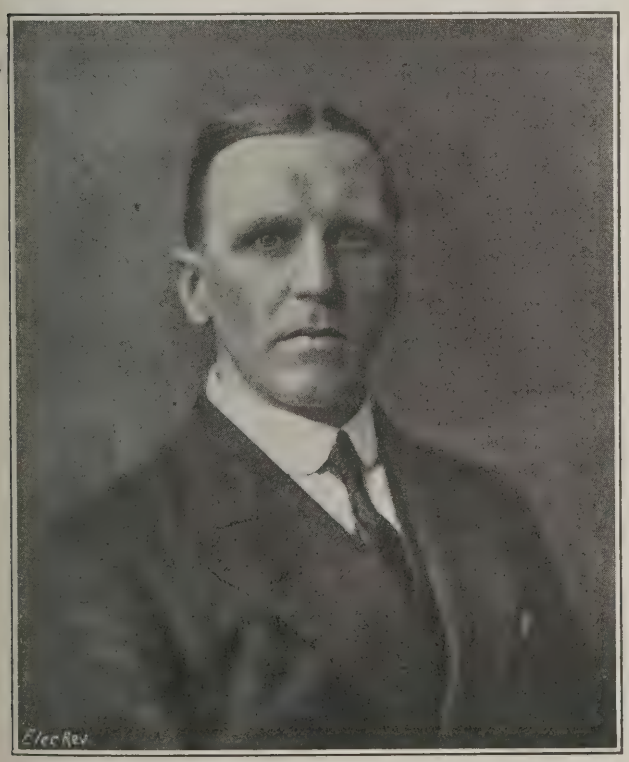
A general meeting of the members was held on May 9th. Sir J. J. Thomson was elected Honorary Professor of Natural Philosophy, and Sir Ernest Rutherford Professor of Natural Philosophy. The chairman announced that the president, the Duke of Northumberland, had nominated, amongst others, Sir Dugald Clerk and Sir Charles Parsons as vice-presidents for the ensuing year. Mr. P. V. Hunter, Dr. Samuel Insull, and Mr. Charles P. Sparks were amongst the members elected.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Messrs. COUZENS & BROWN, consulting engineers, announce that, consequent upon the death of Captain REGINALD J. WALLIS-JONES, who was the sole surviving partner of the firm of Wallis-Jones & Dent, consulting engineers, they have taken over the business of the firm, and all work and correspondence will be attended to by them at 9, Old Queen Street, S.W.1.

Mr. JOHNSTONE WRIGHT, who is leaving Belfast to join the staff of the Central Electricity Board, and whose portrait accompanies these notes, was educated at the Perth Academy and the Glasgow Technical College. He entered business by joining Messrs. Duncan Stewart & Co., Glasgow, and received an all-round practical training. He then went to the British Electric Plant Co., Alloa, where he took charge of the power plant supplying the works and town. Later he went over to the works testing department and was subsequently in charge of outside contracts. One of his principal jobs was the electrification of the Moss End steelworks of Messrs.



Abernethy] [*Belfast.*

Mr. Johnstone Wright, M.I.E.E., M.I.Mech.E.

Stewarts & Lloyds, including power station and works equipment. Leaving Alloa, he became chief assistant engineer at Oban, and in December, 1906, he joined the staff of the Cleveland and Durham Electric Power, Ltd. He spent 13 years altogether with the North-East Coast Power Companies, first as clerk of works and then as constructional and mechanical engineer during the development of the waste heat power stations in the 800 sq. mile area of the Cleveland Co. Later Mr. Wright was appointed engineer and superintendent of the nine stations of the Cleveland and Associated Companies. He entered municipal service in 1919 as chief assistant engineer to the Bradford Corporation, and a year later became deputy city electrical engineer. In 1922 he went to Belfast as city electrical engineer and general manager, and did excellent work. During his tenure the sales of energy rose from 29 to 45 million kWh, and the net profit from £32,766 to £62,402, while the cost of production fell from 2.12d. to 0.769d. per kWh, and the average price obtained from 3.00d. to 1.89d. per kWh. He prepared a complete scheme for electricity generation and transmission throughout Ulster for presentation to the Commission on the Natural and Industrial Resources of Northern Ireland, in 1925. Last year, on behalf of the Belfast Corporation, Mr. Wright made a tour of the United States and Canada to study electricity supply development.

The marriage took place at Shanklin, on April 30th, of Mr. C. U. S. BUXENSTEIN, electrical engineer with the Isle of Wight Electric Light Co., and Miss ELSIE WHITE, daughter of Mr. G. White, of Shanklin. The presents included an 8-day clock from the staff at the Sandown and Shanklin generating station.

The Accrington Town Council has by 15 votes to 7 passed a resolution to the effect that the electrical engineer shall receive his full salary and bonus under the scale, and that the remuneration be further increased until the total sum is £991, according to the number of units consumed.

MR. F. H. BLAXLEY has joined the Electrical Trades Supply, Ltd., Great Charles Street, Birmingham, as Midland representative.

MR. C. PAIGE DICKINS, welfare supervisor at the Sentinel Wagon Works, Shrewsbury, has been appointed sales manager in Liverpool for the Stella Electric Lamp Co. He was the recipient of a number of presents from the Sentinel Works Sports Club, &c., Shrewsbury, on May 6th.

The Hastings Corporation Electricity Committee has received the resignation of Mr. RUSSELL F. FERGUSON, the borough electrical engineer, owing to the state of his health. The committee recommends that Mr. Ferguson be superannuated on September 30th next, and that in view of his long and faithful service extending over a period of 25 years, his special services in connection with works undertaken by him without engagement of a consulting engineer, and of the rapid development of the undertaking, he be granted the sum of £750. The committee recommends that Mr. ALFRED JAMES RYAN, who has held the position of deputy borough electrical engineer since November, 1922, and, for a period of nine years prior to that date, the position of chief assistant electrical engineer, be appointed to the post of borough electrical engineer at £850 per annum, rising to £1,000 per annum.

Mr. W. SINGER has been appointed transformer sales manager and engineer to Messrs. G. Dikkers & Co. (England), Ltd.

Mr. J. W. MASON, manager of the electrical department of Messrs. John Bell & Croyden, Ltd., has been appointed lecturer to the London Clinic, Ranelagh Road, Victoria, in connection with the training of nurses and post-graduate courses for the medical profession.

Mr. EDWIN T. POUND, charge engineer under Glasgow Corporation at Port Dundas power station, has been appointed resident electrical engineer by North Berwick Town Council for the burgh electric lighting works, the Council having recently acquired the local electric light and power undertaking.

Mr. L. ROMERO, who has been in the service of the Salford Corporation Electricity Committee for the past twenty years, latterly as mains engineer, has been appointed to succeed Mr. S. J. Watson as chief electrical engineer. He will take up his new duties on July 1st at a salary of £1,000 per annum, rising to £1,250. It will be remembered that Mr. Watson is taking the post of chief electrical engineer to the London and Home Counties Joint Electricity Authority. Mr. Romero is 44 years of age.

The marriage took place on April 8th at Ahmedmagar, India, of Mr. GEOFFREY EDWARD MARTIN, A.M.I.E.E., of the B.B. and C.I. Railway, and Miss CONSTANCE HEWITT, youngest daughter of Rev. George Hewitt, of Ahmedmagar.

Obituary.—MR. G. F. BURNHAM.—The death is announced from Rye of Mr. George Frederick Burnham, who was for many years on the staff of the Eastern Telegraph Co. abroad.

MR. F. NEWMAN.—We regret to record the death, which occurred on May 11th, at Ruislip, of Mr. Frank Newman, director of the Alliance Electrical Co., Ltd., and late of Drake and Gorham, Ltd.

MR. A. ROTHWELL.—The death occurred at Fern Leigh, Great Harwood, on May 11th, of Mr. Albert Rothwell, aged 30, electrician, a war victim who never fully recovered from an operation following active service. He was one of four sons of Mr. W. Rothwell, electrical engineer, Great Harwood.

MR. K. QUANEY.—The death took place on May 9th of Mr. Kyran Quaney, overhead and cable engineer of the Dublin Tramways Company. He was one of the first engineers appointed when the system was electrified.

MR. J. M. HARLOW.—The death took place on May 10th, at the age of 60 years, of Mr. John Marklow Harlow, founder of the business of J. N. Harlow & Co., electricians, &c., of Burton-on-Trent.

Will.—The late Lieut.-Col. P. W. D'ALTON left £3,233.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Luminad, Ltd.—Private company. Registered May 10th. Capital, £100 in 1s. shares. Objects: To acquire a licence from F. W. Gillard and D. L. West, and to carry on the business of designers, inventors, and manufacturers of and dealers in all kinds of illuminated, mechanical, revolving, swing, fixed, and other signs, and apparatus and processes for internal and external lighting, &c. The first directors are:—F. W. Gillard, 86, Wolfington Road, West Norwood, S.E.27, chartered civil engineer; D. L. West, The Golf House, Mitcham Road, Tooting Junction, S.W., electrical engineer (director of Grant and West, Ltd.); S. M. Stone, M.R.C.S., 86, Harley Street, W.1. T. R. Treloar signs as director and secretary. The first three named are permanent. Solicitors: F. B. Brook, 6 and 7, South Square, Gray's Inn, W.C. Registered office: Bridewell House, Bride Lane, E.C.4.

Electrical Units, Ltd.—Private company. Registered May 5th. Capital, £1,000 in £1 shares (250 7½ per cent. cumulative preference and 750 ordinary). Objects:—To adopt an agreement with H. T. Hall, J. Glanville, and J. F. Rose-Innes, and to carry on the business of manufacturers of wireless component parts and accessories, general and electrical engineers and contractors, tool makers, garage proprietors, &c. The first directors are:—H. T. Hall, 105, Valetta Road, Acton, W., electrical engineer; J. Glanville, 83, Studdridge Street, Fulham, S.W., electrical engineer; J. F. Rose-Innes, 12, Greville Road, N.W., electrical engineer; F. E. Spinner, 83, Studdridge Street, Fulham, S.W., mechanical engineer. Qualification, 25 shares. Secretary: J. F. Rose-Innes. Solicitor: H. W. Stirling, 23, Surrey Street, W.C.2. Registered office: 104, North Street, Edgware Road, N.W.8.

J. Holbrook and Tattersall, Ltd.—Private company. Registered May 13th. Capital, £2,000 in £1 shares. Objects: To acquire the business of an electrical engineer and contractor carried on by J. R. Holbrook as "J. Holbrook & Co.," together with the offices and lease and goodwill thereof at 6, Cheapside, E.C. The life directors are:—J. R. Holbrook, 35, Dalmally Road, Croydon, electrical engineer; J. Tattersall, Sorrento, Church Lane, Sutton-on-Sea, Lincs., gentleman (chairman); G. Langdale, The High Holme, Louth, Lincs. Secretary: J. Tattersall. Solicitors: Curwen Carter & Evans, 1, Grays Inn Square, W.C.1. Registered office: 6, Cheapside, E.C.

Finnell System, Ltd.—Private company. Registered May 13th. Capital, £3,000 in £1 shares. Objects: To act as sole agents, distributors, importers, exporters, manufacturers and dealers in the British Isles of and in electric cleaning machines, known as the "Finnell Electric Cleaner," manufactured and produced by the "Finnell Company of the U.S.A." The first directors are:—R. W. M. Wright, 10, Beach Lawn, Waterloo, Liverpool, agent and importer; L. Buck, 9, Belvedere Road, Great Crosby, Liverpool; J. P. Buck, 13, Marlborough Gardens, Carlisle; and R. W. C. Wright, 10, Beach Lawn, Waterloo, Liverpool (all permanent). Qualification: £100. Registered office: 33, Moorfields, Liverpool.

L. E. Wilson & Co., Ltd.—Private company. Registered May 11th. Capital, £2,000 in £1 shares. Objects: To carry on the business of contractors and suppliers of electricity, electrical, mechanical, and consulting engineers, manufacturers of and dealers in electrical, magnetic, telephonic, telegraphic, and other appliances and apparatus, &c. The first directors are:—L. E. Wilson, 62a, Mosley Street, Manchester, electrical engineer; Mrs. E. L. Wilson, "Ingleton," Bentinck Road, Altrincham; L. Fraser, 43, Radnor Drive, Wallasey, solicitor. The first two named are permanent. Qualification: £1 share. Solicitors: Doughty & Fraser, 43, Radnor Drive, Wallasey. Registered office: 62a, Mosley Street, Manchester.

Electric Bulk, Ltd.—Private company. Registered May 6th. Capital, £100 in 1s. shares. Objects:—To carry on the business of a financial, commercial, electrical, manufacturing, contracting, promoting, mercantile, and developing association, especially electrical matters, &c. The permanent directors are:—J. A. Rogers, 44, Oxford Terrace, W.2; E. J. Woods, 131, Wigmore Street, W.1. Registered office: 12, Mansion House Chambers, 11, Queen Victoria Street, E.C.4.

Liverpool Engineering and Condenser Co., Ltd.—Private company. Registered May 12th. Capital, £20,000 in £1 shares. Objects: To acquire the business of engineers and condenser manufacturers now or recently carried on as "The Liverpool Engineering and Condenser Co., Ltd.," at Perry Street, Liverpool. The first directors are:—H. B. Potter, Lee Cottage, Shawclough, Rochdale; J. E. Tweedale, Barcroft, Marland, Rochdale; W. Kayley, Chancery Lane, Ardwick, Manchester; R. Barnes, The Hollies, Milnrow, near Rochdale; J. W. White, Britain Road, Widnes; D. A. Quiggin, "Freshfield," Liverpool. Qualification: 10 shares. Solicitor: J. A. Hudson, 32, Lord Street, Rochdale.

Cleethorpes Radio Supply, Ltd.—Private company. Registered May 6th. Capital, £1,000 in £1 shares. Objects:—To acquire the business of electrical engineers, &c., heretofore carried on as the "Cleethorpes Radio Supply" at Cleethorpes, Lincs., and elsewhere. The first directors are:—E. Turner, "Birchwood," Clee Road, Cleethorpes; J. Poppleton, 79, Fuller Street, Cleethorpes; H. M. Stannard, "The Ramblers," Old Clee, Grimsby; Mrs. L. Turner, "Birchwood," Clee Road, Cleethorpes. Qualification, 1 share. Secretary: E. Turner. Solicitor: H. A. Howden, Prudential Chambers, Victoria Street, Great Grimsby. Registered office: 11, Short Street, Cleethorpes.

Carrington & Button, Ltd.—Private company. Registered May 13th. Capital, £6,000 in £1 shares. Objects: To acquire the business of an electrical and mechanical engineer, heretofore carried on by C. E. C. Button, at 144, High Street, Crewe, Cheshire. The first directors are:—C. E. C. Button, Lyndhurst, Wistaston, Nantwich; C. E. Gresty, Redmayes, Wistaston, Nantwich. C. E. C. Button is permanent managing director, so long as he holds 1,000 shares. Qualification of directors, 50 shares. Secretary: L. J. Button. Solicitors: Speakman & Hill, 35, Market Street, Crewe. Registered Office: 44, High Street, Crewe.

W. H. Porter & Co., Ltd.—Private company. Registered May 6th. Capital, £100 in £1 shares. Objects:—To carry on the business of manufacturers of, and dealers in wireless, telegraph and telephone instruments, equipment and material, sports outfitters, &c. The subscribers (each with 1 share) are:—C. H. Rosenthal, 12, Rotton Park Road, Edgbaston, merchant; J. Harris, 30, Wheeleys Road, Edgbaston, merchant. C. H. Rosenthal signs as managing director. Qualification, 10 shares. Solicitors: Joseph Cohen & Cowen, 14, New Street, Birmingham. Registered office: 44, Church Street, Birmingham.

Wilrose Co. (Birmingham), Ltd.—Private company. Registered May 6th. Capital, £100 in £1 shares. Objects:—To carry on the business of manufacturers of, and dealers in wireless, telegraph and telephone instruments, equipment and material, sports outfitters, &c. The subscribers (each with 1 share) are:—C. H. Rosenthal, 12, Rotton Park Road, Edgbaston, Birmingham, merchant; J. Harris, 30, Wheeleys Road, Edgbaston, Birmingham, merchant. J. Harris signs as managing director. Solicitors: Joseph Cohen & Cowen, 14, New Street, Birmingham. Registered office: 39, William Street, Ladywood, Birmingham.

M. Woolldridge (Wireless), Ltd.—Private company. Registered May 9th. Capital, £1,500 in £1 shares. Objects:—To acquire the business of a wireless apparatus and material manufacturer and dealer, and dealer in electrical goods now carried on by Mabel Woolldridge at 26 and 39, Lisle Street, W., as "M. Woolldridge." The permanent directors are:—Mrs. M. Woolldridge, 26, Lisle Street, Leicester Square, W.C.2.; P. Parry, 48, Leigh Road, Highbury, N.5. Registered office: 26, Lisle Street, Leicester Square, W.C.2.

Electrical Manufacturing and Plating Co., Ltd.—Private company. Registered May 12th. Capital, £300 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical apparatus and machinery, electrical engineers, and plating experts, &c. The first directors are:—L. French, "Frogholt," Norbiton Avenue, Kingston-on-Thames; E. French, "Glenhaven," 84, Park Road, Kingston Hill, Surrey. Solicitors: Kenneth Brown, Baker, Baker, Lennox House, Norfolk Street, Strand, W.C.2.

Bryterlite Electrical Co.—Private company. Registered in Edinburgh, May 10th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers, agents, commission agents, and dealers in all kinds of electric lamps, globes, shades, wireless valves, &c. The first directors are:—B. Wober, 21, Nicholson Street, Glasgow, commission agent; G. Hope, 52, Carrington Street, Glasgow, clerk. Qualification: £10 shares.

Electrical Agencies (London), Ltd.—Private company. Registered May 10th. Capital, £1,000 in £1 shares. Objects: To carry on the business of agents, factors, and merchants for electrical fittings and appliances of all kinds, &c. The subscribers (each with one share) are:—G. Boggis, 7, Hornsey Lane Gardens, Highgate, N.6, clerk; Jessie M. Thorpe, 126, Salusbury Road, N.W.6, clerk; S. Gevirtzf signs documents as managing director. Solicitors: Landman & Foy, 22-3, Laurence Pountney Lane, E.C.4.

Official Returns of Electrical Companies.

Peter Curtis, Ltd.—Capital, £25,500 in 13,000 7 per cent. cumulative preference and 11,500 7 per cent. preferred ordinary shares of £1 each and 20,000 deferred shares of 1s. each. Return dated March 28th, 1927. 11,455 preference, 11,500 preferred ordinary, and 20,000 deferred shares taken up. £3,000 paid on 2,000 preference and 1,000 preferred ordinary shares. £20,955 considered as paid on 9,455 preference, 10,500 preferred ordinary, and 20,000 deferred shares. Mortgages and charges, £2,000.

Clear Hooters, Ltd.—"A" debenture dated April 21st, 1927, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders:—Barclay's Bank, Ltd. Also "B" debenture of same date to secure £500, charged on the above property. Holder:—L. J. F. Austin, Lichfield Chambers, Upper Priory, Birmingham. (The company may not create any mortgage, charge or lien in priority to or *pari passu* with the above charges.)

Pulford Brothers, Ltd.—Mortgage and charge on leasehold hereditament Nos. 102 and 104, Whitechapel, Liverpool, with machinery and fixtures, and the company's undertaking and property, present and future, including uncalled capital, dated April 13th, 1927, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

County of London Electric Supply Co., Ltd.—Satisfaction in full on April 29th, 1927, (1) of debenture stock secured by indentures dated January 23rd, 1899, and July 5th, 1909, securing £500,000, and (2) of debenture stock secured by indentures dated May 12th, 1903, October 13th, 1904, and July 5th, 1909, securing £500,000.

Wallingford and District Electric Supply Co., Ltd.—Capital, £13,000 in £1 shares. Return dated May 20th, 1926. 12,213 shares taken up. £12,213 paid. Mortgages and charges, £3,500. Return of alloments, made up to February 8th, 1927, shows a further 787 shares allotted for cash.

Korting Brothers (1917), Ltd.—Debenture dated April 27th, 1927, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder:—F. A. Robinson, "Sunnybank," Lucknow Avenue, Nottingham.

Eddystone Components, Ltd.—Capital, £1,000 in £1 shares. Return dated January 28th, 1926 (filed March 11th, 1927). 182 shares taken up. £10 paid. £172 considered as paid. Mortgages and charges at date of return, £500. Since registered: Debenture dated April 23rd, 1926, to secure £500.

Sheffield Wireless Depôt (1926), Ltd.—Capital, £500 in £1 shares. Return of allotments, made up to February 4th, 1927, shows 4 shares allotted for cash and 496 shares allotted as fully paid pursuant to purchase agreement. Mortgages and charges, nil.

Radiolicity, Ltd.—Capital, £1,000 in 950 preference shares of £1 each and 1,000 ordinary shares of 1s. each. Return dated December 31st, 1926. 500 preference and 500 ordinary shares taken up. £525 paid. Mortgages and charges, nil.

J. H. Runbaken, Ltd.—S. Barlow, of 14, John Dalton Street, Manchester, was appointed receiver and manager on April 19th, 1927, under powers contained in debenture dated November 8th, 1926.

Vee Cee Dry Cell Co., Ltd.—H. M. West, C.A., of 1, Station Road, Reading, was appointed receiver and manager on May 2nd, 1927, under powers contained in debenture dated November 10th, 1926.

Electron Co., Ltd.—Satisfaction to the extent of £500, £200, and £500 respectively, on April 4th, 1927, of debentures dated September 22nd, 1925, and February 2nd and 19th, 1926, securing the respective sums of £600, £1,400, and £1,500.

H. T. C. Electrical Co., Ltd.—Capital, £2,500 in £1 shares. Return dated January 3rd, 1927. All shares taken up. £950 paid. £1,550 considered as paid. Mortgages and charges, nil.

Whitfield Electrical Co., Ltd.—Capital, £500 in £1 shares. Return dated December 17th, 1926 (filed April 9th, 1927). 401 shares taken up. £401 paid. Mortgages and charges, £2,000.

L. P. S. Electrical Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1926 (filed March 22nd, 1927). All shares taken up. £5,000 paid. Mortgages and charges, nil.

Crossby (Liverpool), Ltd.—Particulars filed of £500 debentures authorised April 14th, 1927, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Anderton Brothers, Ltd.—D. B. Sandeman, of 194, Union Road, Oswaldtwistle, ceased to act as receiver or manager on May 4th, 1927.

M. S. L., Ltd.—Capital, £500 in £1 shares. Return dated March 15th, 1927. All shares taken up. £500 paid. Mortgages and charges, nil.

City Notes.

British Thomson-Houston Co., Ltd.

The report for 1926 records the deaths of Messrs. C. A. Coffin and A. W. Burchard, directors of the company. The profit for the year was £355,385 (against £467,200), and to this is added £220,126 brought forward, making £575,511. After deducting debenture interest, depreciation, and preference dividends, there remains a balance of £226,468 which it is proposed to carry forward. The directors regret their inability to recommend a dividend on the ordinary shares. (The ordinary dividend for 1925 was 6 per cent.) The prolonged coal dispute and the general industrial conditions resulting therefrom had a direct effect upon the company's output which was substantially less than had been estimated. An amount of £1,150,000 in the balance sheet under the head of "loans" comprises advances from one of the company's associated interests for the purpose of completing works under construction and the financing of the extensions of the company's activities. The meeting is to be held on May 24th.

Urban Electric Supply Co., Ltd.

The annual meeting was held on May 12th, Mr. P. D. Tuckett presiding. In moving the adoption of the report (Elec. Rev., May 6th, p. 731), the chairman said that a year ago there was every prospect of a continuance of steady progress. Then, however, the coal strike occurred, and was accompanied by lighting restrictions and business dislocation, and their income was reduced by £1,200 and their profit from contracting work by £720. They incurred an increase of nearly £20,000 in the cost of coal. They endeavoured to recover some part of the cost by raising their rates of charge in the December quarter, but it was only to a limited extent that they were able to protect themselves in that way, since they were already charging their maximum rates in some of their undertakings, whilst in a number of others they had reduced their lighting rates at the beginning of the year by arrangement with the local authorities and were thus precluded from varying them. The increased output of 1,750,000 kWh was little more than half the previous year's increase, and was insufficient to compensate for the heavy increase in the cost of coal, &c. Moreover, nearly 80 per cent. of the increased output represented power and was mainly accounted for by the Twickenham and Cornwall Electric Power Companies, neither of which paid increased dividends. Their tramways at Glossop and Redruth were seriously affected by the strike as well as by increasing motor-'bus competition. They carried over half a million fewer passengers, a reduction of 23 per cent. as compared with 1925, and showed an actual working loss of £1,764. Those tramways had now been in existence for upwards of 20 years, and if they were to continue to operate, the renewal of the rails and a general overhaul of the rolling stock could not be postponed much longer, so that the alternative of their abandonment was now engaging their serious attention. The Walton Urban District Council had recently exercised its right of purchase of their Walton undertaking, hitherto worked in conjunction with their Weybridge undertaking, and it was to be taken over as from July 1st. The purchase price had been agreed at £89,000, which returned them their capital expenditure in full. They regretted parting with the undertaking, however, since they would be deprived of the profits which it had hitherto contributed to their income, besides being hampered to some extent in the independent working of their Weybridge undertaking. It was possible that a similar situation might arise in connection with the Weybridge undertaking, for the Weybridge Council, recognising the advantages attaching to the continued joint working of the two undertakings at the present time, was considering the question of purchase in the event of its being able to arrange a joint working agreement with the Walton Council. Last year, to meet the growing load of the Cornwall Electric Power Company, the whole of whose share capital of £180,000 was held by them, they found it necessary to order a steam turbine of 7,500-kW capacity together with boilers, switchgear, and other accessories. When installed, this new plant would nearly double the capacity of the generating station and would greatly add to the efficiency of its working. Despite the effects of the coal strike, from which it suffered in common with other industrial undertakings, the Cornwall Company earned an increased profit last year and had every prospect of earning increased profits this year, and, he hoped, for many years to come, since the tin mines, to which the bulk of its output was sold and on whose prosperity its success so largely depended, were being actively developed. It would no doubt have been possible, by reducing the carry forward, to recommend some small increase in the ordinary dividend, but after consideration they came to the conclusion that it would be unwise prematurely to make an increased distribution on this occasion out of profits which had not been earned during the past year, in anticipation of improved results which might not be realised during the coming year. As to the future, in spite of the adverse conditions last year they connected an additional 1,832 kW of load, and there was every prospect of a steady expansion of the business. The report was adopted.

Notting Hill Electric Lighting Co., Ltd.

This company's report for 1926 was reviewed in our issue of May 6th (p. 729). The annual meeting was held on May 10th, when Mr. A. E. Franklin (chairman), in a statement read by the deputy chairman (Mr. L. Jacob), explained the arrangements which had been made for the extension of the company's tenure, and dealt in some detail with the reorganisation of the capital and revenue accounts. He said that the basic charge to consumers had not yet been fixed, but it was considered that the figure would be very close to their present charge. The Wood Lane station was now leased to the London Power Co. at 6 per cent. interest on its valuation (£251,908), but that figure excluded the valuation of the sinking fund investments held by the trustees for the debenture holders. The London Power Co. had to pay them funds to redeem their 4 per cent. debentures on the joint station (up to the amount of the valuation). The securities represented by the sinking fund would supply the balance, and the unused portion of those securities would constitute the surplus, which after clearing debts, would be divided between the two companies. They hoped that their share would raise their distribution to about the equivalent of £4 per share. Referring to the general strike, the chairman said that the loyalty of their technical staff made it possible to maintain the supply; and by the foresight of the chief engineer, the Wood Lane station was able to carry on with its stocks of coal for six months. The directors proposed to consolidate the two classes of preference shares and make them all cumulative; to ask for powers to issue the unissued £56,000 of preference shares in such manner as they thought fit; and to capitalise the free reserves. The reports and accounts were adopted, and subsequently the rearrangement of the capital was approved.

Great Northern Telegraph Co., Ltd., of Denmark.

The directors' report for 1926 states that owing to the closing of the Harbin station, the lines between Leningrad, Irkutsk, and Vladivostok, had to carry the whole of the company's Far East traffic during the latter part of the year. Negotiations with the Russian Administration for the exclusive use of another wire between Irkutsk and Vladivostok have not yet reached a settlement. The company's activities in Russia, in so far as the transmission of Russian terminal telegrams exchanged with Western Europe and America is concerned, are not remunerative owing to salary increases, loss of traffic, &c. In spite of the unsettled conditions in China, the traffic exchanged with that country has not decreased; there is even a slight improvement in the Far East traffic. No result has been arrived at in the negotiations between the Chinese Telegraph Administration, the Eastern Extension Co., and the Great Northern Co. The company's offices at Mariehamn and Stockholm have been closed. The coal dispute caused a decline in British traffic and that of most other European countries shows a decrease. Although there is now radio competition in the Far East traffic, the company feels confident of the superiority of its service. There was a fall of £220,000 in the year's revenue and one of £240,000 in the expenditure. As previously reported, the directors propose to pay 30s. per £10 share less tax, making a total dividend and bonus of 20 per cent. for the year.

Siemens Bros. & Co., Ltd.

The directors' report for 1926 states that notwithstanding the grave industrial conditions prevailing during the greater part of the year, the company's profits showed no diminution as compared with 1925, but the hope of expansion from enlarged manufacturing facilities was not realised. The cost of production was increased by the high price of fuel. Nevertheless, the value of orders in hand from 1925 enabled the company to attain a better output than would otherwise have been possible. Many important contracts were carried out, the most notable being the manufacture and laying for the Pacific Cable Board of a loaded submarine telegraph cable from Fanning Island to Suva, Fiji, a distance of 2,143 nautical miles. This cable is giving excellent service at a very much higher speed of transmission than that which was guaranteed. The accounts show a profit of £358,990 (an increase of £2,109). The final ordinary dividend is 5 per cent., making 7½ per cent. for the year. There remains a balance of £70,364, to which is added the amount brought forward, less £100,000 paid on account of excess profits duty, of £196,400, making a total of £266,504. In view of the unsettled trade conditions and the outstanding liability to excess profits duty it is proposed to carry forward the whole of this balance. Meeting: May 23rd.

Barcelona Traction, Light and Power Co., Ltd.

The annual meeting was held at Toronto on May 10th. Mr. M. Lash presided and said that the results for the past year showed a considerable improvement, and that still further progress had been made during the first quarter of the current year. In addition, the exchange had improved from 33.71 in 1925 to 28.70 in the first four months of this year. There were many circumstances tending to aid the company, including the funding of the Spanish debt, the freedom of the country from labour troubles, the electrification of railways, and telephone development. The company had made arrangements to convert its 7 per cent. 30-year peseta bonds into 6 per cent. 45-year bonds, and it had been decided to pay an interim dividend of 1 per cent. on the common shares. The directors intended to review the position every six months to determine what dividends could be paid.

Brush Electrical Engineering Co., Ltd.

The report for 1926 states that the co-partnership scheme has been put into operation and provision for it has been made in the accounts. The surplus profit for the past year (£8,751) has been credited to the shareholders and "co-partners"; the co-partners' share amounting to £7,301 has been distributed. The accounts for 1926 show that after providing for general charges, depreciation, debenture interest, &c., there is a net profit of £62,887. Of this £5,495 is transferred to general reserve; interest on prior lien debenture stock absorbs £2,044; a dividend of 10 per cent. is declared (including the co-partnership shares); and a balance of £8,835 remains for apportionment between the shareholders and co-partners. The co-partners' share amounts to £7,354. The general reserve has been increased to £239,359 by the addition of certain amounts. During the year £7,853 was spent on capital account. The year's operations were adversely affected by the general strike and coal dispute, but nevertheless important contracts for turbo-electric plant, &c., as well as rolling stock, were carried out. While competition remains severe both in the home and foreign markets, the amount of business in hand and in prospect justifies the expectation of a reasonably busy year. A statement issued with the report shows that the trading profit was £135,464, as compared with £145,491. The undivided profits account stands at £79,122. Meeting: May 23rd.

Lancashire Electric Light and Power Co., Ltd.

The trading profit of the Parliamentary Company (the Lancashire Electric Power Co.) for 1926, plus interest receivable, was £199,937, and after adding the amount brought forward and providing for depreciation and reserves, a balance of £131,431 is paid to the Electric Light and Power Co. With the addition of other items, there is a total of £142,798. The profit balance for the year is £133,904, to which is added £9,826 brought forward, making £143,730. A final dividend, making 7½ per cent. for the year, is to be paid on the 7 per cent. cumulative participating preference shares, and the ordinary dividend is also 7½ per cent. A balance of £5,933 is carried forward. The general strike affected the company's output, but the supply was maintained. The new Padiham station was completed during 1926 and placed in regular operation in January last. The Parliamentary Company's returns show that the energy generated or purchased rose from 151,495,964 kWh in 1925 to 168,244,521 in 1926, while the maximum load rose from 70,200 to 80,450 h.p. and the connected load from 89,200 to 100,500 h.p. Meeting: May 23rd.

Sevenoaks and District Electricity Co., Ltd.

Speaking at the annual meeting on May 10th, Mr. C. F. Tufnell (chairman) said that progress was maintained during 1926 in spite of the difficult conditions, and a dividend of 7 per cent. was being paid on the ordinary shares. The delivery of the new generating set was delayed, but the set was eventually put into commission at the end of the year. The directors had decided to reduce charges; they would have been able to do so earlier had it not been for the industrial troubles. It was proposed to create 20,000 £1 preference shares bearing an 8 per cent. cumulative dividend. Those shares would not be issued for cash but offered to the debenture holders in exchange for their holdings. The report and accounts were adopted, and subsequently a resolution approving the increase of the company's capital was passed.

Potteries Electric Traction Co., Ltd.

The total revenue for the past year was £251,914, and after meeting all expenses, including debenture interest, there remains a balance of £2,549, which it is proposed to carry forward. At December 31st last the reserve stood at £126,750, and the renewals fund at £43,539. The company's business was seriously affected by the industrial unrest; there was a profit on the omnibuses, but losses on the tramway services. The differences between the company and the Stoke-on-Trent Corporation are considered by the Minister of Transport to be capable of solution between the two authorities themselves. Meeting: May 28th.

Eastern Telegraph Co., Ltd.

The revenue for 1926 amounted to £3,436,690 and the balance on working was £1,097,961. After providing for income tax, debenture interest, and preference dividends, there remains £850,909, to which is added £555,716 brought forward, making £1,406,625. Of this £400,000 is placed to general reserve, and £493,002 of that fund has been applied in writing off the balance of expenditure on new cables, &c. Four quarterly dividends of 2½ per cent., free of tax, have been paid on the ordinary stock and £506,625 is carried forward. The report records the death of Mr. A. R. Hardie, a director. Meeting: May 24th.

French Companies.

The *Société Radio-Orient* has declared a dividend of 35 fr. per share out of net profits of 652,000 fr. for 1926, as compared with 30 fr. and 360,000 fr. respectively in the preceding year.

The *Union d'Electricité*, Paris, after placing 36,000,000 fr. to reserve and depreciation, intends to pay a dividend of 9 per cent. for 1926, as against 8 per cent. in the previous year.

The *Société de l'Electrification Industrielle*, which undertakes the establishment of h.p. lines, &c., for various supply companies, reports net profits and balance forward amounting to 1,336,000 fr. for 1926. The dividend is 11 fr. per share.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Buenos Aires Lacroze Light and Power Co.—£300,000 6½ per cent. sterling redeemable mortgage debenture stock, issued at £96½ per cent., partly paid and fully paid.

Electric Supply Corporation.—50,000 new ordinary shares of £1 each, fully paid, Nos. 150,001 to 200,000.

Application has been made to the Committee to allow the following to be quoted officially:—

Consolidated Gas, Electric Light and Power Co. of Baltimore.—82,794 common shares of no nominal or par value.

North Metropolitan Electric Power Supply Co.—850,000 ordinary shares of £1 each, fully paid, Nos. 1 to 850,000.

Atlas Light and Power.—£889,757 5 per cent. debenture stock.

Electrical Finance and Securities.—100,000 7 per cent. cumulative preference shares of £1 each, 2s. paid, Nos. 1 to 100,000; £100,000 5½ per cent. debenture stock, issued at 92½ per cent., £10 paid.

British Electric Traction Co., Ltd.

A final dividend of 5 per cent. is recommended on the ordinary stock, making 8 per cent. for the year, as for 1925-26. A further dividend of 2 per cent. is also recommended on the 6 per cent. cumulative participating preference stock, making 8 per cent. An extraordinary meeting was held on Tuesday last, when a proposal to issue a 10 per cent. bonus to ordinary stockholders in the form of deferred ordinary stock was approved.

German Companies.

The *Korting Electricity Works Company*, Berlin, proposes to pay a dividend at the rate of 8 per cent. out of net profits of 204,000 marks for 1926, as compared with the same rate, and 187,000 marks in the previous year.

The *Dr. Paul Meyer Company*, Berlin, which was reorganised last year, reports a net profit of 251,000 marks for 1926, as compared with a loss of 2,200,000 marks in 1925. It is proposed to pay a dividend of 6 per cent. The export trade is stated to have declined, while favourable development has taken place in the home market.

Belgian Companies.

The *Société d'Electricité et de Traction* reports net profits of 5,218,000 fr. for 1926, as compared with 4,187,000 fr. in the previous year. The dividend is 27.50 fr. per ordinary share.

The *Compagnie Belge d'Exploitations Electriques* has declared a dividend of 25 fr. per share for 1926.

The *Federation d'Entreprises de Transports et d'Electricité*, Brussels, which is an investment concern, reports net profits of 1,098,000 fr. The dividend is at the rate of 19 fr. per share.

Spanish-Argentine Company.

The *Compania Hispano-Americana de Electricidad*, of Madrid (the former *German Transmarine Electricity Co.*), reports that the sum of 40,000,000 pesetas has been set aside for depreciation, as compared with 34 millions in 1925, leaving a net profit of 38,976,000 pesetas for 1926, as against 38,873,000 pesetas. It is intended to pay a dividend at the rate of 14 per cent., as in 1925.

Argentine Company.

The *Compañia Italo-Argentina de Electricidad*, Buenos Aires, reports a liquid profit of $4,569,500 for 1926. A total dividend of $10 m/n has been paid. The extension of the Pedro Mendoza station, aiming at the attainment of the maximum power of 100,000 kW, continued during the year, and the erection of the first of the 25,000/30,000-kVA turbo-generators was almost completed.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Adnil Electric Co., Ltd.
"Cedes" Electric Traction, Ltd.
Electrical Industries, Ltd.
Leitner Electrical Co., Ltd.
Maxim Lamp Works, Ltd.
Portable Electric Motors (1919), Ltd.

Birmingham District Power and Traction Co., Ltd.

The revenue for the past year was £119,740, and the available surplus (including £19,890 brought forward) was £123,522. After providing for debenture service, preference dividend and renewals, it is proposed to place £7,260 to reserve, to pay a dividend of 7 per cent. on the ordinary shares, and to carry forward £36,953. During the year debenture stock to the value of £14,265 was redeemed and cancelled. The meeting was to be held on May 18th.

Rothesay Tramways Co., Ltd.

The receipts for 1926 fell slightly to £19,720. The available balance (including £671 brought forward) is £1,815. It is proposed to pay 5 per cent. on the preference shares and carry forward £1,315. Last year the ordinary shares received 3 per cent.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The report for 1926 shows a gross revenue of £2,047,033 and a surplus of £1,115,975. After providing for taxation and debenture interest, there remains a balance of £951,996, to which is added £413,435 brought forward, making £1,365,431. From this £550,000 is transferred to general reserve; four tax-free dividends of 2½ per cent. each have been paid, and £415,431 remains to be carried forward. Meeting: May 26th.

Greenock and Port Glasgow Tramways Co.

The receipts for 1926 fell from £65,448 to £64,462. After providing for debenture interest, depreciation, &c., there is a net loss of £2,283. Against this is set a balance of £2,371 brought forward, leaving a balance of £88 to be carried forward. The unsatisfactory result is attributed to motor omnibus competition. The company proposes to substitute 'buses for trams on a part of its system.

Oriental Telephone and Electric Co., Ltd.

The directors recommend a final dividend of 6 per cent. on the ordinary shares (free of tax), making a total of 10 per cent. for the year, free of tax, plus a bonus of 2 per cent., free of tax.

Adelaide Electric Supply Co., Ltd.

The usual interim dividends of 4 per cent. on the preferred ordinary shares and 6 per cent., free of tax, on the ordinary shares, have been declared.

Shanghai Electric Construction Co., Ltd.

A final dividend of 6 per cent. (making 10 per cent. for the year, as in 1925) is recommended on the ordinary shares.

Melbourne Electric Supply Co., Ltd.

An interim dividend at the rate of 10 per cent. per annum, free of tax, has been declared on the ordinary shares.

Bengal Telephone Corporation, Ltd.

A dividend of 6 per cent. has been declared on the ordinary shares, as against 2 per cent. for 1925.

Burma Electric Supply Co., Ltd.

An interim dividend of 4 per cent. has been declared on the ordinary shares, as in 1926.

Stocks and Shares.

Monday Evening.

Impatience girds, with a touch of exasperation, at the delay that has occurred in the expected fall to 4 per cent. in the Bank rate. The last change was made on April 21st, and on each successive Thursday there has been a confident anticipation of a further reduction. Stock Exchange markets are counting upon a decline, and new issues achieve notable success in cases where sound stock is offered. "If the Bank rate falls," people argue, "we shall see prices go higher than they are to-day." Business in the industrial departments is tolerably active, with prices well maintained. Our own lists are typical of the general trend, and this week there are four declines to set against nearly a score of rises.

County of London Electric new 5 per cent. debenture, offered at 96, and promptly covered several times over by public subscription, rose from an opening premium of 17s. 6d. until it touched nearly a point higher. At 1¾ premium scrip came to market, and reaction took back the price to 1¼ premium. So many other new candidates have presented themselves for favour during the past fortnight that investment finds it very tempting to change from one thing to another. Buenos Aires Lacroze 6½ per cent. redeemable debenture stock, offered at 96½, is now marketable, the price being about 1 premium. When the market opened in the new Electrical Finance and Securities issues, there was a small premium on the 7 per cent. preference shares, but this ran off, although the 5½ per cent. debenture stock retained a point premium above the issue price of 92½. It may be mentioned that the ordinary shares are all held privately: they received annual dividends of 10 per cent. for the past six years, 1921-1926 inclusive.

Brazilian Tractions, as spectacular speculative leaders, have fallen temporarily out of the front rank, being superseded by other favourites. The common shares are 2¼ points down at 141½. Barcelona Tractions have drooped to 53, and Sidros attract but little attention.

Foreign telephone varieties are strong. United River Plates have been forging ahead steadily for some time past, and are again better at 9¼. Chili Telephones, usually a staid and somewhat humdrum investment, are 18s. 9d. higher this week at 7⅜, jobbers in the market professing some mystification as to what can be the reason for the demand that has swept the shares to their present level. The obvious inference would be buying for control, and in this supposition there may be

an explanation, although nothing definite has transpired to verify it. Anglo-Portuguese Telephones are also rising, the price having advanced to 20s. 9d. The company paid 7 per cent for last year, and at the meeting, held six weeks ago, Lord St. Davids, the chairman, mentioned 8 per cent. as "what you may call the normal rate which the ordinary shareholders in a telephone company expect." Automatic Telephones have fallen to 45s.

Clyde Valley shares are 6d. lower at 30s. 6d. The Central Electricity Board has published the first of the schemes now under preparation by the Electricity Commissioners in pursuance of Section 4 of the Electricity (Supply) Act, 1926. This deals with Central Scotland, and upon adoption of the scheme by the Board, the latter body will put the proposals into operation. The scheme is bold and far-reaching, likely to give rise to criticism as well as to arouse commendation. The Stock Exchange interest lies in the probabilities that it opens of capital requirements in the future, and the advantage that provision of cheap current will afford to the industries in the area served. The East Anglian Electricity Supply Company's scheme is under consideration by a Select Committee of the House of Commons. American capital, according to the evidence presented last week, is invested in the Greater London and Counties Trust, Ltd., which was prepared to find half-a-million pounds, or more, for the purpose of carrying-out the scheme in the Bill.

The Official Receiver has in hand the affairs of the Southern Counties Electric Light and Power Supply, Ltd. Meetings of creditors and shareholders were held last week, under the compulsory winding-up order made against the company. The directors attribute the company's failure to its having insufficient capital at any one time to carry out its undertakings, and other reasons. Readers of the Electrical Review will remember that warnings were raised here against investment of money in the company's shares and debentures. The Southern Counties Electric Light and Power Supply, Ltd., has for its chairman Sir Charles B. H. Soame, Bart. The experience of holders unfortunate enough to own interests in the Southern Counties Electric Light and Power Supply, Ltd., is one which should not be forgotten by people who are tempted to embark money in schemes that have hardly a chance of success.

Brush Electrical shares remain at 28s. 3d., unaffected by the issue of a report repeating the previous 10 per cent. dividend, and showing net profits of £62,900, about £700 more than that of the previous year. A "reasonably busy year" is forecast for 1927. Siemens, as already stated (Electrical Review, May 13th, p. 771) is paying 7½ per cent., also as before, and the price of the shares is 1s. 9d. better at 28s. 6d. The report is very satisfactory. Johnson & Phillips have gained 3s. 6d., at 2½ ex dividend.

Underground Railway stocks have not moved. British Electric Traction stocks retain their substantial rises. The Pernambuco Tramways and Power made a little more profit than in the previous twelvemonth, and again pays the preference dividend of 7 per cent. The price of the shares stands at 16s. 6d., and the ordinary at 6s. 6d. La Plata Trams, after a dip to 3s. 9d., rallied to nearly 5s. Reference was made earlier in the month to vague rumours as to the La Plata Company being coveted by another group. The ordinary shares are a gamble—though an interesting one—because the cumulative preference, now quoted at 20s., carry nearly 14s. per share arrears of dividend.

In December last year the North Metropolitan Electric Power Supply Company announced its intention to pay off at par, on July 1st next, the £250,000 8 per cent. cumulative second preference stock. Stockholders are now offered the right to exchange into the company's 6 per cent. preference shares at par, 20s., carrying dividend as from April 30th, 1927. The existing shares are quoted at 22s. ex dividend. The second preference stock changed hands a few days ago at 105.

The cable list is very hard, and a number of further advances have occurred. Great Northerns are 5s. up, the net profit of £271,200 being £18,000 more than that of 1925. Indo-Europeans, ex their dividend of 37s. 6d. net, have put on 17s. 6d. In the Eastern division, "China" shares rose to 18⅛. A better tendency, too, characterises Marconis. The Marine Company's good showing helped to direct attention to the market. Marconi Marines, ex dividend, are up ¼, and the parent shares touched 19s. 9d. before easing off to 18s. 9d. A few pence were added to Canadian Marconis at 4s. 3d.

Rubber shares present no new points of interest. In the engineering section Babcocks went back a trifle, to 54s. 6d. The iron, coal and steel issues are fairly firm, without any feature developing. Armstrong junior debentures continue to be persistently bought by people in the North of England.

Amongst the dollar stocks, Shawinigan Water common has gained 4 points, at 92. The Mexican Utility issues are somewhat irregular. Profit-taking occurred in Mexican Light and Power preferred, the price shedding a couple of dollars, which, however, were added to the price of the company's 5 per cent. bonds. Mexico Tramways bonds are 1 higher. The Burma Electric Supply interim dividend of 4 per cent. is at the same rate as that of last year. The price of the ordinary shares is 23s. 6d., and the 6 per cent. preference stand at 16s. 3d. Amongst the newcomers, Electrical Distribution of Yorkshire ordinary shares, issued recently at 25s., are changing hands on the basis of 3s. 6d. premium.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price May 16, 1927.	Rise or fall.	Yield. p.c.
	£					
Bournemouth and Poole	1	14	14	57/-	—	4 18 3
Brompton Ordinary	1	10	8⅜	25/-xd	—	5 12 0
Charing Cross Ordinary	1	15	8½	25/-	—	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	12	8⅞	25/-xd	+1/-	5 12 0
City of London	1	15	10	1⅜	—	5 1 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	30/6	—6d.	5 5 0
County of London	1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/6	—	5 19 2
Elec. Supply Corporation	1	10	10	32/-	—	6 5 0
Kensington Ordinary	1	15	8	25/-	—	5 12 0
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	8½	24/-	—	5 16 8
do. do. 6% Pref.	5	6	6	5⅝	+⅛	5 6 8
Metropolitan	1	11	8	29/-	+6d.	4 16 7
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary	1	7	5	23/6	—	4 5 1
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	25/6	—	5 9 10
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1½	—	6 3 0
Urban Ordinary	1	4	7	27/-	+9d.	5 3 8
do. 6% Pref.	1	6	6	1 1/16	—	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	+3d.	7 6 4
Yorkshire Elec.	1	8	8	29/6	—	5 8 4

Home Rails.

Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	,,	5	3	64	—	4 13 9
do. District	,,	3½	3½	63	—	5 11 0
Underground Electric	£1	Nil	1⅜	18/6	—	1 12 5
do. do. Income	Bonds	6	6	102	—	*5 17 8

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 19 0
do. Def.	,,	1½	1½	24½	—	6 3 9
Automatic Telephone	1	8	10	45/-	—1/6	4 9 0
Chili Telephone	5	5	6	7⅜	+18/9	4 1 4
Eastern Extension	10	10	10	18⅜	+¼	*5 10 4
Eastern Tel. Ord.	Stock	10	10	180	—	*5 11 1
Globe Tel. and T. Ord.	10	10	10	18⅞	—	*5 6 0
do. do. Pref.	10	6	6	11	—	5 8 1
Great Northern Tel.	10	20	20	28⅜	+½	6 19 2
Indo-European	25	8½	10	46⅜xd	+7/9	*5 7 6
Marconi	1	Nil	Nil	18/9	+1/16	... ...
Marconi-Marine	1	7½	8¾	25/6xd	+⅛	6 17 3
Oriental Telephone Ord.	1	12	12	53/6	+1/-	*4 9 9
United R. Plate Tel.	5	8	8	9½	+¼	*4 6 6
Western Telegraph	10	10	10	17⅜	—	*5 15 1

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	8¾	—	7 17 2
do. do. 2nd Pref.	5	6	6	8 1/16	—	8 2 8
do. do. 5% Deb.	Stock	5	5	72½	+1	6 18 0
British Electric Traction Ord.	,,	8	—	150	—	5 6 8
do. do. 6% Pref.	,,	6	8	120	—	6 13 4
Brazil Traction	100	5	6	141½	—2½	4 4 10
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11 9
do. do. Preferred		6¾	6¼	118½	—	5 5 6
do. do. Deferred	,,	8	—	158	—	*5 1 8
do. do. Deb.	,,	4½	4½	80½	—	5 5 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	7/9	—	Nil
London United Tram. Deb.	Stock	4	4	51	—	7 16 10
Mexico Trams, 5% Bonds	—	5	5	80½	+1	6 4 8
Mexican Light Common	100	Nil	Nil	45	—	Nil
do. Pref.	100	Nil	Nil	113	—2	Nil
do. 1st Bonds	—	5	5	74½	+2	6 14 8
Yorkshire (West Riding)	1	5	—	8/9	—	... ...

Manufacturing Companies.

Babcock & Wilcox	1	13	13	54/6	—6d.	4 15 5
British Aluminium Ord.	1	12½	10	43/9	—	4 11 4
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 6
British Insulated Ord.	1	15	15	68/9	—	4 7 8
Brush Ord.	1	10	10	28/3	—	7 1 7
Callenders	1	15	—	3½	—	4 5 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	10/	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	10	28/9	—	6 19 2
Enfield Cable Pref.	1	7½	7½	1½	—	6 6 4
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	8	—	12/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	1	20	—	90/-	—	4 8 11
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1⅜	—	*4 9 0
Johnson & Phillips	1	17½	12½	2½xd	+3/6	5 0 0
Met.-Vickers Ord.	1	8	8	27/6	—	5 11 4
do. Pref.	2	8	8	28	—	6 14 9
Siemens Ord.	1	7½	7½	28/6	+1/9	5 5 2
Telegraph Construction	12	10	10	28½	—	*4 4 2

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during April, 1927.

THE Board of Trade returns for April show that there was a further decline in our electrical exports, amounting to £128,304, as compared with the March figure, although when placed against the exports of April last year a substantial rise is apparent. It must be said, however, that April, 1926, was a bad month, exports reaching a very low level; April, 1925, however, was the best month of that year. Comparing last month and March, it will be seen that the machinery section experienced a large decline, the three classes dealt with showing a total fall of over £106,000. Apart from this the only decrease of any magnitude occurred in the case of insulated wires and cables. The other two cable classes (telegraph and telephone) recorded a combined rise of about £21,000. Appreciable increases occurred in the cases of glow lamps and telegraph and telephone apparatus. The increase as compared with April, 1926, was fairly general, outstanding items being unenumerated electrical goods and apparatus, unenumerated electrical machinery, submarine cables, and batteries and accumulators. There were also two substantial decreases, *viz.*, in telegraph and telephone instruments and apparatus and "other motors and generators."

There was a general decrease of imports as compared with March, and only two increases were recorded—in carbons and unenumerated electrical machinery. The imports of unenumerated goods and apparatus were substantially reduced but the rest of the net decrease of £35,730 was fairly evenly distributed. In comparison with April, 1926, although increases and decreases were about equal in number there was a rise of £29,976. This was mainly due to an increase in unenumerated machinery imports (£36,011). The imports of insulated wires and cables were also up £13,480. The decreases were not very large, with the possible exception of non-submarine telegraph and telephone cables in which the fall was proportionately heavy.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Apl., 1927.	Inc. or dec. as compared with Mar., 1927.	Inc. or dec. as compared with Apl., 1926.	Electrical imports for Apl., 1927.	Inc. or dec. as compared with Mar., 1927.	Inc. or dec. as compared with Apl., 1926.	Electrical re-exports for Apl., 1927.	Inc. or dec. as compared with Mar., 1927.	Inc. or dec. as compared with Apl., 1926.
Electrical goods and apparatus (unenumerated)	£220.846	+ £3.810	+ £71,388	£97.778	—£20,224	— £9.099	£3,807	— £612	—£4,355
Insulated wires and cables ...	206,349	— 54.376	+ 23,222	60,984	— 2,591	+ 13,450	754	+ 237	— 320
Glow lamps	63.580	+ 11,125	+ 27,723	19 361	— 8,263	+ 1,897	965	— 2,628	+ 433
Arc lamps and parts	1,032	— 2,952	+ 302	2,240	— 236	+ 1,498	110	— 1,027	+ 103
Batteries and accumulators ...	93.849	— 9,020	+ 35,625	41.967	— 2.409	+ 3,499	726	+ 489	— 1,396
Meters and instruments ...	29,158	— 1,526	— 2,957	19,556	— 6,889	+ 225	723	+ 395	— 64
Carbons	2,081	— 2,321	+ 1,200	8.975	+ 4,982	— 1,889	147	+ 120	+ 93
Electrical Machinery—									
Electrical machinery (unenumerated)	288.996	— 36,486	+ 75,979	147,415	+ 8,687	+ 36,011	9,881	+ 1,096	+ 1,921
Railway and tramway motors	35 345	— 3,463	+ 13,001	—	—	—	—	—	—
Other motors and generators ..	146,640	— 66,674	— 30,861	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	4,963	— 5.063	— 4,528	—	— 13	— 26	—	— 4	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	65,465	+ 9,741	— 307	4.472	— 445	— 7,917	2,110	+ 2,098	+ 2,050
Submarine telegraph and telephone cable...	49,644	+ 11,512	+ 37,487	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	200.839	+ 17,389	— 37,301	28,238	— 8.329	— 7,673	3,748	+ 528	— 598
Totals £1,409,087		—£128,304	+£209,973	£430,986	— £35,730	+ £29,976	£22,971	+ £692	— £2,133
Increases and decreases for four months of 1927 ...		Exports: + £583,852			Imports: + £188,467			Re-Exports: — £12,747	

Conditions in Poland.

A REPORT upon the industrial, commercial and financial situation in Poland in 1926 has been prepared for the Department of Overseas Trade by Mr. R. E. Kimens, C.M.G., Commercial Secretary at Warsaw (Stationery Office, 1s. 6d. net). Mr. Kimens refers to the adverse effects of the introduction of the gold standard, but states that the favourable balance of trade was maintained, one factor assisting Poland being the British coal stoppage. The Government has introduced measures for encouraging export trade; the export duties on a number of articles have been abolished or reduced, and export premiums are being paid in respect of certain finished manufactured goods. Great Britain was the third largest supplier of foreign goods to Poland in 1926, and the second largest buyer of Polish products. It is stated that the supply of machinery, plant, and equipment is still largely in the hands of Germany, and the conclusion of a commercial treaty between Germany and Poland will still further aid the former. There is a market in Poland for many kinds of machinery, including large motors and generators and coal cutters, as well as household appliances, such as vacuum cleaners. During 1926 Poland imported electrical goods and apparatus valued at 26,699,000 gold zloty (43.79 zloty to the £. December 31st last) and exported such goods to the value of 440,000 zloty. Advice to those desiring to trade with Poland is given by Mr. Kimens; this may be summarised as follows:—Prices must be competitive, even better-class articles should not exceed the price of competitive articles by more than 10-15 per cent.; favourable conditions of payment should be allowed—with proper caution, business can be done on a credit basis without undue risk; the goods offered should be adapted to the country's requirements, which vary in different provinces; prices, if possible, should be quoted c.i.f. Danzig or Gdynia; a knowledge of English is not general—Polish, French or German should be employed in communications; catalogues, photographs, and drawings should accompany offers, and the metric system should be used. Agents should be regularly visited, and should be English or Polish; they should be allowed to carry consignment stocks if possible. Goods should not be dispatched until an import licence is actually issued, and should not be consigned to a German port for transshipment.

United States Electrical Production.

Two Years' Progress.

THE results, so far as they concern the electrical manufacturing industry, of the 1925 Biennial Census of the United States Department of Commerce, were summarised in a recent issue of the *Electrical World*. In all cases the figures are compared with those obtained in the 1923 census. It is shown that the number of establishments rose from 1,671 to 1,739 in the two years—an increase of 4.1 per cent., while the average number of wage-earners rose from 234,892 to 239,921—2.1 per cent. The wages paid increased by 6 per cent. to $323,834,541. The total value of products rose by 19.1 per cent., *viz.*, from $1,293,001,771 to $1,540,002,041; the value of electrical machinery, apparatus, and supplies produced in 1925 was $1,444,287,799. In addition, electrical machinery, apparatus and supplies, are manufactured to some extent as secondary products by establishments engaged primarily in other lines of manufacture. The value of such commodities thus produced in 1923, outside the industry proper, was $82,465,360, but the corresponding value in 1925 has not yet been calculated. An analysis of the establishments reveal that New York is the most important state in electrical manufacturing with 334 establishments; there are 236 in Illinois, 205 in Ohio, 142 in New Jersey, 133 in Pennsylvania, 116 in Massachusetts, and 110 in California; the remainder (463) are distributed over 30 states.

From the detailed analysis of production, it is seen that apart from two large groups ("miscellaneous electrical machinery, apparatus and supplies," $327,616,225, and "all other electrical machinery, apparatus, and supplies," $231,692,684), the most important section was "generators, motor-generator sets and transformers," $172,005,613 (as compared with $165,491,396 in 1923). Radio apparatus followed very closely upon this section, the value of the output having risen from $54,000,470 in 1923 to $170,197,861 in 1925. The third largest section was that covering primary and storage batteries, the total value of which increased from $118,065,613 in 1923 to $155,245,226. The production of motors in 1925 was valued at $112,543,596 (against $109,188,685 in 1923). The largest specified class of motors was the polyphase induction type of 200 h.p. and under, the production value of which is given as $34,653,950 (as compared with $35,586,235 in 1923). The value of fractional h.p. motors produced rose from $23,939,172 in 1923 to $28,249,265 in 1925. With regard to domestic appliances, which rose in total value from $67,002,084 to $74,726,908, details of the numbers of the various devices are given. Of the ten classes shown only two (vacuum cleaners and miscellaneous) recorded decreases; the figures, with the 1923 equivalent in parentheses, were as follows:—Air heaters, convector and radiant type, 416,654 (310,363); percolators 434,095 (260,030); toasters 735,856 (476,606); waffle irons, 306,527 (131,445); curling irons, 1,534,786 (no comparable figure); disk stoves, hotplates and ranges under 2½ kW, 178,585 (no figure for 1923); domestic ranges, 2½ kW and over, 70,931 (no figure for 1923); flat irons, 2,759,218 (2,434,280); vacuum cleaners 1,097,640 (1,240,742); water heaters, over 660 W, 53,936 (14,507); miscellaneous (value), $9,658,388 ($10,833,686). It is noted that although the number decreased the value of vacuum cleaners rose from $35,981,514 to $39,591,336. The total value of lamps produced in 1925 was $73,558,210, as compared with $71,966,225 in 1923. This total included $54,892,438, representing the value of 266,461,754 tungsten lamps, other than miniature types; 114,800,550 automobile lamps, valued at $12,432,676 were produced, as compared with 88,243,456, valued at $11,354,546 in 1923. Switchboards, panelboards, circuit breakers and switches, to the value of $69,072,044, were produced in 1925, comparing with $57,856,166 in 1923. The value of ignition apparatus produced in 1925 was $41,364,998. The only leading class of goods which recorded a decrease was telephone and telegraph apparatus (not including wireless), the value of which fell from $94,483,885 to $84,421,231. In conclusion, we give comparative values of production for other important sections:—Measuring instruments, relays and instrument transformers, $31,650,355 ($28,221,484); interior conduits and fittings, $43,328,140 ($35,305,341); motor control gear, $31,032,159 ($33,176,115); and electric fans $12,562,636 ($12,053,861).

French Electrification Halt.

According to the *Electric Railway Journal*, the electrification of the seven regions in France, as outlined in the extensive programme which was started at the conclusion of the great war, has been held up because of lack of funds The cost of construction is enormous, since long-term loans have risen in cost from 5 to 14 per cent. Several proposals for the completion of the programme have been made, but the only reasonable solution seems to be the stabilisation of the franc.

Electrical Association for Women.

Annual Luncheon.

THE second annual luncheon of the E.A.W. was held at the Hotel Cecil, London, on May 11th, under the chairmanship of Viscountess Astor, M.P., president.

Dr. S. Z. de Ferranti, F.R.S., following the loyal toasts, proposed "The Electrical Association for Women." He said that the growth of the E.A.W. was a sign of its utility. Nothing better could have happened for the development of the electrical industry than the formation of the Association. A new phase of the development upon which we were entering was the provision of electrical appliances in the home; electricity was the greatest labour saver available. Outside the professional classes it was more essential for women to have electrical knowledge than men. He congratulated Miss Haslett, director of the Association, on the success achieved by the body, which was largely due to her good organising. There were some able people working for the Association in the local centres. As an engineer he felt that the E.A.W. had a great future before it, and was indispensable to the industry.

Lady Astor, in response, said that it was due to the vision of a few ardent women that the Association had reached its present state of development. The Association was a wonderful inspiration to those who had women's welfare at heart. There was a fine quality of men behind the movement. Dr. Ferranti had been the Association's greatest friend—it was largely as a result of his efforts that the body ever got started.

"Electricity in the Service of the Community" was proposed by Maj.-Gen. Sir Phillip Nash, K.C.M.G. He said that electricity had already entered into almost every phase of our existence. Electricity in the home was well established for illumination purposes, and was fast coming into vogue for heating, cooking, and washing. Electrical power was now essential in industry. The greatest surgical discoveries of recent times would not have been possible without electricity. Broadcasting was another important phase; a few years ago it was considered a social amenity—a year ago it proved a means of maintaining our social stability. When it was considered that the structure of all matter was of electrical origin, it was realised what a great future electricity had. Each new discovery broadened the horizon and showed how electricity could serve man more. We were passing from an age when fuel and man power were wasted to one when, by means of electricity, they would be saved. In a few years' time it would be impossible to discuss international economics without electricity dominating the discussion. To-day Germany was importing and exporting electrical power. Italy was connected by h.p. lines with France and Switzerland, which saved the situation in Italy during the recent drought. Transmission lines were wanted to connect the centres of production of power with those of consumption. To maintain our industrial supremacy we must put ourselves in line with what other countries were doing. It was the duty of the Central Electricity Board to give a cheap and plentiful supply of electrical power. Sir Andrew Duncan and his colleagues had already published the first big scheme, Central Scotland (Electrical Review, May 13th, 1927, p. 754), for the reorganisation of the supply industry. No greater help could be given than to increase the domestic load. The more the Association could make people clamour for electricity the greater the service it would do for the industry.

The toast was responded to by Dame Henrietta Barnett, D.B.E., vice-president, E.A.W. Twenty years ago she inaugurated the Hampstead Garden suburb; all the original cottages were equipped with electric light. The Association, which was continually advancing under the guidance of Miss Haslett, would come to the relief of the overburdened woman and give her the opportunity to gain knowledge.

In proposing "Our Guests," Lady Snell, vice-president E.A.W., heartily welcomed the visitors, referring particularly to Sir Andrew Duncan.

Sir Andrew, in reply, recommended those present not to build their immediate hopes too high. Patience was necessary during the early stages of the Central Electricity Board's work. If Scotland had been favoured with regard to the first scheme, it was not due to him. He hoped that the scheme would set the pace for other areas.

Particulars of the Annual Conference, which preceded the luncheon, appear in our "Notes" pages.

South Wales Centre.

In a recent lecture by Mrs. L. E. Wright, according to the *South Wales News*, before the South Wales and Monmouthshire centre of the E.A.W., at the South Wales Engineers' Institute, she gave an interesting description of the methods of electro-therapy which have become of special importance in the prevention and cure of disease. Mrs. Wright said that the adoption by the medical profession of these new methods of treatment had opened up an interesting sphere of work for women who were prepared to spend two or three years studying the theoretical and practical aspects and obtaining the requisite knowledge of anatomy and physiology.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A New Ironclad Switch-Fuse.

The illustration, fig. 1, depicts a new combined ironclad d.p. switch and fuse which has been designed and marketed by MESSRS. BERRY'S ELECTRIC, LTD., The Switch House, 85-86, Newman Street, Oxford Street, London, W.1. The apparatus has a commercial rating of 10-15 A, and is suitable for working pressures up to 250 V. The switch has a quick-make and -break, and its substantial copper blades are securely clamped to a square-section mica-insulated steel shaft turning in brass bearings. The porcelain fuse holders have a 3-in. straight

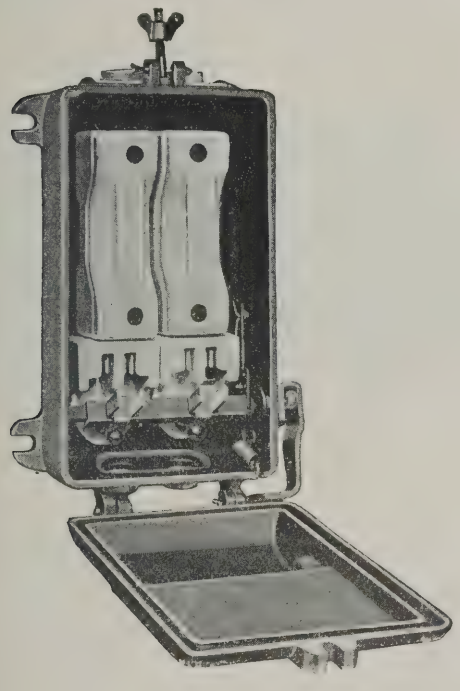


Fig. 1.—Ironclad d.p. Switch and Fuses.

"fuse break" and the copper base clips which accommodate the copper bridge blades are of the self-aligning type. Each pole is mounted on a separate porcelain base, and ample metal-to-case clearances are provided to meet the B.E.S.A. requirements. The internal fitments are all secured from the front. It is claimed that the leading-in cables are easily directed to their respective terminals, and are free from any possible abrasion by the switch shaft. The inlets and outlets are fitted with bushes accommodated in detachable end plates.

Apparatus for Automatic Temperature Control.

A recent production of the DRAYTON REGULATOR & INSTRUMENT CO., LTD., West Drayton, is the "Drayton" transmitting electric thermo-contactor, for the automatic control of temperature. The apparatus consists of a bulb at the far end connected by means of capillary tubing to a helical Bourdon tube, the instrument end of which is connected by a metal strip to a spindle arranged in the tube axis and mounted between two end-plates. Any increase of the temperature to which the bulb is exposed imparts a turning movement to the tube and to the spindle. A contact arm is mounted on a bush carried on the spindle between two collars, connection to the spindle being arranged so that the arm can be set to any point on the scale without straining the tube. A bracket fixed to the front end-plate carries coaxially with the spindle a pin on which is mounted an insulating block carrying three contact arms. The pin further carries a pointer which indicates on a dial the position of the contact device. The three contact arms (common, low and high) are connected by flexible leads to the terminal screws at the top of the instrument. By means of a key the whole contact mechanism can be set to any point on the dial. Whilst the temperature is lower than that for which the contact mechanism is set the central moving contact arm makes contact with the left-hand (low) contact, but is moved to the right to make contact with the right-hand (high) contact when the indicated temperature is reached. The right- and left-hand contacts can be set to make and break within 2 deg. F. if desired, or within any higher temperature interval specified. The moving pointer is completely balanced so that it exerts no strain on the movement in whatever position it may be. The contacts are normally of silver-gold alloy, but tungsten-faced platinum may be employed where desired. The contacts are not intended to break the current, an electromagnetically operated relay being employed for this purpose. The instrument is designed for working on pressures up to

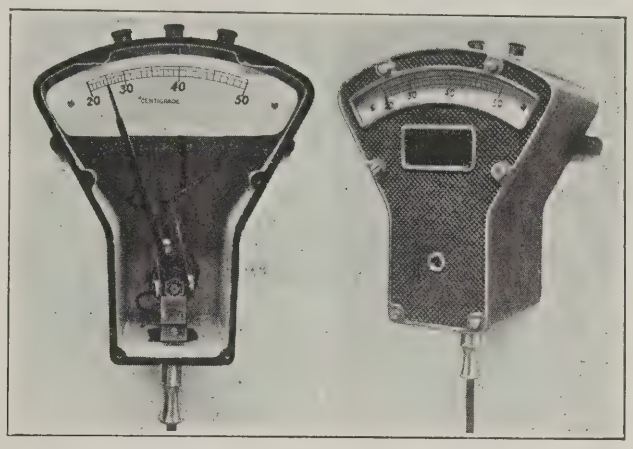


Fig. 2.—Temperature Control Apparatus.

250 V, and is made in standard ranges, covering temperatures up to 1,000 deg. F. Fig. 2 shows interior and exterior views of the control instrument.

A New Electric Fan.

The accompanying illustration shows the "Ellipso" oscillating fan, a new product of MESSRS. BERKELEY & YOUNG, LTD., Hay Mills, Birmingham. It is suitable for a.c. or d.c. working. The makers claim that the elliptical movement of the fan is obtained by the simplest gear yet evolved. A simple traversing link is connected to and rotates with a slow-motion shaft, and is anchored by a universal ball joint to a fulcrum on the pedestal. A simple gearing transmits the drive from the motor spindle to the slow-motion shaft. The link is constructed to turn crankwise and increase and decrease its angle to the slow shaft, thereby giving an elliptical traverse.

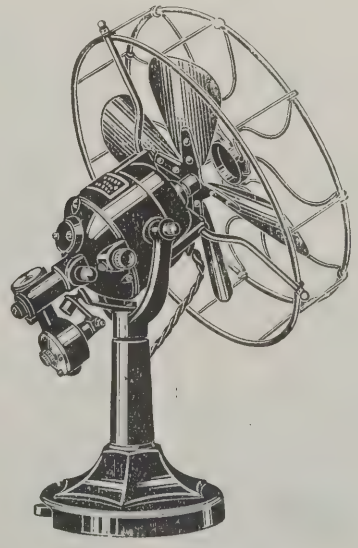


Fig. 3.—An Oscillating Fan.

A simple friction clutch allows the drive to "cut-out" automatically in the event of the movable unit of the fan or guard being obstructed, and also automatically permits of the re-starting of the drive when the obstruction is removed. The clutch may be hand-operated, if desired, by means of a small knurled knob extending from the gear box. The fan can be used as a fixed or oscillating unit in either the desk or wall-bracket position. It can be supplied in various finishes to match decorating schemes. A 3-speed regulator is provided, and standard 12-in. blades are employed.

A Remote-Control Public Lighting Scheme.

A novel system of public lighting control has been adopted at Barnsley, where groups of separate street lighting sections are each, by means of relays, controlled by one switch.

WITH a view to economy, the simplification of switching, centralisation of control, and levelling up of the times of lighting and extinguishing, a system of remote control for public lighting has been developed at Barnsley which presents several features of interest.

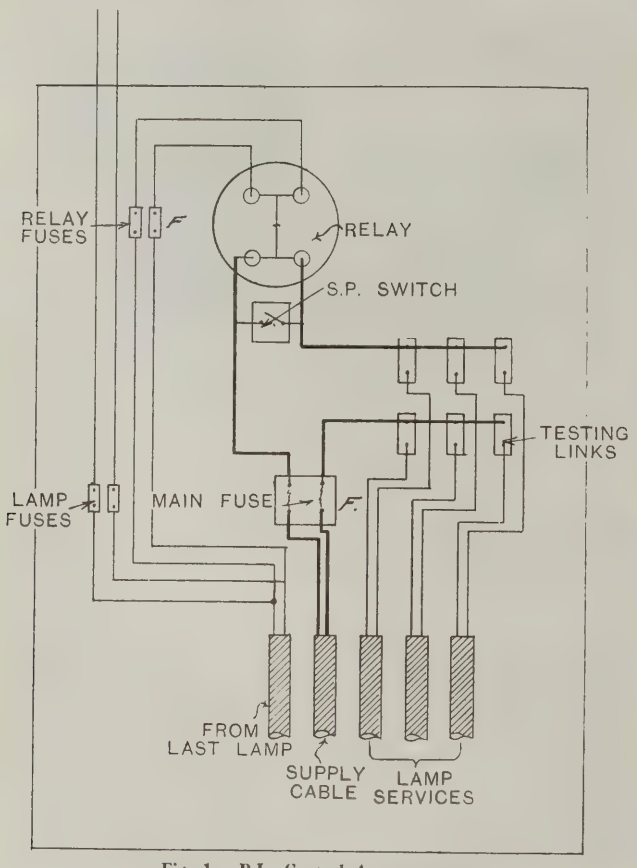


Fig. 1.—P.L. Control Arrangement.



Fig. 2.—Pillar and Standard.

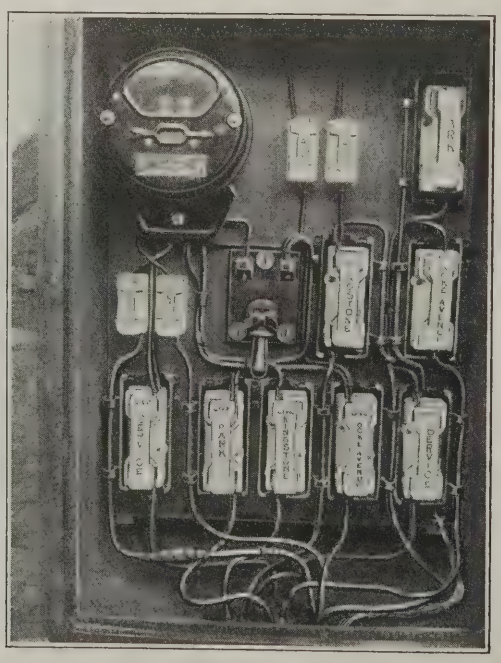


Fig. 3.—Control Chamber.

Since 1919 it has been the practice of the Corporation to lay a 0.0225-sq. in. twin armoured cable in the same trench with all new distributors. This cable is reserved entirely for public lighting and is fed from pillars, or other convenient points on the distribution system. It is looped into all the lamp standards along the route and is divided into sections, each supplying up to a maximum of approximately twenty 100-c.p. lamps, or their equivalent. At the last point on all but the last section a Chamberlain & Hookham relay is installed which is energised by the supply current and switched on with the lamps. The first section is hand controlled by an ordinary switch, each relay controlling the next section of lamps. A separate supply cable is, of course, put in at each relay point for lamps controlled by the relay. Fig. 1 shows the wiring arrangements at one of these control points, where a number of circuits are controlled by the one relay. In one case over 140 100-W lamps are switched on by a 10-A

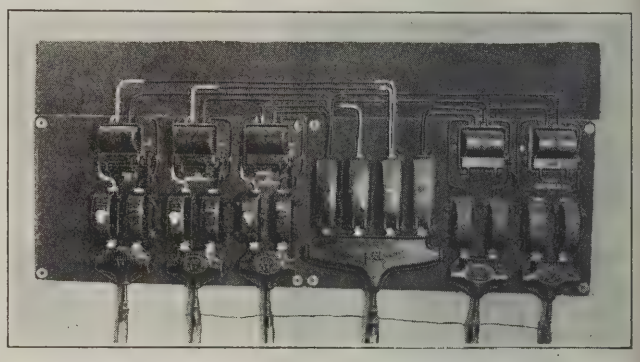


Fig. 4.—Hand Control Board.

switch. The system is extremely flexible, and additions to or re-arrangements of the circuits are easily carried out. An important advantage is that any circuit may be fed from either a.c. or d.c. mains.

Fig. 2 shows one type of lamp standard adopted for the relay control. The pillar chamber contains a board carrying the necessary fuses for several groups of lamps together with one of the relays already mentioned, and a s.p. switch. The s.p. switch is in parallel with the load side of the relay, and is used only for the inspection of the lamps during cleaning and for emergencies, should the relay fail to act. The arrangement is shown in greater detail in fig. 3. It is interesting to note that in the six years since the first relay was put into operation there has only been one failure, and that was due to causes outside the relay itself. The relays, though of the d.p. type, are adapted for s.p. use by bridging across the mercury cups.

Owing to the necessarily restricted space in the base of the standards, the twin cables are fitted with rubber tails, the joint between the paper and rubber conductors being covered by lead sleeves, plumbed to the cable sheathing at their lower ends and filled with compound.

The standards are made locally for the Corporation to the design of Mr. E. A. Barker, M.I.E.E., chief electrical engineer.

It is probable that in the future the relay system will be extended so that ultimately the whole of the public lighting will be controlled from three or four sub-stations, all within easy reach of one another and the central station.

The old practice at Barnsley was to provide extra switch cores in the distributors from which the lamps were fed; this necessitated the tapping of the distributors at the lamp posts, with the consequent weakening of the network. Fig. 4 shows a hand-operated control board in one of the "subs." With this system the number of lamps on any one circuit was limited by the size of the switch wire and neutral. It has been found in practice that the separate cable costs very little more than the old system, at the same time carrying all the advantages enumerated above. The whole of the work on the new scheme has been carried out by the staff of the Corporation.

Electrothermics.

The electric furnace in industrial chemistry and metallurgy.

(*An abstract of three Cantor Lectures delivered by* Capt. G. I. Finch, *at the* Royal Society of Arts.)

COMPARED with fuel heating, the electrical generation of heat has many advantages, the chief of which are: 1, great temperature range, up to about 3,700 deg. C.; 2, perfect temperature control; 3, absence of waste flue gases and consequently high efficiency; 4, cleanliness; and 5, that electrically generated heat may be localised and applied exactly where required. The one objection to electric heating is its high cost. The value of heat energy should, however, be judged not only on a basis of quantity, but also on that of quality. The cost of one electrically generated calorie is approximately that of 18 fuel-produced calories.

The choice of resistor material depends primarily upon the maximum temperature aimed at. Of all solid conductors suitable for the purpose of electric resistance heating, carbon has by far the higher evaporisation temperature, about 3,700 deg. C. Its liability to oxidation, however, renders necessary the provision of an inert atmosphere and, again, the mechanical strength of different forms of carbon is such that in order to obtain sufficient robustness of the furnace resistor, it must be of large cross section. This necessitates the employment of high currents at low voltages and results in heat losses and more or less poor efficiencies due to losses of heat from the resistor ends passing out from the interior of the furnace. Nevertheless, carbon in one form or another is practically the only solid resistor material suitable for temperatures above, say, 1,200 deg. C. The maximum temperature conveniently attainable with carbon resistors is in the region of 2,500 deg. C.

The Morgan Crucible Co. has recently introduced a heating element for radiation heating at temperatures up to 1,250 deg. C. It consists of a long slab of carbonaceous material protected from oxidation by a thin covering glaze of refractory material. Furnaces heated by this element are being successfully used for, amongst other purposes, the firing of pottery at 1,100 deg. C. When this process is carried out with coal heating, the rejections of finished ware, due to fouling, &c., amount to 3 per cent. With electrical heating this figure falls to a fraction of 1 per cent. and the saving thus realised more than covers the cost of the electrical energy consumed at ½d. per kWh. Further, the cost of renewing the electrical elements is less than the cost of saggars used in coal-fired kilns.

The Ajax Electrothermic Corporation, of Trenton, U.S.A., has recently developed furnaces with loadings up to 100 kVA and capacities of 600 lb. The power factor of the furnace is naturally low, but is corrected by the use of condensers. Since the induced currents flow mainly in the outer layers of the metal, the choice of frequency is determined by the internal diameter of the charged crucible and also by the resistivity of the charge; it varies from 500 to 1,000,000 cycles. The most difficult metals to fuse, such as tungsten, can be readily melted by this process, and the Gutta Percha Co. has installed at Bilston, near Wolverhampton, a high-frequency induction-furnace plant consisting of 42 units, each of 35 to 40 kVA capacity for dealing with alloys of critical composition where the freedom from contamination by carbon is essential. The chief disadvantage of this process lies in the present high cost of the installation, but this will certainly be lowered with an increased demand for high-frequency generators.

It has been said that the prosperity of a country may be measured in terms of steel and sulphuric acid. But even in a highly industrialised community such as Great Britain agriculture will continue to be a most important industry, and the nitrogen-fixation industry should be held to rank in importance with those of steel and sulphuric acid. For synthetising compounds from atmospheric nitrogen there are two methods in use in which electrothermics play a leading role. By one method nitrogen is directly oxidised in a high-pressure arc discharge; in the other calcium cyanamide is formed by the interaction of nitrogen and calcium carbide, the latter being the product of one of the first electro-thermic processes to be successfully established on a large scale.

To-day the largest proportion of calcium carbide is manufactured in continuous tapping furnaces, of which the Alby furnace may be quoted as a typical example, this being fitted with a tapping spout through which the carbide is run off in a molten state at regular intervals. The walls of the furnace are lined with refractory material and the bottom with a bed of compressed mixture of tar and electrode carbon, making intimate electrical contact with a steel grating to which one lead of the electric supply is connected. The smaller units employ single-phase current and have a bundle of four or five vertical carbon electrodes of square cross section clamped together in parallel in the supply. The largest tapping furnaces of the Halfenstein type have no hearth electrode, and take up to 12,000 kVA at a power factor of 0.85 to three vertical electrodes. The furnace efficiency is over 60 per cent., about 4,000 kW-hours being required to produce one ton of carbide. In all carbide furnaces the charge is heated by a smothered l.p. arc.

Electrode consumption is an important item, and in the carbide industry accounts for about 10 per cent. of the total production costs in the manufacture of calcium carbide. Despite several advantages the high cost of graphite often renders its use prohibitive and carbon has to be substituted. The Soderberg electrode is a continuous self-baking electrode consisting of sections of sheet-steel tubing, fitted together as required, into which unbaked electrode material is rammed or even simply poured. The mixture is baked by the waste heat of the furnace, the gases escaping through perforations in the steel tubing. The tubes are fitted with radial fins or ribs, directed inwards, which serve to hold the baked section of the mixture and increase the area of electrical contact between the latter and the steel tubing. Since the conductivity of the "green" mixture of the electrode is very low, most of the current in the cooler sections is carried by the steel tubing and fins. As the electrode descends into the furnace, more and more of the current flows through the mixture, according to the degree to which the latter has been baked. The steel tubing melts away a short distance above the furnace end of the electrode, leaving the completely baked electrode mass free.

The advantages claimed are that the consumer makes his own electrodes, and is therefore independent of the electrode manufacturer. The necessary anthracite calcining, grinding, and mixing plant for preparing the green electrode mixture is robust, simple and easily run. Calcining is carried out in a continuous smothered arc-heated kiln. Electrode consumption is reduced owing to the complete absence of butts, and breakages and to the high degree of density of the baked mass, due to the fact that baking goes on under the pressure of the weight of the upper unbaked contents of the electrode. Further, the electrode is well protected against oxidation. Economies in electrode consumption costs varying from 50 to 80 per cent. have been reported in favour of the Soderberg electrode. The maximum current density permissible is high, exceeding 12 A per sq. cm., and the largest Soderberg electrode at present in use is 83 in. in diameter. A carbide or ferro-silicon furnace with Soderberg electrodes can be operated continuously at full load with no stoppage for changing the electrodes, as a fresh section of tube is fitted to the end of the electrode protruding from the furnace, and is filled with fresh electrode mixture. Soderberg electrodes taking over 350,000 kW are said to be in use in Europe, the United States, Japan, and in the Dominions.

The essential distinguishing features of the various nitrogen-fixation arc processes in successful operation to-day lie chiefly in the nature of the arc furnaces employed. There are six such different types of furnace—the Birkeland-Eyde, the Pauling, the Schonherr, the Moscicki, the Guye, and the Wielogaski. The first three all make use of h.p. arcs in which the rate of dissipation of energy is exceedingly high. The short l.p. arc cannot be employed, as it would not be possible to pass air at a sufficient rate through such an arc, and the high concentration of electrode vapours would accelerate the decomposition of any nitric oxide formed and result in a poor yield. Whilst the general efficiency of the Schonherr furnace is much the same as that of the Birkeland-Eyde and the Pauling, the nitric concentration is considerably higher, averaging as much as 1.8 per cent. of nitric oxide. That this is so, despite the fact that the gases only pass slowly along and through the arc, is strong evidence that the oxidation of nitrogen in the high-pressure arc is primarily an electrical process. The efficiency of the three types of furnace are much on the same level, although the Schonherr furnace undoubtedly yields the richest gas. From the point of view of first cost, the Pauling furnace is the cheapest and the Birkeland-Eyde the most expensive. On the whole, however, the latter was said to be the most successful, doubtless due to the fact that single Birkeland-Eyde units can be built to take, and be operated successfully under the enormous load of 5,000 kW, whereas the practical upper load limit of the Schonherr furnace is about 1,000 kW, and somewhat lower in the case of the twin-series Pauling furnace.

The electrical manufacture of steel may be divided into two stages—the electrothermic smelting of iron ores for pig-iron, and the electrothermic production of steels from pig-

iron and steel. Whether or not the electrothermal process can compete with the purely thermal process is largely a question of the relative costs of electricity and fuel. It has been calculated that the two processes will be on a par when the cost of 1 kW-year is equal to that of 3.1 tons of coke, *i.e.*, when 1 calorie can be generated electrically at a cost equivalent to only 3.3 fuel-produced calories. It is clear that this will be the case only in countries where fuel is scarce and electrical power cheap. At present the electric smelting of iron-ore is practically confined to Scandinavia and, to a lesser extent, California. In the former country, where the conditions are most favourable, the electrothermal production of pig-iron has advanced rapidly and now ranks as a leading industry. In the case of steel-making, however, the question of relative fuel and electricity costs are of far less importance, and the electrothermal production of steel is now well established as an important industry in most civilised countries. In electrothermal steel-making steels of any desired quality can be produced from either pure or impure materials.

The electrothermal refining of pig-iron is seldom carried out, the molten pig-iron being either first partially refined in a Bessemer converter, or in an open-hearth furnace with an oxidising slag, and then finished in an electric furnace with a basic reducing slag (duplex process); or the molten pig-iron is first blown in a Bessemer converter, then further refined in an open-hearth furnace and finally finished in an electric furnace (triplex process).

In America the electric furnace is widely used in conjunction with the Bessemer converter or the open-hearth furnace, or both, for the production of high-class rail-steel and steel for constructional and shipbuilding purposes from pig-iron of large phosphorus content. In this country the electric steel furnace is employed almost solely for the melting-up of high-grade scrap steel; refining is not carried out. The two chief uses to which the electric furnace is put are to melt pure materials to steel of crucible quality, and to refine Bessemer open-hearth or scrap steel of similar quality to steel of crucible quality.

The mechanism of the electrothermal production of steel from pure materials is relatively simple and resembles that of the crucible steel process. Scrap steel of suitably low-sulphur and phosphorus content is melted down in the electric furnace, and the carbon content is adjusted by additions of pure high-carbon iron and pure iron-ore, or better, low-carbon scrap. After melting, the charge is kept molten in order to enable occluded oxides and gases to escape to the surface. The reducing atmosphere and the high temperatures attainable render the electric furnace particularly suitable for the making of alloy steels, as the loss of costly alloying elements is low, and it is easy to incorporate in the steel difficultly fusible metals such as tungsten. Compared with the crucible process, the electric furnace possesses further important advantages. Operations can be carried out on a far larger scale, comparable with open-hearth treatment, and there is no risk of contamination of the steel with flue gases or the crucible material such as is liable to occur in the crucible process. The steel is at so high a temperature that it is possible to make intricate castings with a minimum liability to flaws. From the point of view of thermal efficiency, the advantage is overwhelmingly in favour of the electric furnace with its intense and localised heat production. Starting with cold materials, the energy consumption in the electric furnace amounts to about 500 to 600 kWh per ton of finished steel, equivalent to about 430,000 to 516,000 calories (electrically produced), as compared with 1½ to 2 tons of coke, equivalent to, say, 12,000,000 to 16,000,000 calories (fuel produced) per ton of steel made by the crucible process.

In this country the cost of generating electricity is so high that, in order to be on the safe side, it is necessary to put the cost of 1 calorie electrically generated at about 18 calories produced from fuel. Thus, expressed in terms of fuel-produced heat, the cost of making 1 ton of steel from cold scrap in an electric furnace lies between 7,740,000 and 9,288,000 calories, as against 12,000,000 to 16,000,000 calories required per ton of steel made by the crucible process. It is clear that on economic grounds alone the crucible process is to be considered as wasteful. The superb skill of the crucible steel-maker is worthy of a better tool than the scientifically unsound crucible. This is available in the shape of either the high-frequency electric furnace for the production of steels of the highest grades in small batches, or the arc furnace for larger batches of steel of, or even excelling, crucible quality. The electric furnace must have a basic lining, for the removal of phosphorous involves the use of an oxidising basic slag produced by the addition of iron-ore and lime. The high temperature attainable in the electric furnace permits of the use of extremely limey slags, thus ensuring a rapid and complete removal of the sulphur. Slags of similar basicity could not be employed in the open-hearth furnace owing to their viscosity at the relatively much lower temperatures of such furnaces. The frequently observed formation of CaO_2 in the electric steel furnace bears witness to the existence of the high temperatures and the reducing atmosphere so essential to the successful carrying out of this second stage of the process. Upon removal of the second slag, the steel is "killed," recarburised and alloyed. The resulting product is, in quality, fully equal, or even superior, to crucible steel, and certainly exceeds the latter in uniformity over large batches.

From the foregoing it is clear that pig-iron can be refined in the electric furnace to a steel of the highest quality. On economic grounds, however, this is seldom done. The refining of molten pig-iron, to which has been added the necessary quantity of cold iron ore, to open-hearth steel in an electric furnace calls for an expenditure of about 200 kWh per ton of steel. The further refining of this molten open-hearth quality steel to crucible steel requires only about 80 kWh. In an open-hearth furnace a ton of steel is produced with an average expenditure of about 6 cwt. of fuel or, say, about 450,000 fuel-produced calories, as against, say, 200×860=172,000 electrically-produced calories.

With regard to the future prospects of electrothermics in this country, there is ample opportunity for the improvement of the processes. The furnace and process efficiencies can be improved, and the concentration of nitric oxide contained in the arc gases can also be increased very considerably. It is not a question of the relative cost of water-power-generated and fuel-generated electricity. The disparity between the two is by no means so great as is sometimes thought. There are many water-power-generated supplies in Switzerland which are much more expensive than the average run of coal-generated electricity in this country. We have to consider that whereas coal-generated electricity is usually available precisely where it is wanted, water-generated current is usually remote from its markets. In comparing the cost of fuel-generated and water-power-generated electricity we must not forget the important item of transport of material to the site of the water power, and the transport of the products from that site to their markets.

In the future the engineer and the chemist will co-operate rather more than they have been inclined to do up to the present. The chemist has a great deal to do in the way of improving his processes, but he will turn to the electrical engineer and ask him to improve, for instance, his means of transmission. The day may come when it will be possible to import electricity into this country from other countries, such as Norway, Iceland, and perhaps even Canada. It is simply a question of the relative cost of transport of the goods made in Canada to this local market and of the transmission of electricity.

Trolley 'Bus Operation.

An Automatic Centrifugal Governor Switch Designed for Field Shunting at a Predetermined Speed.

IN 1922 the Associated Daimler Co., Ltd. (then the A.E.C.), first tackled the problem of the trolley 'bus built on automobile lines, and had of necessity to fit a standard tramway motor. It was decided to equip the vehicle with a single motor, with rheostatic control, which gave a 'bus speed of 14 m.p.h. with full field, but 18 m.p.h. could be obtained by shunting 50 per cent. of the field current. To put this advantage of extra speed in the hands of the driver meant the possible risk of burning out the motor by overloading, and it was decided to perform the function automatically. A centri-

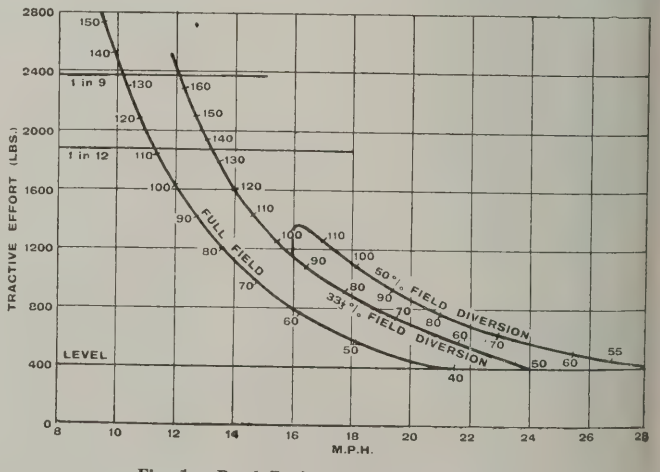


Fig. 1.—Road Performance of Trolley 'Buses.

fugal governor switch was designed to effect the shunting at a predetermined speed when the motor was not overloaded and when the acceleration of the motor was beginning to fall off. This had the desired effect of increasing the speed range and improving the acceleration of the 'bus without risk. The next step in the improvement of the trolley 'bus was the development of the lightweight motor of about 21 lb. per h.p., which was designed to run at higher speeds and with a characteristic giving higher speeds for the lighter loads, giving a greater road-speed range with a full field.

At first sight this would appear to curtail the usefulness of the governor device, especially as the new motors were capable of operating satisfactorily at all loads with 33⅓ per cent. field current shunted. The governor, however, can still further increase the speed by cutting in later and shunting the field current up to 50 per cent. The accompanying curve, fig. 1, shows the road performance of some trolley 'buses recently supplied by the A.D.C. to the Bradford Corporation. The maximum speed on the level at full load and with full field is 21½ m.p.h., and with 33⅓ per cent. field shunting the speed is nearly 24 m.p.h. These speeds are actuated through the controller and are under the control of the driver. When the vehicle reaches 16 m.p.h., the governor cuts in and increases the amount of field current shunted to 50 per cent., and thus

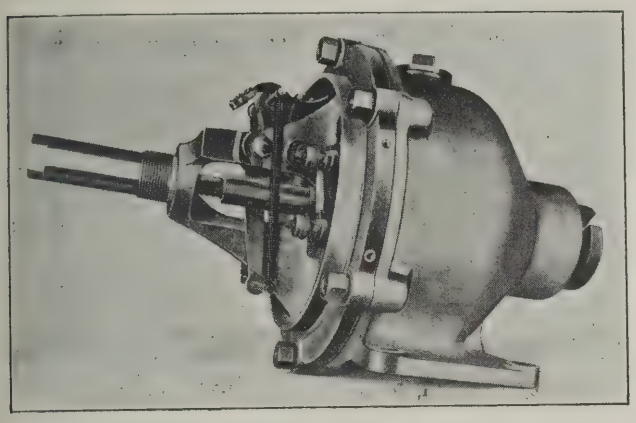


Fig. 2.—Trolley 'Bus Governor Device.

increases the speed to 28 m.p.h. During some road tests made recently at Bradford, it was found that the performance not only checked up with the curve, but that the acceleration was appreciably improved, and that the cutting in of the governor was hardly noticed. When the 'bus was lightly loaded it was found that on the worst gradient, about 1 in 13, the 'bus was 16 per cent. faster than when the governor was disconnected. With heavy loads the speed would not reach 16 m.p.h., and, therefore, the governor would not cut in and overload the motor. The governor can be switched off quite simply if desired by a 10-A switch, so that in cases where traffic conditions do not allow of extra speed it can be cut out until more suitable conditions obtain. Fig. 2 shows the governor device. The centrifugal portion follows the usual form of construction of expanding weights controlled by springs acting through levers on a push rod passing up the centre of the case. This rod in turn operates a quick break switch. The current controlled by this switch is about ¼-A at 500 V, and closes a contactor which cuts in the 5 per cent. shunt resistance.

Parliamentary News.

(By Our Special Parliamentary Reporter.)

County of London Electric Supply Co. Bill.

A Committee of the House of Commons (presided over by Sir John Ganzoni) commenced consideration of this Bill on May 9th. The main purpose of the Bill is to extend the company's area of supply to include the greater part of the county of Essex. It also proposes to confer further powers on the company with regard to its existing area of supply. There was opposition from the Colchester and Southend-on-Sea Corporations, Clacton and Shoeburyness Urban District Councils, the Essex County Council, and the Lea Conservancy Board.

Mr. W. E. Tyldesley Jones, K.C. (who appeared with Mr. Rowand Harker, K.C., and Mr. S. Turner, for the company), said that the company's Barking station was in a position to give a supply to the whole of the area. The proposal of the Bill was that the company should be allowed to supply in the greater part of the county, but where in any district there were authorised undertakers it should only be allowed to supply in bulk to those undertakers. At present the Southend Corporation had three generating stations, in which it used Diesel engines, and there was no question that it would have to get rid of these and embark on a new scheme. If the Bill were passed, the company would be able to supply electricity to Southend on terms better than those on which the Corporation could itself generate, and, in addition, electricity could be supplied in sparsely-populated parts of the county by means of the cable used for supplying Southend. It was provided that if, at the time of the company's application for the present Bill, other people had already made applications for Orders enabling them to supply in parts of the area and if those Orders were subsequently granted, the promoters were to be in the same position as if the Orders had been granted at the date of the passing of the present Bill. Several months after the company had given notice of the deposit of the Bill, the local authorities at Southend, Colchester and Clacton had applied for powers to supply in parts of Essex not supplied at present, and they were going to ask the Committee to extend the clause and to place them in the same position as that in which they would be if they had powers at the date of the passing of the Bill. A clause was inserted in the Bill making the undertaking purchasable at the end of 50 years by the local authorities. Another clause empowered the Electricity Commissioners to make an Order after the expiration of seven years, limiting dividends in relation to charges. There was also a clause providing that within two years from the passing of the Bill the company was to submit to the Electricity Commissioners a scheme for the development of electricity supply in parts of the area in which there was a demand for it. Subsequently such schemes were to be submitted to the Commissioners every five years, until the whole area was covered. If within the period prescribed by the Commissioners for carrying out the proposals approved by them, the company had not substantially commenced the works for the purpose of giving effect to the proposals, the Minister of Transport could order that the company's powers should cease as to the whole or any part of the added area comprised in the proposals. It was also provided that if applications were made or supported by the local authorities for powers to supply in any parts of the company's added area in which the company was not supplying, the company was not to oppose unless the applicants asked for power to erect, acquire, or use a generating station. An important difference between the company's 1924 Bill and the present Bill was that the former proposed to confer upon the company powers of a power company, whereas those powers were not sought in the present Bill. There was a clause, giving the company power to transfer any of its undertakings outside London to another company, with the approval of the Electricity Commissioners. Counsel explained that that was necessary on account of the special position of the London undertakings. It might be found desirable to vest the company's undertakings outside the County of London in a separate company, which would keep separate accounts, and so avoid the difficulties involved in making adjustments. The London and Home Counties Joint Electricity Authority was not deprived of any right exercisable by it at the date of the passing of this Bill to supply electricity in bulk in any part of the added area which was within its jurisdiction, and the consent of the company to any such supply was not necessary. Counsel then dealt briefly with the petitions against the Bill. He said that that of the Essex County Council related to the breaking up of roads, bridges, &c. The Southend Corporation was asking the Committee not to grant the powers which the company asked for, not only as regarded its own area, but also as regarded the whole of Essex. The Clacton U.D.C. raised the same kind of objection. The Colchester Corporation was trying to do on a small scale what the company proposed to do on a large scale. The erection of a small station by the Corporation was nearly complete, but it could not compete with Barking. There was no appearance on the petition of the Shoeburyness U.D.C., and that of the Lea Conservancy Board was left to be dealt with when the clauses of the Bill were finally settled.

Mr. C. H. Merz stated that the company had laid 300 miles of mains, 100 miles of which were in the County of Essex.

On May 10th, Mr. Merz was cross-examined by Mr. Ralph Bury (on behalf of the Essex County Council), and said that the offers made by the company in connection with the company's 1924 Bill, to supply in Chelmsford within two years and in Epping within three years, were not repeated now, because conditions had changed by the fact that the Central Electricity Board was now preparing schemes; any arrangements of this nature with individual authorities could quite conceivably conflict with schemes prepared by the Board.

Sir Harry Renwick (chairman of the company) said with regard to the clause in the Bill to empower the company to transfer that part of its undertaking which was outside London, that the Commissioners could be trusted to ensure that the terms of transfer were fair and proper.

Sir Lynden Macassey, K.C., cross-examining on behalf of the Southend Corporation, asked why the company should put forward a scheme for dealing with Essex before the county had been considered by the Commissioners and the Board. Sir Harry replied that the scheme could only be carried out after it had received the approval of the Commissioners. If they waited until the Commissioners or the Board brought up a scheme to deal with a rural county such as Essex, he was afraid they would have to wait a long time. Before promoting the Bill he had consulted the Commissioners, and the Bill was largely framed on the advice given by them.

Mr. Jacques Abady cross-examined on behalf of the Clacton U.D.C. After securing the admission that, if this Bill were not passed, the company could apply for a Special Order to cover the whole of the added area, he pointed out that if the company did apply for a Special Order, that Order would include, as was always the case, the Section of the Electric Lighting (Clauses) Act which placed undertakers under an obligation to supply in certain districts within specified periods.

On Wednesday, May 11th, Mr. H. Hobson (joint manager of the County of London Co.) gave evidence with regard to the

details of the negotiations between the Company and the Southend Corporation for a bulk supply to the latter. An offer from the County of London Company for a bulk supply to the Corporation, based on conditions imposed by the latter, was not accepted. Subsequently a further offer of a bulk supply was made to the Corporation, but had neither been refused nor accepted. The erection of a generating station on the River Crouch would have necessitated a capital expenditure by the Corporation of £649,000, and the estimated cost of operation, including loan charges on the capital, was £174,615 per annum. Mr. Rider had reported that, carrying the comparison to the year 1930, the adoption of the bulk supply scheme would result in an apparent annual saving of £8,475, but if the comparison were carried to 1940, the advantage would be with local generation.

Mr. F. G. Thomas, K.C., for Colchester Corporation, said that rights of the character asked for should not be given without imposing definite obligations. In 1925, the Colchester Corporation had commenced the erection of a new generating station, but as the work had not proceeded very far, the formal application to the Commissioners for powers to supply in outside districts was not lodged until December of last year. Dealing with the clause under which the company was to submit schemes to the Electricity Commissioners for the development of the various parts of the new area from time to time, he pointed out that its effect was to leave the company, and not the Commissioners, to judge what work should be carried out.

Mr. W. C. C. Hawtayne gave particulars of the costs of the Colchester station designed to show that if electricity were obtained in bulk from the company, it would cost the Corporation more than if it were generated locally.

On May 12th, Mr. Hawtayne said that Colchester had no objection to the company's having distribution powers over the whole of that part of the county which Colchester did not want. Witness said that if the local authority at Wivenhoe wished to become the authorised distributor in its own area the Colchester Corporation would not seek distribution powers there but would supply in bulk. Arrangements were already made for that bulk supply. Negotiations were also in hand for a bulk supply to Brightlingsea. Witness quoted figures of costs for Colchester and Barking, but Mr. Harker contended that he had compared the figure of £26 5s. representing the capital cost per kVA installed at Colchester with the figure of £20 2s. representing the capital cost per kW of output at Barking.

Mr. Jacques Abady, for the Clacton U.D.C., said that although his clients had only a small station, generally speaking they were supplying electricity at a lower rate than that at which the County of London Co. supplied. If the development of the district was entrusted to the County of London Co., it should be through the medium of a Special Order, which would give the local authorities an opportunity to make representations and secure protection. The clause prohibiting the company from opposing any application made or supported by a local authority for an Order, unless the Order applied for included power to erect, acquire or use a generating station, would force such applicants to take a bulk supply from the company.

Mr. G. Broadhurst (electrical engineer to the Clacton U.D.C.) gave evidence to support Mr. Abady's statement, and spoke of the intended developments. He was of opinion that the Clacton station would continue to work for many years.

The hearing was continued on subsequent days and the Committee passed the Bill on Tuesday.

East Anglian Electricity Bill.

A Committee of the House of Commons presided over by Sir A. Shirley Benn on May 10th, began consideration of this Bill. The promoters are the East Anglian Electric Supply Co., who are asking for powers to supply electricity in the counties of Norfolk and Suffolk. There are 11 opponents to the Bill, the principal being the Norwich, Ipswich, Great Yarmouth, and Bury St. Edmunds Corporations.

Mr. H. P. MacMillan, K.C., who appeared for the promoters, said the company had a Special Order for an area in the southern part of Suffolk, bordering on Essex, and including a small part of Essex. It had the backing of the Greater London and Counties Trust, which had a controlling interest. Originally, the Bill included a large portion of the county of Essex, but as the County of London Electric Supply Co. had promoted a Bill which included Essex, the whole of Essex had been cut out of the Bill. The Ministry of Transport now offered no objection to the principle of the Bill. It had been said that the position of some of the authorised distributors in the area would be prejudiced, as a few of them were applying for extensions of their areas. The promoters, however, were willing to concede that those additional areas, if granted, should not be supplied by the promoters without consent, and the same provision was made to apply to any application for an increase of area by an existing authorised distributor made before the date of passing of the Bill. In addition, the promoters had included a clause providing that if after the end of three years from the passing of the Act, applications were made for Orders to supply in any part of the area, the promoters would not oppose. The promoters were compelled every three years, or more often if required by the Electricity Commissioners, to prepare schemes for dealing with areas not supplied in which a demand arose. Any Order made by the Commissioners in those circumstances would make it obligatory upon the company to give a supply within two years. A definite scheme might conflict with subsequent schemes of the Central Electricity Board. The Bill did not provide for a new generating station; it was hoped that bulk supplies would be available from large generating stations.

Mr. B. G. Drummond, general manager and director of the company, said that the policy of the company was to develop the rural demand. Before the Bill was promoted the Commissioners had stated that there was no necessity to make provision for a generating station in the Bill, because it would be the duty of the Central Electricity Board to supply the necessary energy. Should supply be required before these arrangements were made, supplies would be available from the Norwich, Yarmouth, or Ipswich Corporations, or from the North Metropolitan Electric Power Supply Co., and the Bedfordshire, Cambridgeshire, and Huntingdon Electric Supply Co. A clause enabled the company to take and give bulk supplies, and a scheme had been prepared involving a capital expenditure of just under £500,000 for mains. Mr. Craig Henderson, for the promoters, said that in order to meet a point raised by the chairman the Bill would be amended so that the first proposals should be put before the Commissioners within 12 months of the passing of the Bill.

Mr. William May (director of the Greater London and Counties Trust) said that the Trust was formed by some of his American friends to acquire interests in electricity and other public utility undertakings. The Trust was prepared to find £500,000 or more for the purposes of the promoters of the Bill. They would expect a 10 per cent. return on the capital, and they were satisfied that electricity could be profitably developed in the area.

On May 11th, Mr. F. M. Rogers, chairman of the company, and managing director of the Greater London and Counties Trust, Ltd., said that the Trust obtained control of the East Anglian Co. in March, 1926, and since then £15,000 had been found for extensions of the company's business, whilst a further expenditure of £30,000 was contemplated immediately. Any additional capital required would be provided by the Trust. Sir Philip Dawson was chairman of the Trust, and the new capital required would be found by American financiers. During the first year, if the Bill passed, the expenditure would amount to at least £150,000. The £30,000 was required for a trunk main between Braintree in Essex and Sudbury in Suffolk in order to give a more effective supply there. A scheme for carrying h.p. mains throughout the area had been prepared, and although Mr. May had stated that a return of 10 per cent. was anticipated, that would not be possible for a number of years. Mr. Wrottesley, K.C., said that the company would merely be distributing the current taken in bulk from the local authorities at a higher price than the local authorities could supply it. The profits of the company were not limited under the Bill. Mr. MacMillan, K.C., for the promoters, said that the Minister of Transport had suggested a sliding scale, and the promoters were considering that. Clause 16 of the Bill provided for the revision of prices. He also said that the Trust was not associated with any American or other manufacturing firm, so that there was no danger of orders going to America. Mr. Spencer Hawes said that the company's position must be regularised by being changed to a statutory one, otherwise capital could not be raised for extensions. It was the intention, if the Bill passed, to close down most of the local stations and take bulk supplies. The company undertook to prepare a scheme within one year, and to carry it out within two years. The company was prepared to erect a power house if the Commissioners decided that one should be constructed. Mr. Wrottesley commented on the fact that no inquiries had been made concerning the prospects of the area as a whole, and suggested that they should have been made before coming to Parliament. Mr. Hawes replied that the evidence was that supply was being given profitably in a large number of districts by the company under non-statutory conditions. The Bill had the same effect as if it were a Special Order as recommended by the Minister of Transport. The fear that the transmission cables from the Central Board in East Anglia would be in the hands of the company was removed by the fact that the Central Board could, if it thought fit, take over those mains.

Local evidence in support of the Bill was then called and the case for the promoters was closed.

On Thursday, May 12th, Mr. Wrottesley said that the promoting company would not generate electricity, and would be merely in the position of middleman between those who generated electricity in the area and those who used it, which could not be in the interests of the consumers. Looked upon as a power scheme the Bill was unnecessary, whilst the rough outline of a scheme of h.p. mains which had been suggested was premature because it was not based upon any inquiries as to the probable demand.

Mr. F. G. Thomas, K.C., for Stowmarket U.D.C. and some rural district councils, said that under the Bill it was left to the promoters to submit schemes to the Electricity Commissioners, and there was no means of compelling the promoters to put forward a scheme for the whole of the area.

The Chairman said that the Committee, having heard the evidence, was inclined to approve the preamble subject to certain conditions, but it was not satisfied that the financial resources of the company were sufficiently strong at the present time to justify such a large area being entrusted to it. He accordingly adjourned the hearing until the following day to give the promoters an opportunity to confer on the matter.

Mr. MACMILLAN, K.C., for the promoters, referring to the decision on the previous day, said that the Bill would not have been placed before the Committee had it not had behind it the support of the Greater London and Counties Trust, Ltd. That concern was prepared to enter into a contract forthwith with the company, to the effect that in the event of the Bill being passed the Trust would subscribe further ordinary shares to the amount of £150,000 at least for developing the area, and if so desired the contract would be produced to the Committee before the Bill was passed.

Mr. F. G. THOMAS, K.C., argued that if, after the Bill was passed, investigations showed that the area, or large portions of it, would not be remunerative there was nothing to prevent the contract being annulled. Mr. MACMILLAN reminded the Committee that the promoters had to submit proposals within a year, and if they were not carried out the powers under the Bill could be revoked within two years. Mr. THOMAS replied that to meet that obligation it would be necessary for the East Anglian Co. only to provide a scheme for an infinitesimal portion of the area.

The CHAIRMAN announced that the Committee would like to examine the proposed contract between the Trust and the East Anglian Co., and also that it was proposed to put in, as one of the conditions of passing the Bill, an obligation that the company should, within 12 months of the passing of the Act, submit to the Electricity Commissioners a general scheme of transmission throughout the whole area, costing not less than the £500,000 that had been mentioned during the proceedings. In order to give the promoters an opportunity of going into those matters the Committee adjourned until May 19th.

Electricity Schemes.

On May 10th, during a debate on the Ministry of Transport vote, Col. ASHLEY said that the Central Electricity Board had already received one scheme from the Electricity Commissioners, the Scottish scheme, and the scheme for Central England was in an advanced state of preparation and would be ready almost at once. There were two other schemes that were being investigated and that would in a few months come before the Central Electricity Board. The investigations with regard to the Severn barrage had reached a stage in which considerable hopes were raised that it would be a success.

Lt.-Col. MOORE-BRABAZON said that the cost of the Severn scheme would be about £8,000,000. It was said that whether it would ever prove a commercial success would depend entirely on the price of coal. If in future coal were to be more than 17s. a ton the scheme would be a commercial success.

Mr. T. WILLIAMS complained of the attitude of the Electricity Commissioners in refusing to sanction an application by the Mexborough Urban District Council for sanction for a loan under Section 11 of the Electricity Supply Act, 1919. The effect of that refusal was to place the Council in the unfortunate position of having to pay a much higher price for the purchase of power from the Yorkshire Electric Power Company. If the Minister concurred in such decisions of the Electricity Commissioners, it would mean that the small but highly efficient generating plants in the country were going to be handed over to the big electricity companies without any compensation.

Mr. ATTLEE expressed himself as strongly in favour of the concentration of generation in capital stations, but said that some of the big companies had taken very short-sighted and narrow views. They did not offer sufficiently attractive terms for bulk supply, and their attitude was militating against the success of the 1926 scheme. If the Minister approved of the reduction of the period for loan charges from 15 years to 10, he was not really benefiting the progress of schemes under the 1926 Act, but he was really weakening the bargaining power of local authorities and small supply companies to get reasonable terms of bulk supply from the big power companies.

Col. ASHLEY said that he could not interfere with the finding of the Electricity Commissioners regarding Mexborough. His information was that the Yorkshire Power Co. would be able to supply current cheaper than the Corporation.

The Mexborough Case.

On May 10th, Mr. T. WILLIAMS again raised the question of the Mexborough case. He asked if the Minister of Transport was aware that the Commissioners had based their calculations upon repayment of the necessary loan over a period of 10 years instead of the usual period of 20 years; that the facts were such that, without having halved the period of repayment of the loan, the saving was in favour of local generation, and if he would have the case reconsidered.

Col. ASHLEY said that it was the practice of the Electricity Commissioners to allow a period of less than 20 years for the repayment of loans for generating plant in cases where there was reason to anticipate that the utility of such plant might be superseded owing to the probability of bulk supply or other circumstances. Mexborough was in a provisionally determined electricity district, and he was not prepared to ask the Commissioners to reconsider their decision.

Electricity Loan Periods.

On May 10th Mr. T. WILLIAMS asked the Minister of Transport if he would state in how many cases, where a local authority had made application to the Electricity Commissioners to extend its plant, the period for repayment of loan had been calculated on the basis of 10 years; and whether, in view of Clause 14 of the Electricity (Supply) Act, 1926, he would state why that new basis was used.

Col. ASHLEY said there were three cases where the Electricity Commissioners had adopted 10 years as the appropriate period, and that in a number of other cases the calculations were being made on the same basis. It had been the practice of the Electricity Commissioners since 1920 to prescribe a period less than 20 years for the repayment of such loans where there was reason to anticipate that for any special reason the plant might be superseded during a shorter period.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

The Ordinary Engineer and the Beama.

In my recent article on "The Ordinary Engineer and his Remuneration," I expressed the opinion that the subject of vital interest to the "ordinary engineer" is his salary. That is the touchstone with which he tests the various aspects of the industry which affect him. I do not suggest that his views are so narrow that he can only examine the immediate effects of any of these aspects upon his own position, but I do affirm that while he may view them in their correct perspective with regard to their effect on the industry as a whole, their main interest is, to him, how they affect him financially.

The Beama is, of course, the great hush-hush of the electrical industry, and it is a striking testimony to the integrity of the profession that it has escaped criticism for so many years. It was on this account that I refrained from referring to it in the article already mentioned above. Even now, although employed by a firm not in the Beama, I feel myself bound to some extent by the confidence reposed in me by previous employers who were members of it. Since, however, the Association has recently come into the limelight and has been defended by Mr. D. N. Dunlop and others, I feel myself at liberty to make some comments.

Speaking for the "ordinary engineer," I believe that the Beama, like the trade union, is a necessary institution. Like the trade union, I believe it has overshot its mark. Speaking from personal experience, I beg leave to doubt that Beama prices are seldom in excess of the prices which would be charged by the individual firms.

One of the great arguments of the Beama defenders is that it enables them to pay higher wages—and presumably salaries. The fact is that it is hardly possible for them to be lower—moreover, the wages paid by Beama firms are at trade union rates, just as are those paid by firms outside the ring. Salaries are higher, if anything, outside the ring than in it. Taking into account the index figure of the cost of living (published by the Board of Trade) salaries are lower to-day than ever before—lower even than in those dark days before the Beama saw the light of day. I do not deny that shareholders—and probably directors—have benefited by its birth, but I do deny emphatically that the benefits accruing to Beama firms are passed on in any way to the engineering staffs. For instance, since it has been admitted that the Association controls prices and distributes work, let it also be admitted that in very many cases—if not all—unsuccessful tenderers are reimbursed for their quoting expenses by the firm which obtains the contract. These bonuses are very considerable amounts and far in excess of the actual expenses of tendering. They are, nominally, to pay the costs of the engineering and sales staffs. I would like to hear from *any* Beama firm that it sets aside any proportion of such bonuses to augment the salaries of its staff. I should like to hear a denial that such sums are simply thrown into the general account for the ultimate benefit of shareholders—and directors.

We have all of us experienced that threadbare cry of "bad times" as an excuse for unjustifiable parsimony in the matter of salary increases. I should go weak at the knees and goosey all over if I heard of any engineering firm—Beama or otherwise—whose directors said to the engineering staff: "Gentlemen, we have had a jolly good year, and in so far as our success is largely due to the engineering staff, we have pleasure in raising your salaries 10 per cent. all round, so that you can eat butter instead of margarine and have meat three times a week instead of twice."

In conclusion, I throw down a definite challenge to any Beama firm, to show that they have given a definite percentage increase to their engineering staff in the same way that they give a definite percentage dividend to their shareholders.

P. B. E.

May 11th, 1927.

The Bogy of 40.

In your "Situations Vacant" columns for the 29th ult., I noticed an advertisement inviting applications from experienced men who have specialised in commercial work, "Age not over 35," and I am tempted to ask why some employers,

especially those belonging to the electricity supply profession, should consider a man of over 35 years inferior in ability and efficiency to a younger man.

I am 45, and feel that my mental capabilities and powers of concentration and application were never so pronounced as at the present moment, whilst those extra ten years have taught me much more than I ever knew when I was 35.

Let us explode this "40 bogy" once for all. If a chief engineer of 65 is capable of conducting a supply undertaking, he is entitled to draw his £1,000 per year, but need it tax his sense of proportion or charity to suggest that his assistants of 40 and 45 are equally worth their £6 or £8 per week?

May 11th, 1927. **Live and Let Live.**

Sheath Losses in Cables.

All workers in this field will be grateful to Mr. Brockbank for bringing to notice the ingenious and simple method for measuring sheath losses described in his article in your current issue. From the point of view of ease in manipulation and rapidity in carrying out a number of tests the method will certainly commend itself for single-phase work, and if only the author can develop a simple adaptation for use with 3-phase currents on three single-core cables laid side by side he will deserve our further thanks.

Mr. Brockbank gives only one example of the application of the method, and in this he shows that the sheath losses in a short length of 66-kV single-core lead-covered cable with 6 in. between centres amount to 28 per cent. of the copper loss. As so much interest is being displayed in 66-kV cables just now, I think it is important to point out that the figure is not to be taken as indicating the normal sheath loss for transmission at this voltage. If the two cables (there were only two, of course, as it was a single-phase test) had been placed at 3-in. centres instead of 6 in., the value of the losses would have been considerably less than 28 per cent., and as I have shown in my recent paper before the Institution, if the three cables had been laid up close together under one armouring to form a 3-core S.L. cable the total sheath loss would have been reduced to a value less than 5 per cent. of the copper loss.

P. Dunsheath.

Henley Research Laboratories, Gravesend.

May 16th, 1927.

Cheap Electricity.

I read with considerable interest your review of Messrs. Ruston & Hornsby's pamphlet entitled "Cheapest Electricity," but I have not seen the pamphlet yet. I have also read Mr. R. Borlase Matthews's reply to that pamphlet, and I note that he refers to a pamphlet for which I am responsible, entitled "A Word in Favour of the Independent Power Plant," and states that Messrs. Ruston & Hornsby's pamphlet is a condensed version of mine. This may or may not be correct, but I note that Mr. Matthews states that I specialise in advising on small power plants, which is, of course, correct up to a certain point, but he must disabuse his mind of the idea that the pamphlet was written with an interested motive as regards myself; it was written at the time when the Electricity Bill was under consideration, and I felt that it was desirable that the advantages of independent power plants should be recognised, and that consumers who had waste heat, either in the form of unsaleable coal, gas from coke ovens or blast furnaces, or exhaust steam, should realise that they could produce power at a very low cost by utilising this waste heat in independent plants of their own. In support of my statement I would refer to my paper on "Electric Winding Considered Practically and Commercially," read before the Institution of Electrical Engineers on January 16th, 1906, which was very fully discussed at Manchester and in London. In winding up that discussion I made the following statement:—

> "In collieries generally, particularly those in which electric winding is adopted, colliery owners would be well advised to take their current from the supply companies, assuming that they can purchase it at a reasonable price, even if this price is slightly in excess of what they can make the current for themselves; the amount of capital required for generating plant being so heavy, it can usually be applied to much greater advantage in increasing the electrical plant or improving other machinery about the collieries."

During the last twenty years it has been my lot to consider on behalf of consumers the agreements suggested by power companies for the supply of current not only for collieries, but also for iron and steel works, engineering works, and manufacturers generally, and I have endeavoured to follow the advice which I gave in my discussion; but power companies generally do not realise, or at any rate they do not admit, their inability to compete with consumers who are producing their own current from waste heat, nor do they look in a sympathetic manner at all upon the small consumer who may desire to install his own power plant in the form of a steam, oil, or gas engine, notwithstanding the fact that he can do so generally at a much lower cost in all ways, that is, as regards first cost and running cost.

In my opinion, based upon a long experience in connection with agreements, the present form of agreement adopted by many power companies is far too complicated to be understood by the ordinary consumer, who is asked to accept a maximum-demand charge and unit charge, and, in addition, a minimum payment whether he uses current or not, an adjustment if the power factor falls below a certain limit, and other penalties, which make it very difficult to arrive at what the actual cost of the current will be per unit consumed.

I have listened to the arguments of the power companies as regards the fairness or otherwise of the maximum demand plus unit basis of charging, but I fail to see why, except in very special cases, a flat-rate system of charging cannot be adopted, the charge per unit being based upon the consumption monthly or annually.

I entirely agree with the views expressed by Mr. Matthews as regards the Electricity Commissioners taking an interest in the terms of supply to consumers, and, whilst it may be necessary to add to the Commission a certain number of business men who understand the consumers' requirements and the necessity of a cheap and abundant supply, and who would be able to deal also with any disputes that might arise between the consumers and the power companies in connection with the cost of supply, it would certainly inspire a great deal of confidence in the minds of the consumers.

W. C. Mountain.

Newcastle-on-Tyne, *May 5th*, 1927.

The Ideal Wiring System.

"C.T." says in your issue of the 13th inst. that "rubber sheathing is apt to crack on the outside of bends after it has been in position for some time, as rubber will do in tension." "C.T." is half correct. Some rubber sheathing may crack as he states, but C.T.S., when properly made, will not. We have dealt very thoroughly with this matter, ever since the very early days of our patent, when we discovered this fly in the ointment; and we defy "C.T." or anybody else to cause *our* C.T.S. to crack under any of the conditions mentioned by him.

"C.T." further says: "This fault is particularly noticeable in tropical climates, where great variations both in temperature and in dampness or otherwise of the atmosphere are experienced." The reply to this is as above, added to the fact that we have been sending our C.T.S. *for many years* (on the instructions of the most eminent Government and other consulting engineers) to all sorts of tropical places, mainly because it stands up to the severe conditions there which destroy other types of cable.

In conclusion, we thank you and "C.T." for giving us the opportunity of publishing this information in your widely-read columns, equally with your other contributor "C.T.S.," who has spoken so well of our "Baby."

St. Helens Cable & Rubber Co., Ltd.

D. Evans, *Secretary.*

Slough, *May 13th*, 1927.

I have read with interest Mr. H. R. Taunton's article, and can only come to the conclusion that the writer is not very familiar with the advertising columns in your journal. Mr. Taunton states that "a drawback to the use of cab-tire cable is that none of its makers have provided a cheap and simple joint box for use with it—or if they have, they do not seem to be *proud* of them, for we never hear of them."

While this statement may be partly correct, it does not prevent a non-cable manufacturer from inventing and manufacturing a box for use with cab-tire cable.

For Mr. Taunton's information I would state that the majority of the leading C.M.A. manufacturers "list" and "stock" the "J.C.W." universal connector box for use with cab-tire cable.

In conclusion, I would say that I am very *proud* of this connector box, particularly in view of the numerous unsolicited testimonials I have received from users and colleges.

J. C. White.

Manchester, *May 14th*, 1927.

Electro-Culture.

I beg to acknowledge my indebtedness to Mr. R. Borlase Matthews for the information he has given me on the subject. I am pursuing my investigations along the lines indicated by him.

May 14th, 1927. **Paisley.**

Carnegie Awards for Gallantry.

In connection with the accident which occurred at the new works of the London Electric Supply Corporation at Deptford Dry Dock in January last, awards made by the Carnegie Hero Fund Trustees for gallantry were presented by the Mayor at a recent meeting of the Greenwich Borough Council to George Edward Thorpe, George Gaunt, John Henry Perkins, and Thomas John Taylor.

Legal.

Impex Electrical, Ltd., v. Norton Wireless Co., Ltd.

This action, which was adjourned from May 6th, came before Mr. Justice Tomlin in the Chancery Division again on May 11th. The plaintiffs claimed an injunction restraining the alleged infringement by the defendants of their trade mark "Dario" for radio valves.

Mr. Courtney Terrell further cross-examined Mr. Thomas Kelly, a member of the defendant company. In reply to counsel's questions he said his firm in 1925 received a parcel of "Radiomicro Special" valves made by La Radiotechnique, the French firm from which the plaintiff company obtained its supplies; they were not in cartons but in wrappers. Mr. Terrell asked if he had received, since 1925, valves from France in boxes bearing a French inscription. Mr. Kelly replied in the negative. The valves he received were made in Holland and came to him through France. A man in France named Sassoon had supplied him with boxes, but not, to his knowledge, with "Radiomicro" valves. Mr. Terrell then handed to him several Imperial Airways delivery sheets, dated in 1926, which, he said, showed deliveries to the defendants of parcels of "Radiomicro" valves, but witness denied all recollection of them and declared that the signatures on the sheets were not his. In one case, he said, it was his wife's, and another he could not identify.

The freight manager of Imperial Airways, Ltd., said that in 1926 he saw parcels of valves consigned from France to the defendants. The valves were packed in cartons bearing the word "Radiomicro" and other French words.

On May 12th, when the hearing was continued, Mr. Melville, K.C., for the defence, said that Mr. Kelly had been able to find four delivery sheets of last year, some of which related to the delivery of "Radiomicro" valves. Evidence was given by two employés of the defendant company that they had never sold valves bearing the word "Dario."

Mr. David Cartwright, a traveller for dealers in wireless goods, said he was in the defendants' shop when a man dressed as a chauffeur bought a valve. (This man is said to have been the employé of the plaintiff company who bought the alleged infringing valve). He did not know what he bought. He himself bought two "Radiomicro" valves, but he took no special notice of them.

The case was adjourned until May 18th to enable the plaintiff company's chauffeur, who was stated to have purchased an infringing valve, and another witness to be recalled.

Theft of Electricity.

Thomas H. Smith was fined 20s. at Worksop last week for stealing electricity from the Butterley Colliery Company. The company, it was stated, supplied electricity to houses in the village of Ollerton. Wires were found to have been fixed to Smith's caravan, and electric light was used nightly in the caravan. Defendant admitted running a cable from his mother's bungalow to the caravan, and having a light for a week, but "he thought there was no harm in it."

Taunton v. Tomlinson Lee.

In the King's Bench Division last week, before Mr. Justice Rowlatt Mr. H. Tomlinson Lee, formerly borough electrical engineer of Wimbledon, was sued by Mr. Hugh G. Taunton, solicitor, who sought to recover £868 as his costs for acting as Mr. Lee's solicitor. The defence was a denial that defendant retained the plaintiff as his solicitor, and alternatively it was said that the costs which defendant was to pay the plaintiff were limited to five guineas.

Mr. Hawke, K.C., for plaintiff, said that when Mr. Lee relinquished the post of borough electrical engineer he proposed taking legal proceedings. He discussed the matter with Mr. G. E. Bellingham, a solicitor, who was a member of the Wimbledon Council, and wanted Mr. Bellingham to act for him. Mr. Bellingham, however, did not wish to do so, and introduced Mr. Lee to Mr. Taunton, the present plaintiff. The first action was against the Wimbledon Corporation for wrongful dismissal; the Corporation paid £138 into Court in settlement. Then followed a series of four actions for slander, &c., two of which ended in verdicts for Mr. Lee, while in a third the jury disagreed, and in the course of the fourth Mr. Lee changed his solicitor. Mr. Taunton acted for Mr. Lee in all these cases, but there was no doubt that a great deal of assistance was rendered by Mr. Bellingham. It was not true that plaintiff agreed to accept only five guineas for his services.

Mr. Lee said that Mr. Bellingham told him that he would do the necessary work on payment of his out-of-pocket expenses. Witness understood that Mr. Taunton was merely lending his name for the proceedings, and he understood from Mr. Bellingham that he would have to pay Mr. Taunton only five guineas. Several witnesses were called for the defence, who said Mr. Bellingham told them he was doing the legal work and charging Mr. Lee only his out-of-pocket expenses.

His Lordship said that although Mr. Taunton did a great deal the real work was done by Mr. Bellingham. He thought that there was no promise by Mr. Lee to reward Mr. Taunton or Mr. Bellingham through him. He therefore gave judgment for Mr. Lee.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken

26,081. "Electrical primary and secondary cell." A. Sellino. October 19th, 1925. (Convention date not granted. Addition to 225,197.) (241,898.)
29,114. "Railway signal systems." Automatic Telephone Manufacturing Co., Ltd., A. E. Hudd, and A. E. Tattersall. November 18th, 1925. (269,608.)

1926.

712. "Electric current distributors." C. Campbell and British Tabulating Machine Co., Ltd. January 9th, 1926. (269,622.)
955. "Electric switches." A. B. Reeves and F. E. Minton. January 13th, 1926. (269,629.)
1,041. "Electric batteries." H. T. Harrison and G. Campbell. January 13th, 1926. (269,633.)
1,134. "Electrical gas-lighting apparatus." W. E. King and Gas Meter Co. Ltd. January 14th, 1926. (269,635.)
1,229. "Means of and apparatus for transmitting messages through submarine and other like cables." W. Estaugh. January 15th, 1926. (Addition to 233,124.) (269,637.)
1,291. "Electropneumatic valves." S. L. Glenn and E. E. Pierce. January 16th, 1926. (269,640.)
1,292. "Electropneumatic valves." S. L. Glenn and E. E. Pierce. January 16th, 1926. (269,641.)
1,294. "Push-button electric circuit-controlling devices." S. L. Glenn and H. S. Knox. January 16th, 1926. (269,642.)
1,348. "Methods of generating electrical and mechanical oscillations." W. H. Eccles and W. A. Leyshon. January 18th, 1926. (269,643.)
1,547. "Electrical voltage relays adapted for use with alternating or other fluctuating current." Igranic Electric Co., Ltd., J. H. Abbink-Spaink, and J. R. Taylor. January 19th, 1926. (Cognate application 5,200/26.) (269,646.)
1,565. "Charging of electric batteries or accumulators." C. G. Banister and Chloride Electrical Storage Co., Ltd. January 19th, 1926. (269,650.)
1,633. "Paper tape or strip saving device or means for telegraph and like instruments or machines." H. S. R. Murray. January 20th, 1926. (269,651.)
1,685. "Electric switches." J. Y. Fletcher and J. H. Collings. January 20th, 1926. (269,656.)
1,691. "Electric signalling apparatus." Favarger & Cie., Soc. Anon. January 24th, 1925. (246,478.)
1,695. "Gasfilled discharge tubes." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 20th, 1926 (269,657.)
1,696. "Apparatus for the transmission of views, scenes, or images to a distance." J. L. Baird and Television, Ltd. January 20th, 1926. (269,658.)
1,886. "Inductance coils specially applicable for use in wireless telegraphy and telephony." J. K. Im Thurn and G. W. Harris. January 22nd, 1926. (269,668.)
1,922. "Head-lamps for motor and other vehicles." H. Drabble. January 22nd, 1926. (269,671.)
2,023. "Electric plug-and-socket connections." A. Reyrolle & Co., Ltd., and H. W. Clothier. January 23rd, 1926. (269,676.)
2,098. "Electrical connecting devices." F. Bourne and C. A. Bourne. January 25th, 1926. (269,679.)
2,263. "Electric motor control systems." British Thomson-Houston Co., Ltd., and D. E. Jewitt. January 26th, 1926. (269,684.)
2,264. "Moulded castings for electric lamps." British Thomson-Houston Co., Ltd., A. P. Young and A. G. Salisbury. January 26th, 1926. (269,685.)
2,266. "Tuning devices for radio receivers." British Thomson Houston Co., Ltd., and T. H. Kinman. January 26th, 1926. (269,686.)
2,873. "Variable pole windings for alternating-current dynamo-electric machines." Siemens Schuckertwerke Ges. February 2nd, 1925. (246,872.)
4,943. "Electric water-heaters or geysers." Benham & Sons, Ltd., and C. E. Hicks. February 20th, 1926 (269,704.)
5,064. "Electric discharge devices." Raytheon Manufacturing Co. and L. K. Marshall. February 22nd, 1926. (269,705.)
8,650. "Electrical tension indicator." Akt. Ges. Mix & Genest Telephon- und Telegraphen Werke. March 31st, 1925. (250,237.)
8,850. "Apparatus for drawing in electric cables." Callender's Cable and Construction Co., Ltd., and C. J. Greene. April 1st, 1926. (269,720.)
9,842. "Electric power plants." J. E. Calverley and W. E. Highfield. April 14th, 1926. (269,726.)
9,967. "Electric arc lamps." R. V. Boardman. April 15th, 1926. (269,727.)
10,860. "Process for the production of electrically insulating plates provided with a system of connections, more particularly ebonite plates for use in radio outfits." C. Parolini. April 24th, 1926. (269,729.)
11,521. "Electrical transmission of pictures or views." British Thomson-Houston Co., Ltd. May 27th, 1925. (252,696.)
12,064. "Electric switches." C. L. Arnold and M. K. Electric, Ltd. May 10th, 1926. (269,738.)
12,807. "Sound reproducer and method of manufacturing the same." Brandes Laboratories, Inc. October 8th, 1925. (259,535.)
14,078. "Galvanic baths." W. A. F. Pfanhauser and Langbein-Pfanhauser-Werke Akt. Ges. June 3rd, 1926. (269,753.)
14,532. "Protective arrangements for dynamo-electric machines." English Electric Co., Ltd., and J. C. Wilson. June 9th, 1926. (269,754.)
14,556. "Detachable barriers for high-tension electric conductors and apparatus." P. Nicholay. June 9th, 1926. (269,755.)
15,293. "Electric current switches." J. Brettmon. June 17th, 1925. (253,926.)
18,351. "Indicating means for use in charging secondary batteries." H. T. Harrison and G. Campbell. January 13th, 1926. (Divided application on 269,633.) (269,767.)
18,514. "Power factor control of electric systems." British Thomson Houston Co., Ltd. August 5th, 1925. (256,600.)
19,613. "Metallic cores for electro-magnets or the like." J. Y. Johnson (I. G. Farbenindustrie Akt. Ges.). August 9th, 1926. (269,770.)
19,911. "Means for preventing the burning of commutators and slip-rings of dynamo-electric machines due to excessive wear on the brushes." Siemens-Schuckertwerke Ges. August 13th, 1925. (256,978.)
20,784. "Purification of industrial zinc sulphate solutions preparatory to electrolysis." R. H. Stevens, G. C. Norris, and W. N. Watson. August 23rd, 1926. (269,776.)
21,363. "Gasfilled quenched-spark gaps." M. J. Purtschert. September 2nd, 1925. (257,928.)
22,178. "Treatment of zinc-bearing ores for the recovery of zinc by electrolytic deposition." Electrolytic Zinc Co. of Australasia, Ltd. September 17th, 1925. (258,575.)
22,572. "Electric light fittings or fitments." H. Sauveur. September 11th, 1925. (258,291.)
22,980. "Cooling of high-frequency electrical apparatus." C. Lorenz Akt. Ges. September 19th, 1925. (258,610.)
24,184. "Valve transmitters for wireless signalling." Telefunken Ges. fur Drahtlose Telegraphie. October 1st, 1925. (259,224.)
24,406. "Loud speakers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 21st, 1925. (260,230.)
25,423. "Electric arc welding." Soudure Autogene Francaise. October 30th, 1925. (260,571.)
26,755. "Acoustical devices." British Thomson-Houston Co., Ltd. (General Electric Co.). October 26th, 1926. (269,804.)

1927.

530. "Vibration indicators." British Thomson-Houston Co., Ltd. January 15th, 1926. (264,485.)
3,698. "Manufacture of electric incandescent lamps." General Electric Co., Ltd. July 6th, 1926. (269,828.)
6,903. "Television or like systems and apparatus." J. L. Baird. October 21st, 1925. (Divided application on 266,635.) (269,834.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALTON.—Extensions Cripples' Hospital; Hampshire C.C.

AUSTRALIA (Tasmania).—Artificial silk factory for Signors Allamel and Tanfani, of Celli, Bagley, Cusin & Allamel, Ltd., 92, Victoria Street, London, S.W.1.

AYRSHIRE.—Esplanade at Saltcoats for L.M. & S. Railway Company; company's engineer, Buchanan Street, Glasgow.

BARNSLEY.—Extensions, casual wards; Board of Guardians.

BEXLEY.—Nurses' home, Mental Hospital; L.C.C. architect.

BEXLEY HEATH.—School, Wickham Street, Welling, with electric heating, for Kent E.C.; education architect, Sessions House, Maidstone.

BOLTON.—Alterations, Rumworth Cinema; F. S. Hampson.

BRACEBRIDGE.—Extensions to mental hospital (380 patients), for the Visiting Committee; Harold E. Page, clerk, Lincoln.

BRISTOL.—51 houses off Whitehall Road; Bristol Housing, Ltd. 200 houses, Shirehampton; city engineer.

CARDIGAN.—Secondary school; Cardiganshire Education Committee.

CARLISLE.—Extensions, Central Hall, Market Street; H. E. Ayris, architect. Additions at Harraby Hills House for L.M.S.; E. H. Townshend.

CHESHAM.—Secondary school, for Bucks E.C.; C. G. Watkins, secretary, Aylesbury.

COBHAM (Surrey).—Additions, Fairmile Hatch, for Sir G. Rowland Blades, M.P.

DARTFORD.—Central schools (£21,000), for Kent E.C.; education architect, Sessions House, Maidstone. Engineering shop, Kent Road; Dartford Copper and Engineering Works. Additions, Hythe Street; Keyes Daren Mills, Ltd.

DERBY.—Catholic secondary school, Nottingham Road; Mgr. Payne, rector of St. Mary's.

DOVER.—Motor works and garage, for the Cambrian Motor Coaches Co.

DUDLEY.—Engineering shop, Pear Tree Lane; John Thompson, Ltd. Warehouse, High Street; A. Preedy & Sons.

DUNDEE.—Extension scheme at Ashludie Sanatorium (X-ray room, &c.), to cost £40,000; city architect.

EDINBURGH.—388 houses for Corporation; F. J. MacRae, city architect.

EPSOM.—Housing scheme (58), for the R.D.C.; F. A. Pratley, surveyor, Ashley House.

FALKIRK.—Church hall for Christ Church (£1,250); G. Smith, Christ Church Vestry.

GLASGOW.—Dance salon for Codanzo, Ltd. (£12,000); Denny and Blain, architects, 144, St. Vincent Street. Church in Beaconsfield Road for St. John's, Renfield and Hyndland Church (£2,500); Rev. James Muir, St. Andrews U.F. Church. Bakery and garages for Price Bros. (Bakers), Ltd., Clayton, Manchester; the manager. Garage, Kilmarnock Road, for Merryles Motors, Ltd.; J. Austin Laird, architect. Artificial light installation, Govan Town Hall centre; Medical Officer of Health.

GUILDFORD.—Extensions, County Hospital (£28,500); A. Preston, hon. secretary.

HARWICH.—17 houses at Rosebank, and 46 at Dovercourt; borough engineer.

HASTINGS.—Hotel, St. Leonards, with ballroom, garage for 100 cars and repair shop, and heating and electrical work; Callow & Callow, architects, 47, Havelock Road.

HEMSWORTH (Yorks.).—Infirmary, for the Board of Guardians; W. T. Lynam, architect.

LEEDS.—Corporation garage, Mansion Lane; S. Flockton.

LEICESTER.—Civic centre with municipal offices, and other public buildings; City Council Special Committee.

LONDON (Barking, E.).—Outfall works (£21,000); L.C.C.

(Becontree, E.).—2,221 houses for L.C.C.; C. J. Wills and Sons, Ltd.

(Islington, N.).—134 tenements, George's Road area; L.C.C. architect.

(Peckham, S.E.).—Reconstruction, 138a, 140, 142 & 144, High Street; Selfridge & Co., Ltd.

(Fulham, S.W.).—Buildings for Macfarlane, Lang & Co., Townmead Road; Troy & Co. Buildings for Hammersmith Distillery, Chancellors Road; J. W. Faulkner and Sons.

LONDON.—*Continued.*

(Wandsworth, S.W.).—Factory, Merton Road; G. Mason and Co., Ltd.

(Westminster, S.W.).—Alterations, Army and Navy Stores, Victoria Street; Sir Aston Webb & Son. Building, 11-27, Artillery Row; G. Jeeves.

(Holborn, W.C.).—Club for the Holborn Boys' Club (£7,000), for the trustees of the Harpur Trust, Bedford; the clerk, Bedford.

MACCLESFIELD.—Bazaar premises, Mill Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.

MAIDENHEAD.—Reconstruction of Queen Street cinema; the proprietors.

MAIDSTONE.—Grammar school for boys, for Kent E.C.; W. H. Robinson, education architect, Sessions House.

MERTHYR TYDFIL.—Cinema, Castle Hotel site, for Frank Taylor; O. P. Bevan, architect.

MILFORD.—Sanatorium (£211,000), with electrical work, for Surrey C.C.; Sydney Tatchell, architect; Chapman, Lowry & Puttick, Ltd., builders, Haslemere.

MORETON.—School (£17,851), for Cheshire E.C.; director of education, Chester.

NORTHAMPTON.—Two operating theatres, for the Hospital Committee; the secretary.

NORTHERN IRELAND (Belfast).—Extension to goods shed, Dufferin Dock, for Harbour Commissioners; T. S. Gilbert, harbour engineer.

(Newtownards, Co. Down).—Conversion of Regent House into secondary school; C. J. Love, architect, 11, Chichester Street, Belfast.

OLDBURY.—Housing scheme (116), for the U.D.C.; surveyor.

PENRITH.—Premises, Old London Road, for Hayton's Motors, Ltd. (£8,000); James Winskill, manager.

PETERBOROUGH.—Housing scheme (50), for the T.C.; city surveyor.

PLYMOUTH.—Secondary school, Pounds Estate; Education Committee. Museum extension; borough engineer and Carnegie Trust. Landing stages, Stonehouse Bridge and the Barbican; borough engineer. Completion of Burrator reservoir (£30,000); water engineer. Badminton Hall, Eggbuckland Road; W. G. Gingell.

PORTSMOUTH.—Stores and stables, Brunswick Street and King Street; Portsmouth United Breweries, Ltd.

RIPON.—Sewage pumping plant, city engineer. 46 houses, Aismunderby estate; Williams & Williams.

ROTHERHAM.—Electrical extensions, factory; Guest and Chrimes, Ltd.

RUSHDEN.—County school of boot and shoe manufacture, for Northants E.C.; the clerk, Northampton.

ST. AUSTELL.—Garage, South Street by-pass; John Williams and Sons, builders.

SLEAFORD.—Electricity installation, motor works, Northgate; Allen & Sons. Electricity installation, Waverley Hotel, Station Road; H. Baker.

SOUTHEND-ON-SEA.—Church, for Leigh Road Baptist trustees (£10,800); A. J. Arnold, builder.

SPONDON (near Derby).—Extensions to artificial silk factory for the British Celanese Co., 8, Waterloo Place, London, S.W.1.

STIRLING.—Electrical work at 96 houses, Bannockburn Road; Mr. A. H. Goudie, burgh engineer (returnable deposit of £1). Electric lighting scheme, Poorhouse, for the Committee of Management of Stirling Poorhouse; J. J. Inglis, consulting engineer, Glasgow.

TORQUAY.—156 houses, Barton estate; G. E. Tozer.

TRURO.—Improvements, municipal offices; city engineer.

WALSALL.—Houses (83), for the T.C.; W. T. Emery, builder.

WATFORD.—Library, Little Nascot; A. Gold, architect, 14, Bedford Row, London. Extensions, factory, Stanborough Park; Granose Foods, Ltd. Extensions, Chester Road; Standard Range and Foundry Co. Market, Road; Standard Range and Foundry Co. Market; borough engineer.

WELLFIELD.—Secondary school, for Durham E.C.; director of education, Durham.

WEYMOUTH.—Shops and restaurants, Royal Bath site; Gutteridge & Gutteridge, for Messrs. Edwin Jones.

WORKSOP.—Extension, Picture House, Newcastle Avenue; Picture House Co.

The

Electrical Review

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Contents:

	PAGE
The I.M.E.A. at Buxton	825
Cheap Electricity for Farming	826
The Importance of Distribution	826
The Generation of Electricity Statistics	826
The "Electrical Retailer" Supplement	826
Electro-Farming, by R. Borlase Matthews (*illus.*)	827
Mains Engineers' Problems, by D. P. Sayers	829
Electricity Supply in Carlisle (*illus.*)	831
The Incorporated Municipal Electrical Association (*illus.*)	833
The Royal Society's Soirée	836
Legal	837
Business and Industrial Notes	838
Lighting and Power Notes	842
Tramway and Railway Notes	844
Telegraph and Telephone Notes	844
Radio Notes	844
Contract Information	845
Forthcoming Events	847
Notes	847
Institution Notes	849
Our Personal Column	849
Financial Section—	
New Companies Registered	850
Official Returns of Electrical Companies	850
Financial Section—*continued.*	
City Notes	851
Stocks and Shares	853
French Foreign Electrical Trade	855
The Electrical Imports of Egypt	856
Electricity Supply in Gt. Britain	856
Metal-Clad Draw-out Switchgear, by Thomas Carter	857
Electricity Tariffs, by A. Ekstrom (*illus.*)	859
Selected Radio-Telephone Apparatus (*illus.*)	861
The "Electrolux" Refrigerator (*illus.*)	862
Parliamentary News	863
Neon Electric Signs (*illus.*)	865
Correspondence—	
The Ideal Wiring System	865
Safety First: Earthing Transmission-line Towers	865
Sheath Losses in Cables	865
Electric Power in Agriculture	866
The Adequate Distribution of Electricity	866
A Commutation Problem	866
A Mysterious Occurrence	866
Cheap Electricity	866
Balancing Loads on Three-phase Services	867
Trade-mark Applications	867
Published Specifications	867
New Work for Contractors	868

The I.M.E.A. at Buxton.

GIVEN fair weather, such as we have been favoured with during the past month, the members of the Incorporated Municipal Electrical Association should find their gathering at Buxton particularly enjoyable; this year the technical programme is comparatively light, the meeting-place all that could be desired, and the omens wholly favourable. We look forward, therefore, to a highly successful Convention, though our sympathies may be extended to the President, Mr. R. W. L. Phillips, whose own town does not possess the accommodation necessary for some 900 visitors (we understand that the attendance this year will beat all previous records).

Let it not be supposed, however, that the meeting is merely a holiday occasion; in addition to the presidential address, there will be three papers to discuss, and various business meetings to be held. Mr. W. C. Bexon, chief engineer of the Ayrshire Electricity Board, will treat of "Methods and Capital Costs of Distribution over an Extensive Area," a subject on which he is an authority, for he has developed a remarkable distribution system linking-up several towns and supplying electricity to country dwellers. Mr. T. Roles, city electrical engineer, Bradford, will deal with "Recent Developments in Power Plant Design and their Effects on the Economy of Generation," matters of which he has made a special study, with the result that he is making a new departure (so far as this country is concerned) in the latest extensions of his plant. Lastly, Mr. H. H. Berry will read a paper on "Electrified Homes of Great Britain and Ireland, with special reference to the Heating Question"; we know that the author has very definite and original views on this subject, and that they will be found well worthy of careful consideration. The papers form a very appropriate and useful trio, raising questions of interest in relation to generation, distribution, and consumption, and with the discussions should furnish information of immediate and lasting value to station engineers and managers.

Further, it appears from the information that we have already collected that the exhibition of electrical apparatus, which gains in interest at each Convention, will this year again challenge past records. We look forward, therefore, to a Convention which will fully maintain the reputation of the I.M.E.A. for efficiency and usefulness, wisely combined with relaxation and social amenity.

Cheap Electricity for Farming.

In *The Times* and *Morning Post* recently Col. R. E. Crompton, R.E., has drawn attention to the necessity of reversing the flow of population by giving to our farms and villages a "cheap and abundant" supply of electricity, so that the land can be cultivated with greater efficiency at reduced cost and village industries can be established, enabling rural workers to employ their time profitably when weather or season puts a stop to outdoor occupations. He adduces the examples of Sweden and Switzerland in support of his case, and emphasises the great importance of the subject, pointing out that, with the aid of electric power, the useful output of the Swedish labourer has been doubled and the rate of wages in agriculture has been raised to the same level as in other industries.

We are glad to have the support of Col. Crompton—the first to use the term "load factor"—in our contention that filling up the load curve is the most urgent need; in his own words, "there is only one certain way of distributing electricity at low cost, and that is by prolonging as far as possible the hours of user. Technically, we term this increasing the off-peak load." We are not quite so optimistic as he appears to be with regard to the Central Scotland scheme, which, he says, makes accessible to large districts of the best agricultural land in Scotland electrical energy at exceptionally low rates; we shall hope to see that end attained some five years hence, but it cannot be, as he says, "soon." Nevertheless, on the general question of rural electricity supply we agree with him that it can be done, and we base this conclusion on the indisputable fact that in some of our country districts electricity is already available at reasonable prices and is cordially welcomed by the residents. Replying to Col. Crompton in *The Times*, Mr. W. W. Blair-Fish, director of the Rural Industries Bureau, in doleful mood pours cold water on his cheerful forecast, appropriately quoting Mr. Dampier Whetham to the same effect; but that gentleman for some years has held somewhat pessimistic views on the subject of electric power in agriculture. The rapid development of rural electricity supply not only in Sweden and Switzerland, but also in France, Germany, Denmark, Holland, and Italy, cannot always be ignored, and a time must come when even our unbelievers realise the facts. So recently as last week, visiting the Bedford Corporation undertaking, it was borne in upon us once more that the country folk needed electricity, were getting it, and were extremely glad to have it.

The Importance of Distribution.

In a letter to-day in our "Correspondence" columns, Mr. R. Borlase Matthews, referring to the notice issued by the Electricity Commissioners with regard to distributing mains, draws attention to the scandal of repression of demand by electricity supply undertakings, on the ground of inadequate capacity of cables, or worse still, the neglect to lay them. Many instances of this grave dereliction of duty have come to our knowledge from time to time, and the Commissioners' action is doubtless based upon similar information. We read of American undertakings which connect up new consumers almost before the ink is dry on the application forms, but anyone who has become or tried to become a customer of some of our own undertakings knows the difficulties and delays that have to be overcome before the supply is available. Some station managers seem to regard such applications as savouring of impertinence. To such, a period of service with a gas company would afford a wholesome lesson. We are glad to see that the Electricity Commissioners are turning their attention to this end of the chain of electricity supply. Some of the heads of our undertakings are apt to forget that it is their business to *sell electricity*, not merely to make it. As Mr. Matthews remarks, and as we have urged *ad nauseam*, the production of cheap power is of little use unless it is effectively distributed. The market must be cultivated. E.D.A. has done far more than any other organisation to that end, and given adequate support it will do better still.

The Generation of Electricity Statistics.

On Friday last the Electricity Commissioners issued their fuel consumption returns for the year ending March 31st, 1926, explaining that the delay in their publication had been due to the exceptional pressure of work during the past year. On this occasion the returns have taken a more comprehensive form than formerly, a complete list being given of all the 584 generating stations from which returns were received, with a summary of the technical results of working, except where this was not feasible; 20 stations were shut down, but 20 others came into operation.

Whilst the "group classification" according to output is retained, the main table is in alphabetical order of names, so that it is not easy to effect comparisons, the tables giving the best results in each group having been omitted; the data are provided, but not in order of merit, so that the table of 584 stations has to be scrutinised to pick out interesting records. This appears to us to be regrettable; tables 3, 4, and 5 in previous returns were particularly interesting. Some of the statistics are quoted elsewhere in this issue.

Naturally we turn first to the Barton station of Manchester Corporation, which is to be congratulated on an output of 269 million kWh generated at an average consumption of 1.36 lb., and with a thermal efficiency of 21.51 per cent. This is, we believe, the best record yet established for a British power station, and is worthy to rank with the best in any country. The load factor was 41 per cent.; Stuart Street station, with an output of 104 million kWh, a consumption of 2.14 lb., and a thermal efficiency of 13.92 per cent., was obviously robbed of load for the sake of Barton, its load factor being only 13.2 per cent.—quite sound practice, of course, but a little hard on the older plant.

Next in order of merit is the North Tees station of the Newcastle-on-Tyne Electric Supply Co., Ltd., which had an output of 167 million kWh, and a fuel consumption of 1.51 lb., with a thermal efficiency of 18.75 and a power factor of 47.1 per cent. The Lancashire Electric Power Co.'s Radcliffe station again made an excellent showing: 131 million kWh, 1.67 lb., 17.45 and 31.8 per cent. The average for the five stations each generating over 200 million units per annum was 1.89 lb. of coal per kWh.

The "Electrical Retailer" Supplement.

The fourth monthly issue of our Supplement prepared for the assistance of the electrical retailing section of the trade accompanies this number of the "Electrical Review." It contains the usual editorial notes and comments, illustrated articles on "Summer Window Displays," "Some Domestic Electric Fans," a contribution by Mr. E. N. Simons on "Stock-keeping for the Electric Shop," illustrated descriptions of a number of "Selling Lines for Retailers," and a page of trade notes and news. Once again this Supplement will reach all our regular readers and many thousands of electrical traders and contractors of the smaller class, and new business for our manufacturers and traders should result.

Electro-Farming.

The ultra-violet ray treatment of live-stock on a commercial scale; some particulars of the apparatus available for the purpose, and of the results obtained.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

(*Concluded from page* 788.)

3.—*Mercury-Vapour Lamps.*—The working cost of this type is usually less than that of the arc type. The modern patterns consist of short quartz tubes in which the arc is formed. In the case of the atmospheric type (see fig. 2) an orifice, closed by a ground-in quartz stopper, is provided at one end for cleaning purposes. It is started by the heat of a coil fixed on one side of the tube, which vaporises some of the mercury. The running current of the normal atmospheric quartz mercury vapour burner is 2½ to 3 amperes, while the starting current is about 4½ amperes.

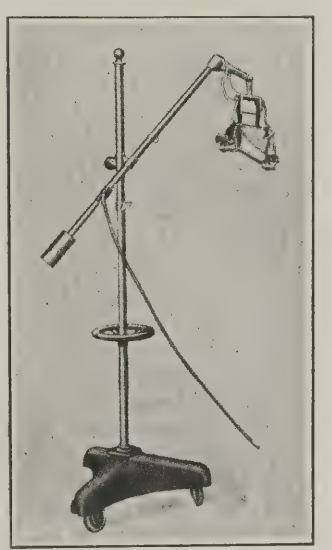


Fig. 2.—Kelvin, Bottomley & Baird Atmospheric Mercury-Vapour Lamp.

The vacuum type (fig. 3), although similar in appearance, is naturally totally enclosed; the arc is started by tilting the tube and thus allowing the mercury to connect the two electrodes momentarily; on breaking this contact the arc is formed. Two sets of aluminium cooling fins are usually fixed at the negative (*i.e.*, the bottom) end of the burner.

Both the atmospheric and vacuum types of lamp fall off in efficiency in the course of time. This is due to the formation of a film on the internal surface of the arc tube. In the case of the atmospheric pattern, this film can be washed off with concentrated nitric acid, then rinsing with distilled water and finally with alcohol. The mercury should be filtered before it is replaced. This work is really beyond the limit of skill of most users, so that in the case of either form of lamp, it will have to be returned to the makers. Cleaning is usually required after 500 to 1,000 hours, though sometimes the period may be as long as 2,000 hours.

Results of Experiments.

The experiments conducted on animals have been carried out chiefly to determine the changes which irradiation produces in the blood and the effect of the absorption of lime and phosphorus which the ultra-violet rays cause.

Experiments carried out on pigs have shown that during the period of treatment the amount of calcium and phosphorus which the pigs were able to retain was considerably increased, and an analysis of the bones of the animals showed that those of the irradiated pigs contained a higher phosphorus and calcium content than did those of the control pigs living under exactly similar conditions but not irradiated. These findings are of great importance, for it is known that in the case of young pigs, owing to their very rapid growth, there is always a danger of rickets, as the result of a breakdown of the pig's calcium and phosphorus metabolism. The application is of special importance in the winter time, when little sunlight is available. Experiments carried out on young pigs at the author's farm seem to indicate that the mercury-vapour lamp is not very effective for this purpose. However, the tests are being continued, and it is hoped that more definite information will be available in the course of a few months (fig. 5). The prevention of the loss of calcium and phosphorus from the body has also been found to be of value in the case of lactating animals. For instance, in the case of a heavy milk-yielding cow, there is a tendency to lose more calcium and phosphorus in the first half of the lactation period than she can absorb in her daily ration, so that a supply has to be drawn from the store in her skeleton. This loss often causes a reduction of the milk yield, a loss of breeding capacity and abortion. By irradiating the animals it has been possible to decrease the net loss of calcium at the height of lactation, and in one case the net loss was actually converted into a net gain. One firm of manufacturers is now producing a lamp specially for the treatment of horses and cows.

While the treatment of animals in this way is probably only in the experimental stage, it is claimed that the treatment of poultry (fig. 4) is already of commercial value both in dealing with young chicks and egg production. Young chicks, especially in the early part of the year, are very susceptible to leg weakness, which is closely related to rickets. Results already obtained show that the ultra-violet ray treatment, acting as a supplement to the antirachitic factor of foodstuffs, minimises this tendency. In the case of laying hens, experiments demonstrate that the number of eggs laid during the winter months can be considerably increased by irradiating the birds. An experiment conducted

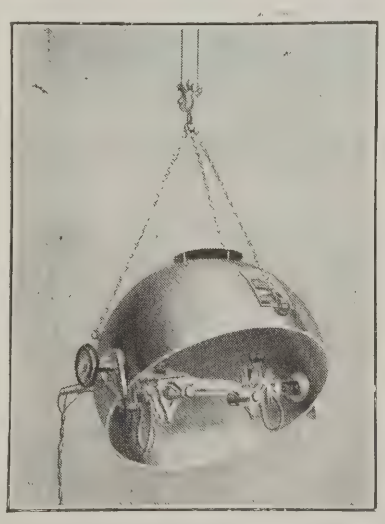


Fig. 3.—"Hannovia" Suspended Tilting-type Vacuum Mercury-Vapour Lamp.

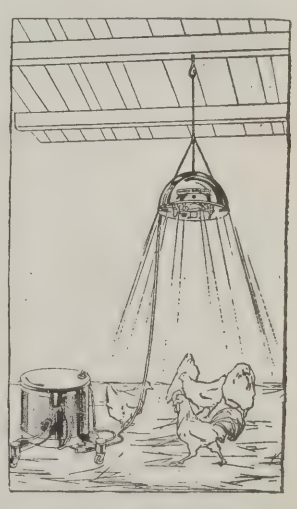


Fig. 4.—"Hannovia" Tilting Lamp in Poultry House.

at the Agricultural University of Wisconsin, U.S.A., was carried out as follows:—

Four groups of hens were confined in coops, out of which natural daylight was shut, artificial light being the only source of illumination. All the birds were treated alike, except that one group was given a daily ten-minute exposure to ultra-violet rays. Tests com-

menced in January and those birds receiving the rays continued to lay abundantly, while the egg production of those not receiving the rays decreased to practically zero. No doubt one of the reasons for this decrease is that laying birds require large quantities of calcium and phosphorus—one egg weighing 56 grammes contains three grammes of calcium—and, as in the case of animals, it is believed that irradiation increases the absorption of calcium and phosphorus from the intestines of the hen. The hatchibility of the egg is also affected. In the case of the irradiated group, the hatchibility was sustained and improved, while that of the eggs from the untreated pens gradually diminished as time went on. Another important fact brought to light was that the quantity of lime in the shell of the eggs, which is an important factor in their value for marketing purposes, was much greater in the eggs of the irradiated hens than in those from the non-irradiated groups.

Interesting results have also been obtained with chickens by using the specially manufactured glass, already referred to, in the windows of the chicken

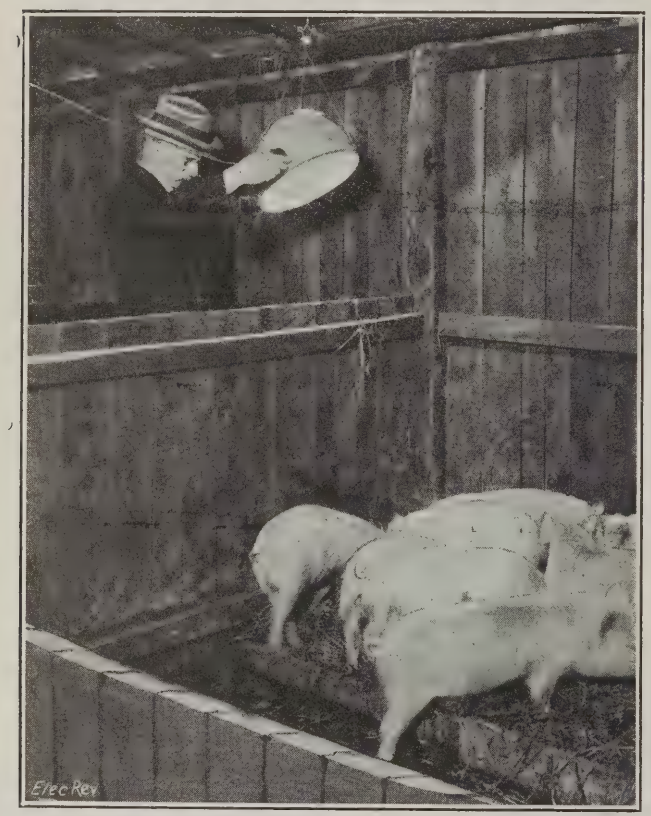


Fig. 15.—Treating Young Pigs with a Quartz Mercury-Vapour Lamp on the writer's Farm at Greater Felcourt.

houses. Chickens reared under this glass have been found to grow more quickly and develop into finer birds than those reared in the ordinary way, although when there is no sunlight about, the artificial lamp must be used. Tests seem to show that black-feathered poultry do not gain much benefit from mercury-vapour lamps; their feathers apparently act as an effective screen.

Dr. Percy Hall, in his book on "Ultra-Violet Rays in the Treatment and Cure of Disease" (Heineman), states "that the absence of sunlight last summer and the preceding winter had more than a little to do with the epidemic of foot-and-mouth disease." By the way, this book deals principally with the use of tungsten arc lamps for treating human beings.

Another interesting book of reference, which deals rather with the use of the mercury-vapour lamp for human beings, is Mackenzie and King's "Practical Violet Light Therapy" (Benn Bros.). Fig. 3 is reproduced from this book, and the writer is indebted to Messrs. Benn Bros. for the loan of the block.

Some recent practical tests in Scotland on well-grown calves did not show any very marked result, though the treated animals certainly did slightly better. One that had ring-worm was cured of it.

So far as the farmer is concerned, the ultra-violet treatment must not be considered as a medical one. It is rather a toning-up of the nervous system, which enables the birds or animals to assimilate their food better and take a more lively interest in life. Mr. J. W. Beauchamp has aptly expressed it as comparable to an aperitif rather than a food.

Foodstuffs.

The effect of treating the food of farm livestock has also been investigated, and it has been found that the animals consuming certain foodstuffs which have been irradiated derive a similar benefit to that which results from the direct treatment of the animal.

Treatment.

There does not seem to be available any convenient practical way of determining the dosage of animals. In the case of human beings the dosage differs with the individual, and it is generally determined by the erythema (or burning) effect on the appearance or pigmentation of the skin. The best plan seems to be to undertreat, so as to be on the safe side, and to adopt, as a rule, ten to fifteen minutes' exposure twice a day at a distance of 3 ft. With a tungsten arc the time should be about ten minutes, and with the impregnated or mercury-vapour lamp, fifteen minutes. The latter time should be more than doubled with an ordinary carbon arc lamp.

The ordinary laws of light must be observed, *i.e.*, the intensity of ultra-violet rays varies inversely as the square of the radius (the law of inverse squares). In other words, if the distance is halved, the intensity of radiation is four times as great. The intensity of radiation is at a maximum along the normal (or perpendicular right-angled) rays. They fall off as the angle of incidence increases. The intensity of inclined rays can be calculated by the "cosine law." As an example, at an angle of sixty degrees the intensity will have fallen to one half that of the "normal" ray. Hence the importance of placing the bird or animal to be treated as close to and in as direct a line as possible with the origin of the radiation. One excellent method of doing this when using arc lamps is to make a hole in the floor, so that the lower part of the mechanism of the lamp sinks below the level of the ground, thus bringing the light on a level with the poultry, pigs, &c. All inflammable matter should be swept away and a wire netting or iron railing guard placed around the lamp.

In the case of milking cows, the writer found that the best results were obtained by placing the lamp on a level with the udder, and directing the rays on to the udder.

The rays between 2,600 and 2,300 Å tend to oxidise some oils and fats, hence a slight smell of burning fat may sometimes be noticed during treatment. Also the waves absorbed by the air produce ozone, which can always be detected when a lamp is in operation by its characteristic smell.

From practical observation, the writer believes that the best months to apply the treatment are November, December, January, February, and March, for at this time of the year the birds and animals suffer through lack of sunshine under the best conditions, while even the small amount of sunshine they do receive usually passes through window glass; further, in winter the sun is so low that the atmosphere cuts off most of the ultra-violet light. The most satisfactory time to apply the treatment is at feeding time, as the animals and birds are together and are not so likely to wander away from the lamp, though in the majority of cases the light seems to attract them.

Protection of the Eyes.

Care should be taken to see that the operator's eyes are protected by goggles from the ultra-violet rays, because,

as these rays are invisible, and no immediate pain is experienced, the harm is done before the operator is aware of the danger. Any ordinary glass (which always contains soda or lead) will serve, but an additional precaution, on account of the strong visible rays, is to use a tinted glass. Fortunately, the eyes of birds and animals, due to their thicker cornea, do not seem to be affected, so the humorous spectacle of a flock of chicks or a herd of cows running around, each fitted complete with goggles, is never likely to be seen.

It is possible that in the near future ultra-violet rays will be used on the farm for many other purposes, such as the purification of water and the sterilisation of milk and butter. This method of treating drinking water has been carried out for some years now. At Amiens, France, about four million gallons of water are sterilised daily in this way, while the French Army has done a great deal of research work in an effort to devise a portable plant of this type for field use.

Practical Results.

In farming operations it takes a very long period of time to establish results, as there are so many variables over which the experimenter has no control. Ultra-violet work is no exception to this rule. However, the treatment of young chicks and young pigs can now be safely recommended. In all probability reliance can also be placed on the treatment of calves and the udders of milch cows. There is more corroboration wanted concerning the treatment of laying hens and fully-grown animals. Also the treatment of foodstuffs is a matter that must still be considered as in the experimental stage.

Examples of ultra-violet lamps intended for the treatment of farm livestock will be demonstrated at the Electro-Farming Exhibit which the writer is arranging on behalf of the Electrical Development Association at the Royal Agricultural Society of England's Show at Newport, Mon., July 5th-8th inclusive.

Mains Engineers' Problems.

A consideration of the methods of, and the advantages to be derived from, duplicating the cables and apparatus used for the supply of electricity to outlying districts.

By D. P. SAYERS, B.Sc.

THE rapid development of electricity supply for domestic heating and cooking of late years, whilst but indirectly felt by generating staffs, has introduced many new difficulties with which the harassed mains engineer has to contend. Not the least of these is the greatly increased difficulty of interrupting the supply to domestic consumers in residential districts. In the past, before the advent of the electric cooker and other electrical domestic appliances, the daytime load in these districts was extremely small. Portions of the l.p. networks could be shut down for an hour or two in the daytime for any special switching or jointing operations without any risk of undue disturbance or public inconvenience. Even where a small industrial load was mixed with the domestic supply, it was generally possible to make the mains dead on Sundays without bringing the mains department into unwelcome notoriety. Now, unfortunately (?—EDS.), those good times have gone for ever; experience shows that a cooking load occurs chiefly during the mornings and in some cases the morning load exceeds the evening lighting peak. Further, of all days in the week, Sunday generally provides the highest cooking peak. Hence, no longer can the mains engineer design a single-line supply to outlying districts and rely on Providence and the quiet of the Sabbath for carrying out any special jointing operations, or odds and ends of routine work, such as cleaning down sub-station switchgear and distribution pillars. The centre and industrial portions of the system have, of course, always been regarded as inviolable in this respect, and have been designed accordingly. The remarks in this article are intended to apply more particularly to outlying suburbs and remote housing estates, of which every undertaking has examples, which are provided with l.p. networks supplied from isolated sub-stations on the h.p. mains.

Generally speaking, it is an economic impossibility to design new distribution networks to the outlying districts in duplicate, or to duplicate the cables and other apparatus of existing networks; such a policy could only result in an enormous amount of idle copper and would give rise to considerable complication in operation. That practice is adopted, necessarily, in areas of heavy industrial load where the revenue is sufficient to justify a certain amount of standby gear; the problem is to provide the same facilities in sparsely populated residential districts.

Dealing first with the l.p. distributors, general practice is almost standardised in the use of multicore cables laid direct in the ground, with service cables of a similar kind. Given these conditions, service connections can be made on the distributor mains without making the cable dead, and "live" jointing is a recognised feature at the low and medium pressures used for distribution. Owing to the extra cost which would be involved, it is not usual to lay sub-distributors along the route of the main distributor. Services are connected direct to the main, and it is therefore not uncommon to find a main distributor anything up to a mile in length, with perhaps sixty or seventy service connections on it. Every joint must be regarded as a possible source of trouble, and a fault occurring on such a main is exceedingly difficult to locate, and the quickest method in the long run being the old-fashioned way of "cut and test." For this purpose it is a great advantage to have permanent disconnecting points at frequent intervals. If there is a main laid along each side of the street, each main can act as a duplicate supply to the other. The ideal arrangement is to lay an interconnecting cable across the street between the corresponding disconnecting points on the two mains. In the event of a fault occurring on either main, only a small number of consumers need be left without a supply whilst repairs are in progress, and only one section of main between two disconnecting points carries more than its normal share of load during this time. In the case of the sub-distributors up side streets, where the ends nearly meet in another road, it pays to extend those extra few yards, if by so doing the distributors can receive an alternative feed in emergency. With regard to the disconnecting points, there appears to be scope for the development of more suitable disconnecting apparatus. Whilst many designs of multi-way link boxes for use in underground pits are avail-

able, they are, for the most part, costly, complicated to install, and when once installed, are not easily altered or added to. The alternative method of fitting the cables with sealing ends and rubber-covered tails which can be connected with screwed or sweated fittings, provides a cheap and flexible job. This arrangement is, however, crude and untidy, and the rubber tails do not give satisfactory service in damp pits. Further, the job of making or breaking heavy currents on two bare cable ends in the cramped conditions of a street manhole does not evoke much enthusiasm in the average workman, especially with the chance of getting a dead short, should tails of opposite polarity be brought together inadvertently.

The question of duplicating sub-stations and high-pressure cables necessarily becomes a matter of greater importance than that of the l.p. networks. In the type of system employing parallel feeders, the principle of duplication is fulfilled immediately; but with the ring-main interconnected type of system, this is not always the case. Economy demands that the load factor of the cables shall be kept as high as possible, and when an extension of the e.h.p. mains is contemplated, it often forms a part only of a scheme which will mature eventually into a ring-main system. This may not be completed for some considerable time, and in the meantime, how is the extension to be safeguarded against breakdowns? A method which is acceptable in many schemes is to make a point of laying a l.p. distributor of a moderate size with the e.h.p. main. This will then become a l.p. interconnector between an existing network and the new distribution point. With the present-day progress, building occurs in the most unexpected places, and it is seldom indeed that such a distributor does not meet the needs of a number of consumers in the course of a few years, and so justify its inclusion in the original scheme. In the meantime it provides an exceedingly useful link for emergency working. It should be remembered that low-pressure mains in a residential district must be designed to keep the voltage-drop within reasonable limits and that the actual loading is much below the ultimate capacity from the point of view of heating. Thus the aforesaid main may well be able to carry the whole of the load of the high-pressure main in an emergency, and even a red glow in the lamps will go some way towards appeasing the consumers' wrath when the e.h.p. main goes down. How many mains engineers to-day, faced with high excavation costs, do not regret the parsimony of their predecessors who failed to lay the low-pressure main with the e.h.p. feeder through the barren wastes which are now budding into respectable suburbs?

Modern e.h.p. switchgear, particularly of the armour-clad type, is fairly immune from serious break-down. Faults have occurred on the older type of sheet-steel cubicle gear, through rain leaking into the sub-station and through faulty alignment, broken porcelains, and so on; on the whole, however, it can be said that this part of the system is not responsible for many breakdowns. On the other hand, modern automatic oil circuit breakers contain so much costly and intricate mechanism that wherever possible they are dispensed with. Duplication is an unwelcome refinement. There are instances of the provision of duplicate busbars being an advantage, and in important switching stations containing more than four or five units, it pays to split the switchboard into two sections with a busbar interconnecting switch. This arrangement allows either half to be shut down for repairs or additions, whilst continuity of supply is maintained on the other half. In the outlying sub-stations, however, everything points to the equipment being kept as simple as possible, ensuring a minimum of initial cost and upkeep. The provision of protective devices is a question on which considerable diversity of opinion exists. That some form of protection for both e.h.p. cables and transformers is essential goes without saying, but the degree is very varied, ranging as it does from simple overload protection with three current transformers to any one of the many developments of the Merz-Price systems with super-sensitive relays, compensated pilot cables, and special tripping batteries. The only rule capable of general application is that the protective gear must be of the most efficient and adequate type near the centre of the system, where shocks occasioned by faults are most heavily felt and the greatest public disturbance caused. The efficiency of the distributing system is greatly improved by a high degree of interconnection, but this can only be carried out safely if the protective gear is absolutely reliable and possesses the two qualities of sensitivity for operation and stability to withstand shock. In the outlying districts both these qualities assume a lesser degree of importance. The vagaries of super-sensitive tripping mechanisms are sufficiently well known to cause the average mains engineer to prefer to fall back upon the old-fashioned plain overload and earth leakage protection, which is at least safe and sure; and the increasing use of the kiosk type of sub-station, in which provision is made for only the most primitive forms of protection, makes this the only practical policy.

The duplication of transformers does not call for a great deal of consideration. This class of plant has now reached a high standard of efficiency and reliability, and the use of two units in place of one involves extra switchgear and entails higher running losses. It is, however, an advantage for an undertaking to keep to as few stock sizes of transformers as possible, and it then pays in large sub-stations to install two standard units in preference to one abnormally large unit, thus providing a measure of duplication and facilitating quick substitution of units.

Thus the problem of what is adequate duplication to ensure continuity of supply faces the engineer at every point between the central station and the consumers' service. In many cases he is handicapped by the lack of standardisation, and this is a point which cannot be stressed too greatly. Standardisation is an essential precedent to inter-connection and duplication; the presence of small networks, relics of earlier days, having non-standard voltages or polarities (frequency hardly comes within the scope of this article), even though they be self-contained, is a hopeless stumbling block to any comprehensive scheme for ensuring continuity of supply. They are pieces which will not fit into the jig-saw puzzle of the distribution system, and every year they go on developing. The only way out is to take the bull by the horns and ruthlessly change over, whether it be d.c. to a.c., 110 to 220 V, or single-phase to three-phase. The cost may be great, but in the matter of duplication, the economic laws are, as usual, at variance with the ideal; and because the benefits of duplication are potential rather than actual, the economic side too often has the last say in the matter. The cause of duplication is well worth fighting for, and to the mains engineer who has fought successfully the benefits become very real indeed when he is faced by a crowd of irate consumers who inform him in no uncertain language that the lights have gone out, the dinner will be spoilt, and the washing cannot be ironed.

A Redeveloped Water-Power Site.

Some particulars are given in *Power* of the 25,000-h.p. hydro-electric installation which has recently been completed at St. Narcisse on the Batiscan River, Canada, 20 miles from Three Rivers, Quebec, by the Shawinigan Water and Power Co. The site was originally developed in 1890 for a capacity of about 1,500 h.p. in three units, operating under a head of 80 ft., the power being transmitted to Three Rivers at 15,000 V by, it is claimed, the first h.p. line in the British Empire. The water is now carried to the new plant, some 4,200 ft. away, where a head of 160 ft. is obtained. The tunnel terminates in a reinforced-concrete surge tank from which two penstocks lead down to the 12,500-h.p. turbines. The generators are supported on concrete pedestals and the operating floor is level with the turbine deck. The project will have an ultimate capacity of 50,000 h.p.

Electricity Supply in Carlisle.

The new 17,000-kW power station of the Carlisle Corporation Electricity Department, which has recently been established at Willow Holme on the River Eden.

PUBLIC electricity supply was first introduced in Carlisle in 1899 as the result of a scheme drawn up in 1897, by Prof. A. B. W. Kennedy, for a generating and distribution system with a power station adjacent to the River Caldew at James Street. The system of supply adopted was three-wire d.c., 460-230 volts, and 500 volts for the tramway undertaking.

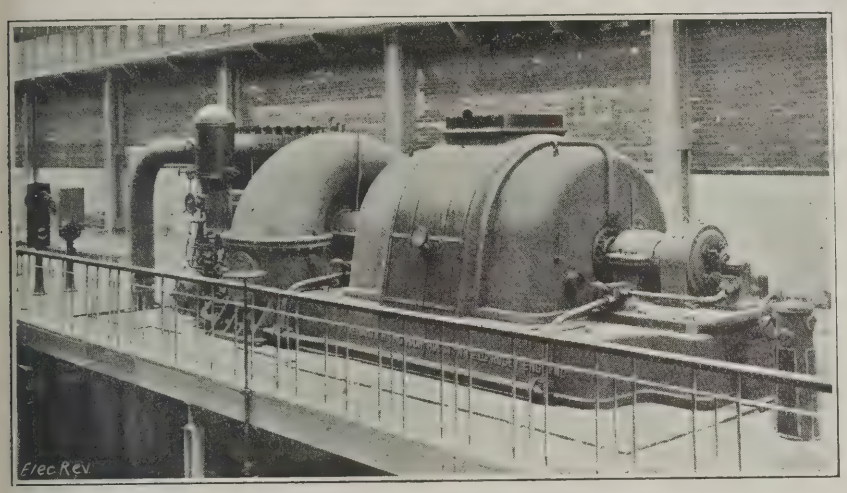


Fig. 1.—6,000-kW Turbo-Alternator.

The original generating plant consisted of two 60- and two 125-kW steam-driven dynamos. Extensions were made to the plant from time to time as the demand increased, up to 1919, when a 2,000-kW turbo-alternator was installed by the British Thomson-Houston Co., Ltd., at a cost of £16,000. This marked the full economic development of the James Street station and led to the building of the new generating works at Willow Holme, which was to be officially inaugurated on Thursday this week. It was in the same year that Mr. C. W. Salt, M.I.E.E., the present city electrical engineer, succeeded Mr. F. W. Purse, M.I.E.E., now engineer and manager at West Ham.

In 1913, a.c. 3-phase was introduced and further development of the old system was restricted. In view of the post-war demand for electricity in and out of the city, Mr. Salt was instructed to report on the situation. A scheme for the new generating station was drawn up by him and referred to the Council's consulting engineer, Mr. Arthur Ellis, who recommended that it should be proceeded with.

During the consideration of these matters the demand increased to an extent that rendered it necessary to install immediately a portion of the new-works plant at James Street. This included a 3,000-kW B.T.-H. turbo-alternator and a 25,000-lb. Stirling boiler.

The Willow Holme station is situated on the River Eden, at a point about 3,000 yards from the centre of the city, where, it is estimated, there is sufficient condensing water for an ultimate plant capacity of 100,000 kW. The general lay-out of the station is on the parallel turbine and boiler-house lines, the turbine room being 201 ft. long by 44 ft. wide, and the boiler house 181 ft. by 72 ft. Between the boiler and turbine houses is an annexe 15 ft. wide for accommodating the main steam headers, steam receivers, booster and feed pumps and other auxiliaries. There is also a 17-ft. annexe which accommodates the switchgear, a battery room, offices, and a repair shop.

The turbine house is designed to accommodate two 6,000-, one 3,000-, and one 2,000-kW turbo-alternators, generating at 3,000 V, 50 cycles, but at present only one new 6,000-kW set, fig. 1, has been installed. The turbine is of the Curtis impulse type, running at 3,000 r.p.m. It was supplied by the British Thomson-Houston Co., Ltd., and is constructed with 10 expansion stages Bleeding branches are provided, and a floating-header steam heater is being installed to work in conjunction with the set. The other machines are to be similarly equipped. The two smaller sets are to be transferred from the James Street works as soon as conditions permit. The turbine room is served by a 45-ton electric travelling crane, by Messrs. A. Jack and Co., Ltd., situated 37 ft. above the basement level,

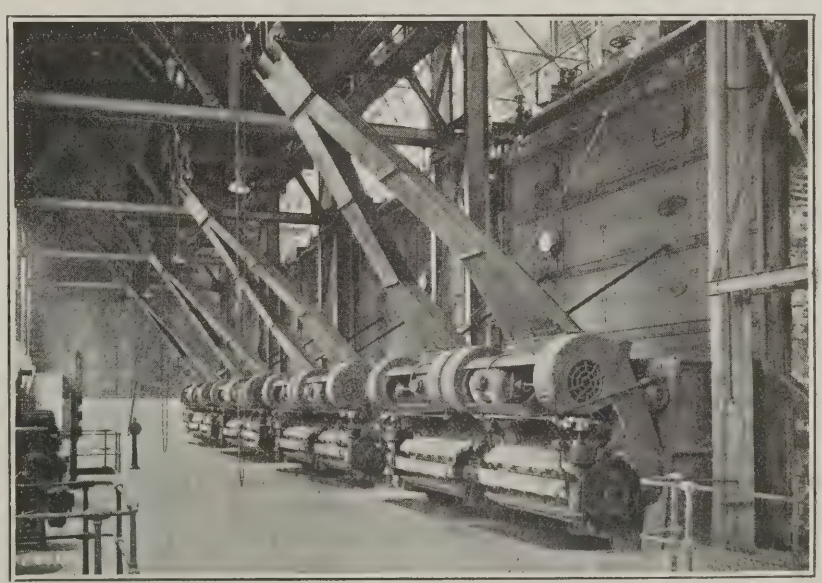


Fig. 2.—Boiler House, Carlisle.

so as to permit the handling of sets up to 20,000-kW capacity. The turbine floor level is 15 ft. 6 in. above the basement.

Ample space being available at the site at a low price, superimposing of the boiler plant has been avoided. The boilers, economisers, main flues, and chimneys are

built up from firing floor level, and a basement extends under the whole plant.

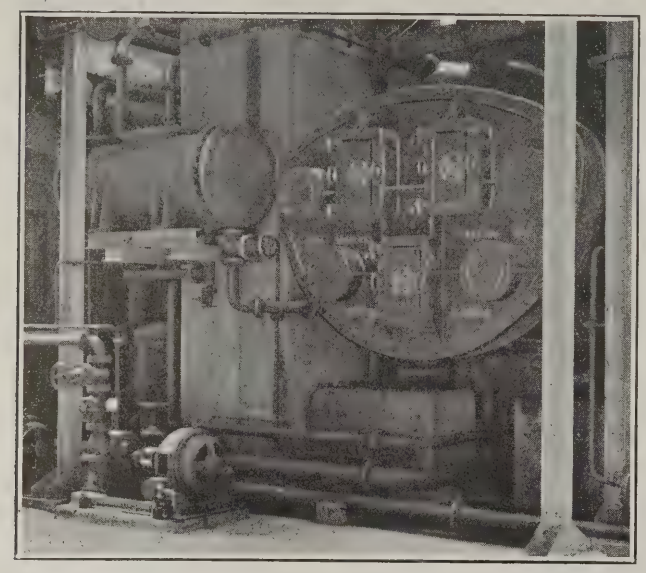


Fig. 3.—Condensing Plant.

With the moderate-sized units installed in the turbine room it was found possible to install boiler plant of sufficient steaming capacity on one side only of the boiler house, leaving the other side available for windows of ample proportions, thus giving good lighting on the stoker fronts and firing floor. Four Stirling boilers, fig. 2, each having an evaporating capacity of 30,000 lb. per hour are at present installed, and one boiler is to be brought from James Street. Provision is also made for the installation of three additional boilers. Two Weir steam turbine feed pumps meet the present needs.

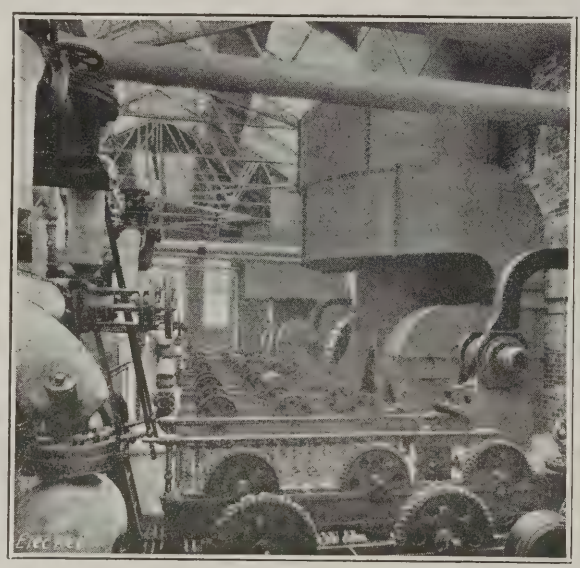


Fig. 4.—Economisers, Fans and Grit Arrestors.

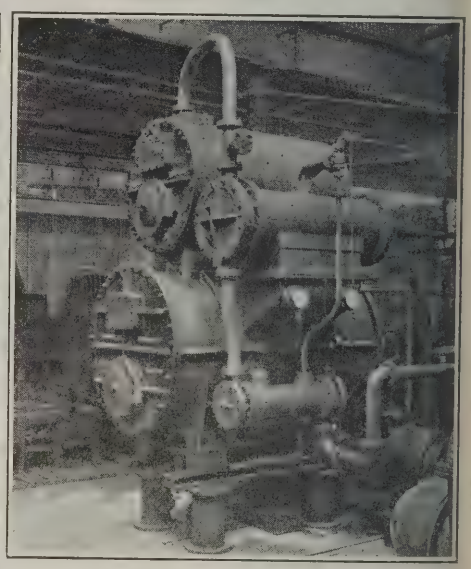


Fig. 5.—De-aerator Unit.

Overhead coal bunkers are provided, and automatic weighing machines check the coal consumption. Forced- and induced-draught fans are controlled from the firing floor, the forced-draught fan in each case being driven by the same motor as the chain-grate stoker; the motor is positioned above the front of the grate, as shown in fig. 2. The steam conditions are 270 lb./sq. in. and 650 deg. F. Each pair of boilers is served by one chimney and a Davidson grit arrestor, fig. 4.

The ashes drop through brick-lined hoppers with their open ends immersed in water contained in a reinforced-concrete trough. A scraper conveyor in the bottom of the trough collects the ashes and elevates them at one end of the boiler house to a ferro-concrete overhead bunker of 30 tons capacity. A stand-by ash elevator of similar design is provided for use when the main elevator is under repair.

Duplicate evaporators for the make-up feed are installed, each capable of dealing with 6,500 lb. of water per hour. They are of the vertical straight-tube pattern, and are equipped with doors just above the floor level to facilitate cleaning. The supply to the evaporators is taken from the river, a storage tank for the crude water being situated on the flat roof. De-aerators, also in duplicate, are installed at the turbine-floor level. Each will deal with 90,000 lb. of water per hour, and is internally lighted and equipped with inspection windows, fig. 5. The evaporators receive the exhaust steam from the boiler feed pumps direct; it is then passed into the de-aerators, where it is condensed by direct contact with the feed water before entering the degassing chambers. Covered feed-water surge tanks supported on rolled-steel joists above the de-aerators are steam sealed. Normally the whole of the water to the boiler feed pumps will pass through the de-aerators, but the system permits of either set being shut off for cleaning and also of the complete by-passing of the equipment. Modern oxygen-content instruments are provided.

The control room is on the upper floor of the switchgear annexe and generally provides for the remote control of the whole works. The main switchgear is of B.T.-H. manufacture and electrically and remotely controlled. It consists of stone cells fitted with steel doors, fig. 6, and is situated on the ground floor. A special interlock system is provided. A system of telegraphs and loud-speaking telephones allows communication between the control room and the turbine and boiler rooms. Remote indicating and recording CO_2 and temperature instruments are installed in the control room. A 230-V battery supplies the necessary energy for operating the switchgear and



Fig. 6.—E.H.P. Switch Cubicles.

protective equipment, and provides for emergency lighting in the station.

The condensing plant for the 6,000-kW set, fig. 3, which, with the evaporators and de-aerators, was supplied by Messrs. Mirrlees, Watson & Co., Ltd., will deal with 65,000 lb. of steam per hour, and is designed to give a vacuum of 29.1 in. with 9,500 gallons of water per minute at 55 deg. F. Duplicate condensate pumps are

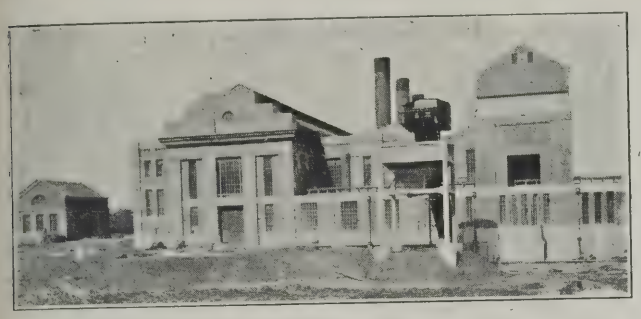


Fig. 7.—External View of Station.

installed, each capable of dealing with the full quantity of the condensate and driven by a 13-h.p. motor. A main supply header receives the circulating water from all the pumps. While the system is designed for siphonic assistance, the pumps will give sufficient head to prevent a shut down. Two circulating pumps are at present installed, each having a capacity of 588,000 gal. per hour. Their centre lines are 2 ft. below the level of the river bed, to ensure an immediate flow on starting, and they are driven by 120-h.p. vertical-spindle motors installed above the maximum recorded flood level of the river. The pump room has been erected immediately on the river bank. Two vertical-spindle service pumps, 27,000 gal. per hour, are also installed to provide a water supply for screen washing, the evaporators, and cooling bearings. The water is taken through two travelling, self-cleaning band screens, having a total effective screening height of 32 ft. because of the high flood level of the river. The pump-house equipment is remotely controlled from the power station. A L.M. & S. Railway siding, which terminates in the turbine room, allows coal to be brought direct to the works, a fireless steam-storage locomotive being used for this purpose. The coal is emptied into a 20-ton receiving hopper, and an endless chain of buckets elevates and distributes it to the overhead bunkers.

The transmission system consists generally of 24 main cables run from the power house, fig. 7, to various points in the city, including the James Street generating station, through earthenware ducts, protected from the road traffic by reinforced concrete where necessary. With the exception of the densely-populated area in the centre of the city, of about 1,000 yards radius, the system of distribution is 3-phase, 4-wire. The centre area is still d.c. and is supplied from rotaries at James Street, where the old generating station will be retained as a convertor sub-station.

An interesting development, which has only just been completed, is a supply to the Carlisle Plaster and Cement Works at Cocklakes, about seven miles south of Carlisle. The transmission is at 11,000 V by means of a simple overhead line. At the receiving sub-station the pressure is stepped down direct to 420 V by means of two 600-kVA J. & P. transformers, the e.h.p. supply being dealt with by a 2-panel, truck-type switchboard by Messrs. Ferguson, Pailin, Ltd., fig. 9. Provision is made in this sub-station for further extensions. Fig. 8 shows the h.p. pillar-type drawout switchgear (F.P.) which is being adopted in most of the sub-stations on the 3,000-V system. It is interesting to note that the same type of switchgear is being used on the l.p. side.

Considerable advance has been made by the under-

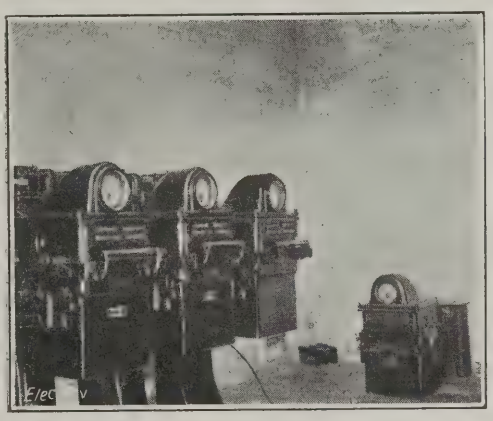


Fig. 8.—Standard Sub-station Switchgear.

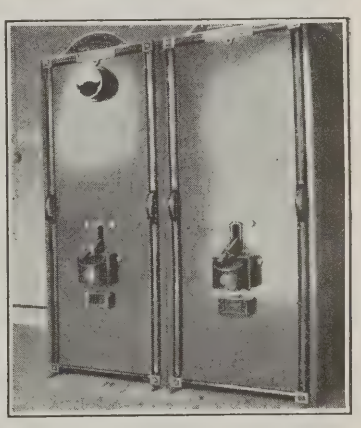


Fig. 9.—11,000-V Switchgear.

taking in the development of the domestic load, and an all-in domestic rate of ¾d. per kWh, plus a fixed ratable-value charge, has been established.

The Incorporated Municipal Electrical Association.—I.

Annual Convention at Buxton.

ON Tuesday next the 1927 Convention of the I.M.E.A. will be opened at the Opera House, Buxton, with a civic welcome by the Mayor, Councillor W. Goodwin, J.P., and the presidential address of Mr. R. W. L. Phillips, M.I.E.E., engineer and manager of the Bedford Electricity Department. In our issue of July 9th, 1926, we gave a portrait of Mr. Phillips, and a sketch of his career, and though the Convention will not visit Bedford, a few particulars of the undertaking which he has conducted with notable success for 26 years will be of interest.

When he resigned the post of deputy chief engineer at Bristol in 1901 to take charge of the Bedford undertaking, the latter was labouring under a cloud of annual deficits, but Mr. Phillips soon brought it into the sunshine of prosperity, by adopting a progressive policy, cultivating a day load, and embarking upon the electrification of the surrounding rural areas.

The generating station is situated on the River Ouse. Sidings of the L.M. & S. Railway are near at hand, and from these coal is transported by road to the works. Modern coal-handling plant is installed; belt and worm conveyors serve overhead bunkers from which eight boilers, with a total evaporating capacity of

170,000 lb. per hour are fed. One boiler, which was converted to oil-firing during the coal strike, still retains the liquid-fuel feature, and is used as a convenient peak-load plant. Two recently installed 40,000 lb. Stirling boilers are equipped with Davidson grit arrestors. It has been found advisable to separate the coal, using the nuts for the old plant and the fines for the new, and for this purpose a rotary screen is employed in conjunction with the coal conveyors.

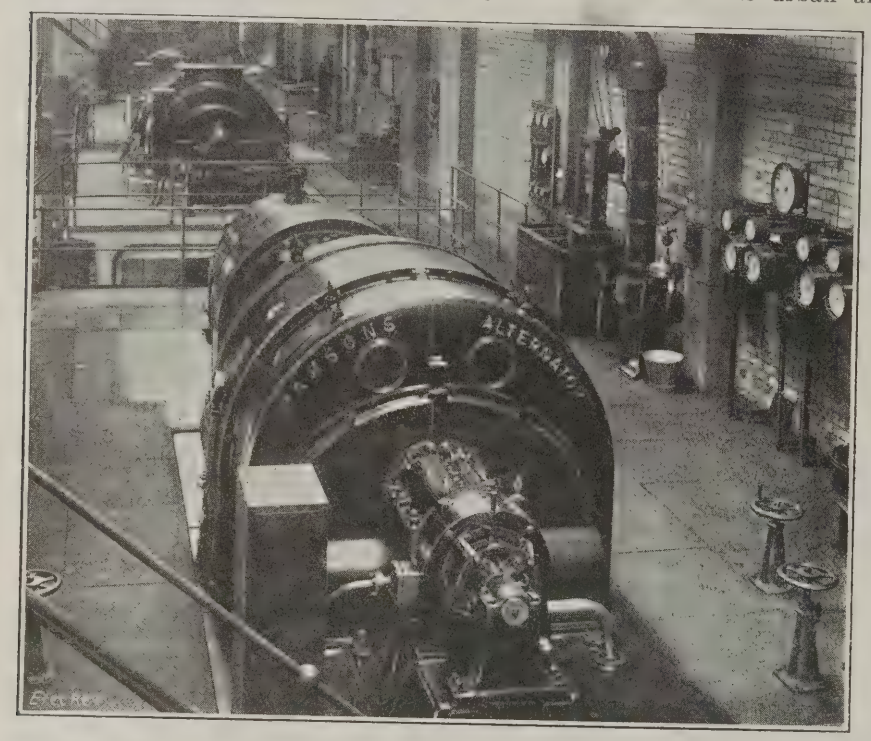


Fig. 1.—New Turbo-Alternators, Bedford.

An interesting feature is the ash-handling equipment. Two water reservoirs under the boiler house are fed with the cooling water from the condensers, and by means of tilting weirs, one at one end of each reservoir, the water is automatically and periodically emptied into troughs into which the ashes from the grates are dropped. The flow carries the ashes into a system of sumps, where they are screened, and the water is returned to the river. The ashes are cleaned in the process, with the result that sufficient revenue is obtained to cover the expenses incurred in removing the residue from the sumps, for which purpose an electric crane and grab are used.



Fig. 2.—Rural Supply Sub-station.

As recently as last year the system of generation at Bedford was changed from single-phase, 60 cycles, to 3-phase, 50 cycles. The first step in connection with this scheme was to install two new 6,600-V, 3-phase, 3,750-kW turbo-alternators, fig. 1, one by Messrs. C. A. Parsons & Co., Ltd., and one by Messrs. W. H. Allen, Sons & Co., Ltd. It was possible to put the whole load of the station on these machines, while two existing 1,500-kW single-phase machines, one Parsons and one B.T.-H., were rewound for 3-phase working. The four machines mentioned now constitute the whole of the active generating plant.

The urban area network is divided into two main sections, and these are supplied at 2,000 V, single-phase, from the two phases of Scott-connected transformer banks, which are fed at the generated pressure.

The authorised supply area of the undertaking now covers about 200 sq. miles, over which a great many tiny villages or hamlets are scattered. To some eleven of these the supply has already been extended, mostly by means of underground cables. In some cases, where further extensions are anticipated, or where ring-main systems to connect up with existing single-phase systems are contemplated, the 3-phase, 6,600-V supply is run out to suitable kiosk sub-stations and there converted to 2-phase, 2,000-V by means of Scott-connected transformer banks for single-phase distribution, or the pressure is reduced directly to that of the l.p. supply system, 365 V, 3-phase. Fig. 2 shows the type of kiosk employed; it is actually a special sub-station for supplying Sandy and district, about ten miles east of Bedford. It houses three 500-kVA transformers forming a 3-phase, step-up bank from 6,600 to 11,000 V for linking up with the mains of the Bedfordshire, Cambridgeshire and Huntingdonshire Electric Supply Co.

Touring the area, one sees small kiosks, approximately 3 ft. square by 6 ft. high, dotted about the countryside in all manner of places. These supply isolated houses or groups of houses at 210 V, single-phase, and are fed from the h.p. 2,000-V single-phase mains. The kiosks were all supplied by the Yorkshire Switchgear Co., Ltd.

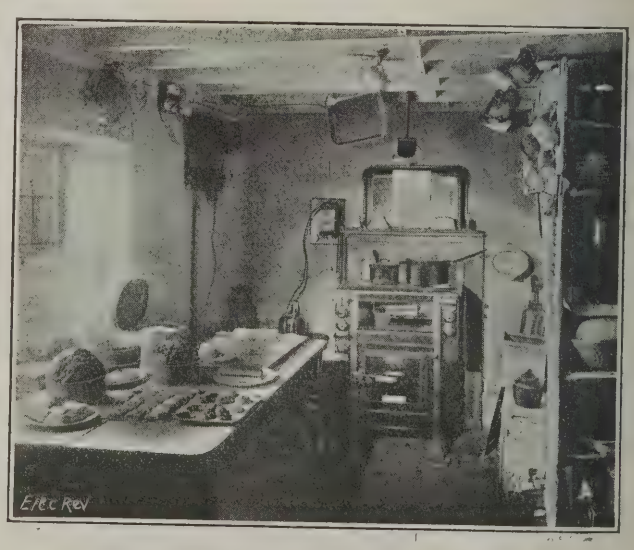


Fig. 3.—Electric Cooker in Country Kitchen.

It is encouraging to note that about 1,000 consumers in the rural areas have so far been connected up, out of a population of about 41,000. Somewhere about 70 miles of h.p. and l.p. cable have been laid in this connection.

While it has been in all cases a difficult problem to

cut the capital expenditure to the necessary fine limits to render the estimated limited revenue from the scheme remunerative, it has invariably been the case

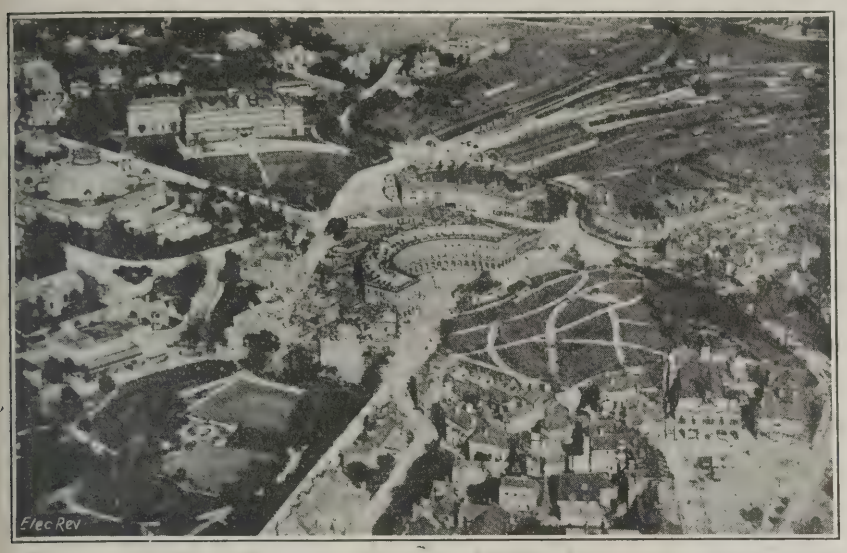


Fig. 4.—Buxton, Bird's-Eye View.

that the supply has resulted in increased building activities in the districts.

The country folk are very pleased with the supply,

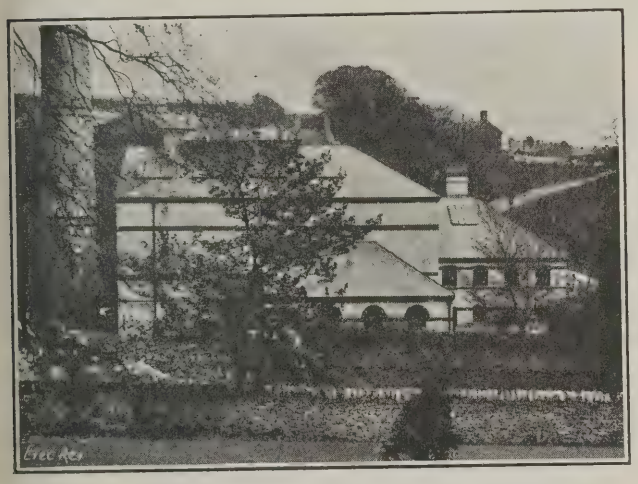


Fig. 5.—Buxton Power Station.

both for lighting and cooking, and take a keen interest in the modern methods and apparatus introduced. Fig. 3 shows a modern cooker in an old-fashioned country kitchen. The housewife of this establishment described the cooker as "wonderful," and said that her bill of 12s. 6d. for five weeks' consumption was considerably less than the figure for coal would have been. The tariffs for lighting and heating vary from 6½d. to 9d. and 2¼d. to 3d. respectively, according to the "zone" or distance from the generating station.

The maximum load on the station to date is 5,350 kW, and the energy generated during the year ended March 31st, 1927, was 15 million kWh. About 7,400 consumers are connected to the mains.

It will be seen that under the President's guidance the undertaking has steadily developed, and has successfully extended its operations far into the rural areas, thus again refuting the arguments of those who still maintain that such areas cannot be dealt with on an economically sound basis.

Apart from the routine business which is so efficiently handled by the Council of the I.M.E.A., Mr. Phillips's year of office, now drawing to a close, has been marked by the termination of the long conflict between the Association and the electrical contractors. Whatever good may eventually come from the main provisions of the Act of 1926, it can hardly be questioned that the one which will bear fruit most quickly and most effectively is the clause that was inserted at the last minute, embodying the agreement between the municipal undertakings and the contractors; and Mr. Phillips is to be congratulated on his share of the work which had so happy a conclusion.

In later issues we shall report the proceedings of the Convention, which this year will be less strenuous than on some previous occasions. A more delightful spot for a convention than "Beautiful Buxton" could hardly be imagined; unlike some watering places of comparatively mushroom growth, it traces its history as a health resort from Roman times, and has frequently entertained distinguished visitors, including Royal guests.

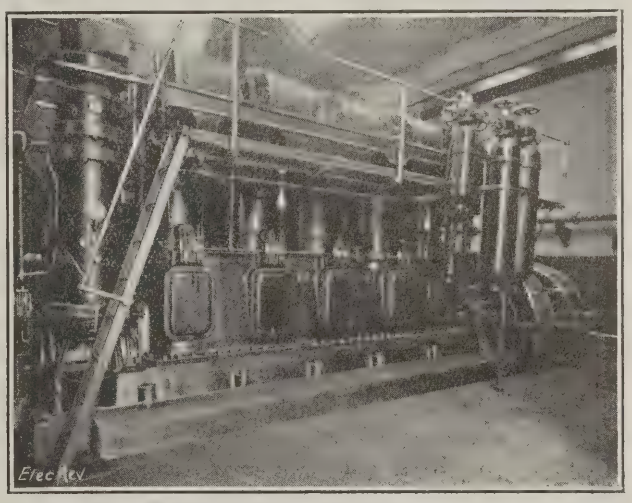


Fig. 6.—340-kW Diesel Set.

Buxton, fig. 4, is the highest town in the Kingdom, being situated 1,000 ft. above sea level, where the air is dry and bracing and fogs are rarely met with. It is noted

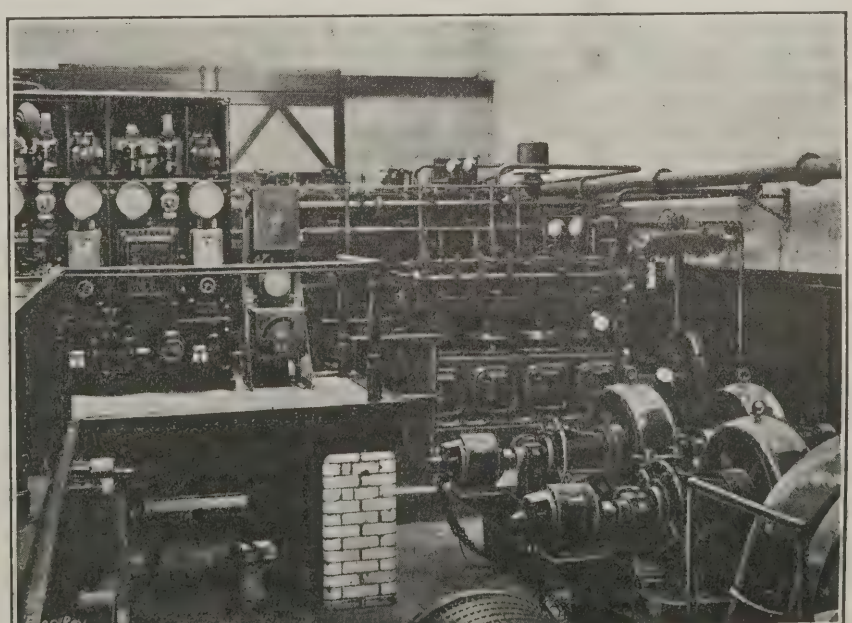


Fig. 7.—Engine Room, Buxton.

for its healing springs, nine in number, which yield a flow of half a million gallons a day at a temperature of 82 deg. F. The water is highly radio-active, and contains a variety of salts, besides an exceptional amount of nitrogen and other gases; abundant provision for its use, both internal and external, is made at St. Ann's Well and the "Natural" and "Thermal" Baths. The town offers other attractions to the visitor in the shape of charming gardens, provision for games, its Pavilion and Opera House, and other means of entertainment, and is itself a pleasant place provided with innumerable hotels; but it is also a centre from which an endless variety of excursions to places of interest and beauty can be made, being situated in the heart of the Peak District, amongst hills and dales that rival those of the Lake District.

The electricity undertaking is owned by the Corporation, and was inaugurated in 1900, giving a d.c. supply at 230/460 volts. The original plant was steam-driven, but the present borough electrical engineer, Mr. A. Bishop, in 1919, introduced a 100-kW E.C.C. dynamo driven by a four-cylinder Browett-Lindley gas engine, the success of which led the Council to sanction the replacement of all the steam plant with gas plant, and in 1920 a scheme was drawn up which, after the late Mr. C. H. Wordingham had been consulted, was adopted practically without modification. Two 200-kW Browett-E.C.C. sets were installed, and by the end of 1923 a profit of £3,500 was realised. Cooling water was provided by a cooling tower and a concrete tank holding 20,000 gallons. A large battery was supplied by the D.P. Battery Co., Ltd., with E.C.C. automatic reversible boosters and Tirrill regulators, by which means the running load factor was kept up to 90 per cent. Extensions proved necessary in 1924, and a four-cylinder Diesel engine by Messrs. Mirrlees, Bickerton and Day, Ltd., was installed, driving an E.C.C. 233-kW dynamo, with which the fuel cost was reduced from 0.94d. per kWh generated with gas at 2s. per 1,000 cu. ft. to 0.37d. with oil at 107s. 6d. per ton, the total working cost in 1925-6 amounting to 0.522d. The Diesel set ran for 4,065 hours, and generated two-thirds of the output, with an average consumption of 0.629 lb. per kWh, the lowest recorded for 37 British stations. In November last year a five-cylinder 340-kW set of the same make was installed, fig. 6, bringing the plant capacity up to 1,150 kW. Figs. 5 and 7 show respectively exterior and interior views of the station.

The total output (sold) in 1925-6 was 843,500 kWh; of this amount 240,160 kWh was used for power and heating, including 111,570 kWh for domestic purposes. There is no industrial power load in Buxton, which is becoming more and more a residential district for Manchester and other large towns. The power station is situated on the River Wye, about a mile from the centre of the town; Callender cables are used. The rates charged for lighting range from 6½d. to 5d., and for power and heating from 2d. to 1d.; a two-part domestic tariff is in contemplation. The capital outlay amounts to £104,800, of which £61,753 has been redeemed. There was a gross surplus last year of £7,949, and a net surplus of £2,086.

The Royal Society's Soirée.

Annual Exhibition and Demonstrations.

(*Concluded from page* 792.)

Mr. A. A. King (Albright & Wilson, Ltd.), with the aid of a mercury lamp and Chance filter, strikingly demonstrated the application of ultra-violet radiation to the detection of impurities in various substances. For instance, distilled water, including grades hitherto assumed to be free from foreign matter, when exposed to ultra-violet light fluoresces more or less according to its purity; in this manner imitation precious stones can be distinguished from true gems, diamonds can be graded according to quality, and the degree of purity of manufactured chemicals and other substances can be quickly and easily checked, whilst the method is also applicable to titration. As a means of detecting and estimating minute quantities it should be of considerable assistance to the chemist, besides its many other spheres of usefulness. For example, when filter paper which has been sensitised with pure mercuric chloride and prepared by the Gutzeit method for testing for the presence of arsenic is examined in ultra-violet light, the unchanged mercuric chloride fluoresces blue, whilst the yellow mercury-arsenic stain on it stands out as a black disk; this contrast is utilised to detect arsenic stains which are quite invisible to the eye in ordinary light, and a quantity of arsenic as minute as 0.00001 milligram may thus be estimated quantitatively. Ultra-violet light is, of course, also used for medical treatment of diseases, and Mr. King indicated how the difficulty of application to such inaccessible areas as the back of the nose, &c., can be overcome by the use of a suitably-shaped applicator; the latter is a quartz rod, curved or bent as required, into the straight end of which the ultra-violet light is directed, following the curve by reflection inside the rod, and emerging from the other end as a beam which impinges on the desired area which is being subjected to treatment.

The research laboratories of the General Electric Co., Ltd., had three exhibits illustrative of: (i) A method of measuring the vacuum in an electric lamp (Mr. J. T. Randall), due to Dr. P. Selényi, of the Forschungslaboratorium Tungsram des Vereinigten Glühlampen und Elektrizitäts A.G., Ujpest. Between the evacuation and "clean-up" processes the residual gas in the lamp is absorbed by the walls of the bulb under certain conditions, usually coincident with an electric discharge which takes place across the space between the two filament electrodes. Selényi's method of observing this discharge is to turn the lamp into a system of condensers by partially immersing it in water: one condenser is formed by the filament system and the inner bulb surface, the other by the inner and outer bulb surfaces. If an oscillating potential is applied between the water and one end of the lamp filament, a note characteristic of the capacity of the lamp condenser can be heard in a pair of telephones inserted at an appropriate point; the oscillating potential is supplied from the two terminals of a "flickering" neon lamp. If an adjustable voltage is now applied to the lamp filament and its value gradually raised, a point is reached when ionisation of the residual gas in the lamp sets in; the gas is now conducting and, therefore, forms a non-ohmic shunt across the condenser formed by the filament system and inner bulb surface; hence the effective capacity of the lamp condenser is changed and the note in the telephones decreases in pitch. As soon as absorption of the gas starts, the number of ions

decreases again and the note in the telephones rises in pitch; when the "clean-up" is completed, the note in the telephones remains at a constant pitch.

(ii) New methods of using photoelectric cells (Mr. N. R. Campbell). Hitherto gasfilled cells have always been used at voltages less than that required to pass a spark discharge; but if higher voltages are used, the discharge being stabilised by a thermionic current-limiter in series with the cell, the current through the cell is intermittent and the frequency of intermittence varies with the light incident on the cell; changes of this frequency are used to detect or measure light. Two methods depending on the principle just stated are: (*a*) the current through the cell is adjusted by means of the current-limiter so that the frequency of intermittence in the dark is about 5,000 per second; very moderate illumination will then cause the oscillations to cease. This method is thought to have applications in the transmission of pictures by radio-telegraphy, for in order to modulate waves of radio-frequency by light signals it is desirable to have those signals in the form of oscillations of about 5,000 per second frequency. In present methods some subsidiary device has to be introduced to convert the signals into this form, but by the new method the signals of the necessary form are produced by the cell itself and, moreover, there is probably some gain of sensitivity, and weaker light can be used. (*b*) The current is adjusted so that the frequency of intermittence is about 1 per second; very feeble illumination will then produce a change of frequency; the illumination can be measured by counting the rate of the clicks heard in a telephone in series with the cell. By this means it is possible to detect and measure, with extremely simple apparatus involving no delicate parts, illumination which otherwise would require a sensitive electrometer, constant batteries, perfect insulation, and other elaborations. It is thought that the method may have applications in astronomy, for the necessity of mounting the apparatus on a telescope makes it desirable to avoid so far as is possible all instrumental elaboration.

(iii) Thermionic emission from absorbed layers of barium on tungsten (J. W. Ryde and A. C. Bartlett). A spiral, which can be heated electrically, is coated with barium azide (BaN_6) which is decomposed, forming barium metal. The spiral surrounds a tungsten filament mounted axially; on heating the spiral, which acts as the anode, the barium slowly evaporates and forms a monatomic layer on the surface of the filament, which is run at a temperature of about 1,200 deg. K. If the supply of barium is relatively small, the emission gradually increases to an equilibrium value and then, if the supply is stopped, it slowly decays. If, however, the experiment is repeated with the spiral at a higher temperature, so that the supply of barium is increased, the emission rises to a maximum and then falls to a much lower equilibrium value. On stopping the supply, the emission current rises to another maximum, after which it slowly decays as the barium evaporates. If the relative rates of supply and evaporation are raised by changing the temperatures of the filament and spiral, either or both of the two maxima may be made to occur. This phenomenon appears to be due to the formation of a second monatomic layer on top of the first, the thermionic emission being due only to the uncovered parts of the first layer of barium. The nature of the second layer has not yet been settled, but it may be nitrogen. On the above assumption it may be shown theoretically that the first maximum will only occur if the supply of barium atoms is greater than the evaporation of those forming the second layer; also the second maximum will only occur if the supply of the atoms forming the second layer is greater than the evaporation of those in the first; this is borne out by experiment. The relation between the thermionic emission and the fraction of the filament surface covered by exposed barium atoms is being studied by these means. The method is also being applied to the study of the formation and evaporation of monatomic layers of barium.

Legal.

Workmen's Compensation Case.

At the Birmingham County Court recently Callender's Cable and Construction Co., Ltd., asked for a revision of the weekly award of £1 3s. 11d. compensation paid to Richard Brinsden, a labourer, who injured his back while lifting heavy slabs of stone on April 26th, 1926. The contention of the firm was that Brinsden was able to do light work. Two consulting surgeons stated that there was nothing to interfere with the man's working capacity, but his panel doctor stated that Brinsden walked in a peculiar and strained position. Judge Dobb took the view, having regard to the contradictory nature of the medical evidence, that the man's working capacity was so limited as to amount to total incapacity. It had been pointed out, on behalf of the employers, that Brinsden deliberately held himself in a strained position, but a man without any medical knowledge could not have adopted the well-recognised posture for abnormal curvature. He therefore gave judgment for the respondent.

Theft of Electricity.

At the Hendon Petty Sessions recently George Cohen, Golders Green, was summoned at the instance of the Hendon Electric Supply Co., Ltd., for the fraudulent abstraction of electricity from its mains and preventing a meter registering. It was stated for the prosecution that the defendant carried on business as "The Reliance Electric & Maintenance Co." One of the company's inspectors, on visiting the defendant's premises in February found that a number of lamps were connected by means of a heating plug, electricity thus being obtained at a lower rate than the correct one for lighting. Defendant, who pleaded "Not guilty," maintained that he had been overcharged for electricity on account of a defective meter, and it was admitted that when his meter was tested it was found to be over-registering to the extent of 5½ per cent. He also stated that the connection to the wrong meter was made by mistake by a boy. The mistake was made in the daytime and no current was used. The Bench imposed a fine of £2 for each offence and £3 3s. costs. The defendant said that he would appeal from the decision.

Action Against the Stepney Council.

It is reported that the action being brought by Messrs. Scammell & Nephew, a Spitalfields firm, against members of the Stepney Borough Council will probably be heard before the Long Vacation. The action is in the nature of a test of the legality of the Council's action in cutting off the supply of electricity to certain premises during last year's general strike. Sir John Simon, K.C., is said to have been briefed by the plaintiffs.

Electricity Finance and Distribution Corporation, Ltd.

In the Companies Winding Up Court on May 17th, Mr. Justice Eve made an order for the compulsory winding up of this company.

Impex Electrical, Ltd., v. Norton Wireless Co., Ltd.

Mr. Justice Tomlin, in the Chancery Division on May 18th, concluded the hearing of this action for an injunction restraining the infringement of the plaintiffs' trade-mark "Dario" for wireless valves.

Mr. David Cartwright, recalled after giving evidence the previous week (*vide* our last issue, p. 823), said he could not identify a man in court as the chauffeur whom he saw buying a valve in the defendants' shop. A man named Scott who went with Hill, but waited outside the shop, said he examined the valve he bought and found that it bore the trade mark "Dario."

Giving judgment, his Lordship said that the evidence of Hill and Scott had convinced him that there was no confusion of valves as had been suggested, and having regard to the evidence of Mr. Kelly, which was unsatisfactory to a high degree, and to the evidence from Imperial Airways, Ltd., and the documents, it was clear to him that in the summer of 1926 the defendants were importing and selling French valves bearing the mark "Dario." He granted the injunction asked for with costs, and said there would be an inquiry as to damages.

Esders v. Porn.

In the Mayor's and City of London Court, before Mr. Registrar Dell, on May 20th, Mr. C. F. G. Esders sued Mr. Marcel Porn for £8 7s. 6d., balance of commission said to be due on account of the sale of electric lifts. The plaintiff stated that the basis of his engagement was that he should receive 5 per cent. and 2½ per cent. on all orders obtained by him. Later the defendant paid him £1 a week salary, which was to go towards his expenses. The defendant maintained that that £1 per week was an advance in respect of commission. The Registrar held that that was so, and gave judgment for the defendant with costs.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Department of Overseas Trade.

The British Engineers' Association has passed a resolution to the effect that, while it realises the urgent need for State economy, it shares in the widespread doubt and anxiety as to the effects of the termination of the separate existence of the Department of Overseas Trade. The resolution emphasises the vital importance of overseas trade to this country, and says that many of the services rendered by the Department are indispensable.

A deputation on the subject from the Association of Chambers of Commerce was received by the President of the Board of Trade on Monday last, when Sir P. Cunliffe-Lister promised to report the views expressed to the Government.

A G.E.C. Fan Campaign.

The General Electric Co., Ltd., is making a special effort to increase the sale of fans now that the summer season is imminent. While a good deal of national advertising is being done, the aid of dealers is also being enlisted, as the company recognises that manufacturers alone cannot achieve the desired results. To this end the company has produced special window display devices and attractive folders for the use of retailers. To further the sales of fans by demonstration (the best way), an extra discount is offered to dealers upon the first fan purchased.

A "Cosmos" Fan Display.

A seasonable display has been arranged by Metro-Vick Supplies, Ltd., in one of the windows of its Charing Cross



A "Cosmos" Fan Display.

Road premises. It consists of a simple arrangement of "Cosmos" fans, each of which bears a card announcing the virtues of the appliance. A large message in the centre of the window indicates the scope of the electric fan's activities.

Rugby and Cable Tenders.

The *Birmingham Post* reports that at last week's meeting the Rugby Urban District Council considered a recommendation from the Electricity Committee that the lowest British tender received for an electric cable should be accepted. A Liberal member of the Council moved the substitution of "the most suitable tender," in the place of "the lowest British tender." He objected to be tied down to the acceptance of British goods, and said that when the Council, some time ago, had accepted a Swiss tender it subsequently received "dirty treatment" from British firms. The amendment was not seconded, but Mr. H. Yates (chairman of the Committee) said that there was a cartel among cable suppliers, and there was very little difference between the tenders sent in by British manufacturers. "The same people tendered every time, and it was always the same firm which was the lowest, giving the impression that each firm had its own field of operation."

Receiver Appointed.

The Electrical Devices, Ltd., Newcastle-on-Tyne.—Mr. Sadler Forster, of County Chambers, Marton Road, Middlesbrough, has been appointed receiver and manager on behalf of the debenture holders as from May 19th.

Local Exhibitions.

Richmond (Yorks.).—Under the auspices of the Electricity Committee, an electrical exhibition was held on May 17th and 18th in the Town Hall, Richmond. A number of leading manufacturers participated, including the Metropolitan-Vickers Electrical Co., Ltd., the Edison Swan Electric Co., Ltd., and the General Electric Co., Ltd. There were also several local exhibitors, including Messrs. Wm. Sykes and Co., Spence & Co., A. Morton, R. Kirtley, L. Paxton, and W. Husband. Mr. A. Brand, chairman of the Electricity Committee, at the opening ceremony, said that, although the matter had been discussed for 20 years, electricity supply only became available in October last. At first there were 140 consumers, and 50 had since been added, and applications were being received daily. It was hoped that the exhibition would increase the demand and permit of a decrease in the charges.

Hammersmith.—During a recent "Health Week Campaign" at Hammersmith the Borough Electricity Department, in conjunction with the General Electric Co., Ltd., arranged a stand at the Town Hall. Upon this appeared a good display of "Magnet" electrical appliances for the home. A view of the stand is reproduced herewith.



An Electrical Display at Hammersmith.

Cheadle and Gatley.—The municipal Electricity Department (engineer: Mr. R. W. Willis) has adopted a cooker hiring scheme, and in support of this is arranging exhibitions and demonstrations in the three parts of its area, Cheadle, Gatley, and Cheadle Hulme, during June and July.

Threatened A.E.G. Strike.

The Berlin correspondent of the *Daily Telegraph* reported last week that differences between the directors and employés of the Allgemeine Elektrizitäts Gesellschaft seemed to portend a serious conflict. The trouble is due to the reduction of toolmakers' wages, coupled with a rise in the cost of living. The directors refused to meet the men, and the latter then demanded a 15 per cent. increase in wages. They were offered an increase of three pfennigs per hour but, declining this, left work. It was expected that the dispute would extend to other departments, eventually involving 50,000 workers, and perhaps to other undertakings. It is being maintained that the industrial "rationalisation" schemes are being carried out at the expense of the employés. It was reported later that a settlement had been reached, part of the demand being granted.

New Earthenware Pipe Works.

Messrs. DOULTON & Co., LTD., are establishing on a 25-acre site at Erith a new works for the production of earthenware pipes. The new works is exceptionally well situated for export, having a private Thames-side jetty and railway siding. The factory is equipped throughout with modern labour-saving plant for handling raw materials and finished products, and the whole of the manufacturing machinery will be driven by electricity produced at the company's own power house adjoining the factory.

Employment during April.

The May *Ministry of Labour Gazette* says that employment in the engineering industry during April was slack on the whole, although there was a further improvement in all sections. In the motor vehicle and electrical sections it was fairly good. The overall proportion of unemployed in the industry fell from 10.3 to 9.7 per cent., and in the electrical engineering branch the figure declined from 6.2 to 5.6 per cent. The other electrical industries also improved. The proportion of unemployed in the electric cable, wire and lamp manufacturing group fell from 8.6 to 7.7 per cent., and that of the electrical wiring and contracting industry from 7.9 to 7.4 per cent. The actual numbers of unemployed were as follows:—Engineering, 96,798; electrical engineering, 4,333; electric cable, wire and lamp manufacture, 6,790; and electrical wiring and contracting, 1,031.

Recent Contracts.

Among the orders recently received by members of the British Engineers' Association are the following:—A mechanical loading, handling and storage plant, for the British Phosphate Commissioners, for dealing with the huge deposits of phosphate of lime on Nauru and Ocean Islands in the South Pacific, which were taken over from Germany during the war. The plant will be electrically driven. Messrs. Marryat & Place, Ltd., have supplied eight two-head rivet heaters to Messrs. Cammell, Laird & Co., Ltd. A contract for an electrically-driven aerial ropeway ten miles long has been received from India by the British Ropeway Engineering Co., Ltd. The order for the hydro-electric plant for this work has also been placed in this country. Messrs. J. Blakeborough & Sons, Ltd., in addition to supplying the turbines for the Waikaremoana (N.Z.) hydro-electric undertaking, have also received an order for the necessary valve equipment. The same company is also supplying the water-controlling equipment for the 126,000-h.p. development at Komaki of the Nippon Electric Power Co. The Harland Engineering Co., Ltd., is providing six motor-driven high-pressure boiler-feed pumps (about 250 h.p. each) for the Bunnerong power station erected by the Sydney (N.S.W.) Municipal Council. Pumps, water-screening plant, circulating mains and pipework are being supplied by the Mirrlees, Watson Co., Ltd., for the Indian State Railways' power station at Kalyan.

Electric Power in Industry.

Continuing its series of Preliminary Reports on the Census of Production, 1924, the *Board of Trade Journal* for May 19th contains particulars of further industries. It is shown that in the typefounding, electrotyping, engraving, process block making and die-sinking trades in 1924 there was only 65 kW of generating plant (as compared with 33 kW in 1907). The electric motors in use had an aggregate capacity of 2,952 h.p., power for 2,877 h.p. of which was purchased. The billiard table and sports requisites trades reported 450 kW of generating plant (against 239 kW in 1912) and 3,974 h.p. of electric motors (power for 3,144 h.p. purchased). The games and toys trades had 239 kW of generating plant and 1,571 h.p. of motors (power purchased for 1,363 h.p.). Generating plant of 2,062 kW was reported by the engine and boiler packing and asbestos trades (against 1,030 kW in 1912); there were 9,350 h.p. of electric motors, power for 7,360 h.p. of which was purchased.

Mansfield and Foreign Cables.

The Mansfield Town Council has received a letter from Sir John Corcoran, a director of the National Union of Manufacturers, in which that Council's action in buying foreign electric cable is criticised, and this was the subject of discussion at last week's meeting. The chairman of the Electricity Committee, Coun. F. Hardy, said he thought the Council's action was already having an effect, because one of the firms associated with the cable manufacturers had reduced its price between 25 and 30 per cent. Coun. J. Pollard hoped the Committee would continue to buy cable from Holland in order to break the "rings" among English manufacturers. Ald. Norris said the remedy was for the people of this country to take the matter in hand and formulate a policy to find work for British workers.

New Italian Companies.

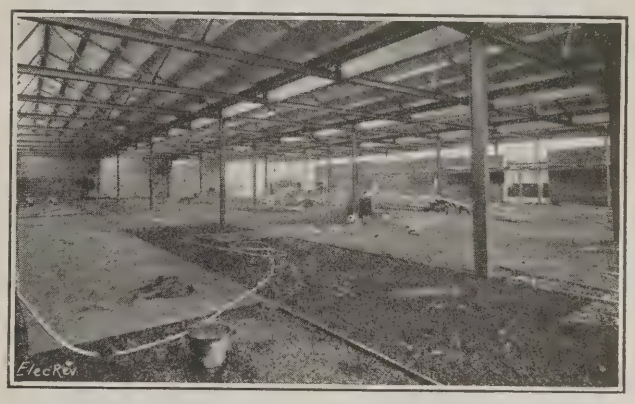
Among the concerns recently formed in connection with electricity supply in Italy are the Società Illuminazione Elettrica Vetture, Milan, capital 60,000 lire; La Società Elettrica Buonalbergo Casalbare, Buenalbergo (Benevento), capital 300,000 lire; La Società Idroelettrica Val d'Agri di Missanello, Missanello (Potenza), capital 100,000 lire; and La Società Elettrica Rinascenza, Nicastro, capital 500,000 lire.

New Belgian Companies.

Eclairage et Force Motrice reports the formation of the following companies in Belgium:—Société Anonyme "Kalovik," Schaerbeek, capital 300,000 fr., to manufacture and deal in electrical appliances; Société Anonyme pour l'Exploitation d'Appareils Electro-pneumatiques, Brussels, capital 150,000 fr.; Ateliers de Constructions Electromécaniques de l'Est de Liége, capital 1,150,000 fr., to manufacture electrical machinery of all kinds, transmission apparatus, &c.; and the Société Franco-Belge de T.S.F. (Paris), capital 100,000 fr., to manufacture electrical and radio apparatus.

Berry's Electric, Ltd., and the McClary Cooker.

Some years ago we made the acquaintance of the McClary electric cooker—a Canadian production, which has attained wide popularity in that country and has been very well received on this side of the water, several electricity supply authorities having commended it highly. The cooker is enamelled inside and outside, and the oven is fitted with removable elements and racks, so that the whole of the interior can be cleaned with ease. The hotplates, which are of the totally-enclosed type, are also removable. We learn



Berry's Electric, Ltd., New Cooker Factory.

with interest that Berry's Electric, Ltd., which has not hitherto made cookers, has acquired the sole rights to manufacture and sell the McClary cooker in Great Britain and Ireland, and is erecting a large extension to its Birmingham works wholly for this purpose; the accompanying illustration shows the interior of the new workshops, which are being got into shape as quickly as possible, and will be completed by the end of June.

We have been requested by Messrs. Berry's Electric, Ltd., to pass on to members of the I.M.E.A. and E.A.W., and visitors, a cordial invitation to visit their Buxton showrooms at 2a, Station Approach. Among the outstanding attractions will be a replica of the "Magicoal" fire designed for the new residence of the Duke and Duchess of York, and approved by the Queen. There will also be continuous cookery demonstrations with the McClary cookers, and exhibitions of clothes washing, ironing, and refrigeration.

Social Event.

The Rugby team of the Chloride Electrical Storage Co., Ltd., has distinguished itself by winning for the second time the Workshops Cup Competition organised by the Broughton Rangers Rugby Football Club. The final was played on May 7th, when the Chloride team defeated the Salford Municipal Employés' team by 9 points to 2 points. The team previously won this cup in season 1924-25, while last season it reached the final.

United States Electrical Exports.

During March electrical goods to the value of $8,551,561 were exported from the United States. This was $34,781 less than the total for March, 1926, but $1,548,079 more than the February figure. The value of goods shipped during the first four months of this year was $23,200,000, about $600,000 more than in the corresponding period of 1926. The principal increases occurring in March, as compared with March, 1926, were for telegraph apparatus and railway signals, switches and attachments. The latter group rose in value by $103,841. The electric lamp class recorded a rise of $85,276. Other important increases occurred in insulated copper wire and cable electrodes for electric furnaces, mining and industrial locomotives, motor-driven household devices, batteries, switches and circuit breakers over 10 A, and portable electric tools. Among the decreases were transmission and distribution apparatus ($319,097), switchboard panels (except telephone) showing the largest fall ($238,196), transforming and converting apparatus ($227,773), electric motors, instruments, radio apparatus, domestic heating and cooking appliances, &c.

Unemployment.

The number of registered unemployed decreased by 23,428 during the week ended May 9th, and thus fell below the million mark. The actual total was 998,300, as compared with 1,021,728 on May 2nd and 1,875,899 on May 10th, 1926 (general strike period).

D

Wages in the Engineering Industry.

A further stage in the negotiations for increased wages in the engineering industry was reached last week. It will be remembered that the trade unions concerned originally asked for an all-round rise of 20s. per week. After lengthy discussions the employers decided that they were unable to accede to this demand, and offered instead an increase of 2s. 6d. per week, subject to certain conditions relating to overtime and night work. The unions considered that the offer left matters much as they were, and declined it. Then the general strike intervened and nothing further was done until early this year. Last week representatives of both parties met again in London. Sir Allan Smith, who presided, reviewed conditions in the industry, and on behalf of the Engineering Employers' Federation again offered a 2s. 6d. increase subject to conditions, with a proviso that the position and prospects of the industry should be reviewed again in July, 1928. The trade union representatives considered that this offer was identical with the previous one, and said that they could not accept it. As an alternative, they suggested an advance of 5s. per week to be made in two stages on July 1st and September 1st. The employers were unable to agree to this and, as a counter-proposal, offered a special advance to time workers of 2s. per week on the war bonus as from August 1st, wages then to be stabilised for 12 months. The union representatives declined this offer, and the conference broke up.

Trade Announcements.

MESSRS. L. WEEKES (LUTON), LTD., state that their business has not been amalgamated with, or absorbed by, any other similar business, nor is there any intention of this nature. They will continue to manufacture their "Safetee" ironclad switches, enclosed indicating cartridge fuses, &c., as hitherto.

The AUTOMATIC COIL WINDER & EQUIPMENT CO., LTD., has been appointed sole distributing agent for "Zeva" electric soldering irons and crucibles.

On and after May 29th the address of B.E.N. PATENTS, LTD., will be 92, Tottenham Court Road, W.C.1 (telephone: Museum 1761/2). The new premises comprise a showroom, a demonstration room, offices, a repair department and stores.

MESSRS. CUNNINGHAM, LTD., have had additional telephone lines installed; the new numbers are: Paddington 9001, 2 and 3.

MR. E. D. CHAPMAN has commenced business as an electrical and wireless engineer at 6, Station Parade, Croxley Green, Herts.

After serving with Messrs. Falk, Stadelmann & Co., Ltd., for seven years, Mr. L. E. FRASER is leaving on June 1st to take up agencies in the electrical and hardware trades. He has an office at 20-21, Finsbury Court, Moorgate, E.C.2. (Telephone: Clerkenwell 1003).

MESSRS. GREEN & SMITH, LTD., Meadow Lane, Leeds, have purchased the business of Messrs. Wallis & Watson, electrical contractors, Leeds; the business will be continued under the same name, and Mr. W. S. McGregor, the manager, and the whole of the staff have been retained. A brochure and leaflets dealing with the company's activities have been received.

ASCOG, LTD., has removed to Ascog House, 44, Theobald's Road, W.C.1. Telephone No.: Fitzroy 1537. Telegraphic address: "Oamcogeta, Holb-London."

MESSRS. BROWETT, LINDLEY & CO., LTD., have appointed Messrs. Green & Jackson, 12, Cherry Street, Birmingham, to be their representatives for the Midland District.

RADIO INSTRUMENTS, LTD., and the wireless section of the VARLEY MAGNET CO. have recently been amalgamated. Mr. J. Joseph, the managing director of Radio Instruments, Ltd., and Mr. J. M. G. Rees, of the Varley Magnet Co., are the directors of the new combination, which is known as R.I. and Varley, Ltd.

New Catalogues and Lists.

BROOK MOTORS, LTD., Empress Works, Huddersfield.—Catalogue No. 157, containing particulars and prices of "Brook" two- and three-phase loom motors. Also List No. 164, giving details of the company's hire-purchase system.

THE CONSOLIDATED PNEUMATIC TOOL CO., LTD., 170, Piccadilly, W.1.—Catalogue No. 14, containing illustrated details of portable electric tools, and three pamphlets advertising pneumatic tools.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—An illustrated price list of "Siemens" electric fans.

SOLEX, LTD., 223-231, Marylebone Road, N.W.1.—A booklet dealing with engine efficiency and the remedying of troubles in automobiles.

MESSRS. RANSOMES, SIMS & JEFFERIES, LTD., Orwell Works, Ipswich.—A handsome brochure illustrating many examples of the company's lawn mowers, including electrically-operated types.

SIR W. H. BAILEY & CO., LTD., Albion Works, Salford, Manchester,—List No. 3,326, containing illustrated particulars of high-speed single-acting air compressors and vacuum pumps.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—Lists Nos. 171/3, describing ironclad distribution panels, and 261/5, dealing with ironclad control pillars. Well illustrated.

THE UNIVERSAL MANUFACTURING CO., 7c, St. George's Circus, S.E.1.—A price list of electric fans, including desk and ceiling types.

THE LONDON ELECTRIC WIRE CO. & SMITHS, LTD., Playhouse Yard, Golden Lane, E.C.1.—A pamphlet announcing reductions in the prices of "Lewcos" two-pin inductance coils.

THE BRITISH TAP & DIE CO., LTD., Stirling Road, Walthamstow, E.17.—A leaflet containing prices and particulars of stocks and dies for screwing electrical conduits.

MESSRS. WINGROVE & ROGERS, LTD., 63, Queen Victoria Street, E.C.4.—A brochure illustrating examples of the company's electric locomotives, trucks and tractors, with full technical details.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The "Osram-G.E.C. Bulletin" for May, containing illustrated articles and notes on "Osram" lighting installations, "Osram" radio valves, "Magnet" domestic appliances, &c. Also a circular letter dealing with "Geeko" moulded accumulators.

THE STURTEVANT ENGINEERING CO., LTD., 147, Queen Victoria Street, E.C.4.—A profusely illustrated booklet describing the construction and use of the company's industrial turbine vacuum cleaners. Many views of their applications are reproduced.

THE CAMPBELL GAS ENGINE CO., LTD., 73a, Queen Victoria Street, E.C.4.—A brochure entitled "The Price of Power," dealing in a non-technical manner with the advantages of independent internal-combustion engine sets for driving machinery and generators.

BURNDEPT WIRELESS, LTD., Blackheath, S.E.3.—An illustrated and priced booklet describing fully the company's five-valve portable receiver.

WELDRICS (1922), LTD., Station Road, Beeston, Notts.—A series of illustrated pamphlets describing the company's arc-welding plant, electrodes, &c.

MESSRS. NEWTON & WRIGHT, LTD., 471-473, Hornsey Road, N.19.—A comprehensive catalogue of apparatus for radiology, containing illustrated particulars of X-ray equipment of many types.

MESSRS. STUART TURNER, LTD., 43-47, Market Place, Henley-on-Thames.—Pamphlets dealing with a small plant for charging high- and low-tension radio batteries. Fully illustrated and priced.

MESSRS. J. J. EASTICK & SONS, 118, Bunhill Row, E.C.1.—A series of advertisements dealing with radio components supplied by the firm.

THE L. P. S. ELECTRICAL CO., LTD., Avenue Road, Acton, W.3.—A catalogue of magnet wires, giving prices and winding data.

THE SUPERHEATER CO., LTD., 195, Strand, W.C.2.—Pamphlets Nos. S.1 dealing with superheaters for power plants; S.2, a report on tests of a steam generating unit at an American generating station; and S.3, describing "M.L.S." bifurcated tube water walls. Well illustrated.

IRON AND NICKEL BATTERY CO., LTD., 17-19, Cockspur Street, S.W.1.—An illustrated pamphlet advertising "Ionic" (nickel-iron) batteries for yacht lighting, and also the company's hand lamp.

WAGNER ELECTRIC SUPPLIES, LTD., 66, Victoria Street, S.W.1.—List 24E, giving particulars and prices of single-phase repulsion-induction motors.

Bankruptcy Proceedings.

H. W. BAYLIS, company director, Aldwych House, W.C.2.—The affairs of this debtor, who died last December, came before Mr. Justice Astbury, sitting on May 16th as bankruptcy judge in the Chancery Division, upon an appeal against the rejection by the trustee of a proof of debt for £22,000. The receiving order was made against the debtor's estate on November 2nd, 1926, and accounts were lodged showing total liabilities of £17,752 (unsecured £13,460), against assets valued at £710, the failure being attributed to liability under a guarantee given on behalf of Radio Phonopore and Electricals, Ltd., of which company the debtor acted as director until it went into liquidation in June, 1926. Mr. Spens, K.C., said he appeared on behalf of Mrs. Anna T. Baylis (debtor's widow) and the Revd. O. F. Walton, who were the trustees under a deed of separation, and the appellants against the decision of Mr. F. S. Salaman (the trustee under the bankruptcy) rejecting their proof of debt to the extent of £22,000. They asked the Court to admit the proof for the full amount of the debt. Counsel explained that under a deed of separation the debtor covenanted that within 12 months from the date of his death a sum, *inter alia*, of £22,000 would be paid to the trustees under the deed. Mr. Clayton, K.C., intimated that the trustee would not further oppose the appeal.

His Lordship made an order for the proof to be admitted for the full amount.

BARNEY PACIFICO (trading as B. H. Pacy), late of Southampton Row, W.C., dealer in electrical fittings.—This bankrupt, who failed in January, 1921, applied on May 17th to Mr. Registrar Mellor at the London Bankruptcy Court for an order of discharge. The Official Receiver reported that the debtor commenced business in January, 1918, with £500 capital. He traded until the following December, when, owing to the business having been carried on at a loss, he closed it. The liabilities were returned at £395, and no assets were disclosed. The discharge was suspended for 12 month on statutory grounds.

A. A. Smethurst, trading as A. Smethurst & Co., 62, Bernard Street, Southampton, electrical and wireless engineer.—The public examination of this debtor was held recently at the Court House, Southampton. According to the statement of affairs the liabilities totalled £1,077, against assets of £315. Debtor stated that in 1905 he commenced business on his own account with £5, undertaking a certain contract. His business was very successful, and he was able to purchase the freehold of the premises, putting down £750 of the £1,250 required. During the war he did very well on Admiralty contracts for the provision of wireless apparatus to trawlers and other vessels, and received a claim for between £3,000 and £4,000 for excess profits duty. He found it inconvenient to withdraw the money from the business at the time, but he had since paid up to within £60 of the total claim. In 1921 he turned the business into a company. Subsequently, however, he had to assist the concern financially, providing about £2,500. As security for the loans which he made to the company, a debenture was issued for £2,100. Debtor said that his failure was due to the slump in shipping. He had been doing a turnover of from £10,000 to £12,000 a year. In 1924 the company was wound up, a receiver for the debenture holders having been appointed, and debtor was appointed to act as manager. At the beginning of 1926 debtor recommenced trading on his own account. He attributed his failure to excess profits duty payments and income tax, loss of work which he had been doing for a firm for years, and bad trade. The examination was formally adjourned.

H. A. S. Glenn, 95, Holderness Road, Hull, gramophone and wireless dealer.—The public examination of this debtor was held on May 16th at Hull. The statement of affairs showed liabilities of £667 and a deficiency of £474. Debtor attributed his failure to bad trade, wireless competition, and illness. The examination was closed.

A. L. Weekes, 13, Crescent Road, Luton, Beds., electrical engineer.—The receiving order in this matter was made on April 28th, on a creditor's petition. The first meeting of the creditors was held on May 17th, at the Official Receiver's Office, Northampton. The following are creditors:—

	£		£
Dryden, T. H.	153	Cumberland Brown	182
Peter Thomas & Clark ...	184		

L. Bell (C. Bell), mechanical and electrical engineer, Joseph Street, Leeds Road, Bradford.—Trustee, Mr. J. Lund, 2, Darley Street, Bradford, appointed May 10th.

J. Atkins (Atkins & Co.), electrical engineer, 59, Church Street, Tewkesbury, Electricity Works, Northleach, and High Street, Winchcombe.—Trustee, Mr. R. A. Rodgers, Coventry House, 3, South Place, E.C.2, appointed May 14th.

H. Milnes (H. Milnes & Son), plumber and electrician, 6, Trinity Street, Huddersfield.—Last day for proofs for dividend, June 1st. Trustee, Mr. A. Pontefract, 6, New Street, Huddersfield.

W. M. Horsfall, Heath Lodge, Hooton, Cheshire, electrical engineer, carrying on business in Liverpool.—Third dividend of 6d. in the £ payable at the offices of the Official Receiver, 11, Dale Street, Liverpool.

H. Robinson, 41, Wigan Lane, Wigan, electrician and wireless and cycle dealer.—Last day for receipt of proofs for dividend, June 4th. Trustee, Mr. E. D. Symond, 11, Dale Street, Liverpool.

W. R. Grigsby, trading as the Wenham Lighting Corporation, 184, Gray's Inn Road, W.C.1, electrical factor.—Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C., released March 28th.

J. Turner, 62, Blackburn Road, Great Harwood, Lancs., electrician.—Trustee, Mr. J. P. Duxbury, 27, Richmond Terrace, Blackburn, appointed May 18th.

Company Liquidations.

Wireless Services, Ltd.—A meeting of members is called for June 20th at 4, Charterhouse Square, E.C.1, to hear an account of the winding up from the liquidator, Mr. E. H. Hawkins.

Radio Valves, Ltd.—A meeting of members is called for June 21st at 182, Temple Chambers, Temple Avenue, E.C.4, to hear an account of the winding up from the liquidator, Mr. W. H. Bevan.

Coughlan & Tyrrell, Ltd.—A meeting of members is called for June 20th at Bilbao House, New Broad Street, E.C.2, to hear an account of the winding up from the liquidator, Mr. A. T. Keens.

Interchangeable Electric Signs, Ltd.—Winding up voluntarily. Liquidator, Mr. C. H. Seaton, 62, Brook Street, W.1. —Meeting of creditors held on May 24th. Particulars of claims to be sent in by June 24th.

District Lighting Supply, Ltd.—Winding up voluntarily. Liquidator, Mr. C. S. Steel, 34-36, Gresham Street, E.C. Meeting of creditors to-day (Friday) at Cannon Street Hotel, E.C.4.

Private Arrangements.

R. F. Hearn, 9, South Wharf, Paddington, electrical and heating engineer.—A meeting of creditors was held on May 18th, when Mr. W. F. Baker, of Messrs. Haynes & Baker, 97, Mortimer Street, W.1, said that the liabilities amounted to £1,641, all due to trade creditors, with the exception of £100, which had been lent by a daughter. The assets, after deducting £40 for preferential claims, amounted to £1,054, but that amount was subject to realisation. The debtor had carried on business since 1915. He attributed his position to losses amounting to £1,700 in connection with contracts carried out for an architect; he claimed that that amount was due to him. It was decided that a deed of assignment should be executed in favour of Mr. Baker as trustee, together with a committee of inspection. The committee was empowered to negotiate for the sale of the assets for a sum sufficient to pay 10s. in the £. The following are creditors:—

	£		£
Ashby & Warner, Ltd.	70	Hartley & Sugden ...	60
Brooks, Phillips & Co. ...	37	Hearn, Miss	100
Boldings, Ltd.	48	Lichtwitz & Peasey ...	82
Crane Bennett, Ltd. ...	70	Matts & Co., Ltd. ...	82
Croggon & Co.	39	Matthews & Yates, Ltd.	40
Digby & Co., Ltd. ...	434	McDowall, Steven & Co.	40
Evered & Co.	80	National Radiator Co. ...	197
Garrod & Co., Ltd. ...	46	Walworth-Munzing, Ltd.	81

Acton Bros., electrical and wireless manufacturers, 33, Edmund Street, Camberwell, S.E.—A meeting of creditors was held on May 18th at the offices of Messrs. H. Rainsbury & Co., 65, Basinghall Street, E.C., when a statement of affairs was presented, which showed liabilities of £317, whilst there were rates and rent owing to the extent of £13. The assets were estimated to realise £196. Mr. H. Rainsbury reported that the debtors, Messrs. N. E. and E. O. Acton, started trading about five years ago at Walworth Road. They were successful, and in December, 1925, they moved to larger premises. Since that time, however, the business had declined, and from time to time they borrowed money from their father, who was now a creditor for £80. The father also guaranteed an overdraft of £86 at the bank. Efforts were made to sell the business as a going concern, but two creditors commenced proceedings, and it therefore became necessary to call a meeting. Mr. Rainsbury stated that no offer of composition could be submitted. The creditors decided that the estate should be realised by Mr. Rainsbury as trustee.

Dissolutions of Partnership.

Langham (Diamond Clear) Radio, wireless dealers, Albion House, New Oxford Street, W.C.—Mr. M. Baynes and Mr. H. H. Havercroft have dissolved partnership. Mr. Baynes will attend to debts.

W. T. Canning & Co., electrical, motor and general engineers, 47, Goldhawk Road, W.12.—Messrs. H. J. Blissett and W. Canning have dissolved partnership. Mr. Canning will attend to debts and continue the business.

Ranburn Magneto Co., 26, Seymour Place, Marylebone.—Messrs. C. W. Pizzey, G. F. Rance, and W. H. A. Wood have dissolved partnership. Debts will be attended to by Mr. Wood, who will continue the business.

The Enforcement of Wage Agreements.

Under existing conditions wage agreements arrived at by Joint Industrial Councils only apply to members of those councils, and as a consequence these organised employers are often undercut by other employers who are not bound by the agreements. Accordingly a Bill is being re-introduced into Parliament which seeks to empower the Minister of Labour to make applicable to the whole industry any agreement made by a Joint Industrial Council where the latter so desires. A group of Conservative Members of Parliament, headed by Sir Cooper Rawson, has issued a manifesto calling for the Government's support of this Industrial Council's Bill. It is stated that several councils have come to the conclusion that their continued existence will be useless unless legislation of the nature proposed is secured. As an example, the Whitley Council for the Granite and Roadstone Quarrying Industry is cited. This Council has made a wage agreement, but the parties to it are seriously affected by the refusal of local authorities and private firms which own quarries to fall in with the arrangement. Eight councils are said to have been disbanded owing to the lack of the powers asked for. It is pointed out that as a Whitley Council represents at least 75 per cent. of those engaged in a particular industry, the effect of the Bill would be simply to bring the majority into line. The Bill passed its second reading in 1924 by a majority of 220 and probably would have become law but for the dissolution. It is anticipated that the same support is available, and it is said that the National Union of Manufacturers and the Trade Union Congress both support the Bill in principle.

The effect of the legalisation of agreements upon the electrical industry is dealt with in the May *Journal* of the Electrical Trades Union by the general secretary (Mr. J. Rowan). He says:—"It has been made very clear to the Ministry that compulsory arbitration is not to be a condition of such enforcement, and that the present procedure of the various joint councils shall continue—namely, that before arbitration can take place both sides must voluntarily agree. There is no doubt that if some such legislation could be given effect to, it would make an enormous difference to electrical installation work. It would even have a good effect on electricity supply, as we have had the spectacle of authorised undertakings actually leaving the National Joint Industrial Council rather than comply with voluntary agreements entered into jointly by the Council."

Business Opportunity in Buenos Aires.

We have been asked by a company with offices in Buenos Aires to put it in touch with British manufacturers or exporters of electrical cables, trolley wire, other wires for electrical purposes, electric lifts, electric lamps, fires, instruments, meters (a.c. and d.c.), turbines, dynamos, motors, conduits, electric motor-cars, electrical accessories, and novelties. British concerns who are open to appoint agents for export trade with Argentina, Chile, Uruguay, and Paraguay, and wish to communicate with the company mentioned are asked to write to the Electrical Review "Service Department," 4, Ludgate Hill, London, E.C.4.

Book Notices.

"Central Station Voltages and Charges Throughout the United Kingdom, 1927." London: S. Rentell & Co., Ltd. Price 1s. net.—This booklet contains the latest information available at the time of printing as to the supply voltages, systems, and charges of the principal central stations in the United Kingdom.

"The New European Coal War" (29 pp.). London: Fleetgate Publications. Price 2d.—This is a report of the mission of miners' leaders to the Continent under the auspices of the *Daily News*, and is a concise and interesting review mainly of the German coal-mining and allied industries. The position of the electrical power industry is shown in its relation to other branches.

The Summer number of *Punch* (1s.) has been issued this week. It is full of fun and good humour, almost entirely pictorial.

"Underground Systems for Electric Light and Power," by T. C. Ruhling. Pp. viii+346; figs. 221. London: McGraw-Hill Publishing Co., Ltd. Price 20s.

"Automatic Telephony," by C. W. Wilman. Pp. vii+223; figs. 76. London: Crosby Lockwood & Son. Price 7s. 6d. net.

"Principles of Mercury Arc Rectifiers and their Circuits," by D. C. Prince and F. B. Vogdes. Pp. ix+233; 155 figs. Price 15s. "Properties and Testing of Magnetic Materials," by T. Spooner. Pp. xiv+385; 223 figs. Price 25s. London: McGraw-Hill Publishing Co., Ltd.

Electrical Patents in the United States.

Mr. Gerard Swope, president of the American National Electrical Manufacturers' Association, has appointed a committee of seven from prominent electrical concerns to investigate the situation regarding patents in the electrical industry, to determine whether some modification of the plan utilised by the National Automobile Chamber of Commerce may be made applicable to the electrical manufacturing industry. The committee comprises Messrs. Kebler, president, Ward Leonard Electric Co., chairman; A. G. Davis, vice-president, General Electric Co.; A. Atwater Kent, president, Atwater Kent Mfg. Co.; M. C. Rypinski, vice-president, Federal Brandes Co.; B. E. Salisbury, president, Pass and Seymour, Inc.; Harold Smith, general solicitor, Westinghouse Electric and Manufacturing Co.; and C. H. Strawbridge, president, Goodman Manufacturing Co. Messrs. A. E. Waller, managing director, and F. E. Neagle, legal counsel of the Association, are *ex-officio* members.

For Sale.

The South London Merchandise Mart will sell by auction on June 2nd, at 10, Red Lion Passage, Red Lion Square, W.C., the electrical and wireless stock of Claremont, Johnson, Ltd. (in liquidation). Bradford Corporation Electricity Department invites offers for one Babcock & Wilcox land-type water-tube boiler, with chain-grate stoker, &c., two Hall's boiler feed pumps, three induced-draught fans, two wrought-iron tanks, &c. Great Yarmouth Electricity Supply and Tramways Departments have for disposal one 600-kW single-phase Brush-Parsons turbo set, complete with surface condenser. (See our advertisement pages to-day.)

New French Company.

A new company has lately been formed at Clichy (149, Boulevard Jean-Jaures) (Seine), with a capital of 650,000 fr. and the title La Société des Etablissements de la Lampe Styx et Fragor Réunis, to manufacture telephone, telegraph, and radio apparatus.

German Materials for Victoria.

The Melbourne correspondent of the *Financial Times* reports that the Victorian State Electricity Commission has ordered material to the amount of £43,245 from German firms. Tenders for one lot of goods were received as follows:—One from England, two from America, and three from Germany. It was found that, allowing for the British preference from the tariff, the English price was 16.7 per cent. higher than that of Orenstein Koppel, of Berlin, which was accepted. The amount involved in this tender is £20,230. An order for six trucks of 20 tons each was given to Fried. Krupp, Berlin; a locomotive is to be ordered from Siemens Schuckertwerke, and cranes costing £1,983 from the Seyboth Co., Germany. The Commission claims that delivery by the Germans will be less than half the time mentioned in the British tender.

Scottish Electricians' Wages.

The Scottish District Joint Industrial Council for the Electricity Supply Industry has approved of an increase of wages to the extent of 1d. per hour to certain classes of employés in the industry.

The British Industries Fair, 1928.

We have received the prospectus of the next British Industries Fair, to be held at Castle Bromwich, Birmingham, from February 20th to March 2nd, 1928. This can be obtained from Mr. C. Stanley, the general manager, Birmingham Chamber of Commerce, 95, New Street.

Prices of Raw Materials.

In their weekly report on the lead market, Messrs. James Forster & Co. state:—"No new feature is apparent in the position. Stocks are considerable, supplies are ample, and consumption is still only moderate. It is rather astonishing that, in spite of the lower price for lead ruling this year, production actually shows an increase, one authority giving it as 33,000 tons over last year for the first quarter. Of course, this has already been discounted in present values, and it will be interesting to see what effect these values will have on present production. Unless producers curtail their output it seems certain that prices will fall still lower, until it becomes unprofitable for some of the more expensive mines to carry on."

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, May 24th:—No change in copper prices.

Messrs. James & Shakespeare report, May 24th:—English pig lead, £26, 5s. dec.

Messrs. Edward Till & Co. report, May 24th:—No change in the price of India-rubber, Para fine.

Lighting and Power Notes.

Blackburn.—Inquiry.—The Corporation General Purposes Committee has appointed Dr. S. L. Pearce to conduct an inquiry into the electricity undertaking, which is being held at the request of the electrical engineer (Mr. P. P. Wheelwright). The Committee has requested Dr. Pearce to examine the organisation and arrangement of the department, with its relations to other departments and to make any recommendation he may think proper to perfect the administration.

Bridgnorth.—Electricity Supply.—At a recent meeting of the Town Council and General Purposes Committee reported that it had had an interview with the chief engineer of the Shropshire, Worcestershire and Staffordshire Electric Power Co. regarding a supply of electricity to the town. The engineer stated that by the end of the year, or early in 1928, cables would be extended from the Stourport power station to Bridgnorth, and that the Corporation would have to incur no capital outlay.

Canada.—Hydro-Electric Development.—The Dominion Government has been devoting attention to power development on the Ottawa River, and the Minister of Railways and Canals announces that the charter of the National Hydro-Electric Company of Montreal, authorising it to develop electricity on a large scale at Carillon Falls will not be renewed. If the plans now being considered by the Federal Government are carried out, the Government itself will proceed with the Carillon Falls development for the benefit of Ontario and Quebec. It is estimated that 400,000 h.p. will be available at the Carillon rapids, incidental to the deepening of the Carillon and Glanville Canals from 9 ft. to 14 ft., at a cost of $40,000,000. There will have to be some negotiations with Ontario and Quebec, as both provinces may question the legal right of the Federal Government to develop power on the Ottawa River, and, failure to come to an agreement, may necessitate reference to the Privy Council.

Chesterfield.—Year's Working.—Mr. D. H. Davies, borough electrical engineer, informs us that the sales of electricity for the year ended March 31st last amounted to 8,199,676 kWh, an increase of 7 per cent., as compared with the preceding year. The cost of coal increased by over £7,000, and the cost per kWh sold from 0.21d. to 0.42d. The total working costs per kWh amounted to 0.99d., as against 0.77d., and the average price obtained was 1.60d. per kWh. Notwithstanding the heavy increases in the coal costs, the charges for electricity were reduced by ½d. per kWh for lighting, and by 10 per cent. for power, resulting in a reduced net profit of £2,522. This was done because at March 31st, 1926, the reserve fund had exceeded the statutory limit allowed. The connected load increased by 2,300 kW, the total now being 19,838 h.p. An addition of 21 miles of mains was made to the distribution system, bringing the total up to 134 miles. The sales of electricity for heating and cooking increased by 111 per cent., which was largely due to the opening of a new showroom during the year. Cookers, fires, wash boilers, &c., let out on hire during the year totalled 539.

Continental.—BELGIUM.—The reports that are being issued by the various electricity supply undertakings in Belgium show that steady progress continues to be made. The report of the Société de la Centrale Electrique de l'Entre Sambre-et-Meuse for the past year shows that it is now supplying electricity to over 30,000 consumers in the provinces of Namur, Hainaut, and Brabant, an increase of about 3,000, as compared with the preceding year. The load of the Société Intercommunale Belge d'Electricité, which controls eight power stations, increased to 256,000 kW, as against 227,000 kW, the sales of electricity showing an increase of 21 per cent. over 1925. During the past year the supply contracts secured by the Société d'Electricité du Bassin de Charleroi increased from 43,398 kW to 52,522 kW, to meet which 30 miles of new mains were laid. The Société d'Electricité du Nord de la Belgique is now supplying electricity to 115 localities in its area, as against 100 a year ago. The company has a total of 52,371 consumers, representing a load of 63,147 kW, to supply which the distribution system has been increased to a length of 1,165 miles.

The Société d'Electricité de la Region de Malmedy, in its report for last year, states that good progress is being made with the construction of the Beverce hydro-electric power station on the River Warch. The station will comprise three 5,500-h.p. turbo-generators, the foundations for which have already been completed. Pending the completion of the station, a steam-operated plant of 2,000-kW capacity has been established at Malmedy, a 15,000-V transmission line erected between Malmedy and Saint Vith, a distance of about 22 miles, and a similar line between Malmedy and Trois Fonts for the supply of electricity to the Compagnie d'Electricité des Ardennes.

FRANCE.—The Société de l'Union d'Electricité, of Paris, is augmenting its electricity supply in the Paris district by power transmitted from the Eguzon hydro-electric station, completed last year. The steam-operated station at Gennevilliers, near Paris, has now a capacity of 340,000 kW. During last year the output of the Union Co. amounted to 749 million kWh, as against 671 million kWh in 1925. Part of the increase is explained by the fact that the Union Co. is now supplying the electricity for all the electrified lines of the Paris-Orleans Railway Co.

AUSTRIA.—At the recent annual meeting of the Oberostereichische Wasserkraft und Elektricitäts Gesellschaft in Linz it was reported that the output of the O.W.E.A.G. hydro-electric power station at Partenstein had increased from 59,974,640 kWh in 1925 to 73,238,680 kWh last year. The third turbo-generator has recently been completed and put into operation, bringing the capacity of the plant up to 45,000 h.p.

El Salvador.—ELECTRICAL DEVELOPMENT.—A contract will shortly be placed for the installation of two electric light plants, either separately or as a whole, for Chinameca (Department of San Miguel), and for Jujutla (Department of Ahuachapan).—*Reuter's Trade Service* (San Salvador).

Guildford.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Corporation to supply electricity within parts of the rural districts of Guildford and Hambledon.

Hastings.—NEW COOLING TOWERS.—The Town Council has decided to erect new cooling towers at the Broomgrove power station, at an estimated cost of £6,974.

LOANS.—Application has been made for sanction to loans of £10,000 for services and £5,000 for meters.

Helensburgh.—LOAN.—The Town Council is to apply for sanction to the borrowing of £25,000 for the purpose of meeting capital expenditure incurred and to be incurred in connection with its Special Order.

Japan.—TOKIO.—The Tokio Denko K.K. has applied to the Government for permission to extend the capacity of its Tsurumi power station from 70,000 kW to 200,000 kW.

Leatherhead.—NEW PLANT.—The Leatherhead and District Electricity Co., Ltd., has received sanction to the installation of a 1,000-kW set at its electricity works. This is required to meet increasing demands, and will also enable the company to provide a bulk supply to any neighbouring undertaking requiring such a service.

London.—WATER WORKS PLANT.—The Metropolitan Water Board has prepared a scheme for the installation of new plant at its Hampton works. It is proposed to replace the existing two generators working at 100 V with two new sets generating at 200 V. The estimated total cost of installing two new generators with new motors, cables, &c., where necessary, and replacing the "Sheffield" engines with electrically-driven pumps, amounts to £9,000. There would be an approximate annual saving in wages of over £1,000, while the fuel charges would not be any higher. The question of the supply of electricity by the local company as against its provision by the Board has been considered, and it is found that by generating at Riverdale works the annual cost would amount to £4,000, a sum very much below that which would be charged by the company.

STEPNEY.—The Electricity Committee has received an application from Bermondsey Borough Council for a supply of electricity in bulk, and has recommended that terms be arranged and an agreement entered into for such a supply to Bermondsey.

Long Eaton.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £17,285 for the installation of two 500-kW transformers at the power station, the erection of two sub-stations, and h.p. cables.

Lowestoft.—ELECTRICITY AGREEMENT.—The Corporation has considered the draft agreement with the Great Yarmouth Corporation relative to the bulk supply of electricity to Lowestoft, and has agreed that the draft shall be submitted to the Electricity Commissioners to determine the points at issue.

Northern Ireland.—PORTSTEWART (CO. DERRY).—At a recent meeting of the Urban District Council the town surveyor submitted a draft plan of the proposed new generating station. The approximate cost of the station is estimated at £1,400, with manager's residence and office £750, and store £100, a total of £2,250. The clerk said the cost of the machinery, including new engines, switchboard, and generators, would be about £2,750, which would bring the total cost of the station to about £5,000.

BALLYCASTLE (CO. ANTRIM).—At a special meeting of Ballycastle Urban Council a communication was read from Mr. Dashwood, electrical engineer, Belfast, with reference to the valuation of the existing plant, mains, &c., of the electricity undertaking owned by the Ballycastle Lighting Co. Mr. Dashwood estimates the value of the plant, including goodwill, at £4,024. This sum does not include any fuel oil or other stores. An additional expenditure spread over the next five years of £1,500 would be required, part of which could be provided out of revenue. If the Council decides to move the station and provide new buildings, the cost of this work would be under £1,000. The Council has decided to make an offer of £4,024 to the Ballycastle Electric Lighting Co.

Prestatyn.—INAUGURATION OF SUPPLY.—An electricity supply for the district was formally inaugurated by the chairman of the Electricity Committee on May 14th. Electricity is obtained in bulk from the North Wales Power Co., Ltd., at 11,500 V, and reduced at the Council's sub-station for distribution. The charge for lighting is 8½d. per kWh.

Preston.—LOAN.—Application is being made for sanction to borrow £10,000 to meet the estimated expenditure for the assisted wiring scheme for the ensuing 12 months. The Housing Committee has been requested to take advantage of the system in connection with two schemes which it has in hand.

LOANS SANCTIONED.—The Commissioners have sanctioned loans of £82,151 and £48,000 respectively for the provision of mains, services, &c., and the installation of a fourth turbo-generator at the Ribble power station.

Sheffield.—ALL-ELECTRIC HOUSES.—A proposal to introduce electricity into 30 of the houses in course of erection by the Corporation on the Longley estate is to come before the next meeting of the City Council. The scheme provides for electric fires, cookers, boilers, &c. Previously all the Corporation houses have been fitted for electric lighting, but the occupiers have had to provide any additional appliances.

Shrewsbury.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking show a gross profit of £7,221, and after providing for capital charges, a net surplus of £2,931, of which £2,000 was placed to reserve account and the balance carried forward.

ELECTRICITY EXTENSIONS.—The Electricity Committee has recommended extensions at a cost of £1,230.

Stourport.—NEW POWER STATION.—The new power station of the Shropshire, Worcestershire and Staffordshire Electric Power Co., which will be inaugurated on June 2nd, will work interdependently with the Electricity Supply Department of the Birmingham Corporation, and for this purpose a cable has been laid between the company's station at Halesowen and the Corporation's undertaking. This is to be put into operation within the near future, and the stations of the company at Smethwick, Halesowen, Kidderminster and other centres will then be connected with the Corporation stations at Nechells and Summer Lane. The initial plant at the Stourport station provides for the development of 50,000 h.p., there being two turbo-alternators, each of 22,500 kVA, generating at 3-phase, 25 cycles, 5,500 V, which will be stepped up to 33,000 V for transmission. The station will eventually be enlarged to a capacity of 200,000 h.p.

Stoke-on-Trent.—EXTENSION OF SUPPLY.—At a recent meeting of the Electricity Committee an inquiry was received from the English Electric Co., Ltd., regarding an electricity supply required by Messrs. Wheatley & Co., at Springfield Tileries, Stone Road. It was decided to lay an e.h.p. main from the London Road sub-station, at an estimated cost of £6,500. The Committee is to extend mains at Pittshill, at a cost of £1,200.

SUPPLY FOR GAS WORKS.—The Corporation gas engineer is negotiating with the city electrical engineer for a supply of electricity to the Etruria gas works.

CHANGE-OVER.—The electrical engineer has submitted a report to the Electricity Committee on the proposed method of changing over the system of electricity supply in the centre of Tunstall from d.c. to a.c. The work will be carried out in three sections, and the cost is estimated at £6,200.

STREET LIGHTING.—The Corporation has asked the city engineer to prepare a scheme for the improved lighting of the main roads in the city.

All-Electric Houses.—The Corporation has deferred for six months a proposal to equip 200 houses on the Abbey housing site as all-electric houses pending definite information as to the costs, &c., from the eight all-electric houses erected in Avenue Road, Hanley.

Swansea.—Mains Extensions.—The Corporation Electricity Committee is to carry out mains extensions, at a total estimated cost of £3,856. The borough electrical engineer has recommended, for the purpose of ensuring continuity of supply to the Gellyceidrim and Brynamman collieries and other consumers on the Amman Valley line, that a by-pass overhead transmission line be constructed at Gellyceidrim, at an estimated cost of £1,500. The Committee has approved the proposal.

United States.—Electrical Development.—A new hydro-electric plant with a generating capacity of 56,000 h.p. will be erected immediately at Oxford Shoals, near Claremont, on the Catawba River, by the Southern Power Co. The plant will cost $5,000,000. Contracts have been let for the equipment of the new station, and much of the preeliminary work has already been done. It is stated that the plant will be in operation by June 1st, 1928. The Oxford Shoals hydro-electric plant will be the twelfth built by the Duke interests. The generating capacity of these plants will be, with the completion of the proposed station, 651,000 h.p.

Weymouth.—Street Lighting.—The Town Council has arranged with the Wyke Parish Council for public lighting in the village by 40 lamps for a period of 20 years, at a charge of £145 per annum.

Electricity in Bulk.—The Council has also arranged to supply electricity in bulk to Portland Urban District Council at £5 per kVA, plus 0.7d. per kWh. The minimum to be paid by Portland is to be £350 for the first year. £525 for the second year, and £700 for the third and succeeding years. The Corporation is to apply for a Special Order authorising the bulk supply.

Whitchurch (Hants.).—Electricity Supply.—The Rural District Council has decided to give its consent to an application by the Basingstoke Town Council for a Special Order to supply electricity in the district.

Tramway and Railway Notes.

Brighton.—Extension of Route.—The Tramways Committee has recommended the extension of the Lewes Road route as double track from the terminus to the existing borough boundary, at an estimated cost of £2,800.

Continental.—Poland.—The Société Chemins de fer Electriques Suburbains has obtained a concession for the construction and working of an electric railway, about 30 miles in length, between Warsaw, Grodzisk and Zyrardow. Work is well advanced on the construction of the line as far as Grodzisk, 20 miles, and this is expected to be put into operation in the near future.

Germany.—At the end of last year 585 miles of main-line railways and 70 miles of suburban lines had been electrified in Germany. Of the main lines 275 miles is in Bavaria, and of the suburban lines 50 miles is in the Berlin area. At the present time 190 miles of line is in course of electrification, including the Konigszell-Breslau mountain railway (30 miles), the Munich-Rosenheim-Kufstein line (62 miles), and about 100 miles of the Berlin city and local railways.

Belgium.—The electrification of the last section of the Brussels-Ninove local railway—that between Eyseringhen and Ninove—has recently been completed by the Société Nationale des Chemins de fer Vicinaux. To supply electricity for the new section an automatic transformer station, the first of its kind in Belgium, has been established at Eyseringhen.

Hull.—Tramway Supply.—At a recent meeting of the Corporation Electricity Committee it was reported that the Tramways Committee was considering the advisability of taking a supply of electricity for the tramway service from the general city supply instead of from the power station in Osborne Street. The matter was left over pending the receipt of a communication of the Tramways Committee on the subject.

Irish Free State.—Cork.—In consequence of motor-omnibus competition, the Cork Electric Tramways Co. has decided to extend its 1d. fare stage and to introduce a 2d. fare for the whole length of the route of five miles. If competition continues to increase, it is probable that the Corporation will supplement its tramway service by a 'bus service of its own.

Japan.—Tokio-Osaka Railway.—In connection with the proposed rapid transit electric railway between Tokio and Osaka, it is reported that the Osaka Municipal Assembly will shortly give its approval to the scheme. The total length of the line will be 299 miles, and there will be only eight intermediate stations.

New Zealand.—Auckland.—The Sydney *Sunday Times* reports that the proposed extension of the Auckland tramway to Point Chevalier, to Meadowbank Road on the Remuera line, and to Mount Albert Road on the Mount Eden, Dominion Road and Ebendale Road routes, as recommended by the tramway manager, Mr. A. E. Ford, has been approved by the City Council. The Council has also agreed to acquire 50 new trams and to add to the 'bus garage accommodation. The proposals are to come before the ratepayers in a loan poll to raise £500,000 to carry out the various works.

Southend-on-Sea.—Inquiry Result.—In connection with the inquiry recently held by the Ministry of Transport into the Corporation's application for a Provisional Order authorising it to introduce a railless-car service from Victoria Circus to the Priory, thence *via* Brook Road, East Street, and Sutton Road to Victoria Circus, the Ministry states that it is unable to authorise the introduction of railless cars on this route at present, except on that portion of the route now in operation. The Council has decided, subject to obtaining the necessary Order, to purchase the two railless cars which have been in operation on this route since January last, at a cost of £1,650 each.

United States.—Railway Electrification.—According to the *Electrical World*, the Pennsylvania Railroad has started to electrify the Octoraro branch of its system. This runs through Lansdowne, Morton, Media, Swarthmore, and West Chester. It is stated that the work will be completed early in 1928. Good progress is being made on the Pennsylvania's electrification between Philadelphia and Wilmington, which has been under way for a year.

Telegraph and Telephone Notes.

Radio-Telegraphy.—Colonial Links.—Wireless problems were discussed at the Colonial Conference in London on May 20th. The opinion was expressed that progress in the application of wireless-telegraphy was so rapid that the formulation of a definite general scheme for the Colonies would be premature. It was pointed out that the amount of work in the Colonies and Protectorates had not been very extensive. During the past 15 years about 30 small stations had been erected, and were utilised mainly for local requirements and communication with shipping, but they were regarded as the preliminary links in a chain of inter-Imperial communication which might ultimately be established. The adoption of a short-wave service between Singapore, Penang, and neighbouring States is contemplated by the Straits Settlements Government, and Kenya looks forward to being in a position to pick up short-wave transmissions from this country.

Switzerland.—Telephone Association.—A number of concerns which supply telephone material to the Swiss Post and Telegraph Department have lately formed a new association with the title "Pro Telephon" to carry through a campaign to develop the use of the telephone in Switzerland. The offices of the new body are temporarily located at those of the Swiss Union of Electrotechnical Specialists, 5, Cacilienstrasse, Zurich.

Transatlantic Telephony.—Extension of Hours.—The Postmaster-General announces that on and from May 23rd the transatlantic telephone service will be available from 12.30 p.m. to 11 p.m. (British summer time) daily, including Sundays.

Radio Notes.

Canada.—New Station.—One of the most powerful stations in Canada is to be erected in Red Deer, Alberta, by the Alberta Pacific Grain Co. Studios will be operated in both Calgary and Edmonton by remote control from the main station, says *World Radio*. It is also announced that Alberta is to have a permanent radio inspector to serve the entire province, whose headquarters will be at Calgary.

Empire Broadcasting.—Service Urged.—Since the end of 1925 the British Broadcasting Corporation has indicated its desire to co-operate in any practicable enterprise designed to interchange programmes between, or simply to make them available in, various parts of the Empire, but it has neither had the financial resources required for the necessary experiments, nor has it been convinced that any of the proposals so far made are likely to be productive of that degree of efficiency which would justify the expenditure involved. Nevertheless, it committed itself in May of last year to construct the necessary experimental apparatus and received Post Office permission to do so; it was proposed to test the opinion of representatives at the Colonial Conference this

week with a view to ascertaining the demand that may exist for such a service, and the extent to which they would be prepared to co-operate financially and otherwise.

Meeting in London on May 20th, the Colonial Conference delegates are reported to have expressed a desire for the formulation of a policy of broadcasting as a channel of communication and a means of entertainment, but stated that prolonged experiments would have to be made before a scheme of distribution throughout the Empire could be regarded as technically practicable in all respects. Ceylon took the lead in establishing a broadcasting service in 1924, and Hong Kong, Palestine, the Gold Coast, Cyprus, and Zanzibar have been considering the possibilities of setting up broadcasting services.

The Wireless League and the Wireless Association of Great Britain are urging the initiation of an Empire service, in which connection it is of interest to note that on the occasion of the relaying of the after-luncheon speeches from the Guildhall on May 18th, when the City of London entertained the President of the Republic of France, arrangements were made, on receipt of the speeches in the control room at 2LO, to transfer them to land lines so that they could be transmitted to Paris for simultaneous re-broadcasting from the French radio stations.

The Sydney (Australia) broadcasting station (2BL) successfully relayed the (5 to 8 p.m., May 20th) programme of the British Broadcasting Corporation's London station (2LO) between 3 and 6 a.m. on May 21st. The relay took place *via* the B.B.C.'s Daventry station (5XX, 1,600 m.) and the short-wave station of Messrs. Philips in Holland; it was relayed again by Broadcasters, Ltd., from Sydney to New Zealand, and in South Africa also from the Cape Town, Johannesburg, and Durban stations, while the programme was heard at Rangoon in India as well.

This feat of PCJJ, the Philips experimental station at Eindhoven, Holland, which broadcasts on a wave-length of 30.2 metres merits attention. Numerous amateurs in the Dutch East and West Indies have also testified to the excellence of the reception of this short-wave transmission. Holland has been one of the pioneers of the broadcasting industry; indeed, it was the old station at The Hague (PCGG) which English listeners were first able to hear long before the inauguration of the B.B.C.

Union Internationale de Radiophonie.—Annual Meeting.—The annual meeting of the Union, consisting of the Council and various Commissions, has concluded its sittings at Lausanne. Vice-Admiral Carpendale (Great Britain) has been re-elected president of the Union; Messrs. H. Giesecke (Germany) and R. Tabouis (France) vice-presidents; and M. M. Rambert, delegate of the Council. Agreement was arrived at on certain questions, with regard to which experience has shown the need of international collaboration, which are to be discussed at the coming international conferences at Washington and Rome. The Lausanne conference also discussed the adjustment of some of the wave-lengths allocated in the Geneva plan; the suggested modifications have yet to be approved by the respective Governments. It was decided, among other things, to establish a permanent central post where a check will be kept by nightly observations on the stability of wave-lengths from the technical point of view. The Commission which deals with social and cultural matters has been augmented, and the following broadcasters have been elected active members of the Union:—Polskie Radjo (Poland), Radiogenossenschaft Basel (Switzerland), and Nederlandsche Draadlooze Omroep, the Dutch organisation which will shortly work the Huizen station. Extra-European associate members have been elected as follows:—National Broadcasting Co. (U.S.A.), Nihon Hoso Kyokai (Nagoya, Japan), Indian Broadcasting, Ltd., Amalgamated Wireless (Australasia), Ltd., Cuban Telephone Co., the Peruvian Broadcasting Organisation, and General Broadcasters, Ltd. (Australia). The European broadcasting organisations which are members of the Union now direct 113 transmitting stations serving approximately 7,000,000 receiving sets.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Aberdare.—June 2nd. Electricity Department. E.h.p. overhead and underground main and branch transmission lines. (May 13th.)

Armagh.—June 7th. Urban District Council. Heavy oil engine generating plant, underground and overhead mains. (May 13th.)

A.c. switchboard and overhead travelling crane. (May 20th.)

Australia.—Melbourne.—July 5th. State Electricity Commission. One 15,000-kW steam turbo-generator and accessories. (B.X. 3369.)*

July 4th. 66,000-V and 22,000-V insulators for the Yallourn brown coal scheme. (May 6th.)

June 7th. Switchboard cable. (B.X. 3532.)*

June 28th. Postmaster-General's Department. Jacks, switchboard instruments, &c. (B.X. 3474.)*

August 15th. One 55-ton 3-motor-type electrically-operated overhead travelling crane. (A.X. 4727.)*

Sydney.—June 20th. Municipal Council. Turbo-alternators for Bunnerong power station. (B.X. 3443.)*

July 18th. Boiler-house equipment for the Bunnerong power station. (B.X. 3531.)*

Basingstoke.—June 7th. Corporation. Electrical installations at the Council's housing estate (approx. 1,015 wiring points). (May 13th.)

Castleford.—May 31st. Urban District Council. Electrical plant, switchgear, wiring, &c., public baths. D. Firth, engineer.

Chile.—Santiago.—July 18th. Chilean State Railways. Materials for electric lighting and power (Group 30). Materials for electric lighting of locomotives and coaches (Group 32). August 22nd. Signalling, telegraph and telephone supplies (Group 36). (C.X. 2271.)*

Grimsby.—June 4th. Electricity Department. Sub-station equipment. (May 13th.)

Hull.—June 16th. Electricity Department. Steel coal bunker and conveyor housing. (May 20th.)

Switchgear extensions. (See this issue.)

Ilford.—June 1st. Electricity Department. E.h.p. and l.p. paper-insulated cables. (May 20th.)

India.—June 14th. India Stores Department, Simla. Generating sets for Fyzabad power station. (B.X. 3486.)*

London.—H.M. Office of Works.—June 3rd. 5-ton gantry crane. (May 20th.)

Hammersmith.—June 1st. Electricity Department. Cables, transformers, h.p. switchgear and ironclad feeder switchgear. (May 20th.)

Manchester.—May 30th. Electricity Department. L.p. valves for circulating water system, two electrically-driven and one steam-driven boiler feed pumps. (May 13th.)

June 13th. Seven 250-kVA static transformers. Mr. H. C. Lamb, chief engineer and manager, Town Hall, Manchester.

June 1st. Education Committee. Electric lighting installation at Levenshulme High School for Girls. Specification, &c., from Education Offices, Deansgate.

Marlborough. — Electricity Department. Additional underground feeder and overhead feeder. (See this issue.)

New Zealand.—Auckland.—July 4th. Auckland Electric Power Board. Switchgear. (B.X. 3471.)*

Wellington.—August 9th. Public Works Department. 1,500 suspension insulator strings and 470 strain insulator strings. (B.X. 3533.)*

Oldham.—June 11th. Electricity Department. Water-cooling towers, foundations, tanks, and circulating water pipes. (See this issue.)

Portsmouth. — Electricity Department. Transformers. (See this issue.)

Pudsey.—June 14th. Electric lighting installation at the School of Art. Specifications from Education Department, County Hall, Wakefield.

Scarborough.—June 3rd. Corporation. Installation of electrical pumping plant in duplicate for the new Irton water scheme No. 2. Specifications (£5) from Dr. H. Lapworth, engineer, 25, Victoria Street, S.W.

Sheffield.—June 11th. Tramways and Motors Committee. Supply and erection of weighbridge. Mr. A. R. Fearnley, general manager, Division Street, Sheffield.

South Africa.—CAPE TOWN.—June 30th. South African Railways and Harbours Board. Gasfilled and vacuum lamps for 12 months. (B.X. 3518.)* Telegraph material. (B.X. 3519.)*

ELLIOTT (C.P.).—June 15th. Municipal Council. Electric lighting plant, including engines and dynamos, steel poles, copper wire, insulators, switchboard meters, house-service fuses and street-lighting brackets and suspension fittings.

EDENBURG (O.F.S.).—June 21st. Municipal Council. Electric lighting plant, including engines, dynamos, steel poles, &c.—*S.A. Mining and Engineering Journal.*

Switzerland.—BERNE.—June 4th. Swiss Federal Railway authorities. Three 3,000-kVA, 60,000/15,000-V oil transformers for outdoor use, &c., for the new transformer station at Gruze. Particulars for 5 fr. from the Abtheilung für Elektrifizerung C.B.B. Dienstgebaude, 43, Mittelstrasse, Berne.

Tynemouth.—June 11th. Electricity Department. One voltage regulating transformer. (May 13th.)

Whitley.—Electricity Department. One 1,000-kW turbo-alternator, with condenser, pumps, air filter, &c.; one 200-kW semi-Diesel or heavy-oil engine alternator. (May 6th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Belgium.—BRUSSELS.—The municipal authorities last week opened tenders for two 6,000-kW turbo-alternator sets and a 1,500-h.p. set for the Brussels municipal electric power station. Five tenders were received, the quotations ranging from £30,245 to £45,370, the lowest being that of the Belgian branch of the Brown-Boveri Co.

Bexhill.—Electricity Committee. Recommended:—
1,000 yd. cable (£346).—Enfield Cable Works, Ltd.

Glasgow.—Lighting Committee. Accepted:—
Electrical fittings and accessories.—Wm. Brown & Co.; Wm. M'Geoch & Co., Ltd.; British Electrical Mfg. Co.; Chalmers & Mitchell; Stella Conduit Co., Ltd.; John T. Cartwright; Bayliss, March and Newey, Ltd.; Lighting Trades, Ltd.; Electric Conduits, Ltd.

Government Contracts.—The following contracts were placed by various Government Departments during April, 1927:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

300-kVA alternators.—British Thomson-Houston Co., Ltd.
Motor alternators.—Small Electric Motors, Ltd.
W/T boards.—General Electric Co., Ltd.; Whipp and Bourne, Ltd.
Distribution boxes.—Hawkers, Ltd.; E. Holme & Co., Ltd.; Basebe, Sadler & Co., Ltd.; Engineering and Lighting Equipment Co., Ltd.; Pinnacle Switchgear, Ltd.; Telford, Grier & Mackay, Ltd.; Whipp and Bourne, Ltd.
W/T condensers.—Telegraph Condenser Co., Ltd.; Dubilier Condenser Co. (1925), Ltd.
Magazine lighting fittings.—Oliver Pell Control, Ltd.
Electric light installation.—Read & Partners, Ltd.
W/T panels.—Radio Communication Co., Ltd.
E.h.p. transmission line.—G. E. Taylor & Co., Ltd.
W/T valves.—Mullard Radio Valve Co., Ltd.

WAR OFFICE.

Batteries and cells.—Siemens Bros. & Co., Ltd.; General Electric Co., Ltd.; Edison Swan Electric Co., Ltd.

AIR MINISTRY.

Magnetic adaptors.—H. W. Sullivan, Ltd.
Direction finder land station.—Marconi's W/T Co., Ltd.
Magnetos and spares.—Simms Motor Units, Ltd.
Stripping magnetos.—British Thomson-Houston Co., Ltd.
Transmitters.—Gambrell Bros., Ltd.

POST OFFICE.

Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Peel-Conner Telephone Works; Siemens Bros. and Co., Ltd.; Telephone Mfg. Co., Ltd.
Testing, protective, and miscellaneous apparatus.—Chamberlain & Hookham, Ltd.; Siemens Bros. & Co., Ltd.
Cable (various).—British Insulated Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; Enfield Cable Works, Ltd.; General Electric Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.
Loading coils.—Siemens Bros. & Co., Ltd.
Electric lamps.—Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.
Tungar rectifiers.—British Thomson-Houston Co., Ltd.
Copper wire.—E. & E. Kaye, Ltd.
Switchboard wire.—Connollys (Blackley), Ltd.
Manufacture, supply, drawing in and jointing cable.—London-Uxbridge; Callender's Cable & Construction Co., Ltd.
Lifts, Temple Bar Telephone Exchange.—W. Wadsworth and Sons, Ltd.
Radio station power plant, Humber (Lincs.).—Austin Lighting Co., Ltd.
Telephone exchange equipment.—Doncaster: General Electric Co., Ltd. Headingley (Leeds): Automatic Telephone Mfg. Co., Ltd. Walton (Liverpool): Standard Telephones & Cables, Ltd. Harrods, Ltd. (H.O.); Harrods, Ltd. (Estate Office); (London, S.W.); Cumberland County Council; J. & E. Hall, Ltd. (Dartford); Union Coal Storage Co., Ltd. (Liverpool): Relay Automatic Telephone Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Armatures.—Railway Signal Co., Ltd.
Cable.—W. T. Glover & Co., Ltd.
Electric welding sets.—Premier Electric Welding Co., Ltd.
Lamps.—General Electric Co., Ltd.
Motors.—Laurence Scott & Co., Ltd.
Switchgear.—British Thomson-Houston Co., Ltd.
Telephone materials.—Siemens Bros. & Co., Ltd.; Ericsson Telephones, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.
Train lighting spares.—J. Stone & Co., Ltd.
Transformers.—British Electric Transformer Co., Ltd.

London.—LONDON COUNTY COUNCIL.—Education Committee. Electric lighting installation, Burghley Road schools, St. Pancras:—

Pinching & Walton. (Recommended.) ...	**£1,138**
A. Hawkins & Sons	1,189
A. Dean & Co., Ltd.	1,213
H. J. Cash & Co., Ltd.	1,249
Berkeley Electrical Engineering Co.	1,493
Commercial Telephone & Electrical Co., Ltd.	1,662

Electric wiring and fittings at Sudbourne Road school, Brixton:—

Fordham Electrical Engineering Co., Ltd. (Accepted.)	**£298**
Bailey & Incledon, Ltd.	340
E. Dyne	347
Smith & Hammond, Ltd.	360
A. Higginbotham & Sons	375
Alpha Mfg. & Electrical Co., Ltd.	375
Anderson, Angell & Co.	397
A. Hawkins & Sons	398
E. Wender	403
Emerson Bros.	403
R. Hunt & Co., Ltd.	407
J. Briggs, Electrical Contractors, Ltd.	444
South London Electric Supply Corp., Ltd. ...	470
Smethurst & Co. (London), Ltd.	470
South London Electrical Co.	478
Stegman & Co.	530
A. Sparrow & Co.	579
J. Vigon	593
Tyche, Ltd.	775

Electric lighting at Stonehouse Street school, Clapham:—

Holder & Snider. (Recommended.)	**£379**
Alpha Mfg. and Electrical Co., Ltd.	440
A. Higginbotham & Sons	449
J. Briggs, Electrical Contractors, Ltd.	467
E. Wender	484
A. Hawkins & Sons	498
Bailey & Incledon, Ltd.	499
H. Shaw	520
Smith & Hammond, Ltd.	535
Stegman & Co.	577
Ridout & Ratcliff, Ltd.	650
Burgess & Garfield	650

Wiring and fittings at Everington Street school, Fulham:—

Holder & Snider. (Recommended.)	**£439**
W. & G. Firmin	500
Alpha Mfg. and Electrical Co., Ltd.	500
Bailey & Incledon, Ltd.	507
Anderson, Angell & Co.	517
A. Higginbotham & Sons	520
A. Hawkins & Sons	539
E. Wender	540
H. Shaw	570
S. Hellyar, Ltd.	630
Smith & Hammond, Ltd.	639
J. Briggs, Electrical Contractors, Ltd.	695
Ridout & Ratcliff, Ltd.	720
R. Hunt & Co., Ltd.	723
H. G. Gunner	799
Stegman & Co.	817

CORRECTION.—By a printer's error, the tender of Messrs. Rashleigh Phipps recommended for acceptance by the Westminster Housing Committee, was incorrectly stated in our last issue. The tender was for an electric lighting installation at Regency Street Dwellings. Messrs. Bailey & Incledon, Ltd., received the contract placed by the L.C.C. Education Committee in connection with the Drayton Park School, as stated.

Highways Committee. Accepted:—
Conductor rails (£5,846).—Frodingham Iron and Steel Co., Ltd.
Track rails and fastenings (£31,837).—Dorman, Long and Co., Ltd.

The London County Council has placed a 12-months' contract for electric incandescent lamps with Siemens & English Lamp Co., Ltd.

HACKNEY.—Electricity Committee. Recommended:—
One 10,000-kW turbo-alternator (£25,300).—C. A. Parsons and Co., Ltd.
Converting plant and booster (£15,643).—Bruce Peebles and Co., Ltd.
Switchgear (£13,413).—Johnson & Phillips, Ltd.; (£6,394), A. Reyrolle & Co., Ltd.

STEPNEY.—Electricity Supply Committee.
Meters, &c., for 12 months:—
5 to 20 amps.—Measurement, Ltd.
Prepayment meters and 50- to 100-amp. meters.—Ferranti, Ltd.
Combined meters and demand indicators.—Aron Electricity Meter, Ltd.
Time switches.—Venner Time Switches, Ltd.
Conduits, troughs and covers.—Albion Clay Co., Ltd.

Hamilton.—Town Council. Recommended:—
Electric lighting work in connection with the re-housing scheme at Low Waters.—W. Y. M'Adam.

Kiveton Park.—Rural District Council. The Eastern Counties Electrical Construction Co., of Ipswich, has received a contract from the Kiveton Park Rural District Council, near Sheffield, for an extensive electrical development scheme in the Harthill district.—*East Anglian Daily Times.*

Tynemouth.—Electricity Committee. Accepted:—
Cable (£308).—Connolly's (Blackley), Ltd.; (£92), Hogan and Wardrop.

Forthcoming Events.

Institution of Production Engineers.—Friday, May 27th. 83, Pall Mall, S.W. 7.30 p.m. "Rate Fixing." Mr. J. Ronald.
Physical Society.—Friday, May 27th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.
Incorporated Municipal Electrical Association.—May 30th to June 4th. Buxton. Annual Convention.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the name and address of makers of the following:—

McDONALD hair waving machine.
Perkins' YANKEE switch.
ELECTRA curling iron.

Notes.

London's Tramways.

In a letter to the *Morning Post*, Sir George H. Hume, M.P., refutes some of the allegations that have been made with regard to the financial condition of the electric tramways of the London County Council. Referring to the statement that the loss on their working for the year ended March 31st, 1927, has been £302,114, he points out that that sum, in fact, represents the deficiency for the period mentioned after payment of interest on debt (£270,000) and repayment of debt (£234,500), a very different thing to a loss. "It would be well," he says, "for the public to realise that with all the deficiencies that have had to be faced, it only amounts to this: that the ratepayers will have had to pay, up to date, a little over a million pounds for a property which is maintained at concert pitch, and represents a capital expenditure of something like sixteen million pounds, a large part having been incurred at pre-war values.

"The actual loss during the general strike, and the additional cost of fuel as a result of the long stoppage in the coal industry, was £226,000, a loss which was unavoidable and abnormal. Allowing for this sum, the deficiency figure would be reduced to about £76,000, and, even then, it is fair to say that much of this resulting deficiency was due to the general disturbance of trade and the consequent depression of revenue."

The Chiswick Power Station.

The London and Home Counties Joint Electricity Authority has issued a 20-page booklet, containing a coloured map and reproduced photographs of a scale model of the buildings, dealing briefly with various aspects of the proposed generating station at Chiswick to serve the whole of the western portion of the J.E.A.'s area. The 44.5-acre site is on the River Thames, and served by the Southern Railway; it is proposed to construct a tidal dock and a drive and promenade along the river frontage; the station's ultimate capacity will be 325,000 kW, and its maximum sustained load 250,000 kW. Three boiler houses will contain 30 boilers, and the chimneys will be invisible, as they will not extend above the parapet of the walls, while poplar trees will be planted to screen the coal storage site. The J.E.A.'s No. 2 Parliamentary Bill is now being considered by a committee of the House of Commons, and Mr. J. H. Rider (consulting engineer to the Joint Authority), in evidence, said that the Chiswick site was that which he and the other engineers concerned had recommended to the Commissioners in 1921. In the Joint Authority's district the demand in 1919-20 was 308,822 kW, and in 1925-26 it was 577,317 kW. He now estimated that the demand in 1930-31 would be 878,590 kW, and 1,179,920 kW in 1935-36. Excluding railway plant, in the Joint Authority's district there were 62 stations, with a gross capacity of 1,327,784 kW of installed plant. The scheme put forward in his report to the Authority in 1926 provided for the retention of three primary and 20 secondary power stations, having a total plant capacity of about 1,245,000 kW, the three primary stations being those at Deptford, Brimsdown, and Barking. An installed plant capacity of over 1,500,000 kW would be needed to meet the estimated demand in 1935-36, with proper provision for stand-by, but it was likely that that estimated demand would be exceeded. The first section's installed capacity of 125,000 kW would serve a load up to 75,000 kW, leaving 50,000 kW for reserve. The ultimate capacity of 325,000 kW would consist of six 50,000-kW and one 25,000-kW sets; each boiler would have a normal evaporative capacity of 100,000 lb. of water per hour, and the ashes would be conveyed through water and dropped into trucks and carried to barges in the dock. Coal would come by railway; in addition to the service hoppers sufficient only for a day or two, there would be three silos, each having a capacity of 9,000 tons, and a reserve silo with a capacity of 100,000 tons; its top would be some 15 ft. below ground level, and this large stock of coal would be under water. When the station was going at full capacity it would require something like 16.8 million gallons of water per hour, which gave some idea of the absolute necessity for finding a site where ample condensing water could be obtained.

Mr. Rider said that on the basis of a 40 per cent. load factor and coal at 20s. per ton, the total cost per kWh sent out from the first section of 125,000 kW would be 0.4315d. When the station was completed the total cost would be 0.366d. per kWh. The total capital cost of the station, when completed, would be £13.9 per kW, or a total of just over 4½ millions sterling, whilst the capital cost of the first section would be £14.9 per kW. There was no doubt that the station at Chiswick, if passed, would become a "selected station" under the scheme of the Central Electricity Board. Referring to the opposition of the London Power Co., Mr. Rider said the fact that that company was applying to the Commissioners for permission to erect a large power station at Battersea would not affect the present proposal in any way, because he believed there would be need for two large stations of this character by the time they were both erected.

Industrial Electric Vehicles.

The Ministry of Transport has recently issued for the first time a return of the actual number of motor vehicles registered in this country at the end of September, 1926. A section of the return is devoted to electric goods-carrying vehicles, from which we learn that at the date mentioned there were 603 such vehicles in use in Great Britain, 552 being in England, 26 in Wales, and 25 in Scotland. Vehicles of an unladen weight up to 25 cwt. head the list with 156, those between 3 and 4 tons following with 150; 105 are between 2 and 3 tons, 101 between 4 and 5 tons, 75 between 25 cwt. and 2 tons, seven between 5 and 6 tons, six over 4 tons, but exact weight not stated, and three over 6 tons. Trailers are used in conjunction with 23 of the 603 machines.

E.P.E.A. Visit.

At the invitation of Mr. C. M. Shaw, M.I.E.E., chief engineer and general manager of the Worcester electricity undertaking, over one hundred members of the Birmingham and North-West Midlands Sections of the Electrical Power Engineers' Association paid a visit to Worcester on May 14th, when a motor tour was made of the extended area of supply. Some very interesting examples of overhead transmission and distribution schemes were inspected, and also the hydro-electric power station. In the evening the party inspected the plant at the city power station. At a meeting which followed Mr. Shaw gave a historical survey of the undertaking's development.

Electrical Association for Women.

On May 16th members of the Birmingham and Midlands Branch of the above Association attended a lecture-recital on the "Duo-Art Pianola Piano," at the invitation of Messrs. W. H. Priestley & Sons, Ltd., at Queen's College, Birmingham. The lecture took the form of an explanation of the uses of the "Duo-Art Pianola Piano," and was followed by a recital.

Electrification of Aberdeen Sawmills.

Messrs. W. Fiddes & Son, Ltd., Aberdeen, whose factory is equipped with the latest sawing and box- and barrel-making machinery, have recently adopted individual motor drives for each machine; the round logs are placed on a continuously moving chain, by which they are automatically fed through circular saws which square the logs on four sides. The squared logs then automatically travel forward to re-saws, which cut them rapidly into boarding. The slabs which fall from the round logs are simultaneously carried to edgers, where they are sawn to breadths at a speed of over 200 lineal feet per minute. Thereafter they are rapidly sawn into thin boards by circular saws, some of which run at speeds as high as 2,900 revolutions per minute. Conveyors carry the timber from one stage to another.

Each machine, or bench, is provided with suction tubes which branch off from a large overhead duct, through which all sawdust from the saws is conveyed direct to the furnaces, where, consumed as fuel, it generates steam for driving the electric generating plant, no coal being used. Thus, the factory, which is quite free from dust, is run with the utmost economy, efficiency and cleanliness, with a total absence of sawdust accumulation about the benches, or the floors or pits adjacent to the saws. All the motors are pipe-ventilated, each pipe being connected to either of two main air ducts. The lighting installation consists of some 30 "Geco" dispersive type vitreous enamelled steel reflectors, used in conjunction with 300-watt "White Osram" bowl sprayed gasfilled lamps; uniform illumination of high intensity, free from glare or dazzle, prevails everywhere in the factory. The lighting scheme was designed by the Illuminating Engineering Department of the General Electric Co., Ltd., which, in determining the height spacing ratio, had to take into consideration the necessity of rendering the saws absolutely free from shadow; this was deemed to be of the utmost importance from the point of view of safety.

The Earthing of Portable Domestic Appliances.

We are gratified to see that the article upon this subject by Mr. R. H. Rawll in our issue of February 11th has attracted attention in Belgium. Our Brussels contemporary, *Eclairage et Force Motrice*, published the greater part of the article (in French) in its May issue, but, apparently by an oversight, omitted to mention its source.

Local Societies.

On May 20th members of the Birmingham Electric Club visited the Preston works of the English Electric Co., Ltd., and the Siemens and English Electric Lamp Co., Ltd., at Preston, where they were entertained and welcomed by Mr. W. Marshall and Mr. W. H. Le Marechal, the managers of the two concerns, respectively.

Irish Free State Electricity Supply.

The Free State Government's Electricity Supply Bill last week passed through the Senate of the Free State Parliament, and has now received the Royal Assent. In the closing stages in the Senate, a Government amendment was adopted to relieve the Shannon works from liability for rates. The Minister for Industry and Commerce, Mr. McGilligan, said that the undertaking would be in the position of a municipal undertaking. Senator Kenny protested against the non-inclusion of a fair wages clause.

At a meeting of the Irish Centre of the Institution of Electrical Engineers, the question of rural distribution of electricity under the Shannon scheme was discussed. Mr. C. P. Coote Cummings expressed the view that price was the factor that would determine whether the farmer was to become a customer of the Board. If the scheme did not become a reasonable success it would be a definite set-back to the country. He did not think it would be a great success in a short number of years. It was a great pity that it should be handicapped at the outset by the antagonism of a very large proportion of the electrical industry of the Free State. Dr. Lothman, Free State Government expert, urged the necessity for having the co-operation of electrical engineers in educating the farmer in the uses of electricity. He mentioned the difficulties experienced in this respect with the Canadian farmers, who had now, however, been convinced.

A meeting of the Executive branch of the Surveyors' Institution has completed arrangements for a visit of the Institution to the Shannon works early in June.

Tramways and Light Railways Association.

The annual congress of the Association will be held on June 30th and July 1st, at Bath. The headquarters will be at the Grand Pump Room Hotel. The following papers will be read on Thursday, June 30th: "Some Aspects of Local Passenger Traffic," by Mr. W. E. Hardy, and on Friday, July 1st, "Modern Tramway Equipment," by Mr. A. V. Mason.

Appointments Vacant.

Temporary clerk of works (£5) for the Hazel Grove and Bramhall Urban District Council Electricity Department. Assistant engineer in the Mains Department, for the Portsmouth Corporation. Mains assistant for the Wolverhampton Corporation Electricity Department. Probationary assistant telegraph engineer for the Government of Nigeria. Visiting teacher of carpentry and joinery, and visiting instructors of acetylene welding, electrical installation, engineering workshop practice and engineering economics, for the L.C.C. School of Engineering and Navigation. (See our advertisement pages to-day.)

An Electric Thrashing Demonstration.

A successful demonstration was recently carried out at Messrs. S. & J. M. Podmores's Deeside Farm, Chester, where a 7-acre oatcrop was placed at the joint disposal of the Chester Corporation Electricity Department and Messrs. Ransomes, Sims & Jefferies, Ltd., to demonstrate the utility of modern electric thrashing machinery. With a 25-h.p., 3-phase, 400-V portable Ransomes motor, driving a medium-finishing thrashing machine, fitted with a drum 4 ft. 6 in. wide and 22 in. in diameter, and a Ruston & Hornsby straw-pressing machine driven by belt from the main shaft of the thrashing machine, the crop was thrashed in 8 hours 38 minutes; 199 cwt. of grain and 282 bales of straw, weighing 191 cwt., were produced. The consumption of electricity amounted to 90.6 kWh, or .45 kWh per cwt. of grain, or 12.93 kWh per acre. The charge for electricity for power



Electric Thrashing at Chester.

purposes is 1¾d. per kWh, making the total cost for power 13s. 3d., .79d. per cwt. of grain, or 22.65d. per acre. During the first hour no attempt was made to work the thrashing machine to its full capacity. The machine was fed by several different people who wished to have personal experience of feeding the machine and testing its capacity. A large number of farmers witnessed the demonstration, and without exception the opinion was expressed that electric power offered great advantages over other methods of driving.

A Cheap American Toaster Banned.

The *Electragist* for May contains the following note:—The ordinance against the sale of unapproved electrical appliances in Portland, Oregon, was recently invoked in causing the arrest of the manager of the Woolworth store there who was offering a toaster for 15 cents. Deputy Electrical Inspector Caine was the complainant, and the court imposed a fine of $25 for the offence with an order to cease selling these appliances at once. He further ruled that all who had purchased the contrivances might recover their money upon application at the store, and that the failure of the store managemnt to return it would result in further fines. Caine said that the toaster was the most dangerous life and fire hazard he had ever seen in Portland.

An Electrical Relay.

A new electrical relay, invented by Mr. D. D. Knowles, research engineer of the Westinghouse Electric and Manufacturing Company, is known as the grid-glow relay, and resembles a radio vacuum tube in appearance. When properly connected, a billionth of a watt is sufficient to control the flow of a current which, in opening or closing another relay, can control currents as high as twenty-five amperes. Though exhausted of air, the tube contains neon, argon, or some similar gas which is chemically inert; the parts within are an anode, a cathode and a grid, but there is no filament. When the anode and cathode are connected to the two terminals of a circuit of about 440 volts no current flows, because an electrical charge is built up on the grid which blocks it, so long as the grid is insulated; but if the grid be earthed, the current will flow and operate any device connected in the circuit. In demonstrations to show how jewelry may be protected, a watch was laid on a plush cover under which was a piece of tinfoil connected to the grid of the relay tube; as soon as the hand was brought near the watch (and the tinfoil) the grid being discharged, the 440-volt current flowed through the tube, and operated any device in the circuit.

National Illumination Committee of Great Britain.

We have received a copy of the report for the year 1926, which was presented at the special annual meeting of the Committee on February 1st, 1927. The chairman (Lt.-Col. Kenelm Edgcumbe) states that the Sectional Committee on Illumination, of which members of the above Committee form the nucleus, set up by the British Engineering Standards Association, has made very satisfactory progress, and five specifications dealing with important illumination materials or problems have been issued, or are on the point of completion. The Committee has supported a proposal to standardise miners' lamp bulbs, which has been considered favourably by the British Engineering Standards Association.

The proposed plenary session of the International Commission on Illumination has been postponed provisionally until 1928. In the meantime meetings of the executive and technical committees are being arranged in Rome for September, 1927. The International Commission now includes Belgium, France, Germany, Great Britain, Italy, Japan, Switzerland, and the United States of America.

The progress of the work of the Illumination Section of the British Engineering Standards Association during the past year is summarised by Mr. Percy Good, who states that the Sub-Committee on Illumination Glassware has practically completed its first specification for an illumination fitting of translucent glassware for interior lighting. The Committee has had the benefit of the assistance of five or six of the leading glass-makers during the past six months.

The Sub-Committee on Industrial Reflector Fittings, as was reported last year, completed the Specification No. 232, "Industrial Reflector Fittings for Direct General Lighting, No. 1 (Dispersive Type)." Since the issue of this specification the Committee has agreed to alter the table to show the gauges of metal instead of the thicknesses of steel, and the note to Clause 6 has also been altered to read: "This figure is *based upon* and complies with the recommendation of 20 degs. from the horizontal for light sources at distances of not less than six feet, contained in the second report of the Departmental Committee on Lighting in Factories and Workshops, 1921."

The Sub-Committee on Street Lighting has completed its draft specification, which was presented for discussion at the Institution of Electrical Engineers and the Illuminating Engineering Society in March.

The session at Bellagio, mentioned in our last issue, is solely for the Executive Committee and sub-committees, preparatory to next year's plenary session; it will be under the presidency of Dr. E. P. Hyde, and the arrangements are being made by the Italian National Committee on Illumination.

Tale of a Rat.

The Times reports that a failure of the electricity supply at Brentford on May 18th was found to have been caused by the gnawing by a rat of one of the main cables of supply. The rat was killed. This is the second time in 12 days that the Brentford electricity supply has been cut off in this manner.

Institution Notes.

Institution of Electrical Engineers.

NORTH-WESTERN AND MERSEY AND NORTH WALES (LIVERPOOL) CENTRES.—On May 14th, at Chester, a party of 136 members, ladies, friends and guests spent the morning viewing the works of Brookhirst Switchgear, Ltd., whilst the ladies of the party toured Chester. The luncheon at the Grosvenor Hotel was a happy gathering, and in the afternoon the Chester Corporation's hydro-electric station was visited. There followed a trip up the River Dee in motor launches to Iron Bridge, where tea was served, the party returning through the gardens of Eaton Hall (by permission of the Duke of Westminster) to Eccleston Ferry, and there joining the motor launches for Chester. The meeting was a decided success and was very much appreciated and enjoyed.

WESTERN CENTRE.—The week-end summer meeting of the Western Centre took place from May 20th to 23rd at Plymouth, where the annual meeting was held on the Friday evening. On the Saturday morning a motor coach trip was arranged to Bodmin, where the "beam" radio-telegraph station of the Post Office was inspected; after luncheon the drive was continued, tea being served at Downderry and dinner at Plymouth. On the Sunday morning facilities were provided for viewing the historical parts of Plymouth; during the afternoon there was another drive, and Mr. W. G. Heath (chairman of the Centre) entertained the party to tea at his house on Crown Hill. On the Monday morning the Royal Naval Engineering College Laboratories at Keyham were visited, the meeting terminating at noon.

There was an attendance of 80 members, with their wives and friends. The chairman referred to the fact that since the last meeting was held in Plymouth four years ago the organisation had grown considerably in membership, and was in a flourishing condition. Notwithstanding the scattered area which comprised the Western Centre, the attendance had been well up to the average, and compared most favourably with those of other Centres. It was reported that the total membership amounted to 632, made up of 88 members, 247 associate members, 7 associates, 114 graduates, and 176 students. The ballot for filling vacancies on the Committee resulted in the election of the following:—Messrs. R. D. Archibald (Devonport), A. F. Coates (Bristol), L. A. Hards (Cornwall), J. W. Spark (Bath), and T. J. Plevin (Cardiff).

WIRELESS SECTION.—The following gentlemen have been nominated by the Wireless Section Committee to serve from October 1st, 1927:—*Chairman*: Lieut.-Col. A. G. Lee; *ordinary members*: Mr. J. Hollingworth, Mr. E. B. Moullin, Mr. G. H. Nash, and Mr. C. E. Rickard. The following will continue to serve as members of the Committee: The president, I.E.E., the chairman of the Papers Committee, I.E.E., a nominee of the Council, I.E.E., a nominee of the General Purposes Committee, I.E.E., Major B. Binyon, Mr. P. R. Coursey, Capt. P. P. Eckersley, Dr. R. V. Hansford, Prof. E. Mallett, Mr. S. R. Mullard, Mr. E. H. Shaughnessy, and Mr. G. Shearing, together with one representative each to be nominated by the Admiralty, Air Ministry, General Post Office, and the War Office.

Institute of Transport.

The Council has elected the undernamed to take office on October 1st, 1927:—*President*: Mr. Roger T. Smith, B.Sc., M.I.E.E.; *Hon. Treasurer*: Sir Henry P. Maybury, C.B., K.C.M.G.

American Röntgen Ray Society.

The twenty-eighth annual meeting of the American Röntgen Ray Society will be held in Montreal on September 20th to 23rd, 1927, under the presidency of Dr. A. Howard Pirie, of Montreal. This is the first occasion on which the Society has met outside the United States; and, to acknowledge the honour paid to a British radiologist by his election to the presidency of the Society, a party of radiologists from this country will take part in the proceedings. Dr. G. W. C. Kaye has been invited by the Society to give the Caldwell lecture.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. R. E. KIMENS, Commercial Secretary at Warsaw, will be in attendance at the Department of Overseas Trade, 35, Old Queen Street, S.W.1, from June 1st to 4th inclusive. Applications for interviews by representatives of United Kingdom firms interested in Polish trade should be made to the Comptroller-General of the Department.

The Islington Borough Council has confirmed the appointment of Mr. ALEXANDER P. MACALISTER as borough electrical engineer in succession to the late Mr. Albert Gay, at a salary of £1,050, rising to £1,250. Mr. MacAlister was educated privately and at the City of London School, leaving there in 1894 to serve an apprenticeship at the Engineering and Locomotive Works of the London and South-Western Railway Co., at Nine Elms. After passing through all the departments, Mr. MacAlister went, in 1899, to the Croydon Electricity Department as draughtsman, and was in succession charge engineer, mains engineer, and technical assistant in charge of extension work. In 1903 he became mains superintendent to the Battersea Electricity Department, and was later chief assistant engineer, acting as chief engineer pending the appointment of Mr. Bond. He went to Islington in 1907 as chief assistant and deputy electrical engineer, and during his service there has been largely responsible for the extension and other work in connection with the modernising of one of the original London stations.

Messrs. Merz & McLellan announce the introduction of members of their engineering staff into partnership as follows: Mr. H. H. BAKER with Mr. C. H. MERZ and Mr. W. MCLELLAN in the firm of Merz & McLellan; Mr. F. LYDALL with Mr. C. H. MERZ in the firm of Merz & Partners; and Messrs. R. NELSON and A. H. HUMAN with Mr. W. MCLELLAN in the firm of McLellan & Partners.

Mr. BERNARD SLEATH has resigned the position that he has held with Messrs. Chamberlain & Hookham, Ltd., for the past 16 years, and has joined the staff of Venner Time Switches, Ltd., in whose interests he will visit South Wales, the Midlands, the West of England, and other parts.

The *Manchester Guardian* says that Mr. C. W. LOVERIDGE has resigned his post on the engineering staff of the Manchester Ship Canal Company to take up an appointment at the headquarters in London of the Central Electricity Board.

According to the *Review of the River Plate*, Mr. JAMES DALRYMPLE, late general manager of the Glasgow Corporation Tramways, who has been on a special mission with reference to street traffic in Sao Paulo and Rio de Janeiro, was to leave for England on the *Arlanza* on May 15th.

Mr. SINGER, whose new appointment was mentioned here last week, asks us to state that his initials are M. W.

Obituary.—Mr. W. E. Hardy.—The death is reported, following an operation, of Mr. William Eversley Hardy, managing director of the Bath Tramways Co. Mr. Hardy had been with the company for 24 years, having previously served with the City of London Electric Lighting Co., Ltd.

Mr. J. B. Malpass.—We regret to note the following announcement in *The Times* "Deaths" column:—"On May 17th, 1927, in Calcutta, of pneumonia, John Bernard Malpass (late Capt. R.E.T.), of Metropolitan-Vickers, Ltd., only son of Capt. A. Malpass (Indian Army, retd.), in his 43rd year."

Wills.—Sir J. S. Harmood-Banner, Bt., left £449,279 gross and £232,451 net personalty.

Mr. Walter Leaf, chairman of the Central Electric Supply Co., Ltd., and the St. James' and Pall Mall Electric Light Co., Ltd., left £124,186 (net personalty £117,640).

The late Mr. A. R. Hardie, a director of the Eastern Telegraph Co., Ltd., left £13,027 gross, and £12,044 net.

The late Mr. J. C. Phillips, of C. D. Phillips, Ltd., Newport, left £22,793 gross and £22,385 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Catton & Coates, Ltd.—Private company. Registered May 16th. Capital, £2,000 in £1 shares. To acquire the business of manufacturers' agents carried on by E. F. Catton and W. Coates at 13, Chapel Road, Southampton, as "Catton and Coates," to manufacture heating and cooking appliances, and to carry on the business of electricians and mechanical and electrical engineers, &c. The permanent directors are:—W. A. Hammock, 135, Above Bar Street, Southampton, insurance manager (chairman); L. Phillips, 49a, London Road, Southampton (director of L. Phillips (Southampton), Ltd.); W. H. Stone, 23, Windsor Terrace, Southampton, hotel proprietor; E. F. Catton, 63, Violet Road, Southampton, manufacturers' agent; W. Coates, 2, Middle Street, Southampton, manufacturers' representative. Remuneration, £100 per annum divided between them. Registered office: 13, Chapel Road, Southampton.

Perring-Thoms Wireless Syndicate, Ltd.—Private company. Registered May 16th. Capital, £525 in 500 ordinary shares of £1 and 500 founders' shares of 1s. Objects:—To acquire the business of a wireless, telephone, and telegraph engineer and manufacturer of wireless apparatus, &c., lately carried on by P. Perring-Thoms at Brighton. The subscribers (each with one ordinary share) are:—G. C. Wilkinson, 148, Hatherley Gardens, East Ham, E.6, registrar; R. Backer, "Ivydene," Holyrood Drive, Westcliff-on-Sea, clerk. Solicitors: Vallance & Co., 8, Union Court, E.C.2.

W. Baron & Co. (London) Ltd.—Private company. Registered May 16th. Capital, £2,000 in £1 shares. Objects:—To carry on the business of manufacturers of articles of all kinds from vulcanised fibre, fibre, ebonite, bakelite and/or other like substances, &c. The first directors are:—S. T. Tracey, 59, Kingsway, Wembley, Middlesex (director of Domestic Supply Co., Ltd.); J. T. J. Hollom, 28, Croftdown Road, N.W.5 (director of Hillier, Hollom & Co., Ltd.). Secretary: F. C. Munt. Solicitor: C. H. Wright, 34, Clement's Lane, E.C.4. Registered office: 1-3, Red Lion Court, E.C.4.

Microfuses, Ltd.—Private company. Registered May 14th. Capital, £100 in £1 shares. Objects:—To execute an assignment by R. H. D. Barklie to the company for the purchase of patent No. 265,263, dated February 7th, 1927, granted to him for improvements in the manufacture of electric fuses, and to carry on the business of mechanical and electrical engineers, manufacturers of, and dealers in wireless and all other electrical apparatus, &c. The directors are:—C. D. Barklie, Penton Lodge, 47, Old Lodge Lane, Purley; R. H. D. Barklie, Penton Lodge, 47, Old Lodge Lane, Purley, research chemist. Qualification, 1 share. Secretary: C. D. Barklie. Solicitors: George L. Barnett and Co., Balfour House, Finsbury Pavement, E.C.2. Registered office: 3, Finsbury Square, E.C.2.

Sydney W. Bussell, Ltd.—Private company. Registered May 17th. Capital, £500 in £1 shares. Objects:—To carry on the business of electrical and general engineers and contractors, manufacturers of, and dealers in machinery, appliances, instruments, apparatus, metals, &c. The first directors are:—S. W. Bussell, 91, Hawthorne Road, Willesden Green, N.W.10, mechanical and electrical engineer; Mrs. H. M. Bussell, 91, Hawthorne Road, Willesden Green, N.W.10. Solicitors: Kennedy, Lindo & Co., 79, Coleman Street, E.C.2.

Radio Service (London), Ltd.—Private company. Registered May 17th. Capital, £1,000 in £1 shares. Objects:—To enter into a contract with Rotax (Motor Accessories) Ltd., for the purchase of the business known as The Radio Service Co., and carried on by it at 105a, Torriano Avenue, Camden Town, N.W., and to carry on the business of hirers, maintainers, and repairers of accumulators and batteries, manufacturers of, and dealers in wireless broadcasting and receiving sets, &c. The first directors are:—G. D. Le Lievre, 8, Beverstone Road, Brixton Hill, S.W.; F. W. Larner, 48, High Street, Camden Town, N.W.1; E. A. Minter, 68, Park Street, Camden Town, N.W.1. Secretary: R. B. Marler. Registered office: 105a, Torriano Avenue, Camden Town, N.W.

Leeds Sunlight and Electrical Clinic, Ltd.—Private company. Registered May 16th. Capital, £500 in £1 shares. Objects:—To carry on the business of medical and general electricians, masseurs, radiologists, &c. The first directors are:—Mrs. I. Collins, 39, The Drive, Adel, Leeds; Mrs. E. G. Blackburn, 106, Westfield Road, Leeds. Qualification, £100.

C. D. Bond & Son, Ltd.—Private company. Registered May 19th. Capital, £2,000 in £1 shares. Objects: To acquire the business of manufacturing and general engineers carried on by C. D. Bond and V. C. Bond, at 43, Johnson Street, Westminster, as "C. D. Bond & Sons," and to carry on the business of electrical, mechanical, motor, telephone, and general engineers, manufacturers of and dealers in electrical goods and accessories, &c. The permanent directors are: C. D. Bond, Runnymede, Charlton Road, Shepperton-on-Thames, engineer (director of Marpole & Bond, Ltd.); V. C. Bond, Runnymede, Charlton Road, Shepperton-on-Thames, engineer. Qualification, £50 shares. Registered office: 43, Johnson Street, Westminster, S.W.

Official Returns of Electrical Companies.

Rapinet, Ltd.—S. Sharpe, of Balfour House, Finsbury Pavement, E.C., ceased to act as receiver or manager on May 10th, 1927.

Brighton Lighting and Electrical Engineering Co., Ltd.—Particulars filed of £2,000 debentures authorised April 23rd, 1927, charged on the company's property, present and future, including uncalled capital (subject to mortgage on 10a to 10c, St. Martin's Place, Brighton, securing £1,000), the amount of the present issue being £1,250.

International Electrolytic Plant Co., Ltd.—Debenture dated April 22nd, 1927, to secure £550, charged on the company's undertaking and property, including uncalled capital. Holder: H. Rowlands, Bremesgrave Chase, Barnt Green, Worcs.

Chislehurst Electric Supply Co., Ltd.—Satisfaction in full on April 12th, 1927, of debentures dated February 23rd, 1900, and July 2nd, 1906, securing £10,000.

Lithanode Co., Ltd.—Particulars filed of £5,000 debentures authorised January 27th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £2,900.

Nefa Co., Ltd.—Capital, £1,000 in £1 shares. Return dated January 14th, 1927. 999 shares taken up. £999 paid. Mortgages and charges, £500.

Aberayron and District Electricity Supply and Power Co., Ltd.—Capital, £3,000 in £1 shares. Return dated November 16th, 1926 (filed March 29th, 1927). All shares taken up. £2,998 considered as paid. £2 calls unpaid. Mortgages and charges, £1,400.

Stella Conduit Co., Ltd.—Capital, £20,000 in £1 shares. Return dated January 14th, 1927. All shares taken up. £20,000 considered as paid. Mortgages and charges, nil.

High Salvington Electric Supply Co., Ltd.—Capital, £1,300 in £1 shares. Return dated January 5th, 1927. 1,122 shares taken up. £722 paid. £400 considered as paid. Mortgages and charges, nil.

Interchangeable Electric Signs, Ltd.—C. H. Seaton, of 62, Brook Street, W., was appointed receiver on May 5th, 1927, under powers contained in first debenture, dated February 26th, 1926.

Gwynedd Trust, Ltd.—Capital, £10,000 in 9,500 7 per cent. cum. preference shares of £1 each and 10,000 ordinary shares of 1s. each. Return dated March 14th, 1927. 2,002 preference and 10,000 ordinary shares taken up. £2,502 paid. Mortgages and charges, nil.

International Hydro-Electric Development Syndicate, Ltd.—Capital, £10,000 in £1 shares. Return dated January 14th, 1927. 2,254 shares taken up. £2,254 paid. Mortgages and charges, nil.

Mackallen Heating Co., Ltd.—Capital, £99 in £1 shares. Return dated January 6th, 1927. All shares taken up. £99 paid. Mortgages and charges, nil.

Attaix, Ltd.—Mortgage dated May 5th, 1927, to secure £1,000, charged on 106, High Street, Southampton. Holder: S. Rogers, 4, Rotunda Terrace, Cheltenham.

Callington & District Electric Supply Co., Ltd.—Issue on April 27th, 1927, of £250 debentures, part of a series already registered.

City Notes.

Siemens Brothers & Co., Ltd.

The annual meeting was held on Tuesday last, Mr. G. Mure Ritchie presiding. In moving the adoption of the report (ELECTRICAL REVIEW, May 20th, p. 810), the chairman, after referring in detail to the balance sheet which, he said, showed that from the point of view of capital resources the company was in a stronger financial position than at any time since the shareholders acquired the undertaking nine years ago, remarked that at the beginning of 1926 he was hopeful that the year's profits would have exceeded £400,000. The lamentable coal strike dissipated that prospect, but, nevertheless, the net profit amounted to £358,990, an increase of £2,109 over 1925, which could be regarded as satisfactory. During 1926 there was some slackening in orders for public telephones. They completed the conversion of four exchanges in the Edinburgh area to automatic working, 12,000 lines being cut over successfully in October last, while in March this year the whole of the Sheffield area was converted and brought into service, having nine automatic exchanges with approximately 15,000 subscribers connected. These two systems now represented the two largest automatic areas in Britain, while the Sheffield transfer represented the largest number of exchanges ever simultaneously transferred to automatic working. Among overseas telephone contracts might be mentioned a telephone installation in the City Hall, Cape Town, public exchanges for Salisbury (Rhodesia), Vina del Mar (Chile), Nutana (Canada), as well as six exchanges in the Brisbane (Australia) area, the last totalling upwards of 12,000 lines. They had specialised, among other things, in the manufacture of the loaded type of submarine telephone cable for long-distance transmission. In addition to the supply and laying of another such cable between England and Belgium, which had provided greatly improved telephone facilities for the Continent, they also supplied a similar cable to British Columbia, connecting the mainland to Vancouver Island. There were good reasons for expecting business in this highly specialised type of cable to continue, as there were many parts of the world which, sooner or later, would want telephonic connection by means of submarine cables. Their plant for submarine telegraph cable was well occupied throughout 1926. In addition to the manufacture and laying of a submarine cable for connecting Bilboa, near Panama, and Santa Elena, Ecuador, they made a high-speed loaded cable of 2,143 nautical miles for the Pacific Cable Board, to connect Fanning Island and Fiji. In underground light and power cable their plant was again fairly well occupied, although many schemes requiring this class of cable were awaiting the passing of the Electricity Bill. Now that this measure had become law, power transmission schemes were being pushed, and at the present time their plant was well occupied with orders. During 1926 arrangements were completed for manufacturing a new type of e.h.p. cable (the "H" type), which it was believed would overcome many of the difficulties which had been experienced, and they had just been successful in securing a very important contract for supplying and laying a cable of this type for connecting the new station at Portishead to Bristol. That contract was of considerable interest, inasmuch as it was probably the first of such magnitude that has been placed in this country for "H" type cable. They had also secured the first important contracts to be placed for this type of cable in Australia, New Zealand, and Greece. The Australian contract was of considerable interest as it consisted of the supply and laying of a number of 33,000-V jointless submarine power cables across Sydney Harbour. Mining and marine apparatus showed an increased turnover. Progress on the technical side was being maintained. Excellent reports had reached them in regard to their direction-finding apparatus. He would also call attention to their short-wave apparatus, and in particular to the installation on the Cunard liner *Carinthia*, the first to be employed in the British Mercantile Marine, proving most satisfactory. Their overseas business had shown a notable expansion, mainly due to their having secured the orders previously mentioned for telephone exchanges. Business in South Africa carried out by their branch had shown steady progress, and they had recently registered a local company under the title of Siemens Bros. and Co. (British), Ltd. Regarding their prospects for the current year, he said that although the orders so far received in 1927 were in excess of those received in 1926, it would be too optimistic to assume under current conditions that the volume of orders for the remainder of the year would be sufficient to absorb their manufacturing resources. Competition was getting keener, and the margin of profit was consequently reduced. However, their products were chiefly required in connection with utility services, and there was every reason to expect that in course of time the demand for those services would again increase. The report and accounts were adopted.

Brush Electrical Engineering Co., Ltd.

The annual meeting was held on May 23rd. Mr. E. Garcke (chairman), who presided, in proposing the adoption of the report (*vide* our last issue, p. 810) said that the past year had not been very notable from the general point of view; the business done had been of a normal character, and the progress was satisfactory, having regard to all the circumstances. The company, among others, was prejudicially affected by industrial events, and but for those events the profits would have been larger. It was very satisfactory, however, that the net result was approximately the same as for 1925. The gross profit was about £10,000 less, but the total expenses were nearly £9,000 less; the net result was about £700 better than in the preceding year. The company's liquid resources were now over £300,000, compared with the share and debenture capital of about £750,000. Although the accounts showed considerable financial strength, it was not the best economic position to have over £300,000 of liquid resources earning only about 5 per cent. It was prudent, however, to keep those resources liquid, because they hoped for improvement in engineering prosperity, and then the spare cash resources would be available, and needed, for carrying a much larger volume of business than at present. All the main departments were kept well occupied throughout the year. Important contracts were carried out for turbo-generators and transformers for both home and abroad. Their Brush-Ljungström turbine plant continued to hold its own in competition with other turbines. Recently they booked an order for Hull for two 12,500-kW turbo sets immediately upon the completion of a previous contract for two 7,000-kW sets for the same authority. The rolling stock department was taxed to the fullest capacity on tramcars and omnibuses. A marked improvement had taken place in the view held by municipalities and companies owning tramway undertakings with regard to the renewal of rolling stock, and substantial contracts had been carried out for corporations, among others Birmingham, Leeds, Bournemouth, Cardiff, West Ham, and East Ham. Their present order list compared favourably with that for the same period last year. Extensions to the buildings and machine tools were in hand, to enable them to deal with larger units and with increased demand. The intense competition, to which previous reference had been made, did not show any sign of slackening. That applied particularly to overseas contracts. The company had no intention whatever of joining in suicidal competition to the extent of carrying out orders without a moderate profit or, as some firms were doing, at a ruinous loss. Mr. Garcke then went into some details regarding the co-partnership scheme which was dealt with in the report, and said that it was a question for the shareholders to decide how the increase in the undivided profits account derived from the allocation of surplus profits should be dealt with. The directors intended to take the matter into careful consideration and submit a recommendation at the next meeting. In respect of the surplus for 1925, the employés unanimously agreed to receive their bonus in ordinary shares. A certain number of those shares were sold on the market by the recipients, but the proportion of the shares sold was, he considered, less than was to be expected in the circumstances. So far as their short experience extended, the co-partnership scheme had had a beneficial effect. The report and accounts were adopted.

Anglo-Portuguese Telephone Co., Ltd.

The *Financial Times* states that with the change in the chairmanship of this company—Viscount St. Davids retiring and Sir Alexander Roger taking his place—there has been a change in the control of the company. Our contemporary says:—"In this deal it is understood that Sir Alexander Roger brought together trust companies and individuals specialising in telephones to purchase the undertaking from the existing interests—mainly companies in which Viscount St. Davids is interested. While the price paid for shares is not known, it is believed to be substantially over par. Debenture stock has also been secured. This deal is an answer in part to the well-known attempt by important American interests to obtain control of international telephone communications."

Our contemporary quotes an "authority" very closely in touch with international telephone matters, to the effect that the deal will keep control out of the hands of important American interests which are endeavouring to secure a hold on all telephone companies, and will be of great advantage to Britain. "With control in British hands, all orders for

new plant will come to this country." Extensions to the Anglo-Portuguese system anticipated during the next ten years are expected to represent an expenditure of £1,500,000 to £2,000,000. "The acquiring group has all the necessary expert and financial resources to enable the company to function to its utmost capacity."

Pernambuco Tramways and Power Co., Ltd.

The annual meeting was held on May 17th. Mr. W. Higgins, O.B.E. (chairman), who presided, said that the expansion of business and the improvement in the exchange had produced satisfactory results. The number of electricity consumers had increased, and the new 6,000-kW set was put into operation on April 24th last. After reviewing the accounts and mentioning that £8,000 had been placed to reserve, the chairman spoke of the decree for the stabilisation of the exchange at 6d. That, he said, militated against the chances of the improvement which was expected from the rising exchange, and the receipts for the current year showed a decrease. The Brazilian Government should realise that foreign capital could not be remunerated with such a low rate as the current one. The tramway fares remained the same whether the exchange was 6d. or 1s. When the original concession was obtained, the exchange was 15d. or 16d. The company would also be adversely affected by the withdrawal of the abatement of duties on material imported by the company; it would probably mean an additional annual outlay of £10,000. There was no question of protecting home industries, and he hoped that the Government would see its way to modify its action. In conclusion, Mr. Higgins said that the company was considering the running of an experimental omnibus service.

New Issues.

Thomas Bolton & Sons, Ltd.—On Monday last this company offered for subscription £300,000 of 6 per cent. first mortgage debentures of £100 each at £98 per cent. The debentures are repayable at £102 per cent. on April 1st, 1947, or at £104 on six months' notice, after 1932, at the company's option. The liquid assets of the company are said to exceed by over £500,000 the amount of the issue. The bulk of the proceeds (£216,360) will be used to redeem the existing debentures of the company and the balance for working capital. The issue was over-subscribed and the lists were closed on Monday.

Metropolitan District Railway Co.—The *Financial Times* reports that arrangements are understood to have been completed for the issue of £500,000 5 per cent. debenture stock, redeemable in 1943, or earlier at the option of the company. It is stated that the stock has been sold to a financial group at 95 per cent., free of stamp duty.

Madras Electric Supply Corporation, Ltd.

After providing for debenture service the net profit for 1926 is £58,061, and to it is added £5,550 brought forward, making £63,611. It is proposed to pay a final dividend of 5½ per cent., free of tax, on the ordinary shares, making 8 per cent. tax-free for the year (as for 1925); to transfer £5,124 to general reserve; to devote £2,736 to additional remuneration to directors; and to carry forward £5,907. In November last the capital was increased to £800,000, and an issue of 110,000 ordinary shares was made to existing shareholders at the price of 25s. 6d. each; the premium after deducting expenses has been credited to the general reserve. The new shares rank for dividend from July 1st last. The tramways show an available balance of £13,166, as against £21,515. The dividend on the 6 per cent. preference shares has been paid and £7,166 carried forward. Meeting: May 30th.

Shanghai Electric Construction Co., Ltd.

The net profit for 1926 was £122,410, as compared with £72,159 for 1925. Adding the balance brought forward, the amount available is £127,570. Of this £40,000 has been allocated to renewals, £5,000 for taxation, and £1,831 to staff provident fund. In view of the unsettled conditions in Shanghai the directors propose to restrict the final ordinary dividend to 6 per cent., making 10 per cent., as in 1925; £30,739 is carried forward. It is the directors' intention, when conditions are more favourable, to pay off bankers' advances and make an issue of capital. The first year of operation of the Singapore Traction Co., Ltd., resulted in the company receiving £10,000 in respect of its half share of profits. The Singapore company's revenue from lighting came to an end upon the opening of the municipal station in October last. Meeting: June 1st.

British Electric Traction Co., Ltd.

As we briefly reported in our last issue, a proposal for the issue of a bonus of 10 per cent. to ordinary stockholders, in the form of deferred ordinary stock, was approved at an extraordinary meeting last week. Mr. J. S. Austen (chairman), introducing the resolutions, said that under the proposed arrangements the preference stock would receive a cumulative dividend of 6 per cent.; then the ordinary stock, which would be known as 8 per cent. non-cumulative preferred ordinary stock, would receive 8 per cent.; then the preference stock would participate with the new deferred stock until the former had received 8 per cent., the deferred stock at the same time receiving what would otherwise have gone to the existing ordinary stock, being also entitled to all the remaining profits. That method was adopted on account of an agreement which precluded the issue of ordinary stock as a bonus. The amount of 10 per cent. was fixed as a basis on which they could reasonably expect to make a satisfactory distribution. Referring to the results of the past year, Mr. Austen said that they were practically the same as those of the previous year, and were much better than had been anticipated. In conclusion he asked the ordinary stockholders to regard the new stock as a means by which they would recover not only all the capital which had previously been lost, but something more.

Cawnpore Electric Supply Corporation, Ltd.

The surplus on the past year's working was £61,761, and after deducting debenture interest and adding £3,700 brought forward there is an available amount of £52,721. From this £10,000 is transferred to depreciation and renewals reserve, £2,000 to general reserve, and £6,778 to sinking fund; £3,671 is written off share and debenture issue expenses, and after paying the preference dividend and a final dividend of 7 per cent. (making 10 per cent.) on the ordinary shares, £2,512 is carried forward. The report was accompanied by a striking view of the company's Riverside station, Cawnpore. Meeting: May 30th.

Yorkshire (Woollen District) Electric Tramways Co., Ltd.

The report for 1926 states that the receipts were £193,972, and after meeting all expenses, including £27,900 for renewal fund, there remains £21,083, to which is added £29,271 brought forward, making £50,354. It is proposed to pay a dividend of 6 per cent. on the ordinary shares for the year and to transfer £10,000 to reserve, leaving £27,154. The directors aim at maintaining the 6 per cent. dividend, and accordingly propose to pay a further 3 per cent. on the ordinary shares (as last year), making up the full dividend for 1921 when no distribution was made. This reduces the balance to be carried forward to £21,874.

English Electric Co. of Canada, Ltd.

The report presented at the annual meeting at Montreal on May 9th, showed that the company had materially improved its position, profits being much in excess of those of any previous year. The company benefited particularly from the expansion which took place in the pulp and paper industry, as well as from activity in the mining industry, and the extensive water power development. Profits for the year were $203,156, as against $74,003 in 1925, and $94,092 in 1924. After paying 3½ per cent. on the cumulative preference stock amounting to $70,000, as compared with $50,000, the balance carried forward to profit and loss was $384,311, as against $293,848 a year ago.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted:—

Atlas Light and Power.—£889,757 5 per cent. debenture stock.

Consolidated Gas, Electric Light and Power of Baltimore.—82,794 common shares of no nominal or par value.

Application has been made to the Committee to allow the following to be officially quoted:—

City of London Electric Lighting.—400,000 ordinary shares of £1 each, fully paid, Nos. 1,500,001 to 1,900,000.

Chloride Electrical Storage Co., Ltd.

The profit for the past year was £158,666, as compared with £157,395 in the preceding year. A final dividend of 5 per cent., free of tax, making 10 per cent., free of tax, for the year, has been declared on the ordinary shares, together with a bonus of 2s. per share, also tax free. A similar distribution was made in respect of 1925. £50,000 is transferred to general reserve (making £225,000); £25,000 is put to depreciation reserve; £10,000 to employés' benefit fund; and £47,352 is carried forward.

Weston-super-Mare and District Electric Supply Co., Ltd.

The net revenue for 1926 was £34,448, as compared with £34,881 for 1925. After meeting all expenses, including £14,000 for renewals, there is a surplus of £10,721 (against £12,247). To this is added £6,204 brought forward, making £16,925. It is proposed to transfer £4,000 to reserve and to pay a dividend of 10 per cent. on the ordinary shares, leaving £4,525 to be carried forward.

Iron Trades Employers' Insurance Association, Ltd.

The report for 1926 shows a premium income of £508,962 and total receipts of £627,577. From the surplus of £160,918 the directors propose to return 10 per cent. on the Workmen's Compensation premium paid for 1926, together with a bonus of 15 per cent., for which income tax has already been paid.

Merthyr Electric Traction and Lighting Co., Ltd.

The net revenue for the past year fell from £27,337 to £24,072, and the net surplus from £7,230 to £4,648. It is proposed to pay the 5 per cent. preference dividend and carry forward a balance of £3,148. The adverse results are attributed to last year's industrial troubles. Meeting: May 30th.

British Thomson-Houston Co., Ltd.

The annual meeting was held on May 24th, Mr. H. C. Levis presiding. In moving the adoption of the report (Elec. Rev., May 20th, p. 809), the chairman, after referring with regret to the deaths of Messrs. C. A. Coffin and A. W. Burchard, directors, said that Mr. C. H. Minor had been appointed a member of the board since the last meeting. During the year under review the company again had to face keen competition. In addition, the general industrial conditions arising from the prolonged coal dispute affected them seriously, and resulted in a smaller input to their factories of orders which could be completed during the year; that in turn meant a smaller amount invoiced to customers, with the result that the profits for the year were decreased, and they were unable to recommend the payment of a dividend on the ordinary shares. Now that the effects of the coal strike were beginning to disappear and the uncertainty regarding the Electricity Bill had been removed, the position with respect to new orders had improved, and they had on hand to-day a considerably larger volume of orders than they had at any time during the past year. The outlook for the present year was favourable provided they did not again suffer from disturbed industrial conditions. The orders, beside those for use at home, included many important ones from every part of the Empire, from Japan and China, practically all of the countries of South America, Mexico, Cuba, Egypt, and Siam. Some of those orders, on account of their size or of the special engineering features involved, were unique in the history of British electrical engineering. Mr. W. C. Lusk, the managing director, seconded the motion, and the report was adopted.

West Gloucestershire Power Co., Ltd.

Presiding at the recent annual meeting, the chairman (Mr. J. Davidson) said that, in spite of the mining dispute, the sale of energy and the revenue had increased. During the year special campaigns had been carried out by the company and schemes for the assisted wiring of small premises and the hire of appliances had been instituted. The prospects were favourable; the receipts during the first three months of this year had shown a satisfactory increase as compared with the first quarter of 1926.

Lewes and District Electric Supply Co., Ltd.

The net receipts for last year rose from £9,545 to £10,683, and the net surplus from £3,550 to £3,868. It is proposed to repeat the dividend of 10 per cent. on the ordinary shares, to place £2,000 to reserve (against £1,000), and to carry forward £3,667.

Auckland Electricity Loan.

The Auckland (N.Z.) Electric Power Board has decided to borrow £150,000 in Australia for electrical development. The net interest is £5 10s. per cent., while the best London offer was £5 12s. 6d. per cent.

Veritys, Ltd.

The directors state that they hope to put forward this year proposals for dealing with the arrears of dividend on the cumulative preference and preferred ordinary shares.

Doulton & Co., Ltd.

A dividend of 6 per cent. has been declared on the ordinary shares (against 7½ per cent.).

Swiss Companies.

The *Société d'Exploitation des Câbles Electriques (Berthoud, Borel & Co.)*, Cortaillod, reports a net profit of £52,132 for the past financial year, as compared with £40,964 in 1925. The position of the company is unique in that the balance sheet shows no liability for capital, this having been entirely returned to the shareholders in 1920, to whom were then issued 5,000 participating certificates. After making provision for depreciation, &c., a sum of £36,000 is being distributed to the certificate holders at the rate of £7 5s. per certificate, as against £6 8s. in 1925.

The *Société Franco-Suisse pour l'Industrie Electrique*, Geneva, reports a net profit of 1,092,917 fr. for the past year, as compared with a loss of 3,920,410 fr. in 1925. A dividend of 4½ per cent. is being paid on the preference shares.

Austrian Company.

The *Felten and Guilleaume Company*, of Vienna, whose relations with the German parent company in recent years have become closer, reports net profits of 1,360,000 schillings, as compared with 890,000 schillings in 1925, and a dividend of 9 per cent., as against 6¾ per cent. in the previous year, has been declared. The production of long-distance cables, which was taken up as a new branch, afforded activity for the Vienna works during the whole of the year, while an improvement at the Styrian wire works only took place after the increase in the import duties. The export trade was difficult and was not profitable.

Swedish Company.

The *Nya Luth & Rosens Elektriska A.B.*, which acquired most of the assets of the former concern of the same title last July, states that it was not possible to work at full capacity. The turnover was considered satisfactory, however, although the sale prices were on a very low level.

German Company.

Voigt and Haeffner, Frankfort-on-Main, report that in general the electrical industry was not employed in proportion to its capacity so that extremely keen competition took place. The net profits declined from 664,000 marks to 521,000 marks, and the dividend is reduced from 8 per cent. to 6 per cent. An improvement is reported to have taken place in the current year.

French Company.

The *Compagnie Radio-France* proposes to pay a dividend of 46.80 fr. per share for 1926, as compared with 30 fr. for 1925.

Stocks and Shares.

Monday Evening.

Most people who are interested in stocks and shares have felt a tinge of disappointment at the Bank Rate being retained at 4½ per cent. instead of its falling to 4 per cent., as it was expected to do last week. Gold has been going out of the country so freely as to quench the hopes of any early drop to the level 4 per cent. in the rate, though as the money position changes with kaleidoscopic rapidity, there are still optimists who look for an early cut to the level 4 per cent. The disappointment has had a somewhat depressing effect upon prices of stocks and shares all round, in addition to those which are immediately affected through their close association with the money market.

New issues have gone back a little, and a good many others which were projected are postponed for the time being. This postponement is by no means a bad thing, because the new issues had been rushed out so precipitately as to arouse talk of possible indigestion in the stock markets. A pause to the flood of new borrowing will give time for the recent comers to settle into more permanent hands than those of the underwriters and stags, who, it may be, still hold a good part of certain offerings made lately.

The County of London Electric debenture, the price of which touched 1¾ premium, remains at 1¼ premium quoted a week ago. The Electrical Finance and Securities 5½ per cent. debenture stock, offered at 92½ is about ¼ premium, and the 7 per cent. cumulative preferences, which changed hands at a very small discount, strengthened to their par price, and attracted buyers. B.A. Lacroze 6½ per cent. debenture stock can be obtained at the issue price of 96½ or a little cheaper, free of stamp and fee, the yield being 5¾ per cent. outright, and 4s. per cent. more, allowing for redemption. The first interest payment is a partial one, due in November.

Another new issue of interesting character is the Metropolitan District Railway 5 per cent. debenture stock, redeemable 1933-1943, which has just come into the market for sale at 95 ex dividend. Interest payments are due in December and June. The yield, at the present price, is £5 5s. 3d. per cent. Taking redemption into account at the longer of the two dates, the return is raised to 5½ per cent. on the money. Not many years ago District debenture was a security tinged with speculative flavour, but in view of the remarkable manner in which the company has gone ahead, the new stock can be characterised as a first-rate investment, carrying in it the probability of a quiet rise to the neighbourhood of three figures as the stock becomes settled down into investment hands and as money grows cheaper.

There is very little prior-charge Tube Railways' stock offering at present, apart from a small amount of District 6 per cent. debenture obtainable at 114¼, January and July dividends, paying £5 6s. per cent. on the money, and about £2,000 of the same company's 4 per cent. Power House Rent Charge at 77, yielding £5 5s. 6d., also with interest due in January and July. Metropolitan Railway 3½ per cent. debenture, a full trustee stock, can be bought at 70¼, though the yield in this case is barely 5 per cent. on the money, and an oddment of the railway's 5 per cent. preference might be bought at 91¼, February and August dividends, at which price the return would be 5½ per cent. The debenture stocks of the steam railways pay between 5 and 5¼ per cent., the higher yield being offered by the London & North-Eastern Railway issues.

Metropolitans have dropped to 62½, and Districts, at the same price, are half a point down, the decline in the latter being due to the appearance of the new debenture stock. Underground Electrics are steady. British Electric Traction

ordinary has shed a couple of points, the 6 per cent. preference stock, however, being the fraction up at 120½. London United Tramway debenture advanced to 52½. The British Electric Traction Company has declared its usual dividend of 5 per cent., making 8 per cent. for the year, and the preference, as already announced, will receive an extra 2 per cent., also making 8 per cent. for 1926. The bonus of 10 per cent. on the ordinary stock is to be satisfied by the distribution of a new deferred ordinary stock to be created, and at the same time, steps are being taken to convert the ordinary stock into preferred.

The cable market is good, and fresh rises have been secured by the Eastern group. Eastern Telegraph is up 1½, Eastern Extensions 10s., and Westerns 2s. 6d. The Eastern Extension report shows a profit for last year of £1,116,000, an increase of £110,000 over the previous twelve months. The Eastern company made a profit of £1,098,000, a reduction of £330,000 on the year. This result is attributed to an increase in the expenses. The dividends on both companies continue at 10 per cent. free of tax for the year, and the financial position of the undertakings remains exceedingly strong. The Eastern Telegraph has reserves amounting to £3,230,000. Its issued capital is £7,000,000 in ordinary and £2,000,000 in debentures. The Eastern Extension's capital is 4¾ millions, and the company has nearly £4,000,000 in reserves.

The feature in the telegraph and telephone group is the manner in which South American telephone shares have gone ahead. For weeks past there have been steady rises in United River Plates, and a fresh gain of 2s. 6d. has lifted the price to 9⅜ Chili Telephones are 10s. up at 7⅞, and Orientals retain their rise of last week at 53s. 6d. With each week's rise in prices, curiosity becomes more piqued as to the reason which lies at the back of the buying that has brought about these substantial gains, and gossip grows stronger as to the possibility of the companies being taken over by some other group whose presumed purchases for control have brought about the handsome price appreciation.

Great Northern Telegraphs are easier at 28¼. Anglo-Portuguese Telephones are 1, showing a trifling decline.

Mexican utility issues are reactionary after their recent remarkable rises. Mexican Light & Power preferred, which went up to 115 a fortnight ago, have gone back to 110, and the common stock is a little easier at 44. On the other hand, Mexico Tramway bonds continue their rise at 81½. The reaction in Mexican Light preferred follows the ordinary course: the satisfactory news which had been expected in regard to a reorganisation of the capital having been published, people who had bought the stock on the anticipation of this announcement are content to take the excellent profits that they can secure by selling. Brazilian Tractions after a somewhat abrupt dip, shot up to 146½, which left the prices better on the week, but Barcelona Tractions, Sidros and others in this class, are disposed to droop by reason of the superior attractions offered by American Celanese and certain other shares which have recently sprung into popularity.

Changes in the prices of electricity supply shares are few and far between. The disappointment felt at the retention of the Bank Rate at 4½ per cent., when 4 per cent. had been commonly expected, became reflected in a slight dulness which crept into investment securities. This affected a wide area of stocks and shares, and it was accompanied by the talk of financial accommodation becoming contracted as the end of the first half of the year gets nearer. Bournemouth and Poole are weaker at 55s. 6d. Newcastle-on-Tyne ordinary eased off to 23s. There are no changes at all in the ordinary shares of the London electricity companies, but Charing Cross preference at 17s. 6d. have gained the pennies. Urban 5½ per cent. debenture came into demand at 99½.

Telephone Manufacturing shares have been sold with persistence, and the price dropped to 6s. International Automatics are better at 38s. 9d., while Automatic Telephones have not changed from 45s. Marconi shares touched 20s., then went back to the previous price of 18s. 9d., but the market is a good one and it is considered, in serious quarters, that the price is likely to harden. The argument rests upon the impression that, free from internal troubles and with a reorganised capital account, the Marconi Company is at last in a position to take advantage of the opportunities and the experience that lie at the command of the undertaking. But the day-to-day speculator knows that disappointment dogs the heels of the gambler in Marconi shares. Marconi Marines are higher at 27s. The rise of 1¼ per cent., to 8¾ per cent., in the dividend has encouraged anticipations of 10 per cent. for the current year. Canadians keep closely to 4s.

Manufacturing shares are disposed to be dull for choice. Cromptons make an outstanding exception with a half-crown gain at 12s. 6d. Henley's, Callender's and British Insulated have surrendered a little of their recent advances. The reason is to be found in the report of the British Thomson-Houston Company, showing a reduction of £111,600 in the profit, to £355,400, as compared with £467,000 in 1925. The ordinary share capital, of two million pounds sterling, then received 6 per cent., but is to go dividendless for 1926. General industrial conditions and the strike are blamed for the contraction in the company's earnings The preference shares stand at 22s. 6d., the 4½ per cent. debenture at 88, and the 7 per cent. debenture, redeemable, at 103½. Ever-Ready shares have gone back to 83s. 9d. The engineering list is listless and somewhat heavy, Babcock receding to 53s. 9d. The rubber market presents no points of fresh interest.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price May 23 1927.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	55/6	—1/6	5 0 11
Brompton Ordinary	1	10	8⅝	25/-	—	5 12 0
Charing Cross Ordinary	1	15	8½	25/-	—	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/6	+6d.	5 2 10
Chelsea	1	12	8⅝	25/-	—	5 12 0
City of London	1	15	10	13⅜	—	5 1 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	30/6	—	5 5 0
County of London	1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/6	—	5 19 2
Elec. Supply Corporation	1	10	10	32/-	—	6 5 0
Kensington Ordinary	1	15	8	25/-	—	5 12 0
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	8½	24/-	—	5 16 8
do. do. 6% Pref.	5	6	6	5⅝	—	5 6 8
Metropolitan	1	11	8	29/-	—	4 16 7
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary	1	7	5	23/-	—6d.	4 6 11
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	25/6	—	5 9 10
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1¼	—	6 3 0
Urban Ordinary	1	4	7	27/-	—	5 3 8
do. 6% Pref.	1	6	6	1⅛	—	5 13 0
Westminster Ordinary	1	15	8⅝	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	29/6	—	5 8 4
Home Rails.						
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	,,	5	3	62½	—1½	4 16 0
do. District	,,	3½	3½	62½	—½	5 12 0
Underground Electric	£1	Nil	1½	18/6	—	1 12 5
do. do. Income	Bonds	6	6	102	—	*5 17 8
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 19 0
do. Def.	,,	1½	1½	24⅛	—	6 3 9
Automatic Telephone	1	3	10	45/-	—	4 9 0
Chili Telephone	5	5	6	7⅞	+10/-	3 17 5
Eastern Extension	10	10	10	18⅝	+⅛	*5 7 3
Eastern Tel. Ord.	Stock	10	10	181½	+1½	*5 10 2
Globe Tel. and T. Ord.	10	10	10	18⅝	—	*5 6 0
do. do. Pref.	10	6	6	11	—	5 8 1
Great Northern Tel.	10	20	20	28½	—½	7 1 7
Indo-European	25	8½	10	46⅜	—	*5 7 6
Marconi	1	Nil	Nil	18/9	—	... ...
Marconi-Marine	1	7½	8⅝	27/-	+1/6	6 9 8
Oriental Telephone Ord.	1	12	12	53/3	—	*4 9 9
United R. Plate Tel.	5	8	8	9⅜	+⅛	*4 5 4
Western Telegraph	10	10	10	17½	+⅛	*5 14 3
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3½	—	7 17 2
do. do. 2nd Pref.	5	6	6	3 1/16	—	8 2 8
do. do. 5% Deb.	Stock	5	5	72½	—	6 18 0
British Electric Traction Ord.	,,	8	—	148	—2	5 8 1
do. do. 6% Pref.	,,	6	8	120½	+½	6 12 10
Brazil Traction	100	5	6	146½	+5	4 1 8
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	89½	—	5 11 9
do. do. Preferred		6⅜	6¼	118½	—	5 5 6
do. do. Deferred	,,	8	—	158	—	*5 1 3
do. do. Deb.	,,	4½	4½	80½	—	5 5 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	7/9	—	Nil
London United Tram. Deb.	Stock	4	4	52½	+1½	7 12 5
Mexico Trams, 5% Bonds	—	5	5	81½	+1	6 2 8
Mexican Light Common	100	Nil	Nil	44	—1	Nil
do. Pref.	100	Nil	Nil	110	—3	Nil
do. 1st Bonds	—	5	5	74½	—	6 14 3
Yorkshire (West Riding)	1	5	—	8/9	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	1	13	13	53/9	—9d.	4 16 11
British Aluminium Ord.	1	12½	10	43/9	—	4 11 4
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 6
British Insulated Ord.	1	15	15	67/6	—1/3	4 8 11
Brush Ord.	1	10	10	28/3	—	7 1 7
Callenders	1	15	—	3 1/16	- 1/16	4 7 3
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	12/6	+2/6	... ...
Edison-Swan	4/-	10	10	10/	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	10	28/9	—	6 19 2
Enfield Cable Pref.	1	7½	7½	1¼	—	6 6 4
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	3	—	12/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	1	20	—	89/9	—3d.	4 9 5
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1⅜	—	*4 9 0
Johnson & Phillips	1	17½	12½	2½	—	5 0 0
Met.-Vickers Ord.	1	8	8	27/6	—	5 11 4
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	7½	7½	28/6	—	5 5 2
Telegraph Construction	12	10	10	28½	—	*4 4 2

* Dividends paid free of Income Tax.

French Foreign Electrical Trade.

Distribution of Imports and Exports.

THE French Government has now published a detailed statement of the foreign trade of France, by countries, for 1925. From this the following figures relating to imports and exports of electrical and allied material have been extracted. Comparative figures for 1924 are given and a note is added of increases or decreases. The metric quintal = 220 lb.

Exports.

	Metric quintals. 1924.	1925.	Inc. or dec.
Dynamo-electric machinery—			
Total	40,780	47,977	+ 7,197
To Belgium	15,000	9,185	− 5,815
,, Switzerland	438	597	+ 159
,, Spain	5,195	3,607	− 1,585
,, Algeria	2,666	4,370	+ 1,704
,, Tunis	1,138	1,053	− 85
,, Morocco	1,452	2,419	+ 967
,, Indo-China	1,010	3,315	+ 2,305
,, Egypt	835	1,351	+ 516
Electrical and electro-technical apparatus—			
Total	43,632	39,888	− 3,744
To Great Britain	2,448	2,581	+ 133
,, Belgium	10,865	10,114	− 751
,, Switzerland	1,275	1,330	+ 55
,, Spain	5,421	5,372	− 49
,, Algeria	3,107	3,757	+ 650
,, Morocco	1,739	1,824	+ 85
,, Indo-China	1,112	1,737	+ 625
,, Italy	1,483	2,240	+ 757
Dynamo and motor frames—			
Total	333	90	− 243
To Germany	—	38	+ 38
,, Spain	17	7	− 10
,, Algeria	20	16	− 4
,, Morocco	218	25	− 193
Insulated wires and cables—			
Total	52,367	23,727	−28,640
To Belgium	2,425	2,043	− 382
,, Egypt	1,397	1,377	− 20
,, Algeria	7,395	7,500	+ 105
,, Tunis	1,502	1,839	+ 337
,, Morocco	*	2,593	—
,, Spain	927	1,302	+ 375
,, Great Britain	801	2,222	+ 1,421
Armatures and parts for electrical apparatus—			
Total	9,904	11,649	+ 1,745
To Belgium	1,409	3,536	+ 2,127
,, Spain	693	506	− 187
,, Great Britain	1,127	727	− 400
,, Algeria	651	984	+ 333
,, Morocco	637	659	+ 22
,, Germany	—	1,103	+ 1,103
Incandescent electric lamps—			
Total	2,523	2,705	+ 182
To Great Britain	142	430	+ 288
,, Belgium	358	174	− 184
,, Algeria	362	299	− 63
,, Indo-China	500	437	− 63
Accumulators and parts—			
Total	6,903	7,896	+ 993
To Great Britain	1,436	2,154	+ 718
,, Belgium	1,599	1,556	− 43
,, Spain	366	564	+ 198
,, Algeria	745	739	− 6
,, Morocco	495	420	− 75
Dry cells—			
Total	2,963	2,988	+ 25
To Great Britain	440	1,198	+ 758
,, Belgium	1,096	556	− 540
,, Algeria	239	184	− 55
,, Morocco	150	140	− 10

Imports.

	Metric quintals. 1924.	1925.	Inc. or dec.
Dynamo-electric machinery, 1,000 kg. and over—			
Total	12,912	19,903	+ 6,991
From Belgium	—	1,298	+ 1,298
,, Germany	895	5,438	+ 4,543
,, Switzerland	6,482	8,584	+ 2,102
,, United States	3,673	1,199	− 2,474
,, Great Britain	574	1,808	+ 1,234
Dynamo-electric machinery, 50-1,000 kg.—			
Total	6,780	5,609	− 1,171
From Switzerland	1,863	1,789	− 74
,, Belgium	977	572	− 405
,, United States	825	498	− 327
,, Germany	670	1,211	+ 541
,, Great Britain	726	784	+ 58
Dynamo-electric machinery, less than 50 kg.—			
Total	7,155	5,609	− 1,546
From Germany	*	1,211	—
,, United States	4,949	498	− 4,451
,, Italy	852	298	− 554
,, Switzerland	227	1,789	+ 1,562
Electrical and electro-technical apparatus, with insulated windings—			
Total	10,161	7,036	− 3,125
From Great Britain	3,175	1,470	− 1,705
,, Germany	932	1,679	+ 747
,, Switzerland	1,294	1,076	− 118
,, United States	3,108	1,300	− 1,808
Ditto, without insulated windings—			
Total	5,020	4,779	− 241
From Great Britain	1,048	845	− 203
,, Switzerland	1,018	1,033	+ 15
,, United States	1,247	860	− 387
,, Germany	438	1,110	+ 672
Dynamo and motor frames—			
Total	1,560	842	− 718
From Great Britain	287	52	− 235
,, Belgium	1,273	788	− 485
Insulated wires and cables—			
Total	1,443	3,057	+ 1,614
From Great Britain	246	949	+ 703
,, Switzerland	344	496	+ 152
,, United States	289	657	+ 368
,, Italy	229	522	+ 293
Armatures and parts for electrical apparatus—			
Total	7,926	4,827	− 3,099
From Great Britain	817	377	− 440
,, Switzerland	1,539	1,561	+ 22
,, United States	1,399	1,162	− 237
,, Germany	817	636	− 181
Metal-filament lamps, mounted—			
Total	4,972	5,093	+ 121
From Holland	4,509	4,370	− 139
Ditto, unmounted—			
Total	56	77	+ 21
Accumulators and parts—			
Total	5,687	8,220	+ 2,533
From Great Britain	4,112	6,078	+ 1,966
,, Belgium	277	577	+ 300
,, Switzerland	698	60	− 638
,, Czecho-Slovakia ...	*	741	—
Dry cells—			
Total	116	105	− 11
From Denmark	96	85	− 11

* Figures not available.

Electric Ploughing in France.

A party of members of the Société Française des Electriciens recently visited Puiseux (Seine et Oise) to inspect a new system of electric ploughing which has recently been introduced there by the Société des Travaux Electriques. The electric power available is 15,000-V, three-phase, which, by means of a country-type transformer station, is stepped down to 500 V. A flexible cable conducts the power at this pressure to a winch operated through reduction gearing by a 60-h.p. three-phase motor. The winch cable lies on the ground and passes round four pulleys fixed at the corners of the field to be ploughed, so that the plough connected with the cable can reach any part of the field. The Travaux Co. states that the consumption of energy is about 100 kWh per hectare of ploughed land.

The Electrical Imports of Egypt.

THE following statement, showing the imports of electrical and similar goods into Egypt during the year 1926 is taken from the recently-issued trade statistics. The figures for 1925 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1925. £E	1926. £E	Inc. or dec. £E
Electrical machinery and parts—			
Total	165,000	152,000	− 13,000
From Great Britain ...	31,000	21,000	− 10,000
,, United States ...	6,000	14,000	+ 8,000
,, France	52,000	41,000	− 11,000
,, Italy	12,000	19,000	+ 7,000
,, Switzerland	10,000	11,000	+ 1,000
,, Germany	29,000	31,000	+ 2,000
Internal combustion engines, stationary—			
Total	650,000	425,000	−225,000
From Great Britain ...	371,000	215,000	−156,000
,, France	4,000	4,000	—
,, Italy	7,000	12,000	+ 5,000
,, Switzerland	135,000	55,000	− 80,000
,, Germany	123,000	115,000	− 8,000
Electric lamps—			
Total	45,000	40,000	− 5,000
From Great Britain ...	1,600	2,600	+ 1,000
,, Germany	9,600	7,000	− 2,600
,, France	2,000	1,400	− 600
,, Holland	15,000	16,000	+ 1,000
,, Czecho-Slovakia ...	1,300	300	− 1,000
,, Austria	7,000	8,000	+ 1,000
Carbon rods for arc lamps—			
Total	500	600	+ 100
Electric cars and wagons—			
Total	1,000	6,000	+ 5,000
Telegraphic and telephonic apparatus and fittings—			
Total	121,000†	—	—
From Great Britain ...	92,000	—	—
,, France	3,600	—	—
,, Sweden	22,000	—	—
Telegraph and telephone apparatus, ordinary—			
Total	*	30,000	—
From United Kingdom ...	*	11,000	—
,, Sweden	*	18,000	—
Radio apparatus—			
Total	*	2,000	—
Telephone and telegraph parts and fittings, wireless or not—			
Total	*	70,000	—
From United Kingdom ...	*	35,000	—
,, Sweden	*	30,000	—
Meters, electric, gas and water—			
Total	26,000	27,000	+ 1,000
From Great Britain ...	3,000	1,000	− 2,000
,, France	16,000	14,000	− 2,000
,, Germany	3,000	5,000	+ 2,000
Electric and gas pendants—			
Total	64,000	63,000	− 1,000
From Great Britain ...	2,000	1,400	− 600
,, France	28,000	32,000	+ 4,000
,, Germany	15,500	14,000	− 1,500
,, Italy	12,500	10,500	− 2,000
Electro-medical apparatus—			
Total	9,300	16,600	+ 7,300
From Germany	4,400	8,600	+ 4,200
Other electric appliances and batteries—			
Total	44,000	53,000	+ 9,000
From Great Britain ...	9,000	14,000	+ 5,000
,, Austria	600	300	− 300
,, France	6,800	6,600	− 200
,, Germany	14,000	15,000	+ 1,000
,, Italy	8,000	8,000	—
,, Switzerland	700	—	− 700
,, United States ...	3,000	5,000	+ 2,000
Electric cables, insulated—			
Total	40,000	51,000	+ 11,000
From Great Britain ...	1,500	3,250	+ 1,750
,, Belgium	5,000	9,000	+ 4,000
,, France	8,000	12,000	+ 4,000
,, Germany	12,000	17,000	+ 5,000
,, Italy	7,000	6,000	− 1,000
Electric wire and cable, armoured—			
Total	69,000	40,000	− 29,000
From United Kingdom ...	3,000	4,000	+ 1,000
,, Belgium	11,000	4,000	− 7,000
,, France	27,000	16,000	− 11,000
,, Germany	16,000	15,000	− 1,000
,, Italy	11,000	2,000	− 9,000
Uninsulated electric copper wire—			
Total	55,000	15,000	− 40,000
From Great Britain ...	16,000	1,000	− 15,000
,, France	25,000	11,000	− 14,000
,, Germany	12,000	1,000	− 11,000
,, United States ...	1,000	—	− 1,000
Electric light fittings—			
Total	70,000	69,000	− 1,000
From Great Britain ...	4,500	6,700	+ 2,200
,, Belgium	2,000	4,000	+ 2,000
,, France	14,000	17,000	+ 3,000
,, Germany	34,000	24,000	− 10,000
,, Italy	5,000	6,000	+ 1,000
,, Switzerland	4,000	4,000	—
,, United States ...	3,000	4,000	+ 1,000

£E=£1 0s. 6½d.

* Not specified.

† See next 3 items.

Electricity Supply in Great Britain.

Fuel Consumption Returns for 1925-26.

THE summarised monthly returns made to the Electricity Commissioners were published last week (H.M. Stationery Office, price 1s. 6d. net), and on this occasion the Return contains a complete alphabetical list of all the generating stations from which records were received, and in most cases a summary of the technical results of working, though in some instances the latter are not available for publication. The returns relate to 584 stations.

The lowest fuel consumption recorded was at Barton (Manchester Corporation), namely, 1.36 lb.; the output was 269,036,130 kWh generated, thermal efficiency 21.51 per cent., maximum load 74,790 kW, and load factor 41.0 per cent.

North Tees station (North-East Coast companies) came next with 1.51 lb., the output being 167,194,850 kWh, with a maximum load of 40,500 kW, and a load factor of 47.1 per cent. The thermal efficiency was 18.75 per cent. Carville produced 250 million kWh for 1.69 lb. per unit, at an efficiency of 18.95 per cent., the maximum load being 54,000 kW and the load factor 52.9 per cent.

The Radcliffe station of the Lancashire Electric Power Co. generated 131,315,948 kWh for 1.67 lb. per unit, with an efficiency of 17.45 per cent. and a load factor of 31.8 per cent. Other stations which used less than 2 lb. per kWh were Grove Road (Central Electric Supply, Ltd.) 1.81, Mersey Power Co. 1.81, Dalmarnock (Glasgow Corporation) 1.85, Valley Road (Bradford Corporation) 1.85, Whitebirk (Blackburn Corporation) 1.91, Bow (Charing Cross Co.) 1.91, Thornhill (Yorkshire Electric Power Co.) 1.91, Dunston (North-East Coast) 1.92, Clyde's Mill (Clyde Valley Electrical Power Co.) 1.96, Prince Rock (Plymouth Corporation) 1.96, and Prince of Wales (Rotherham Corporation) 1.98 lb. per kWh.

The average consumption of five stations in Class A (over 200 million kWh per annum) producing 1,241 million kWh, was 1.89 lb. coal per kWh. Nine stations in Class B (from 100 to 200 million kWh) produced 1,355 million units, with an average consumption of 2.11 lb., and 32 stations in Class C (50 to 100 millions) produced 2,237 million kWh, with a consumption of 2.21 lb. These 46 stations therefore generated 4,833 million kWh, at an average consumption of 2.1 lb. per kWh; the aggregate output of all the steam stations was 7,804 million kWh, with an average consumption of 2.4 lb.

Of the oil-driven stations, the lowest consumption was recorded by the Bognor Gas Light and Coke Co., and Felixstowe (East Anglian Electric Supply Co.), 0.64 lb. per kWh. Both stations had, roughly, 600,000 kWh output, a thermal efficiency of 27½, and load factors of 17 to 19 per cent. The aggregate output of 101 oil-driven stations was 45½ million kWh, at an average consumption of 1.05 lb. per kWh.

The only gas power station in Group G is that of Guernsey, which produced over three million kWh with a consumption of 1.61 lb. of coal, and a thermal efficiency of 17.23 per cent. Nine stations in Groups H and I generated 8.3 million kWh, with an average consumption of 3.1 lb., but the lowest consumption was recorded at the Littlehampton station of the Sussex Electricity Supply Co., Ltd., namely, 1.48 lb. The total output of 57 gas-producer stations was 20½ million kWh, and the average consumption 2.60 lb. of coal.

Metal-Clad Draw-out Switchgear.

A comparison of the horizontal and vertical types.

By THOMAS CARTER, M. Inst. C.E., M.I.E.E., Fel. A.I.E.E.

I HAVE had an opportunity lately of examining the question of metal-clad draw-out switchgear from the point of view of comparing the horizontal with the vertical types, to see if there is really any such inherent advantage of either type over the other as various manufacturers assert there is. Whether the conclusions I have come to are sound may be a matter of opinion: I have no doubt about them. It appears to me that the subject is one that should be looked at very broadly, because it has in some respects an international bearing, and is not merely something for one maker to outdo another in by devising a variation in design with the object of having something different to talk about. What I mean is that metal-clad switchgear is the result of intense British thought and concentration on an ideal (the word is not too strong, as those who know even a few of the facts are aware)—the ideal of making British standard switchgear a pattern for the world to follow.

It is well known that the originators of the metal-clad draw-out type refused to be turned aside from their conviction that this was the right thing, to be pushed day after day through thick and thin until it went home everywhere; and in the end their view prevailed, and people at home and abroad realised that they could not afford to be without this good aid to security in operation. Many manufacturers, in this country and out of it, now make metal-clad draw-out switchgear, and the vertical type, which was made on a very small scale many years ago, has recently cropped up again. Claims have been made for it as though it were on a level in merit with the horizontal type: these claims appear to me to be unjustifiable. I am thinking of the vertical type in which the draw-out is downwards; there is a large vertical type in which the draw-out is upwards, and special needs have led to the development of that type to fulfil a particular purpose. It does not enter, therefore, into the present discussion, which relates to gear of small and moderately large sizes only. What must be most carefully safeguarded is that metal-clad draw-out switchgear of any type made by a British manufacturer shall continue to be, as it certainly has been, in advance of gear made anywhere else; and it is thus essential that British practice shall be founded on a desire to give the world (including, of course, Britain itself) the type that from the most unbiassed point of view can be said to be the best. While I cannot pretend that a statement of the conclusions of one person will settle the question once and for all, I venture to think that the expression of a carefully-arrived-at opinion, with some definite knowledge behind it, may at least provoke further thought on the subject, the great importance of which will not be disputed by anyone. I feel quite sure that when the advantages of one type are carefully weighed against those of the other, the horizontal will not only hold its own, but will be found to be really very much superior to the vertical in all important respects.

It seems to me that the horizontal type is the one that would naturally be chosen because it embodies an obviously superior mechanical principle, namely, that of pushing something along on the level, and so having to overcome friction only, instead of lifting or lowering its whole weight vertically. The horizontal type supports the moving parts on its framework in precisely the same way at every point during the whole range of their travel; the framework itself forms the guide for the movement; and the gear for effecting the withdrawal is, to my mind, much simpler in the horizontal type. We have, in fact, an example of the same kind of contrast when we compare a vehicle moving on the level on a simple pair of rails with a lift working in a vertical shaft where it has to be provided with all kinds of safety devices and special guides to keep it in the desired position while it is moving upwards or downwards, not to speak of a suspension strong enough to carry the whole weight, and yet capable of being itself moved in such a way as to communicate its motion to the whole mass of the moving parts. It is claimed that it is much easier to remove the circuit-breaker and the oil-tank, or the oil-tank alone, from the vertical than from the horizontal type of gear, because the movement in the latter is first horizontal and then vertical, as compared with only vertical movement in the former. There is really much less in this than might appear, the fact being that, at any rate when a number of units are combined into a whole switchboard, a horizontal motion is required after the vertical lowering in the vertical gear if the part removed is to be taken out into the passage-way. Since, therefore, motion in two planes is necessary with both kinds of gear, neither of them is markedly superior to the other in this respect; but, if there is anything in it, the horizontal type seems to me to have the advantage in that the part to be removed is clearer of the rest of the gear if it is first racked out horizontally than if it is first lowered vertically, because it is then more accessible, and easier to place on a truck for removal.

The shape of horizontal gear, and the relative disposition of its several parts, are such that they quite clearly suit the convenience and promote the comfort of the people attending to it much better than vertical gear does. It is very much easier to stand and inspect horizontal orifices at approximately the ordinary level of the eyes than to put oneself into the rather contorted position necessary when vertical orifices have to be looked into; switchgear, in a word, should be made for man, and man ought not to be expected to have been made for switchgear. Again, when alternative busbars are provided, and the simplest method, namely, the plug method, of changing from one to the other is in use, the ease and rapidity with which a change-over can be made in horizontal gear certainly tell in favour of that type. Another point in its favour also is that should a complete circuit-breaker have to be exchanged, the process, for reasons already stated, is simpler in horizontal than in vertical gear, and is probably rather quicker too, because racking out and racking in are more rapid operations than lowering and raising.

The removable parts of horizontal gear, being always supported on permanently fixed structures, are easily pushed home to their full-in position, and equally easily locked there. Vertical gear, on the other hand, is more complicated in this respect, because the movable parts must have their weight taken on hangers of some kind, and these have obviously to be removed or got out of the way somehow before the gear is lowered, and must be replaced securely when the movable parts are put into their working position again. A further great advantage of horizontal gear is that when its movable parts are in the withdrawn position, and the tank is lowered away, it is possible to inspect all the

working parts adequately, just because they are well away from the rest of the gear, whereas the corresponding parts of vertical gear are no further away when they are withdrawn than when they are in the working position, and thus the rear parts cannot be made as fully visible. The operating mechanism of horizontal gear is very accessible, and although it certainly sticks out a little beyond the front of the main part of the gear, the projection is a very small one, and the convenient position of the mechanism far more than compensates for the slight amount of additional room required. The cable box is ordinarily mounted near the top of vertical gear, and is usually in such a position that it is less accessible when the movable parts are withdrawn than the cable box of horizontal gear, which takes a natural place underneath, and so is snugly housed and yet quite easily got at when necessary.

It has already been mentioned, but is worth mentioning again while the question of space required is being dealt with, that horizontal as well as vertical motion takes place during the process of completely removing either a vertical or a horizontal tank or circuit-breaker. It is therefore clear that a certain width of passage-way is required for each type, and the advantage claimed for vertical gear, that space is saved in this respect, is really largely illusory. Again, now that there is a growing tendency to use basements for housing switchgear in, the amount of headroom required is becoming exceedingly important, because it is so much more costly to provide by excavation than sideroom, and under these conditions the smaller height of horizontal gear gives it an advantage over vertical gear already great, and likely to increase.

If a short-circuit occurs in a large supply system, while both the vertical and the horizontal types of switchgear are ordinarily robust enough not to be strained, the stresses set up are occasionally so great that some parts are damaged. The disposition of the internal conductors in vertical gear is such that any occasional fault so bad as to lead to a wholly abnormal strain may quite easily do considerable damage to the bus-bars, because they are situated directly above the circuit-breaker and its tank, and the mechanical displacement resulting from the fault is reasonably certain to be an upwards one, and to do damage in an upwards direction. In the horizontal type, on the other hand, the part of the gear likely to move when the circuit-breaker is strained is well in front of the bus-bars; any displacement in a vertical direction will simply raise it more or less from its mechanical supports; and no possible risk of damage to the bus-bars can arise from such a movement. This is so important from the point of view of continuity of supply that it makes it one of the great advantages of horizontal gear over vertical that in the event of a short-circuit violent enough to strain the circuit-breaker unduly, and so, consequently, to damage the bus-bars of vertical gear, the bus-bars of horizontal gear will remain quite unaffected. Bus-bars are so vital a nerve-centre of any supply system that if they are damaged no one can tell how serious the consequences may be; they must be preserved in security, therefore, at all costs; and it is just because horizontal gear is in the last resort slightly flexible mechanically, in such a way as to confine whatever damage may be done to a part less vital than the bus-bars, that it is so undoubtedly superior to vertical gear in this essential particular. Accidents in horizontal gear, resulting in the putting out of commission of an individual unit, obviously cannot interrupt more of the supply than the part that was controlled by that unit, whereas the much more probable destruction of bus-bars in vertical gear, arising out of, say, the explosion of a tank, may cause wholesale interruption.

Duplicate systems of bus-bars are required in many switchgear equipments, and I do not think it is seriously questioned that the horizontal type is much more suitable than the vertical for the two undoubtedly simplest methods of selecting alternative bus-bars, namely, those using either removable plug contacts or oil-immersed change-over switches mounted in the hoods, in which there is ample room for them. A third method of selecting alternative bus-bars is to have complete duplicate circuit-breakers. These may be quite satisfactory if they are entirely separate, and each has its own tank, but even then elaborate interlocks are required to prevent the closing of both circuit-breakers together, and the gear is thus made more complicated, even under the best conditions, when this method is used. Owing to the ease with which the simpler selecting appliances can be mounted, the standard tendency is to use one or the other of these in gear of the horizontal type. The difficulty of applying them to vertical gear, for lack of room, leads to the more frequent adoption of the double circuit-breaker; and the necessity for keeping the overall size small has actually caused some makes to be designed with both the circuit-breakers in one common tank. The futility of this as a means of achieving anything except increased damage in a breakdown will be realised after a very little thought. There is the greatest possible danger, if a fault should occur, that the trouble may spread in the tank to the contacts of the circuit-breaker nominally out of commission, and may thus actually involve both sets of bus-bars, even when only one circuit-breaker has been mechanically closed. It seems to be beyond doubt, therefore, that the horizontal type of switchgear is quite definitely better than the vertical in respect of facilities for the selection of alternative bus-bars.

The last point I want to refer to is concerned with weather-proofness. At first sight, it might appear that the vertical direction of the orifices in vertical gear would make that type much less likely to suffer from dripping water than the horizontal type, with its horizontal orifices; and, so far as that comparatively simple point matters, it is true that a vertical shield is in itself more directly rainproof than a horizontal shield. There is, however, far more than that to be taken into account. It is, incidentally, not difficult to make a weather-proof and rain-tight joint between the fixed and the moving parts of horizontal gear; but the real point is that the ordinary humidity of the atmosphere and sweating are sources of much greater danger than dripping water ever is, and the care that has to be taken in making horizontal gear water-tight is also effective in making it thoroughly proof against insidious damp from any source. The need to protect insulating surfaces against this real danger makes it equally essential to provide complete water-tightness and damp-proofness in both kinds of gear, and unless this is seen to in vertical gear (for example, by immersing the isolating contacts in oil and avoiding the use of air as an insulator, the possibility of doing which is in truth practically the only inherent virtue of the kind of vertical gear we are considering), any idea that it has an advantage over horizontal gear in this respect is an entire fallacy. Indeed, the very fact that a vertical orifice looks safer may result in the giving of less care to the joints on the assumption that drip-proofness is all that is required, and thus a false sense of safety may be created.

If I have succeeded in expressing myself as I have wanted to do, I will have made it clear that the balance of advantage lies with the horizontal type for small and moderately large units. This is a matter in which experience counts enormously; and I am, therefore, encouraged to believe that my conclusion is sound by the fact that the manufacturers who have been making metal-clad switchgear for by far the greatest number of years still stick closely to their original horizontal type in the sizes for which it is obviously the most suitable. There are many sufficient proofs that this is not due to mere narrow conservatism, and my own view is that it clinches the argument in a way that brings one unavoidably to the conclusion that the interests of switchgear users (here I get back to the international point of view) will be best served if British manufacturers concentrate on still further perfecting horizontal-type switchgear, which has already done so much to establish a prestige for them in all parts of the world.

Electricity Tariffs.

A special two-part tariff in combination with an automatically-operating peak meter-switch device, introduced by the South Swedish Power Co., which has proved very successful in stimulating the domestic use of electricity for heating purposes, &c., during "off-peak" periods.

By ALFRED EKSTRÖM, Sc.D.

FOR the encouragement of the use of electricity on as large a scale and over as large an area as possible, a low price of energy is a *sine-qua-non*.

The bulk of the cost of the production and transmission of electrical energy is a fixed charge; the variable charge, that in proportion to the kWh sold, is only a fraction of 1d. per kWh. Therefore the more thoroughly the plant can be utilised, the greater will be the number of kWh upon which the fixed charge can be distributed; thus the problem involves not only the framing of tariffs, but also the stimulation of fresh demands for electricity and the introduction of suitable metering devices.

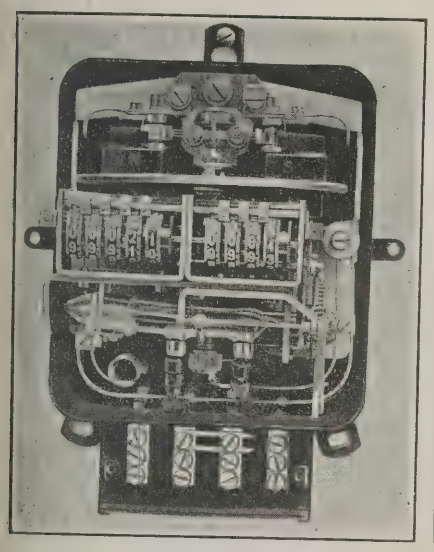


Fig. 1.—Peak Meter without Cover.

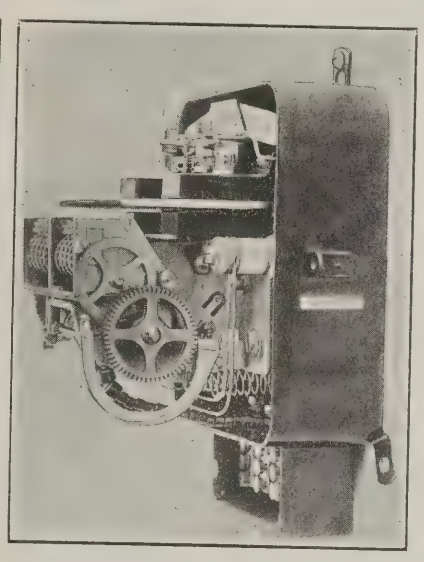


Fig. 2.—Side View of "Subtraction" Meter.

Fixed Annual Price per Kilowatt.

In Norway a certain number of kilowatts per annum has hitherto generally been contracted for. In Oslo, for example, a subscriber pays £10 per kilowatt per year, and is then able to make use of it for as many hours as he wishes. For measuring, simple "current limiters" are used which, so soon as the amount of power subscribed for is exceeded, periodically disconnect the supply, alternately extinguishing and switching on the lamps. This tariff presupposes a supply of cheap water-power; even in Norway, however, a commencement has been made to depart from this system, as it not only encourages a waste of energy (it is considered that about 40 per cent. is wasted through the subscribers not having any economic interest in saving energy), but also possesses many drawbacks.

A Purely Kilowatt-hour Price.

In Sweden a certain price is charged per kilowatt-hour to a large extent: in many places a higher price is charged for lighting than for motor power, special meters being used for the different purposes; in other places a higher price is charged during the lighting periods than during the rest of the day, in which case only one meter is necessary, but it must be fitted with two registering devices for measuring the current according to both the high and low tariffs, as well as a clock, which (as a rule monthly, according to daylight conditions) resets the periods during which the energy consumed shall be registered at the one or the other tariff.

In Switzerland there has even been introduced a third tariff for stimulating the night consumption of energy. Multiple-tariff meters, however, are not quite reliable, and also entail a great deal of work on account of the monthly re-settings, for which reason these tariffs are not very popular.

The Two-Part Tariff.

So far as only large consumers of electricity are concerned, this form of tariff may be considered satisfactory. For small consumers, such as agriculturists, households, and handicraft, however, such a tariff is inappropriate. They will probably be far from anxious to make a purely temporarily occurring maximum load the basis for the calculation of an appreciable portion of the energy cost; further, the electricity meters necessary for this purpose are far too expensive to make them suitable for small consumers of energy. For this reason other methods of calculation have to be made the basis for the fixed charge. In agricultural cases the number of hectares of arable land is therefore often used as a basis for this purpose; in the case of dwellings the number of lamps fitted, or the number of rooms, &c., being the criterion. A medium fixed charge in Sweden is 11 shillings per hectare, and for non-agriculturists two lamps are generally taxed similarly to one hectare.

The variable charge has hitherto generally been a purely kilowatt-hour charge. In order to encourage the use of energy during non-lighting time double-tariff meters with a low kilowatt-hour charge have frequently been retained, but if this is to achieve any success, the charge must be exceedingly low. Such a tariff is nevertheless not without its risk: in America, for example, such cases have revealed the surprising fact that on every Sunday morning so many people used electricity for heating their bath water that there were difficulties in the transmission of power.

The Peak-Meter System.

Of late, however, a peak-meter system has been introduced in Sweden which, to judge from all appearances, will assume great importance as regards the use of electricity in the home. This tariff is based upon the fact that the energy subscribed for can be divided (i) partly into a certain optional load, for which the fixed annual charge is made per kilowatt per year, no matter how many hours the subscriber makes use of it, and (ii) partly into the energy consumed *beyond* that load,

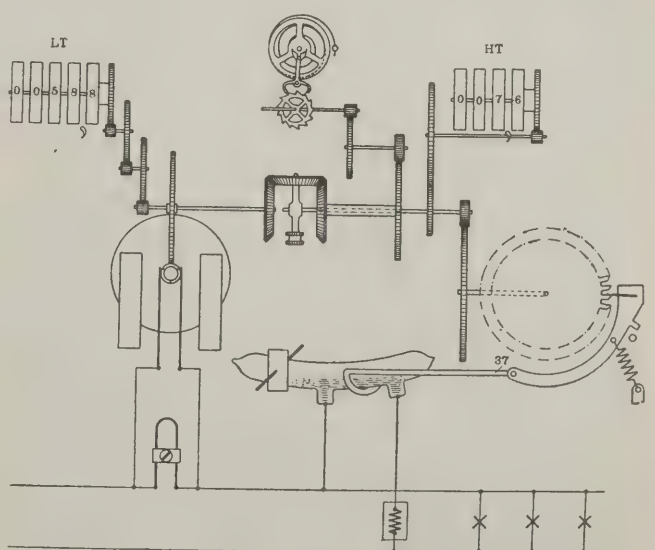


Fig. 3.—Diagrammatic Representation of Ericsson Meter and Switch.

for which a certain charge is made for each kilowatt-hour consumed. The energy consumed *below* the optionally-limited load is called *basis energy;* that consumed *over and above* the former is called *supplementary energy*. The basis energy is paid for, by way of example, at the rate of £14 per kW per year, and the supplementary energy at the rate of 1½d. per kWh. As experience has shown that a longer period of use of the basis energy than 7,000 hours per year is never reached, £14 per kW therefore corresponds to a price of at most ½d. per kWh. The choice of such a tariff depends upon the availability of a comparatively simple and reliable so-called " subtraction " or peak meter. The City of Stockholm

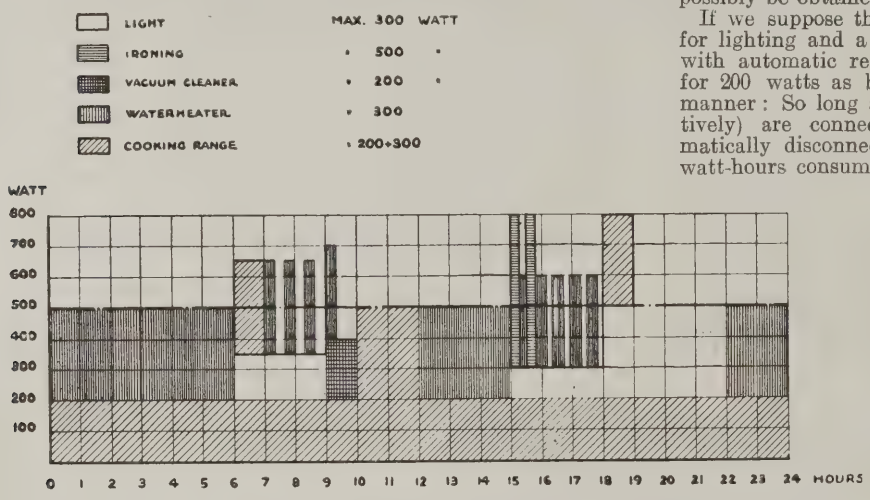


Fig. 4.—Load Curve, Lighting and Domestic Apparatus.

electricity works have designed an excellent meter of this kind (figs. 1, 2 and 3), which measures and registers *both* those kilowatt-hours consumed below a certain optionally-adjustable load (the so-called *basis load*) and also those kilowatt-hours consumed over and above that load (the so-called *supplementary energy*). This meter is manufactured by the L. M. Ericsson Company, and it might be considerably simplified if only the kilowatt-hours consumed as excess energy were to be measured, for it is really unnecessary to measure the kilowatt-hours consumed as basis energy, inasmuch as a fixed charge per kilowatt per year is made for it, no matter how many hours in the course of the year it is utilised.

The meter is combined with an automatic connecting and disconnecting device, by means of which the basis energy can be automatically rigorously utilised when it is not used, for instance, for lighting or by other devices. The electric water heater for family use is especially advantageous for such a purpose, enabling the electrical energy to be stored in the form of heat whenever it is not used by other devices which have priority in the utilisation of the basis load. It is desired to emphasise the advantage of the bulk of the power subscribed for being consumed as basis energy at the comparatively low price, whilst the subscriber is entitled at any moment whatsoever to exceed this on payment of the higher price for energy consumed on such occasions. This is also a great advantage for the consumer, as compared with the current-limiters employed in Norway, which do not permit of a temporary use of a higher load than that for which one has subscribed. In so far as the price of basis energy is reduced as mentioned above, the use of electrical energy for heating water in households and farm dairies becomes important. How essential the price for basis load in this connection is becomes apparent from the following examples:

Examples of " Subtraction " Meter Operation.

Lighting and Water Heating.—Assume the sale to various subscribers of basis energy at £17, £14, or £12, respectively, and excess energy at the rate of 1½d. per kWh; the maximum consumption for lighting has been found to be about 50 watts for each person, with an annual period of use of 800 hours. If by means of suitable automatically-regulatable apparatus, such as the above-mentioned L. M. Ericsson meter, a hot-water tank is automatically connected in circuit so soon as the maximum amount ceases to be consumed, it will probably be possible with advantage also during some days in December and January, when lighting is most called upon, to utilise for the heating of water an average of 50 watts for about 18 hours per day, or 0.050 by 18=0.9 kWh. For this from 7 to 8 litres of water could be heated from 10 to 90 deg. C. with an efficiency of 80 per cent. of the water heater.

The cost of lighting current would, if the maximum load consumed during 800 hours is consumed as excess energy, be $0.050 \times 800 \times 1\frac{1}{2}/100 = 5$s. per head. Furthermore, a fixed annual charge will have to be added; this, however, is levied only for the lighting subscription, not for water-heating, for which reason it can be omitted from the comparison.

Should, however, a water heater be connected which consumes electrical energy only so far as the maximum load is not used for lighting, and obtains from 7 to 8 litres of warm water per day for 300 days per annum, the energy-consumption for the heating of the water would be $300 \times 0.9 = 270$ kWh. With a basis price for power at the rate of £17, £14, or £12, respectively, the whole subscription for 0.050 kW would cost 17s., 14s., or 12s., respectively. If we still calculate the expense for lighting at 5s., then 12s., 9s., 7s., respectively, would be on account of water-heating, or about 0.5d., 0.4d., or 0.3d., respectively, per kWh.

Possibly it is only at the last-mentioned price that a fairly general use of electrical energy for heating water can be considered. To this price, however, must be added the cost of a water-heater and automatic switching apparatus with appurtenant meter. These may, when in general use, possibly be obtained for £8 for a family of five to six persons.

If we suppose that the family has ntted six 50-watt lamps for lighting and a water-heater of 200 watts, a meter fitted with automatic regulation (adjusted to a fixed subscription for 200 watts as basis load) would operate in the following manner: So long as 4 to 6 lamps (200 or 300 watts, respectively) are connected, the water-heater will remain automatically disconnected; the meter registers only those kilowatt-hours consumed by the lamps exceeding four in number. If, on the other hand, fewer than four lamps (*e.g.*, three lamps, or 150 watts) are connected, the water-heater will be disconnected or connected for periods of a couple of minutes' duration according to the diagram reproduced in fig. 5. During the first period both the water-heater (200 watts) and three lamps (150 watts) are connected, 350 watts being consumed. During the second period the water-heater (200 watts) is disconnected, and only three lamps (150 watts) are connected; this period lasts so long that the shaded surface in period 2 becomes as large as the shaded surface in period 1. During periods 3 and 4 the same course is repeated, and so on, the average consumption being thus only 200 watts. During period 1 there will no doubt have to be added a certain number of kilowatt-hours as excess energy, but these are again deducted during period 2, so that the final result in this case is that no excess energy is registered by the meter.

Lighting and Sundry Household Apparatus.—The diagram reproduced in fig. 4 shows the consumption of energy of a subscriber who uses electrical energy for—

	Watts.
Lighting, six 50-watt lamps, maximum	300
Ironing	500
Vacuum cleaner	200
Electric cooking range, one resistance-coil of 200 watts being permanently connected, and one of 300 watts on occasions when the cooking plate is made use of, maximum	500
Water heater, maximum	200

The water heater is automatically disconnected as soon as the load for other purposes exceeds the basis load subscribed for, for instance, of 500 watts, and is automatically switched in as soon as the load for other purposes is less than 500 watts. Fig. 4 shows that the 200-watt element of the range

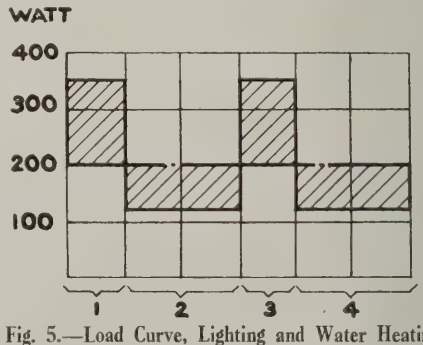


Fig. 5.—Load Curve, Lighting and Water Heating only.

is permanently connected during all the 24 hours of the day*; from midnight to 6 a.m. the water heater is also connected; the subscription for 500 watts is then fully utilised, and no excess energy is drawn upon.

From 6 to 7 a.m. there are, besides the 200 watts of the range, also connected three 50-watt lamps and the 300-watt cooking plate of the range; the whole subscription is made use of, and besides that excess energy of 150 watt-hours.

From 7 to 9 a.m., besides the 200 watts of the range and 150 watts for lighting, the water-heater is periodically connected, so that its average load during this time is 150 watts; the whole subscription is used, but no excess energy.

From 9 to 10 a.m. the 200 watts of the vacuum cleaner are continuously connected, besides the 200 watts of the range; the water-heater is periodically connected, so that its average load during this period is 100 watts; the whole subscription is used, but no excess energy.

From 10 a.m. to 12 (noon) the two resistance coils of the range (200 and 300 watts) are continuously connected; it is

*See Elec. Rev., September 17th, 1926, p. 473, for description of " Seves " cooker.

assumed that during this time luncheon is being cooked; the whole amount subscribed for is used, without any excess energy.

From 12 (noon) to 15 o'clock the water-heater is continuously connected, besides the 200 watts of the range; the whole subscription is used, without excess energy.

From 15 to 16 o'clock the flat iron of 500 watts is connected during two periods of 15 minutes each, besides the 200 watts for the range and 100 watts for lighting; besides this, the water-heater has automatically been connected when the flat iron was disconnected; the whole amount subscribed for is used, and excess energy of 150 watt-hours.

From 16 to 18 o'clock, besides 200 watts of the range, there are connected 100 watts for lighting and periodically the water-heater; so that the average load of the latter during this time is 200 watts; the whole amount subscribed for is used, without excess energy.

From 18 to 19 o'clock there are connected the 300-watt coil of the range, as well as the 200-watt coil for the range, and 300 watts for lighting; the whole amount subscribed for is used, and, furthermore, excess energy of 300 watt-hours.

From 19 to 22 o'clock 300 watts for lighting are connected, besides the 200-watt coil for the range; the whole amount subscribed for is used, without excess energy.

From 22 to 24 o'clock 300 watts for the water-heater are continuously connected, besides the 200-watt coil of the range; the whole amount subscribed for is used, without excess energy.

Total amount of excess energy is 150+150+300=600 watt-hours. Besides the ½ kW subscribed for as basis load, there is being used 0.6 kWh excess energy; assuming that this curve is repeated on 300 days, the cost for a family of six persons will be :—

Fixed charge for local distribution for six lamps at 5s. 6d. each	£1 1 1
500 watts at £11 per kW per year	£5 10 0
180 kWh at 1½d.	£1 1 10
Total	£7 12 11

Therefore, for this price is obtained light from six 50-candle-power lamps, heating of about 40 litres of water to about 90 deg. C., as well as all the electrical energy required for cooking, vacuum cleaning, and ironing.

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Recent Developments and Improvements.

A Large Hospital Receiver.

What is probably one of the largest receiving sets in England is to be installed in St. Giles' Hospital, Camberwell, London, and is on view at Messrs. Holdrons', Ltd., Peckham. It was made by the Oxford Wireless Telephony Co., Ltd., and has been built into one container, not formed of a multiplicity of units, and is the one hundred and forty-second instrument turned out by this firm for use in British hospitals and institutions. There are 12 valves only, so arranged that the 1,100 pairs of headphones it is required to supply, never less than 550 at a time, are equally fed from the central source, and are arranged in banks which can be switched on or off at will by the authorities in charge of a particular ward, or group of rooms, but the set is capable of energising double the number of headphones in use, and there is therefore an ample reserve of power. In addition, the apparatus can deliver adequate volume to 50 loud-speakers, and a microphone attachment has also been fitted whereby a concert held in one of the rooms of the hospital will be heard throughout the wards, 2LO and Daventry being cut out. The control panel is so arranged that, once the set has been installed and adjusted, it will be necessary only to push a switch from its central position to a position marked "London" to switch on the entire equipment, no tuning adjustment being required; if the programme from Daventry is wished for, the same switch is pushed to a position marked with the name of that station, and again all tuning is completed by that action. The whole of the wiring is readily accessible by raising the glass-panelled lid; there are six separate and distinct headphone circuits, each one separately controlled at the set. "Bottom-band" rectification without reaction of any description is used, and inter-action is guarded against by the fact that all components which could cause the set to oscillate are enclosed in non-magnetic nickel screens. The whole of the cost of the instrument, together with that of the wiring of the hospital and the supplying of headphones, is being borne by voluntary subscription; at present over £500 has been raised, but £100 more is wanted to complete the work, one of the objects of exhibiting the set being to give the charitable minded an opportunity of contributing.

A D.C. Battery Eliminator.

A new product of Messrs. Philips Lamps, Ltd., is an anode battery eliminator for operation off d.c. domestic supply mains at from 200 to 250 volts. The output is regulated by two controls: one is marked "det," and provides 14 mA at a voltage variable from 20 to 60 V for the h.f. and detector valves, whilst the other is marked "volt," and furnishes 20 mA at 120 V, which is variable to about 40 V. The device is neat in appearance and, if the instructions are carefully followed, there should be little risk of short-circuiting the mains through the earth connection of the receiving set.

An "Individual-Gang" Condenser.

A major improvement in the "ganging" of condensers appears to have been achieved by Messrs. Arthur Preen and Co., Ltd., who have produced a "Formo" triple-gang condenser which operates on a new principle. It consists of three condensers, each having the usual rated capacity of .0005 mfd., but instead of being mounted with their axes in alignment the condensers are mounted side by side. Each separate condenser is provided with its own dial; the centre dial will, however, operate the three condensers simultaneously, and all three are "ganged" together by an ingenious arrangement of two moulded bars, each condenser spindle being attached to these by means of a specially shaped metal bracket; by means of a friction arrangement either of the two outer condensers may be adjusted independently of the others so that any variation in the tuning of its circuit may be counteracted by altering its own dial. Mounting the new instrument is simplified by the provision of a template and special bolt; if a centre hole be drilled to accommodate the spindle of the centre condenser, the bolt may be used to clamp the template to the panel so that the outer holes for the other two spindles may be drilled correctly. The new condenser should considerably simplify the tuning operation, the aim of the design being to overcome the difficulty of the condensers "falling out of step" at some part of the range.

"Hunt" Specialities.

Messrs. A. H. Hunt, Ltd., have secured the sole selling rights for the United Kingdom of the range of hydrometers produced by the ALA Manufacturing Co., of Chicago, U.S.A. They are made in a variety of types to meet different requirements, the sample sent us (fig. 1) having been designed for radio purposes; the substantial rubber bulb is fitted with a perforated stopper, whilst a perforated hard-rubber nozzle plugs the lower end of the glass barrel, acid being drawn up into the latter through the extension tube, which can be inserted into quite small cells. The float contained inside the glass barrel is moulded, which process is claimed to result in a stronger and more accurate article than the hand-blown variety. The "B" pattern illustrated is 10.5 in. long and its bore is 9/16th in.; it is well made, and sold at a modest price.



Fig. 1.—The 'ALA' Hydrometer.

When rooms are being wired for loud-speaker extension Hunt wall jacks can be conveniently incorporated to provide definite contact. Following the usual design, the jack is mounted on a small erinoid panel only ¾ in. wide so that the device can be unobtrusively fitted; contact points are more widely spaced than usual to increase insulation, and it will accommodate any standard plug, the total projection being 1 in. only sideways; a nickel-plated cover is provided.

A Thermo-electric Generator.

We are informed by Messrs. Attaix, Ltd., that they are placing an instrument on the market which they claim will enable users of receiving sets to dispense with accumulators, whether they have electricity in their houses or not. A compound of metals is employed to produce electricity when heated, either electrically or otherwise, and the generator is to be made in 2-, 4- and 6-volt types; its output is said to be from 0.3 to 0.6 ampere and the instrument begins to function at 100 deg. F.

New Marconi-Osram Valves.

We have received samples from the Marconiphone Co., Ltd., and the General Electric Co., Ltd., of their recently-marketed 2-volt, 0.1-amp. filament valves. The DEH.210 type is a high-magnification pattern suitable for resistance-capacity coupled l.f. amplifiers, or as a detector followed by an r.c. stage, but may also be used in h.f. stages when some form of stabilising device is employed. Its amplification factor is 35 and it has an impedance of 75,000 ohms, which, for a valve of such small filament wattage, gives a "steep slope"; high amplification per stage will be obtained by the use of an anode resistance of ½ megohm and applying 150 volts to the plate with grid negative bias of 1½ volts.

The type DEL.210 general purpose valve, when transformer coupled in an l.f. stage, needs 120 anode volts with 6-V negative grid bias to operate a loud-speaker at medium strength. Its amplification factor is 9 and impedance 17,000 ohms. Its 120-volt curve is perfectly straight for almost its entire length, and the bottom bend is so short and slight that it is almost included between minus 12 and minus 14 grid volts in a horizontal direction and between zero and 5 milliamperes in a vertical direction.

A New "Ediswan" Valve.

The Edison Swan Electric Co., Ltd., has sent us a sample of its latest valve, the RC.610, which is intended for resistance-capacity coupling. Of the 6-volt 0.1-A filament type, it has a lower impedance (100,000 ohms) than the RC.2, with a consequently higher amplification factor of 40. Its filament is longer and anode of larger area; the anode voltage is 120 V and the slope 0.4 mA per V. The correct power valve to use in combination with it is the PV.5.

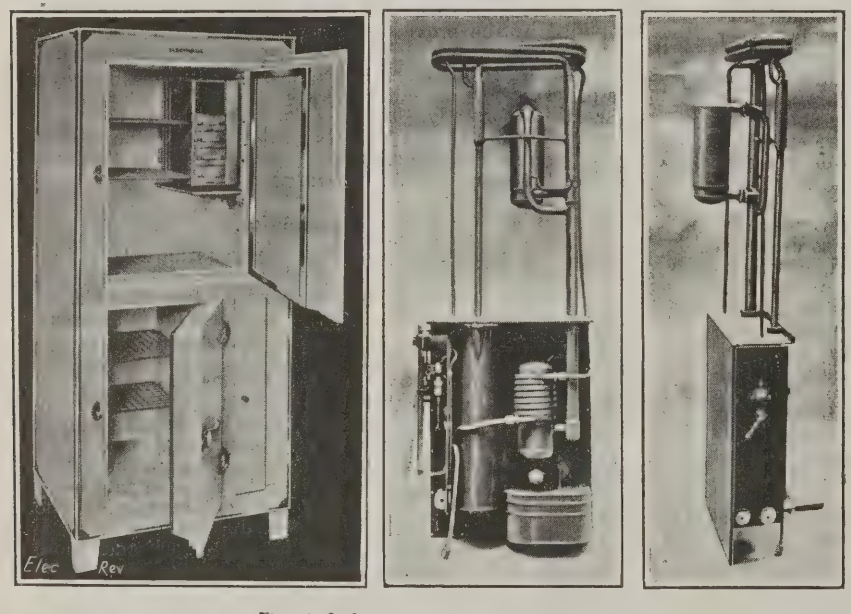
The "Electrolux" Refrigerator.

Some Noteworthy Modifications in its Design.

SINCE we previously described the Platen-Munters system* the refrigerator has been modified in several respects, consequently improving its efficiency of operation. It is, of course, important that the water vapour contained in the ammonia gas as it leaves the generator should be removed before the gas reaches the condenser. For this purpose a water separator has been incorporated (see fig. 4): as the gas and water vapour leave the boiling liquid they are at a comparatively high temperature, and the water is removed partly by the effect of the baffle plates within, and finally by the cooling effect of the ammonia in the annular space around, the separator. The warm gas passing through the separator (raising the temperature of the ammonia liquid in the annular space a few degrees) causes this liquid to evaporate, the gas so formed passing straight back into the condenser where it is again cooled and recondensed. No further rise of temperature of the liquid ammonia takes place, the liquid being thus kept at a constant temperature by its own evaporation. The inner wall of the annular chamber thus forms a surface at a fixed temperature for pre-cooling the ammonia gas and so purifying it before it enters the condenser; the water thus condensed drips back over the baffle plates and finally falls into the generator. It will be realised that only so much of the liquid ammonia as is necessary for depriving the gas of its water-vapour content passes into the separator, the balance passing into the evaporator. This device is a material improvement on the previously used air-cooled radiator which it has displaced; consequently more heat can be applied to the generator, which fact has led to the addition of a switch for 3-heat control. Further, a safety switch, in the form of a tilting glass tube containing mercury, is now employed to interrupt the heating circuit in the event of the failure of the flow of cooling water.

Another modification is the incorporation of a gas-temperature exchanger, through the central tube of which the intensely cold mixed gases from the evaporator pass; the temperature of the warm hydrogen gas from the absorber is thereby lowered before it enters the evaporator. The exchange of heat therefore results in an increase of the cooling effect, otherwise the hydrogen entering the evaporator would be comparatively warm, and the evaporating ammonia would have to cool this gas in addition to cooling the cabinet; in other words, the "coldness" in the mixed gases which would otherwise be wasted is transferred to the pure hydrogen. The object of the vent pipe which is shown in the interior of the vertical tube connected to the lowest part of the condenser is to provide a direct passage to the absorber, through which any hydrogen gas which may have found its way into the condenser can pass. When the apparatus is not in use, it is possible that some hydrogen may find its way into the condenser, where it would be detrimental to the working of the apparatus: as soon as heat is applied to the generator, ammonia gas flows into the condenser, driving the hydrogen gas down the vent pipe into the absorber or evaporator. The pipe is bent down to prevent any possibility of the liquid ammonia from the condenser falling down it.

It should also be explained that all steel pipes which are liable to corrosion are now provided with an inner tube of copper. Moreover, the evaporator is no longer encased in a brine tank, which has been eliminated. In its stead an aluminium casting (not shown in the diagram), having fins like a radiator, is fixed around the evaporator so that it also is cooled to a similarly low temperature, the icy cold surface of the aluminium fins, in turn, cooling the air in the cabinet. The latter is of all-metal construction, with the exception of wooden inner door frames, white enamelled outside and in, the interior surfaces being porcelain enamelled.



Figs. 1, 2, 3 and 4.—"Electrolux" Refrigerator Cabinet, Cooling Element and Circuit Diagram.

* See Elec. Rev., February 26th, 1926, p. 327.

The Works at Luton.

On Wednesday, May 18th, the works of Electrolux, Ltd., at Luton, were visited by a large company of ladies and gentlemen connected with the electrical industry and the newspaper and trade Press, the occasion being their formal opening by Sir Robert Horne, K.C., M.P. The various departments of the works where the "Electrolux" vacuum cleaners are being turned out at the rate of 1,200 or 1,300 per week, and electrical refrigerators in considerable and increasing numbers, were inspected from the receipt of stores and parts to the assembling, welding, porcelaining, testing, and other processes, and the packing of the finished article ready for dispatch. The factory buildings cover an area of 200,000 square feet with considerable extensions in prospect; 200 additional acres have been acquired and workmen's cottages will form a model Electrolux village, while canteen, tennis, and other welfare and sports facilities have been provided; it is even stated that a bonus system has been introduced for the employés. It is understood that since the inauguration of the company at the Savoy Hotel, London, over a year ago, 1,200 additional persons have been employed either at the works, or on the road in selling activities. At the function last week, Major H. A. Wernher, the chairman, referred to the large orders that the company and its Swedish associates had placed for British raw materials to be used in the production of their refrigerators here and on the Continent. The present output of refrigerators and cleaners was far short of what it eventually would be. The new works started a new British industry and their equipment included British plant made to special specifications. Sir Robert Horne, the Mayor of Luton, and the Member of Parliament for Luton, followed. The cheapness of electricity at Luton as an inducement to such companies to start manufacturing operations in the area, was frequently alluded to.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The County of London Bill.

As briefly mentioned in our last issue, the Bill promoted by the County of London Electric Supply Co., Ltd., principally to confer powers with regard to the county of Essex, was passed by a committee of the House of Commons on May 17th A short report of the last two days' proceedings follows:—

On May 16th Mr. R. BURY, for the Essex County Council, asked that the Bill should be rejected as no definite scheme had been put forward by the promoters. The company should be made to proceed by means of a Special Order, for if the Bill were passed other authorities would be unable to develop the area, although their extension might be desirable. When the Central Electricity Board had prepared a scheme, the company might be allowed to bring forward a Bill. Alderman H. E. BROOKS (Essex County Council) said that all the large towns in the county proposed to supply large rural areas around their boundaries. If those orders were not granted the company should be asked to give guarantees. He could not agree that the clause allowing local authorities to apply for Special Orders after the passing of the Bill was effective, for the erection of generating stations was precluded.

Sir LYNDEN MACASSEY, K.C., for Southend Corporation, said his clients had decided to apply for a Special Order for an increased area of supply and to erect a power station at Canvey Island. The company should, therefore, not be given powers which would prejudice that application. Sir Harry Renwick had stated that the Bill was largely framed upon advice received from the Electricity Commissioners. Counsel deprecated that, and said that it would create grave misgivings in the minds of local authorities, who looked to the Commissioners to be impartial. Sir Lynden Macassey also said that Mr. Merz, the promoters' chief technical witness, had stated that his firm had prepared the schemes upon which the Central Board was proceeding. Moreover, Mr. Page, who was until recently general manager of the company, was now engineer to the Central Board, and would have been called to give evidence for the promoters if he had been in London. It might be that the Bill was promoted with advance knowledge of the Board's intentions. If that were so the local authorities had equal right to know what those intentions were. He argued that the correct procedure was by Special Order, which would receive the same attention as Orders applied for by local authorities. While maintaining that the Bill should be rejected, counsel asked that in the event of its being passed a clause should be inserted protecting the Southend Corporation from competition in the extended area applied for in its Special Order.

When the proceedings were resumed on May 17th the chairman announced that the Committee found the preamble of the Bill proved subject to the insertion of a clause providing that within 12 months of the passing of the Bill, and within each succeeding 12 months, the company should submit to the Electricity Commissioners proposals for giving a supply in all parts of the added area in which there was a demand and in which there were no authorised distributors. The proposals were to be carried out within two years of approval, or such period prescribed by the Commissioners, failing which the powers in such parts of the added area could be annulled. The time for the lodging of applications by local authorities was also extended to April 1st, 1927.

Mr. ROWAND HARKER, K.C. (for the company), referring to observations made the previous day by Sir Lynden Macassey, which had been reported, had been taken by the Commissioners to mean that the company was in some way attempting to detract from their jurisdiction and powers, and that the company could ignore them. Sir John Snell had interviewed Mr. Merz, and the latter would like to explain his position. With regard to Mr. Page, the Bill was ready before he left the company, but he took the view that it would not now be proper for him to give evidence for the company. Therefore, Mr. Merz, who was familiar with the company's work, was called upon instead. The chairman said that Mr. Harker had taken a proper course, and the Committee thought that nothing which had been done was in any way reprehensible. Later, Mr. HARKER, replying to a point raised by Sir Lynden Macassey, stated that there was a clause in the Bill giving local authorities power to purchase the parts of the undertaking in their areas. He also asked for a provision that when applications for Special Orders were made by local authorities the company should have the right to be heard. The chairman said that the Committee would agree to such a provision in connection with the applications of Southend, Colchester, and Clacton. Beyond that the decision already given must stand.

Subject to the insertion of clauses giving effect to the Committee's decisions, the Bill was then passed for third reading.

On May 19th, the Committee approved clauses which were submitted to give effect to its decision. The Lea Conservancy Board asked for the insertion of a clause giving it power to impose conditions with regard to the execution of work by the company upon its property, and providing for a reasonable payment to the Board in respect of wayleaves.

Mr. S. G. TURNER (for the company) contended that the matter was covered by the general law, but after discussion the Committee decided to insert the clause.

London and Home Counties Bill.

A committee of the House of Commons, presided over by Sir A. Shirley Benn, commenced the consideration of the London and Home Counties Joint Electricity Authority (No. 2) Bill on May 18th.

Mr. CRAIG HENDERSON, K.C., for the promoters, dealt with the circumstances leading up to the formation of the Joint Electricity Authority, and said that the object of the Bill was to secure power to erect a generating station at Duke's Meadows, Chiswick. The Brentford Gas Co. had twice endeavoured to secure the site for the erection of gasworks, but had not succeeded. The erection of a generating station, however, would not interfere with the amenities of the district. The Ministry of Health had expressed the opinion that the site should not be used unless the use of another site would raise the cost of electricity. Mr. J. H. Rider, the Authority's consulting engineer, had been unable to find another suitable site. The Authority had arranged to exchange a larger and better site for the one in question, and so the public would benefit. The London Power Co.'s opposition to the Bill was due to a fear that it would prejudice the company's application for powers to erect a station at Battersea, but the Authority's station was required to serve an area in which none of the constituents of the London Power Co. operated and there was room for both stations. The promoters had no desire to "side-track" the Electricity Commissioners; indeed, the latter had already said that the site was suitable, and in any case the equipment of the station would be under their control. If, however, the promoters proceeded under the Electricity Act of 1919 there would be further delay. Mr. Rider gave evidence for the Authority, and said that the estimate of the demand in the London Electricity District in 1925-26 was 441,795 kW, but the actual demand was 577,317 kW. He now estimated that the demand in 1930-31 would be 878,590 kW, and in 1935-36 1,179,920 kW. Mr. Rider dealt in some detail with the existing plant in the area, and said that the gradual shutting down of smaller plant would necessitate additional plant in a few stations. He recommended the retention of three primary and 20 secondary stations (out of the 62 existing), having a total capacity of 1,245,000 kW, the three primary stations being Deptford, Brimsdown, and Barking. The CHAIRMAN said that the Committee would be guided by the Electricity Commissioners' decision that a riverside station in the West of London was necessary, and would merely want to know which was the best site. Mr. RIDER said that, after thorough investigation, he had no doubt that the Chiswick site was the most suitable. It was proposed that the first section should have a capacity of 125,000 kW. On May 19th, he dealt very fully with the details of construction of the proposed station, and dwelt particularly upon the arrangements which would be made to prevent any nuisance arising from the combustion processes. He then gave particulars of the generating costs, and said that with a 40 per cent. load factor and coal at 20s. a ton, the total cost per kWh sent out would be 0.4315d. When the station was completed the cost would be reduced to 0.366d. per kWh, and the total capital cost would be 4½ millions sterling, or £13.9 per kW. At the end of seven years, he said, the Authority would be called upon to supply

64,590 kW of the total demand of 112,590 kW, not taking into account any supplies which might be required by the North Metropolitan Company or the Central Electricity Board. Questions were put by Mr. Wrottesley, K.C., for the Barnes Urban District Council, suggesting that the smoke from the station would be a nuisance, but Mr. Rider said that a thoroughly modern station would not offend in that respect. The Committee adjourned until May 24th.

East Anglian Electricity Bill.

When the Committee of the House of Commons, presided over by Sir Arthur Shirley Benn, met again on Thursday, May 19th, Mr. Craig Henderson, K.C., mentioned the steps which had been taken to meet the Committee's requirements. He stated that a resolution had been passed by the board of the company to the effect that the capital would be increased by £150,000 with the sanction of the shareholders, and there was little doubt that this sanction would be obtained. Counsel also produced a draft contract between the East Anglian Co. and the Greater London and Counties Trust by which the Trust agreed to subscribe the whole of the additional £150,000, at the same time undertaking to subscribe or procure additional capital to the extent of £500,000, as and when called upon by the company. Moreover, the Trust agreed to exchange its debenture holding in the company for ordinary shares. After the Bill had been approved by the Committee the contract would be produced in its executed form. With regard to another suggestion by the Committee, counsel produced clauses providing that the company should, within one year from the passing of the Act, and at such other times at intervals of not less than three years as it might be required to do by the Electricity Commissioners, submit proposals for the supply of electricity in those parts of the area where there was a demand for electricity and there was a reasonable prospect of the supply being remunerative. It provided that the question of the existence of a demand in any area should be determined by the Commissioners. Further, the clause provided that in submitting the first proposals the company should submit a general statement of further proposals for the ultimate development of the whole area at a cost of not less than £500,000.

The Chairman said that the Committee would consider the proposals, but it occurred to him that in such a rural area there was hardly a place where supply would be remunerative at first. The Committee wished to see that the area was provided with transmission lines whether the districts through which the lines passed were remunerative or not.

Mr. Craig Henderson said that until the promoters knew what the national scheme was going to be it would be impossible to draw up a scheme of transmission lines of a definite character.

The Chairman then asked for some evidence as to the financial standing of the Trust. Mr. F. M. Rogers, chairman of the Trust and also of the company, said that there was cash available at present to provide the £150,000 new capital, and there was no doubt whatever that the £500,000 would be forthcoming as and when required. He agreed that there would not be much prospect of an immediate return, and the policy of the company would be to stimulate the demand and gradually build it up.

Mr. Wrottesley, K.C., cross-examining for a number of local authorities in the area, suggested that the proposed contract did not bind the Trust if, on further investigation, the area was shown likely to be unremunerative. In the meantime, the local authorities now supplying would be prevented from extending their areas of supply into the surrounding districts. Further, the new proposals put no compulsion on the promoters to bring forward schemes. Mr. Craig Henderson replied that there was nothing to prevent local authorities from bringing forward schemes if they could show that a supply was needed and the company was not giving it.

Mr. Rogers said that the capital of the Trust was £300,000. Already it had provided £250,000 for various schemes, and its reserves were about 40 per cent. of its nominal capital.

In reply to the Chairman, Mr. Craig Henderson said that it was obvious that the districts in which the greatest demand was likely to arise must be developed first, and the less likely districts would follow. The latter could only get a supply by the development in the first place of the former.

Mr. Moon, appearing for various local authorities, said that the clauses now produced would have the effect of holding up indefinitely the development of supply in the whole of the area included in the Bill and preventing districts getting supplies which could be given from the power stations belonging to local authorities. He contended that the clause compelling the promoters to bring forward a scheme within one year did not do what it purported to do, and that while nebulous schemes were being prepared by the promoters, the Electricity Commissioners could not consider schemes from the local authorities. The proposed contract between the company and the Trust would have no force.

The Chairman, referring to the clause binding the promoters to bring up schemes for areas where there was a reasonable prospect of the supply being remunerative, asked whether the promoters would agree to alter this to "a prospect of the supply being remunerative within a reasonable period." Mr. Craig Henderson said that the promoters would accept the amendment.

The Chairman subsequently said that the Committee found the preamble of the Bill proved subject to the financial arrangement being carried out, and also subject to the clauses being so worded as to ensure that the whole area would be supplied in a reasonable period with an adequate supply of electricity. The Committee then adjourned until May 23rd, when clauses were considered.

There was some discussion as to the form of the latter part of the clause dealing with the provision of an adequate supply within a reasonable time. As passed by the Committee, it provided that the proposals to be submitted should be so framed as to provide, to the satisfaction of the Commissioners, for an adequate supply being furnished within a reasonable time in those parts of the area of supply within which the company was empowered to distribute; that the scheme to be submitted should be so framed as to provide, to the satisfaction of the Commissioners, for transmission lines to be laid down throughout the area of supply; and that the proposals and scheme should be on such a scale that the estimated cost of carrying them into effect would be not less than £500,000. When the scheme had been approved by the Commissioners, it should be carried into effect within such reasonable time as determined by the Commissioners.

Coal Research.

On May 17th, Mr. Tinker asked what was the quantity of oil extracted per ton of coal treated by the Dr. Bergin's process; and asked for a comparison between that method and the low-temperature carbonisation process.

The Duchess of Atholl said that the crude oil and spirit obtained from one ton of suitable coal treated by the method amounted to from 110 to 135 gallons. In addition, a further unknown amount of coal was necessary for power and hydrogen production. The highest yields of dry tar and spirit, observed by the Fuel Research Staff, as obtained from the low-temperature carbonisation of ordinary coal in a large scale plant, was about 21 gallons, but the average bituminous coal would probably not yield more than about 15 gallons. Good quality cannel coal, of which, however, there was only a limited supply, might yield 50 to 60 gallons.

North Metropolitan Electric Supply Bill.

The Bill promoted by the North Metropolitan Electric Power Supply Co., authorising it to raise a further £1,000,000 of capital, together with further loan capital of £500,000, was considered by the Unopposed Committee of the House of Commons on May 19th, and was ordered to be reported for third reading.

Mr. W. Sidgwick said that the present authorised share capital of the company was £2,000,000, all of which was issued, and the authorised loan capital was £1,000,000, of which nearly £550,000 had been issued. He asked the Committee to report the Bill that evening, because the company wished to obtain Royal Assent to it before the Whitsun recess.

Trade Facilities Act Guarantees.

On May 16th the Chancellor of the Exchequer gave Sir F. Wise a statement showing the distribution among the various important industries of the £75,000,000 guaranteed under the Trade Facilities Act. The statement showed that the construction and equipment of electric railways accounted for 17 per cent. (£12,583,000); hydro-electric construction for 9.5 per cent. (£7,000,000); and other electrical works 10.8 per cent. (£8,004,600).

Hydro-Electric Works at Snowdon.

On May 19th Sir Robert Thomas asked the Minister of Transport whether his attention had been drawn to the fact that the hydro-electric works in the neighbourhood of Snowdon were causing disfigurement to the scenic beauties of the district by the erection of overhead transmission lines; and whether he would take steps to require the interests concerned to relay their cables in underground conduits.

Colonel Ashley said that such information as he had been able to obtain showed that the overhead lines were erected many years ago with the consent of the Board of Trade. In the event of any application being made to him for further overhead lines, the local authority would be given an opportunity of being heard before any such consent was given, but the desirability of securing all reasonable economy in the production and distribution of electricity was an important consideration, and he was not prepared to say in advance what his decision on any such application might be.

Electricity Schemes.

On May 17th, Colonel Burton asked the Minister of Transport whether he could give any information as to the progress of the preparation of schemes by the Electricity Board; if he could state whether any scheme was in preparation which would cover the rural areas of East Anglia; and, if so, when the publication of such scheme might be expected.

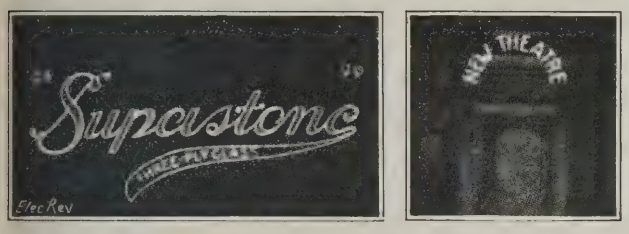
Colonel Ashley said that one scheme had already been prepared by the Electricity Commissioners, and published by the Central Electricity Board. He understood that a further scheme was in an advanced stage of preparation by the Commissioners and that they had other schemes in hand, but that the rural districts of East Anglia were not wholly covered by any of the schemes which the Commissioners were at present engaged in preparing.

Neon Electric Signs.

Varying Types of Neon Signs and some Interesting Data.

WE have received from Messrs. Philips Lamps, Ltd., some interesting data regarding neon signs, the salient features for which are claimed to be great penetrative power of the light obtained, small cost of upkeep, and an entire absence of anything approaching dazzle or heat. The vividness of the colour of neon lighting is such, it is claimed, that the sign stands out conspicuously from all other forms of illumination. It arrests attention and can be easily read from a great distance—even in foggy weather. The signs can be supplied in three different colours, red, blue, and green.

The efficient running is naturally a point of the greatest importance in exterior illumination, and in this respect Neon signs can be used with great advantage. The makers guarantee their tubes for one year, calculating a year to be equivalent to 1,800 burning hours. In actual practice this figure has been exceeded by 100 per cent. and more before it has been necessary to have the tubes re-filled with new gas. The patented construction and connection of the tubes assures, it is claimed, an absolutely steady light without the least flicker. Further, the tubes are not affected by continual incandescing and nigrescing, which is so detrimental to the apparatus, as special resistances are employed which give an efficient damping effect to the oscillations. The standard working pressure for the signs is 3,500 V, and the consumption of a 10-ft. length of 13-mm. tube is only 90 W. This diameter is normally used for the tubing, but special tubes are made of diameters varying from 7 mm. to 30 mm., the consumption varying accordingly. In addition to the ordinary type of neon sign, Messrs. Philips also manufacture box signs with tubes on one or both sides, as desired, in red, blue, or green, all the electrical accessories with the exception of the rotary convertor (if necessary) being contained in the box. Another form of sign is the "Mignon" Case sign, in which the tubes are worked off an induction



Neon Electric Signs.

coil connected to a 6 to 8-V supply. They will operate from an accumulator, or where an a.c. supply is available a low-pressure transformer is utilised. Here, again, tubes can be supplied giving red, blue, or green colours, in block or script formation as desired.

This form of sign is very much cheaper to produce than those previously mentioned, as no high-pressure transformers, resistances, &c., are necessary. Moreover the daylight appearance is greatly enhanced by the fact that the neon tubes are recessed in a wooden background, and all the necessary accessories are contained in the case, the whole forming an entirely self-contained sign.

The "Mignon" sign is particularly suitable for use above entrances to premises, shop windows, or show cases, and in all situations where a small and inexpensive sign is required. The accompanying illustrations show two types of neon signs which are produced by Messrs. Philips.

Correspondence.

***Correspondents should forward their communications* as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

The Ideal Wiring System.

I have read with interest your numerous readers' views of ideal wiring systems, but I believe most will agree that the best system to be adopted depends, first, upon the premises to be wired; secondly, on cost; and thirdly, on efficiency.

For country houses and small estate buildings, lead-sheathed cables have proved a perfectly sound proposition; large numbers of contractors are using this method to-day, and are perfectly satisfied, except so far as bonding is concerned. The main objection, as some of your readers agree, has been the use of small screws and clips of various sizes.

To obviate this, some cable manufacturers recently have gone to the trouble of running a separate earthing wire under the sheathing, this wire being earthed to a common terminal on the base of the junction box. This, on the face of it, appears very well, and has possibly been thought out for use as their system, with their special junction boxes, but there is always the risk of the earth wire breaking through the insulation of one of the feed wires, on sharp bends, or the wire itself breaking, and I am convinced that most cable manufacturers will not adopt this unnecessary method of earthing lead-sheathed cables.

I have recently designed and patented a box eliminating the troubles mentioned by your readers, and although it is a recent production, it has met with favour from contractors generally, and I am receiving repeat orders. The "Bonfix" patent junction box was kindly described and illustrated in the ELECTRICAL REVIEW of March 25th, and the method adopted eliminates all screws. The adoption of spring clips, as part of the base, successfully bonds and fixes the cable in one operation by merely sliding the cable under the clips, the clips being made wide enough to accommodate a single-, 2- or 3-core cable.

If a cable with an earth wire is used, the earth wire is bound round the centre fixing screw under a washer, thus giving two independent bonds to each cable.

H. H. Leage,
SEFTON-FIDDIAN, LEAGE & Co.

London, *May 17th*, 1927.

We have followed the article on "The Ideal Wiring System" with much interest. As considerable users of C.T.S. and lead systems we have arrived at the conclusion that the most all-round satisfactory method is to combine the use of a liberal amount of slip tube with either. The conduit gives all the protection needed (and also the rigidity so desirable in various instances) when passing through walls and all hidden or doubtful places, and for protection from switches to ceiling we invariably use a length of conduit. Threading through joists does all the rest and enables the work to proceed expeditiously and safely. We think that C.T.S. treated thus, with a little careful planning, gets as near to the "ideal" as any reasonable person can require. Our opinion has frequently been endorsed by—among others—supply officials.

Wm. Paterson & Co.

Watford, *May 20th*, 1927.

Safety First: Earthing Transmission-line Towers.

Having found that tests published in the United States, in the National Electric Light Association's *Proceedings*, 1926, pp. 663-5, Vol. 83, are not yet available in some of our London technical libraries, I am led to call attention to them as of more than passing interest.

To determine whether the voltage drop along the surface of the ground near a three-conductor 120,000-volt transmission tower would be dangerous to life at the moment that one conductor becomes accidentally earthed on the tower, tests were made at low voltage and the results applied as follows:—

Test number	1	2	3
Figure number	12	13	14
At power house, 1st tower	Earthed	Earthed	Earthed
do. 1st Condtr.	,,	,,	,,
2nd tower	Not earthed	not earthed	not earthed
Possible earth current at moment 2nd cond't'r is accidentally earthed at	1st tower	2nd tower	3rd tower
Amperes	5,700	5,700	2,375
Calculated volts to earth	2,650	19,350	6,175
Volts through person leaning against tower...	1,590	12,600	4,550 to 6,175
Volts between a person's 2 feet on ground ...	300	3,000	1,300
	ft. in.	ft. in.	ft. in.
Scale 1 inch stated on figure equals	4 0	4 0	10 0
Square tower, measures	10 3	1 6	9 0
Test recorded, East ...	11 0	9 2	14 0
West ...	—	9 9	14 0
North ...	4 0	5 6	14 0
South ...	—	1 0	14 0

Presumably the same tower is represented in each test, and I venture to think scale on fig. 13 unlucky.

A favourite question of mine has been:—What practical value have you discovered for earth wires (against lightning) on overhead transmissions?

Here is a very substantial reason for installing earth wires, also for the efficient earthing of every tower. Setting their feet in concrete insulates them.

Theodore Stevens.

London, *May 10th*, 1927.

Sheath Losses in Cables.

With reference to Capt. Dunsheath's remarks, he will be interested to know that a bridge method has been developed for measuring the losses in a 3-phase 3-core system, both for the flat and triangular spacing

It is hoped to publish details of the method in due course.

R. A. Brockbank.
STANDARD TELEPHONES & CABLES, LTD.,
Research Laboratories.

London, *May 21st*, 1927.

Electric Power in Agriculture.

A letter in *The Times* on May 19th from Mr. W. W. Blair-Fish states that there are some very cold figures and estimates in a report "Electric Power in Agriculture" which Mr. Dampier Whetham presented to the Royal Agricultural Society in 1925. I have again read this report; valuable as it is in stating the position in 1924, I venture to suggest that it does not form a basis, to quote Mr. Blair-Fish, "to wait until the rural demand has become sufficiently urbanised to be self-supporting." I do not think it was in the mind of Mr. Dampier Whetham that further progress could not be made in electric machinery for the agricultural industry. He states: "I regard lighting as the chief function of electric current in country districts, and power as subsidiary"; further he states: "experience shows that at present electric ploughing is not usually convenient or a financial success." However, his figures show a demand of 9,000 to 12,000 units per square mile which can be obtained if suitable electrical agricultural machinery is provided.

At last year's Royal Agricultural Show at Reading I inspected a rotary cultivator; at a later date I obtained the opinion of a well-known agriculturist, who said it was a splendid machine and its effect on the land was remarkable. Dr. A. Ekström in his paper "Twenty Years' Practice in Rural Electrification" (Sweden), states that in Germany, lately, rotary tillers have aroused great interest. Major McDowall's system of conveying current from a point in the field to travelling electrical apparatus shows great promise. Mr. Dampier Whetham states that the demand for electric power for drying crops is likely to be small. The account in your journal of April 8th this year shows progress.

I have followed the beet sugar industry as a means of improving the load factor. The present method creates a demand for a short period of the year, but again there are hopes of improvement. The report on the De Vecchis beet sugar progress working in Italy is very encouraging; the process can be extended over 300 working days, instead of about 90 days, and further, it can be carried on in small units over a wide area, which would provide another demand for electric power.

If rural electrification is to be subsidised, let at least some of the funds go to improving electrical apparatus which will increase the load factor and assist the agricultural industry in reducing cost of production, and not delay progress until the rural areas grow into urban districts.

E. A. Mitchell.

Cuckfield, *May 21st*, 1927.

The Adequate Distribution of Electricity.

I should like to comment on several matters arising out of your issue dated May 13th. The first is the importance of the point put forward by Mr. E. E. Hamar in his article on "Publicity for Supply Undertakings," *viz.*, that ordinary people do not really know for what, and to what extent, they can use electricity. In this connection, the E.D.A. ballot competition did a great deal of good educational work.

The second is the note on inadequate distribution mains (p. 783). It is astonishing what a large number of consumers are not "allowed" by their electricity supplier to connect up cookers and heaters of over three kilowatts capacity. Coupled with these starved consumers are an enormous number of would-be users, who cannot obtain a supply "because no main is laid."

I know of central-station engineers who proudly point to stacks of cards, on which are recorded the names of prospective consumers, to whom it has been agreed to give a supply—but the station staff is entirely unable to cope with the work for many months to come. Under such circumstances it would seem wise to call in the assistance of a contractor, for it is not merely a question of adding to the station load, but also one of moment to the electricity industry generally as a means of increasing the sales of materials and apparatus. Further, these unconnected "consumers" are made an excuse for delaying rural extensions (this is, of course, where the shoe hurts my hobby).

In referring to the first scheme of the Central Electricity Board (p. 754), you mention that the Central Scotland area includes 4,980 square miles. My comment is: how few of those square miles, comparatively, will see a supply of electricity during the next decade, *unless* some radical change is made in bringing about an effective distribution network. By the way, both Fifeshire and Ayrshire can show (thanks to the enterprise of Messrs. Thompson and Bexon, each in his respective area) a very good example to most of the rest of Great Britain in the way of rural electrification.

The Central Electricity Board has as its chief object the production of cheap power—but this is not of much use unless it is effectively distributed, and that to an educated public. The amount of power mentioned as being the requirement of the Central Scotland area is far too little, if that district were only properly developed.

Hence I venture to submit the problem to your readers: "What is the best method of ensuring an adequate and universal distribution of electricity in Great Britain?"

R. Borlase Matthews.

Greater Felcourt, East Grinstead, *May 20th*, 1927.

A Commutation Problem.

With reference to the inquiry by Mr. A. O. Griffiths which appeared in your issue of May 6th, since the generators operate satisfactorily when new and for a short time after turning the commutators, the trouble would appear to be electrical and not mechanical, as if it were the latter it would always have existed and been noticeable.

It is quite possible that after turning slight sparking existed, not noticeable, and in small high-speed motors of this class it is difficult at times to locate the trouble, but a consideration of the following may help to solve the difficulty, having regard to the particulars that are available:—

(*a*) Since the trouble is more apparent after turning, it may be that the reduced diameter of the commutator, although small, has reduced the brush-contact area; if the current density of this has been pushed to the limit and perhaps over in the new machines as may happen in these small generators, good conditions exist when new, but as soon as this area is reduced, if ever so little, the density will be increased and disintegration of the brushes will take place; sparking will occur at an earlier period of use and will become more marked each time the commutators are turned. The current density of this area should not exceed 30 amps. per sq. inch.

(*b*) The contact area being reduced, the speed may be such as to give insufficient time for good commutation, and a coil not under commutation comes under the brushes.

(*c*) If the rotation is such that the toe and not the heel of the brush is against rotation, it is possible for heating to take place due to the smaller brush section at this point.

(*d*) It may be that during turning operations the commutator has moved slightly on the shaft.

As the conductors are evenly spaced around the armature and average 7½ deg. from the neutral position, the commutator must have moved, otherwise this condition has always existed; this, however, should be checked up electrically with a new machine when loaded to get this doubtful point settled.

A remedy for these conditions and to keep the cost of the machines down at the same time would be to increase the size of the commutator and so get a larger contact area; this could be taken up with the manufacturers.

P. Oaks.

Blackheath, *May 12th*, 1927.

A Mysterious Occurrence.

Can any of your readers account for the following?

On going to inspect a transformer house one Monday morning, after the usual week-end stoppage, we were surprised to find that the floor was flooded to a depth of four inches with oil from the transformer. An examination of the drainage tap showed that it had not been turned on, and it had not been disturbed, as it was thickly coated with dust, and a plug in the end of the mouth of the tap was also intact.

The transformer was still found to contain thirteen inches of oil, which we eventually drained off. After lifting the interior out, and cleaning the container, we carefully examined and tested the container for a leakage, but failed to find any; therefore we put the interior back again, filled up with fresh oil, and coupled the transformer up. It has now been working three weeks, and there is no sign of any further leakage.

The top is bolted down tightly with a packing ring between the lid and the edges of the container. The transformer is of 250 kVA, primary 2,500 volts, secondary 550 to 525 volts, periods 50, and holds about 200 gallons of oil. The old oil had been in use about 10 years.

I should like to hear some views on how this oil—over a hundred gallons—got out.

W. H. M.

May 16th, 1927.

Cheap Electricity.

Our attention has been drawn to a letter from Mr. R. Borlase Matthews which appeared in your issue of April 29th last, on the subject of your review of our pamphlet entitled "Cheapest Electricity—How to Obtain It."

We cannot allow to pass unchallenged the following statement:—

"This is, of course, a condensed version of a pamphlet by Mr. W. C. Mountain, entitled 'A Word in Favour of the Independent Power Plant.'"

Also the implied suggestion that, because Mr. Mountain is not disinterested in power plants, our announcement that the booklet in question was written by an independent electrical engineer is inaccurate. Nothing could be further from the truth, and we shall be glad if you will let your correspondent know this through the medium of your columns, seeing that we now give you—in confidence and not for publication—the name and address of the independent electrical engineer whose opinion is printed in the pages of our booklet.

Ruston & Hornsby, Ltd.
J. A. Walker, *Advertising Manager.*

Lincoln, *May 16th*, 1927.

[We are satisfied that the pamphlet, "Cheapest Electricity," was written by an independent electrical engineer, of whose *bona fides* there can be no question.—Eds. Elec. Rev.]

Balancing Loads on Three-phase Services.

It would be of interest to know to what extent a supply authority can make regulations for balancing circuits on 3-phase supply. There appears to be some divergence of opinion on this point, and practice varies very much in different areas.

A case in point is one in which the supply company require all loads over 3 kVA to be balanced over the three phases, and on making inquiries the contractor was informed that the load on each phase must, for all practical purposes, be identical. The supply authority engineer even went to the length of asking that individual sections of the installation should be balanced in themselves, *e.g.*, both window and shop lights were to be balanced separately, and even a small load of 250 watts for use in lavatories and offices was to be divided over two of the phases. Further, as balancing is to be in watts, not points, will the supply company have the power, at a later date, to insist on a redistribution in the event of the ultimate wattage at various points differing from the wattage estimated during the erection of the installation?

Perhaps contractors or supply authorities, in districts where the distribution is three-phase, will state their experience on this point—though a legal opinion as to the supply authority's rights would be even more valuable.

E. Arthur Pinto.

Ramsgate, *May 16th*, 1927.

[Supply authorities have no legal right to make "regulations"; those issued by the Electricity Commissioners alone are valid. The only sound bases of refusal to connect an installation are (1) inadequate insulation resistance, and (2) reasonable ground for holding that the conditions obtaining on the applicant's installation would adversely affect the supply to other consumers. The official regulations have no reference to balancing loads.—EDS., ELEC. REV.]

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the stated dates. In the case of foreign applications, the name and address of the British representatives are also given:—

May 11th.

Cadillac. No. 473,273. Class 6. Electric vacuum cleaning machines and parts thereof, and ventilating fans and parts thereof.—Clements Manufacturing Co., Chicago, U.S.A. (Lloyd, Wise & Co., 10, New Court, Lincoln's Inn Fields, W.C.2.)

Miniamp (lettering and design). No. 474,620. Class 8. Radio valves.—S. Hector, trading as the Miniamp Radio Valve Co., 32J, High Holborn, W.C.1.

Uniflex. No. 471,506. Class 13. Reflectors.—Holophane, Ltd.

Stegolith. No. 473,202. Class 50. Electrical insulating substances, and electric insulators made therefrom, namely, holders, plates, sockets, handles, or other switch parts.—Steatit Magnesia Gesellschaft, Berlin. (Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

May 18th.

Hætanic. No. 479,688. Class 5. Unwrought and partly wrought metals used in manufacture.—L.P.S. Electrical Co., Avenue Road, Acton, W.3.

Rotomag. No. 477,509. Class 6. Ignition apparatus for internal-combustion engines—Joseph Lucas, Ltd.

Tefag, Berlin (lettering and design). No. 472,327. All goods in Class 8.—Die Telephon Fabrik Gesellschaft vormals J. Berliner, Berlin. (Abel and Imray, 30, Southampton Buildings, Chancery Lane, W.C.2.)

Siemens & Halske, S. & H. (lettering and shield design). No. 474,996. Class 8. Physical and electro-technical instruments and apparatus, Pupin coils, resistances, accumulators, &c. No. 475,000. Class 15. Glass. No. 475,001. Class 16. Porcelain and earthenware. No. 475,002. Class 17. Manufactures from mineral and other substances, for building or decoration. No. 475,011. Class 40. Goods manufactured from india rubber and gutta-percha.—Siemens & Halske Gesellschaft, Berlin. (Hazeltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Celestion. No. 475,669. Class 8. Microphones, &c.—Electrical Manufacturing Co., Ltd., 29, High Street, Hampton Wick, Middlesex.

Noctoscope No. 478,273. Class 8. Optical apparatus and instruments.—Television, Ltd. Motograph House, Upper St. Martin's Lane, W.C.2.

Long Life Lithanode, Our Slogan for 45 Years (lettering and design). No. 476,603. Class 8. Electric accumulators (not for medical purposes).—Lithanode Co., Ltd., 190, Queen's Road, Battersea, S.W.8.

Monette (lettering and design). No. 478,287. Class 8. Apparatus for use in radio-telegraphy and telephony.—Bruno Becker, trading as George Becker, 203-205, Edgware Road, London, W.2.

Jupiter. No. 476,515. Class 13. Electric lamps (ordinary), lamp holders, switches (ordinary), wall plugs, and other similar electric fittings.—Die Jupiter Licht Gesellschaft, Keisern & Brasch, Berlin. (Chatwin & Co., 253, Gray's Inn Road, W.C.1.)

Repex. No. 476,331. Class 50. A composition of asbestos and bitumen for use in sealing accumulators.—Chloride Electrical Storage Co., Ltd.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

27,516. "Excavating channels for telephone and the like cables." J. A. Kirby. November 2nd, 1925. (269,681.)

29,982. "Processes and electrolytic methods for separating and recovering the constituents of metallic salts in a state of fusion for use in the treatment of ores or chemical or metallurgical products." E. A. Ashcroft. November 27th, 1925. (269,749.)

31,733. "Apparatus for announcing and indicating broadcasting and other wireless stations. A. A. Schaschke. December 16th, 1925. (269,792.)

1926.

31,847. "Motor vehicles for railways, tramways, or the like, specially applicable to electrically-propelled tramcars." J. P. Barker. December 17th, 1925. (269,951.)

2,088. "Safety device for the protection against overheating of electrical heating elements." A. L. Large. January 25th, 1926. (Cognate application, 21,230/26.) (269,969.)

2,354. "Construction of electrolytic or valve rectifiers and filtering apparatus for obtaining d.c. from a.c. supply mains for wireless receiving or transmitting apparatus and the like." A. Mathisen. January 27th, 1926. (Cognate application, 8,081/26.) (269,972.)

2,430. "Dry batteries." M. Van Koningsveld and Ever-Ready Co. (Great Britain), Ltd. January 27th, 1926. (269,977.)

2,569. "Protective arrangements for duplicate feeder electric systems." A. Reyrolle & Co., Ltd., R. W. Biles and J. Piquet. January 28th, 1926. (269,983.)

2,664. "Ignition magnetos for internal-combustion engines." British Lighting and Ignition Co., Ltd., and J. C. Hutton. January 29th, 1926. (269,986.)

2,751. "Clamps for welding electrodes or for contacts for electric switches." E. G. Budd Manufacturing Co. January 31st, 1925. (246,868.)

2,782. "Electric accumulators." E. Deodato. August 7th, 1925. (256,569.)

2,919. "Electric signalling systems employing carrier waves." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). February 1st, 1926. (269,996.)

3,003. "Carrier-wave signalling systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). February 2nd, 1926. (270,001.)

3,013. "Electric switchgear." A. Reyrolle & Co., Ltd., and E. Waterhouse. February 2nd, 1926. (270,002.)

3,156. "Electrical insulators." Automatic Telephone Manufacturing Co., Ltd., and C. R. Woodland. February 3rd, 1926. (270,010.)

3,740. "Electric horns." North-East Electric Co. March 30th, 1925. (249,826.)

3,813. "Electrical condensers." T. S. Riley. February 10th, 1926. (270,020.)

4,357. "Appliances for starting, stopping, diverting, reversing and changing the direction of flow of electric current." G. H. Nedderman. February 16th, 1926. (270,023.)

4,416. "Telephone systems." Siemens Bros. & Co., Ltd., and W. H. Grinsted. February 16th, 1926. (270,026.)

4,705. "Thermionic valve amplifying systems." British Thomson-Houston Co., Ltd. March 3rd, 1925. (248,731.)

4,784. "Generators for electric arc welding." M. M. Irvine. February 19th, 1926. (270,032.)

5,192. "Electrically-heated kilns." B. J. Moore and A. J. Campbell. February 23rd, 1926. (270,035.)

6,198. "Protective systems for groups of rotary electrical machines." General Electric Co., Ltd., and A. E. Angold. March 5th, 1926. (270,043.)

6,571. "Variable-frequency variable-voltage converting apparatus." British Thomson-Houston Co., Ltd. March 10th, 1925. (249,118.)

7,032. "Electric tumbler switches." J. B. Tucker. March 15th, 1926. (270,048.)

7,888. "Electrical coil holders." I. Shapin. March 22nd, 1926. (270,058.)

8,661. "Regulators for dynamo-electric machines." W. H. Glaser and C. A. Vandervell & Co., Ltd. March 30th, 1926. (270,065.)

8,902. "Metering of calls of automatic telephone systems." Siemens Bros. & Co., Ltd., and H. E. Humphries. April 1st, 1926. (270,068.)

9,452. "Electric arc lamps." R. V. Boardman. April 9th, 1926. (270,070.)

9,506. "Multi-frequency crystal-controlled oscillator." Wired Radio, Inc. October 2nd, 1925. (259,174.)

9,547. "Sound amplifiers or loud speakers." C. N. Harrison. April 12th, 1926. (270,073.)

9,731. "Sound-reproducing apparatus." Hopkins Corporation. November 18th, 1925. (261,698.)

11,679. "Telephone transmitters." W. J. Rickets and E. E. Smith. May 3rd, 1926. (270,088.)

12,488. "Loud speakers." Gramophone Co., Ltd. May 14th, 1925. (252,194.)

13,367. "Apparatus for the control and operation of electric lifts and the like." J. B. M. Knutsen. May 26th, 1926. (270,098.)

13,936. "Electrolytic cells." A. K. Croad (Jessup & Moore Paper Co.). June 2nd, 1926. (270,104.)

14,149. "Mechanical connector for electrical purposes." E. Bawtree. June 4th, 1926. (270,106.)

15,167. "Coupling or connection of electrical wires and the like." L. H. Reid. June 16th, 1926. (270,110.)

16,982. "Electrical loud-sounding telephone." B. A. Butt. July 7th, 1926. (270,121.)

17,767. "Apparatus for electroplating." Dr. G. Caraccio. July 15th, 1926. (270,127.)

18,266. "Electric light fittings." R. W. Buckingham. July 21st, 1926 (270,130.)

19,869. "Electrically-heated hand irons." H. B. Jackson. August 12th, 1926. (270,139.)

21,057. "Chromium plating." Metropolitan-Vickers Electrical Co., Ltd. September 12th, 1925. (258,242.)

28,151. "Utilisation of ultra-violet rays for supporting combustion in heat engines and the like." H. A. Gill (Studienges fur Wirtschaft & Industrie). November 9th, 1926. (269,808.)

28,536. "Thermionic lamps." M. Balsera (Rodriguez). November 12th, 1925. (261,402.)

29,769. "Contact device for electric signalling apparatus." L. Rado and J. Modern. August 25th, 1926. (270,172.)

29,948. "Electric arc cutting." British Thomson-Houston Co., Ltd. (General Electric Co.). November 26th, 1926. (270,175.)

30,428. "Indicating devices." British Thomson-Houston Co., Ltd. December 1st, 1925. (262,432.)

30,701. "Means for drying electric bright annealing furnaces." Siemens-Schuckertwerke Ges. December 10th, 1925. (262,766.)

31,354. "Apparatus for automatically lighting electric lamps at any predetermined time." L. Mercier and V. Borgne. December 11th, 1925. (262,807.)

31,560. "Thermionic amplifiers, modulators, detectors, and like devices." Marconi's Wireless Telegraph Co., Ltd. December 12th, 1925. (262,820.)

31,610. "Railway signal systems." Automatic Telephone Manufacturing Co., Ltd., A. E. Hudd, and A. E. Tattersall. November 18th, 1925. (Divided application on 269,608.) (269,815.)

31,631. "Modulating systems for electrical high-frequency currents." C. Lorenz-Akt.-Ges. December 14th, 1925. (262,825.)

31,718. "Electric control systems." British Thomson-Houston Co., Ltd. December 18th, 1925. (263,150).

32,312. "Method and means for the repetition of telegraphic signals." C. L. Hamel. December 24th, 1925. (263,800.)

32,603. "Switch devices for electric transmission lines." Metropolitan-Vickers Electrical Co., Ltd. January 13th, 1926. (264,478.)

1927.

2,442. "Manufacture of electric incandescent lamps and the like." General Electric Co., Ltd. (Patent Treuhand-Ges., für Elektrische Gluhlampen). January 27th, 1927. (270,210.)

3,219. "Electrically-driven railway ticket-printing press." Allgemeine Elektricitats Ges. February 4th, 1926. (265,604.)

3,554. "Apparatus for filtering electrical currents." Dubilier Condenser Co. (1925), Ltd. October 24th, 1924. (Divided application on 241,946.) (265,635.)

4,508. "Oil switches." Akt.-Ges, Brown, Boveri et Cie. March 29th, 1926. (268,305.)

4,583. "Electromagnetic sound reproducers, such as loud speakers." Brandes Laboratories, Inc. October 16th, 1926. (270,216.)

6,904. "Television systems and apparatus." J. L. Baird. October 21st, 1925. (Divided application on 269,219.) (270,222.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABRAM.—Electric light installation, 50 houses, Bickershaw, for the U.D.C.; W. Aspinall, clerk.

ASPATRIA (Cumberland).—Church, for the Wesleyan trustees.

AYRSHIRE.—Shops and houses at Troon (£3,300); Wm. Govan & Sons, builders, Prestwick.

BARNSLEY.—Business arcade; J. R. Wilkinson, architect, 15, Regent Street. Hotel, for John Smith's Tadcaster Brewery Co., Ltd.; Bertram Wilson, Architect, High Street, Tadcaster.

BEDWAS AND MACHEN.—Housing scheme (40), for the U.D.C.; surveyor.

BLYTH.—Central School, Plessey Road; Education Committee.

BOURNEMOUTH.—Business premises and flats, Holdenhurst Road; H. J. Holt, Ltd.

BRIGHTON.—Operating theatre, &c., Royal Alexandra Hospital, Governors. Synagogue, Middle Street; Brighton and Hove Hebrew Committee. Alterations, 28, St. James Street; F. W. Woolworth & Co. Housing scheme, North Moulescombe Estate (184); borough surveyor.

BULGARIA (Sofia).—New slaughterhouses for the Town Council (100,000,000 leva). An international competition for plans and projects will be held.—*Reuter's Trade Service* (Sofia).

BURTON-ON-TRENT.—Extension of board room block, for the B.G.; R. S. Litherland, architect, 10, High Street.

CHELMSFORD.—First part of £91,000 county office scheme, Duke Street; Essex county architect.

CHESTER.—Housing scheme (26), Hoole Lane; C. Greenwood, city engineer, Town Hall.

CHESTERFIELD.—Baptist church, Cross Street, with heating and lighting (£9,400); Jackson & Fryer, architects; W. G. Kirk, Ltd., builders.

DERBY.—Hospital (£33,999), Friar Gate; J. W. Wildgoose and Sons, Ltd., builders, Matlock.

DOUGLAS (I. of M.).—Loch promenade improvement (£60,000); Corporation and Harbour Commissioners. Hall, corner Hanover Street and Lord Street; Salvation Army.

EDGEHILL (Devon).—Extensions to Girls' College, with electrical work, for the governors (£15,000); Rowntree, architect; Ellis & Sons, builders, Bideford.

EDINBURGH.—Warehouse and garage in Leith Walk; Danish Bacon and Co-operative Trading Co., Ltd. Secondary school, Leith Academy (£66,000), for the Burgh E.C.; Reid & Forbes, architects, 7, Ainslie Place.

FALKIRK.—School for Stirlingshire Education Authority; Master of Works, Education Authority, Stirling.

FERRYHILL.—Primitive Methodist church, with electrical work; T. W. T. Richardson, architect, Stockton-on-Tees; G. W. Lazenby & Co., Ltd., builders.

GLASGOW.—Warehouses in Sauchiehall Street for Messrs. Woolworth; the manager.

GOUDHURST.—Central school; Kent Education Committee.

GRAVESEND.—Improvments, Technical Institute, at School of Art; Kent Education Committee. Club, Overcliffe; Gravesend Trades Hall, Ltd.

GRAYS.—Re-erection of works, Thames Road (electrically equipped), (£30,000); Drums, Ltd.

HARROGATE.—Re-erection of portion of the George Hotel (several thousand pounds); Mr. Edge, manager. Police headquarters; P. O. Platts, County architect, County Hall, Wakefield.

HASTINGS.—Reconstruction of baths, with electrical work (£72,004), for the T.C.; borough surveyor. Entertainment hall, Gordon House, and lecture room, Buchanan Hospital; H. Ward & Sons, architects. Business premises, York Buildings, for McIlroy Bros., Ltd.; Callow and Callow, architects.

HAWARDEN.—Additional housing scheme (36), Penyffordd, for the R.D.C.; F. Barrett, surveyor, Wold House.

IRISH FREE STATE (Pembroke, Dublin).—Houses, Meleady's Field (77), Havelock Field (77), and Irishtown Road (29), for the U.D.C.

KEIGHLEY.—Secondary school for girls; West Riding Education Committee.

KEMPTON.—Filters and mains at Metropolitan Water Board works (£90,000).—W. Moss & Sons, Ltd.

KETTERING.—Dispensary and weights and measures offices, Market Street; Northants C.C.

KNARESBOROUGH.—Sanatorium, for West Riding C.C.; the clerk, County Hall, Wakefield.

LEEDS.—54 houses, York Road, 68, Meanwood Estate; city engineer.

LLAY (Denbighshire).—Housing scheme (200), for the Llay Main Colliery Co., Ltd.

LONDON (E.C.).—Extensions and alterations, engineer's department, Guildhall; City engineer. Extensions, Guildhall School of Music, for Corporation; L. & W. Whitehead, Ltd.

(Whitechapel, E.).—Buildings, 196-200, Commercial Road; A. T. G. Harbour for P. Young.

(Cricklewood, N.W.).—Aqueduct (£105,000); Metropolitan Water Board.

(Hendon, N.).—Bank and shops, Edgware Road and Station Road, Watling Estate; B. W. Blower.

(Bermondsey, S.E.).—Buildings, Saltpetre Works, Neptune Street, for Brandram Bros., Ltd.; J. Perkins & Sons, Ltd.

(Lewisham, S.E.).—Church and elementary school, Moorside Road, Downham; Roman Catholic authorities.

(Brixton, S.W.).—Trade school for girls, Clapham Road; L.C.C. Education Committee.

(Tooting Junction, S.W.).—Repertory theatre (£30,000), Mitcham Road, for the Furzedown Repertory Theatre Guild.

LUTON (Beds.).—Works extensions, for Vauxhall Motors, Ltd.

LYMINGTON (Hants.).—Additional 34 houses, for the T.C.; borough surveyor.

MANCHESTER.—Hospital for Manchester Northern Hospital for Women and Children; C. E. Marshall, secretary, 38, Barton Arcade. Infants' school, and alterations to Blackley Municipal School; S. Hey, director of education, Education Offices, Deansgate.

MUSSELBURGH.—Housing scheme (52), Monktonhall; burgh surveyor.

NEWHAVEN (Sussex).—130 bungalows, Telscombe and Saltdean, for the Peacehaven Estates Co.

NORTHANTS.—Mental hospital; County Hospital Committee.

OULTON.—Mental colony (£500,000); West Riding C.C.

PAISLEY.—Garage for J. McFadyen & Co., Ltd. (electric light and central heating); the manager.

PRESTWICH.—50 houses, Langley Estate, for U.D.C.; Titterington Bros. Housing scheme (76), for the T.C.; burgh engineer.

ROSS (Herefordshire).—Housing scheme (50), for the U.D.C.; E. R. Davies, clerk.

ROYSTON.—Extensions to hospital, with kitchen wing; B. Parker, architect, Norton Way, Letchworth, Herts.

SALISBURY.—Conversion of St. Edmund's College to municipal offices and council chamber (electric lighting); W. J. Goodwin, city engineer and surveyor, Municipal Offices.

SEVENOAKS.—Central school for boys; Kent Education Committee.

SHIRLEY.—66 houses and 52 garages, Wickham Road; Ivall Bros., Shirley Nursery, Wickham Road.

SIDCUP.—Secondary school; Kent Education Committee.

SITTINGBOURNE.—Grammar school, Borden, for Kent E.C.; W. H. Robinson, education architect, Sessions House, Maidstone.

SOUTHAMPTON.—Mental institution; medical officer of health.

STIRLINGSHIRE.—212 houses for County Council (£95,400); county clerk, Stirling.

STOKE-ON-TRENT.—44 houses, Goldenhill; city engineer.

SWANLEY.—Central school; Kent Education Committee.

SWANSEA.—Shops and cafe, Woodfield Street; D. Jones.

TAUNTON.—Five transformer sub-stations, for the T.C.; Ivor F. Shellard, borough engineer.

TENTERDEN.—Mental institution; Kent C.C.

TORQUAY.—Houses (238), Barton, for G. E. Tozer. Housing scheme (130), Windmill Hill, for the T.C.; borough surveyor.

TROON.—Housing scheme (104), with electrical work, for the T.C.; burgh surveyor. Shops and houses (£3,300), Dundonald Road; W. Govan & Sons, builders, Prestwick.

WALSALL.—Hospital (£30,890), for the T.C.; borough surveyor.

WARLINGHAM.—Nurses' home, Mental Hospital (£17,000), for Croydon Corporation; J. B. Edwards, Piccadilly.

WEDNESBURY.—Extensions, County Technical College, for Staffs. E.C.; education architect, Stafford.

WEST LOTHIAN.—Rebuilding Picturedrome after fire for Armadale Picturedrome Company; the secretary.

WREXHAM.—Additional 328 houses, for the R.D.C.; surveyor.

The

Electrical Review

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Contents:

	PAGE
Tariffs and Wayleaves	869
The All-Electric Home Competition	870
Electricity Used Dangerously	870
A South-East Lancashire Scheme	870
Deptford (East) Re-visited (*illus.*)	871
Single-Phase Induction Motor Starting Devices, by G. Windred (*illus.*)	874
A Radio-Telephone Loud-Speaker, by Ernest W. Braendle (*illus.*)	876
Electrical Manufacturing in Russia	878
Results of the "W.O.B." Ballot	879
A Lancashire Electricity Scheme	880
Business and Industrial Notes	881
Lighting and Power Notes	885
Tramway and Railway Notes	886
Telegraph and Telephone Notes	887
Radio Notes	887
Reviews	887
Contract Information	889
Forthcoming Events	890
Notes	890
Our Personal Column	893
Financial Section—	
New Companies Registered	894
Financial Section—*continued.*	
Official Returns of Electrical Companies	895
City Notes	895
Stocks and Shares	897
The Incorporated Municipal Electrical Association.—II (*illus.*)	899
Presidential Address, by R. W. L. Phillips	899
Distribution over an Extensive Area, by W. C. Bexon	900
The I.M.E.A. Exhibition	904
Electrical Imports of Spain	905
Conditions in Switzerland	906
New Electrica Devices, Fittings and Plant (*illus.*)	907
A Window-Dressing Competition (*illus.*)	908
Parliamentary News	908
Correspondence—	
Cheap Electricity	910
The Ideal Wiring System	910
A Mysterious Occurrence	910
Electromobiles	910
Magneto Repairs	910
Legal	911
Published Specifications	911
Trade-mark Applications	911
New Work for Contractors	921

Tariffs and Wayleaves.

WE venture to think that in refraining from using the Electricity (Supply) Act as a text for his presidential address to the Incorporated Municipal Electrical Association, Mr. R. W. L. Phillips was extremely well advised: the electrical industry has read, said, and heard enough on that subject to last for a long while to come; the working of the Act will, however, provide abundant material for comment and criticism when the machine gets into motion. We would congratulate Mr. Phillips also on his timely reference to the excellent Report of the Advisory Committee on Domestic Supplies of Electricity; as he says, that Report was overshadowed by the Bill, but it is too valuable a document to be pigeonholed, and thanks are due to the president for bringing it into prominence on so appropriate an occasion.

It will be observed that he tacitly accepts the two-part tariff as correct in principle, his comments relating mainly to the method of determining the fixed charge; this has always been a vexed problem in connection with domestic consumers, and as Mr. F. W. Purse recently demonstrated in our columns, it offers difficulties even in the case of bulk supply. The Advisory Committee itself was unable to arrive at a definite conclusion on the subject. We would suggest that so far as domestic electricity supply is concerned, it is undesirable to attempt to make assessments on individual installations; a broader basis should be sought, founded on averages, not on particular instances. Mr. Phillips almost committed himself to this view, hinting that the actual method adopted was immaterial, and that the practice followed in fixing the values of other forms of rating might meet the case sufficiently well. The universal adoption of a uniform principle of assessment, leaving the actual charge to be fixed by each undertaking for itself, would, as he says, be of immense benefit to the whole country. Even now, a large number of undertakings adhere to the flat-rate system, which discourages the development of the use of electricity in the household.

With regard to that other very important question—the cheapening of distribution—Mr. Phillips's comments on the difficulties and abuses of the wayleaves problem are abundantly endorsed by Mr. W. C. Bexon, in

his practical paper on "Distribution over an Extensive Area." Both these gentlemen have acquired extensive experience in the negotiation of wayleaves, and Mr. Bexon in particular is somewhat bitterly eloquent over the obstacles presented not only by landowners and tenants, but also by the too-stringent regulations of the Post Office and the Electricity Commissioners. It is a familiar subject, a grievance of long standing, but practically no progress has yet been made towards facilitating the use of overhead lines in rural areas; we hope that, as the result of the publicity given to it at this Convention, this very urgent question may receive the attention that is its due.

The All-Electric Home Competition.

In this issue we are able to give the results of the competition which formed a part of the recent E.D.A.-E.L.M.A. Campaign. We extend our heartiest congratulations to Miss Gardiner, who headed the list of prize-winners, as well as to the others comprising the list. It is peculiarly appropriate that a lady should secure the first prize, for the Campaign was primarily a ladies' affair, being directed towards the improvement of lighting in the home as a first step to complete domestic electrification.

It is noteworthy that so large a body of people took a practical interest in the Campaign; about 150,000 papers were received. The order of preference of the public for the given attributes of electric lighting should form a useful basis for future publicity.

We think that it can be said that this branch of the Campaign was successful, and there is no doubt of the excellent results obtained from the all-electric demonstration homes which were set up all over the country.

It may be possible in a short time to give some more definite information regarding the effects of the Campaign and the lessons to be learned from it, but in the meantime all concerned can rest assured that the money spent was well spent.

Electricity Used Dangerously.

In a leaderette under this title in our issue of September 19th, 1924 (p. 418), we drew attention to certain conditions under which the use of electricity might be attended with danger to person or property. Referring to the introduction of broadcasting, we said: "the wearer of a headphone which happens to be faulty may, in effect, have an earthplate clamped to his head, or hers, and on picking up an electric kettle or other device which is likewise faulty may have a very unpleasant experience." To avoid such an accident we advised occasional inspection. Unfortunately last week precisely what we had foreshadowed as a possibility was realised in fact; a woman wearing headphones apparently grasped an electric table-lamp fitting which was in a faulty condition, and received a fatal shock. It appears that the headphones, which were connected to a crystal receiving set, were likewise faulty, a not uncommon occurrence, so that the circuit to earth was complete. As we have pointed out, there is in bedrooms as a rule no means of making contact with earth, so that the chance of receiving a shock from a faulty fitting is infinitesimal, but the extension of the wireless circuit with its necessary earth connection changed the conditions.

It will be seen that two faults must occur simultaneously before the risk arises at all; in the present instance one of them was known to exist, for the lamp fitting was out of order and the family of the unfortunate lady, it was reported, "had been anxious about her making use of it." The fitting should certainly have been put out of commission or repaired directly it came under suspicion—and the same applies to all electrical apparatus, whether fixed or portable.

In view of the combination of circumstances necessary to bring about an accident of this kind, we do not regard the risk as one that calls for drastic action; it is no greater than scores of others to which we are constantly exposed in the daily round. But those wh care to take precautions can readily insert a tran former between the receiver and the listening circuit at small cost and without detriment to the reception It will then be necessary for faults to occur simulta neously in three separate apparatus— a contingency s remote that no one need worry about it.

A South-East Lancashire Scheme.

We have received from the South East Lancashire Electricity Advisor Board a copy of a document which is o considerable interest from severa points of view; a *résumé* of its con tents appears elsewhere in this issue. It is describe as "indicating a method by which the District coul be developed with general advantage, provided th Central Electricity Board could make the necessar arrangements for carrying it into effect," but th authors "expressly refrain from putting forward th scheme as a proposal or recommendation within th meaning of the South-East Lancashire Electricity Dis trict Order, 1923," yet it has been "approved by th South-East Lancashire Electricity Advisory Board," on May 24th.

The South-East Lancashire electricity supply authorities are noted for their enterprise and alertness; even before the Government took action in the matter of co-operation, some eleven years ago, they had formed a committee to prepare a scheme of interconnection for Lancashire and Cheshire, and on other occasions they claim to have been first in the field. Last year, when the Electricity Bill was passing through Parliament, a Special Committee of the Advisory Board proposed that the Board should be replaced by a Joint Electricity Authority, with a view to developing the District and securing a lower tariff within that area than the national tariff. The idea was, as we said (October 15th, 1926, p. 606), to secure exemption for the area from the collective operation of the national scheme; but the Board did not actually adopt the proposal. In the present instance, when it "approved" the Committee's scheme, the Board also adopted a resolution agreeing to afford facilities to, and to co-operate with, the Commissioners in the preparation of a scheme for the District by the latter.

Our reading of the circumstances is that the Board, through its Committee, is endeavouring to shape its ends and to lead the Commissioners in the direction in which it would have them go. Up to a point, this is a commendable policy, and it certainly does credit to the shrewdness of the authorities, to which we have already alluded. But, as the Commissioners indicated to a deputation from South-East Lancashire last year, an area under the national scheme may, and probably will, comprise more than one Electricity District—perhaps five or six of them. In the scheme before us we see no evidence at all of any recognition of this fact; the scheme relates almost solely to the one Electricity District, takes no account of interconnection with external areas, and provides no 132,000-V trunk mains. We gather that, as before, South-East Lancashire wishes to be left to work out its own salvation. Technically, we do not criticise that ambition; very probably the residents in the District would be better off if they could gain their end. But the Act has been passed, and *now we must all think nationally*. It is not in the national interest that South-East Lancashire, or any other area, should enjoy a selfish isolation; it has been decreed by Parliament that we must all pull together, even though some Districts gain nothing—or even lose a little—thereby. We think we see in this proposition the parochial policy again, on a larger scale, it is true, but still the same in essence. It will not do: broader views must prevail, and we have no doubt that the Commissioners, when they transmit to the Central Electricity Board a scheme involving S.E. Lancashire, will be found to have gone their own way, and to have dealt with the northern counties as a whole.

Deptford (East) Re-visited.

A brief outline of the extensions of plant carried out during recent years to meet the needs of electric railway traction, in addition to normal industrial load expansion.

THE Deptford (East) electricity generating station, the pioneer high-voltage plant of the world, is a lasting memorial to the directors of the London Electric Supply Corporation, Ltd., to Mr. G. W. Partridge, its managing director and engineer, and to Dr. S. Z. de Ferranti, whose genius gave it birth, always recalling to mind reminiscences of those stirring times of 40 years ago.

The last two original Ferranti generating sets are now being dismantled, and the remaining historic Partridge h.p. switchgear will soon be displaced, for the station now aggregates 100,000 kW, and forms one of the permanent centres of the production of electricity for the London area.

Since the station was last visited in 1919,* besides the normal growth of industrial load, it has added to its list of consumers the whole of the electrified South-Eastern section of the Southern Railway, together with considerable additions on the L.B. & S.C. section, the curves reproduced in fig. 2 indicating more eloquently than words the growth in output of the station, due largely to what is one of the most important railway electrification schemes so far carried out in Europe. The old reciprocating engines, some of which did duty for over 30 years, had of necessity to be scrapped, and the engine room which formerly housed 16,000 kW of plant is to-day occupied by turbo-generators which are capable of a combined output of nearly 10 times that capacity; a view of one bay of the engine room as now constituted is shown in fig. 1, in which eight turbines are installed, the other bay being similar.

The extension of the single-phase lighting system has been met by installing three 4,000-kVA and one 7,500-kVA turbo-alternators, generating at 2,500 volts, which pressure is stepped up by means of transformers to 10,000 volts. To meet the increase in the single-phase railway load and the growth of the industrial supply one 8,750-kW and one 15,000-kW three-phase turbo-alternators generating at 6,600 volts have been installed, while to supply the South-Eastern section of the Southern Railway, three 20,000-kW turbo-alternators generating at 11,000 volts have been installed, and a further 25,000-kW three-phase turbo-alternator for the latter purpose is to be built.

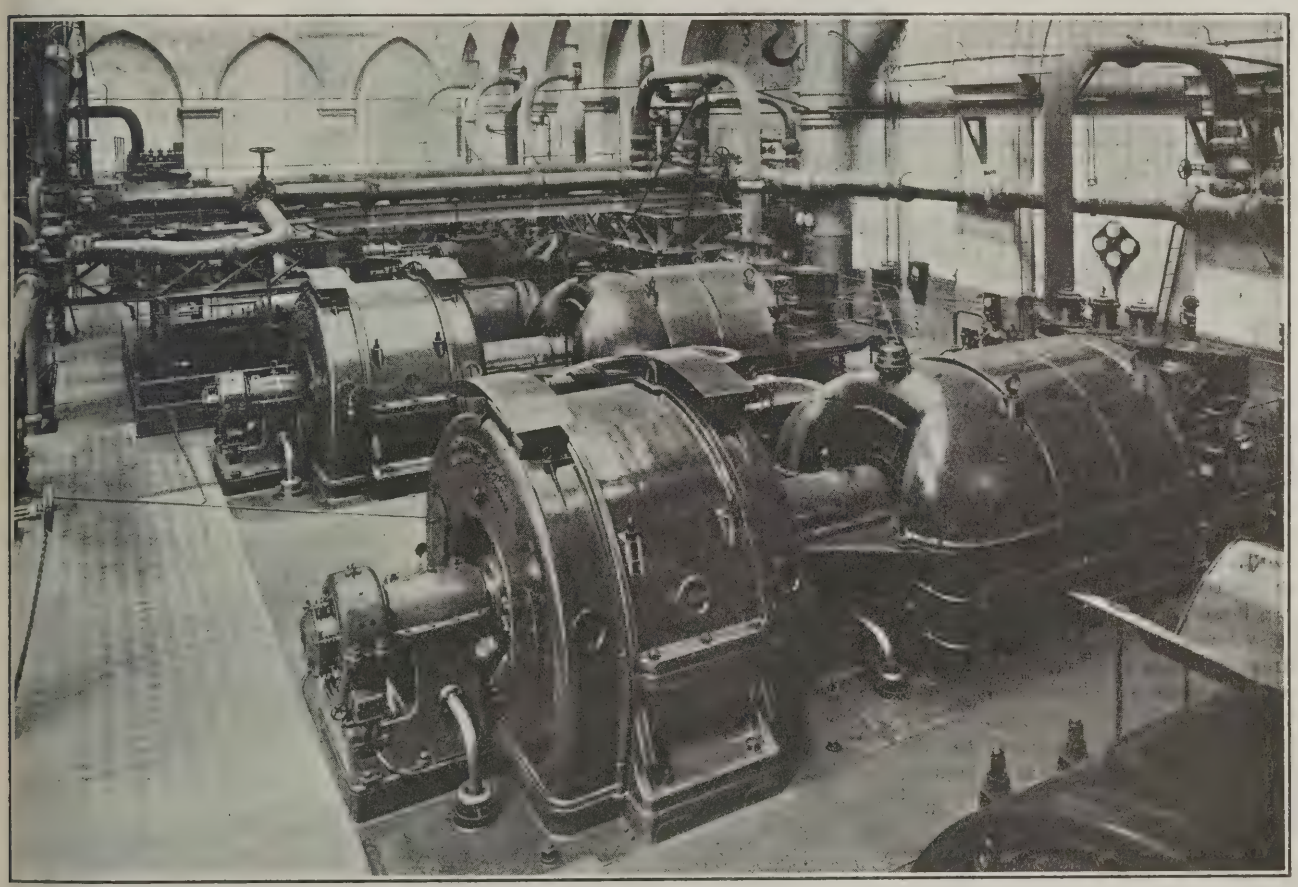


Fig. 1.—Part of the Turbo-generator Room at Deptford (East) Power Station.

With the exception of the machines which serve the lighting system proper, all the generators have been wound for three-phase working, but so built and arranged that any one set can supply the single-phase railway system. The turbines are all supplied with steam at 300 lb. per sq. in. pressure at 700 deg. F., and are bled at two stages: one high-pressure stage for water evaporators, of which one is connected to each main unit, and the low-pressure stage for working in connection with water de-aerators, one of which is used with each turbine for removing all oxygen from the condensate before it is pumped into the boilers through a closed-feed system.

* See ELEC. REV., August 9th, 1912, and July 11th, 1919.

When these extensions were commenced four or five years ago, no complete closed feed system was in existence, and the Deptford staff had to evolve a system which has proved its efficacy by limiting the oxygen content to an average of 0.05 c.c. and under. The condensate, after being removed from the condenser by the extraction pumps, is pumped through a de-aerator heater of the surface flash type wherein all air is removed by a connection to the main condenser from the water side, while at the same time the temperature is raised by means of the steam bled from the low-pressure stage of the turbine, the action being practically automatic, a constant temperature being maintained at all loads and the vacuum in the water space of the de-aerator corresponding to the temperature. The flow of water passing to the de-aerator is controlled by a float valve in the lower part of the vessel; a second, or booster, pump extracts the condensate from the de-aerator and delivers it under pressure to the suction side of the feed pumps that deliver to the boilers *via* high-pressure heaters which raise its temperature to 220 deg. F.

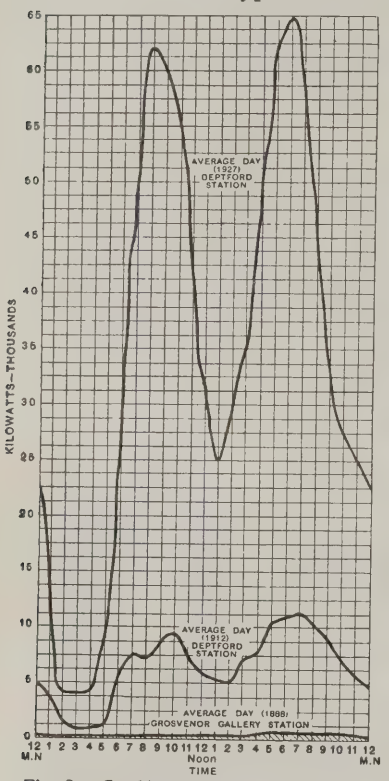


Fig. 2.—Combined Maximum Loads on Generating Station.

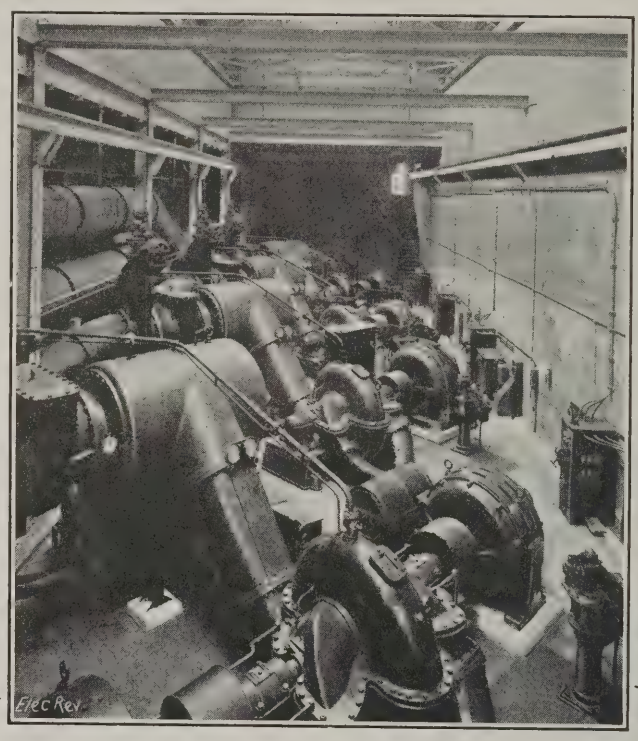


Fig. 3.—New Condenser Water Pump House.

An open surge tank is connected between the main condenser extraction pump and the de-aerator booster pump, into which any surplus condensate is discharged by the condenser extraction pump during such times as the boiler feed pumps do not require it; should the demand by the feed pumps be greater than can be satisfied by the main plant, then the pressure fall on the discharge side of the extraction pumps will allow the stored water in the surge tank to discharge into the de-aerator. An unusual feature is a connection between the surge tank and the suction eye of the feed pump, called the pressure head line, in which a non-return valve is inserted; normally, so long as the booster pump is working, this valve is kept closed by the discharge pressure of the booster pump, thus preventing the latter discharging to the surge tank; if however, the booster pump should fail, thus starving the feed pumps, the pressure head line will immediately come into action, due to the pressure on the bottom of the non-return valve being relieved, allowing the surge tank to discharge direct to the feed pumps, the tank being placed at a height above the feed pumps to ensure sufficient head on the suction side.

Each main turbine is provided with extraction and booster pumps in duplicate, one being steam driven and the other motor driven. Make-up water for the boilers is obtained from the town's mains, and is either treated in lime-soda plant, or passed through evaporators. The water, which is chemically softened, passes through an independent de-aerator before going to the boilers; that from the evaporators is either discharged to the surge tank, or otherwise mixed with the main condensate and is de-aerated along with it as described above.

To provide circulating water for the surface condensers, an entirely new pump house (fig. 3) was constructed and equipped with five motor-driven centrifugal pumps, each having a normal capacity of 1½ million gallons of water per hour. The water is drawn from the River Thames through a 10-ft. diameter tunnel, which is divided on its horizontal centre line, the top part forming the return, while the bottom suction part ends on the land side in an open 20-ft. diameter sump shaft, in which settles the larger and heavier *débris*, which is removed at intervals by grabbing; from the land shaft a 10-ft. diameter tunnel passes under the floor of the pump house to the suction side of the pumps. There are also removable screens in the land shaft which prevent floating material passing through, and for removing leaves and similar material each pump is provided with a "Deptford"

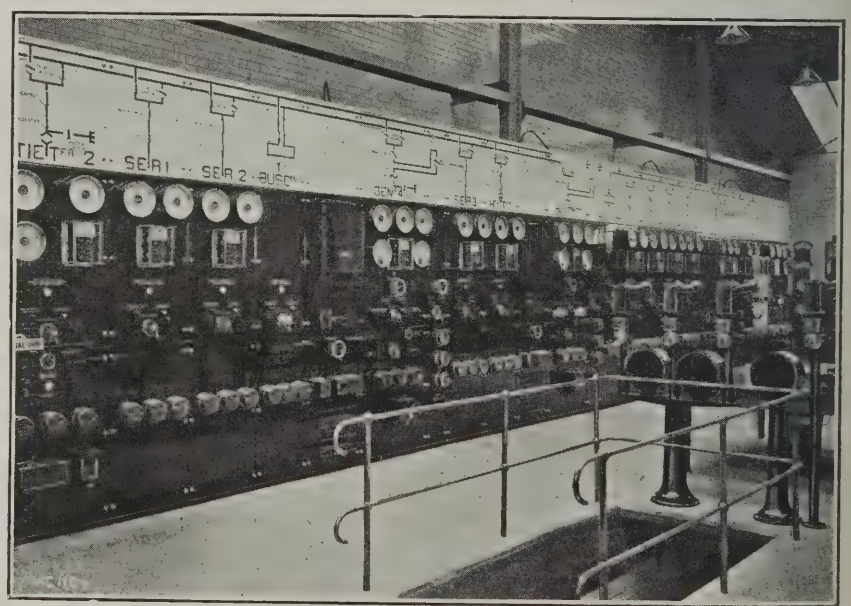


Fig. 4.—Control Room, showing 11,000-V Board.

rotary strainer on the discharge side, visible in fig. 3, after passing through which the water is discharged into two 48-in. diameter cast-iron pipes which carry it to the condensers, whence it returns through two similar pipes that converge a little beyond the land shaft into the top part of the tunnel leading back to the river; the system works on the siphon principle, and all valves on the pumps and condensers are so far as is possible electrically operated.

The cooling air for the main generators is circulated on the closed system, each having its own cooler, water for which is obtained from the circulating-water mains. Temperature-indicating and alarm devices are fitted.

The recent switch-house extension is a brick building 104 ft. long by 52 ft. wide, adjacent to the turbine room. The gear consists of 27 oil switches arranged on the top floor; on the floor below are the duplicate bus-bars, whilst on the same floor as the switches, but separated from it by a brick wall, is the main control room (fig. 4), which overlooks the turbine room. Of the cellular construction, each oil switch has a rupturing capacity of 750,000 kVA. Both the extensions on the 6,600-volt and the 11,000-volt systems are housed in this building, and to admit of both systems being connected together to suit the running conditions of the station, two 7,500-kVA banks of single-phase transformers fitted with tertiary windings have been connected in star-star; means are also provided whereby the forced oil-cooled transformers can be switched on to the single-phase railway bars to enable a supply to be given from the 11,000-volt generators, two phases of the three-phase windings being used for this purpose.

The control wiring is arranged so that it is impossible to open any main oil switch until the isolator is in the full "off" position, which avoids the danger of mistakes being made, and the main generators are protected by means of two oil switches in series, one directly against the bus-bar, whilst the other is placed by the machine, one of them being arranged for balanced protection and the other for overload only. The method of mounting the current transformers which operate the relays is to slip them over the lead covering of the cables, and they are as far away from the high-voltage gear as it has been possible to place them, so that any fault developing on the bus-bars, &c., will not involve the apparatus on which the clearing of the circuit depends. For the same reason, the control cables follow different routes to the main cables, and where they pass into the bus-bar cell structure.

The capacity of the station when the 6,600-volt and 11,000-volt three-phase systems are tied together by means of transformers has necessitated the installation of reactor coils in circuit with the transformers, and also with several of the feeders which serve the adjacent sub-station, to lessen the shock to the system in the event of a fault occurring. Some of the features of the special arrangement of the switchgear to meet the needs of the Southern Railway electrification scheme have already been dealt with.*

A complete new boiler house has been erected (fig. 5), each of the 14 boilers installed having a normal actual evaporation of 50,000 lb. of water per hour, and an overload rating of 65,000 lb. per hour, at 325 lb. pressure and a total temperature of 725 deg. F. A further 6 units are now in course of erection, each having a normal evaporation of 64,000 lb. per hour, and an overload rating of 80,000 lb. per hour. Each is fitted with a steel-tube economiser and an air heater (the gases being discharged from the stack at a temperature not exceeding 230 deg. F.), and two travelling grates, each 8 ft. 6 in. wide, of the compartment type arranged for balanced draught. Two coal shoots are fitted to each boiler to enable two different types of coal to be burnt on the "sandwich" system; each boiler is equipped with its own forced- and induced-draught fans, directly coupled to d.c. variable-speed motors, while a complete outfit of measuring instruments has been installed for each unit, there being an operating combustion engineer on duty during each shift. The seven feed pumps are all turbine driven, varying in capacity from 11,000 to 35,000 gallons per hour, the exhaust steam from them being discharged into the high-pressure feed heaters.

The ashes are discharged through a closed shoot from the hoppers into a concrete trough in the basement floor,

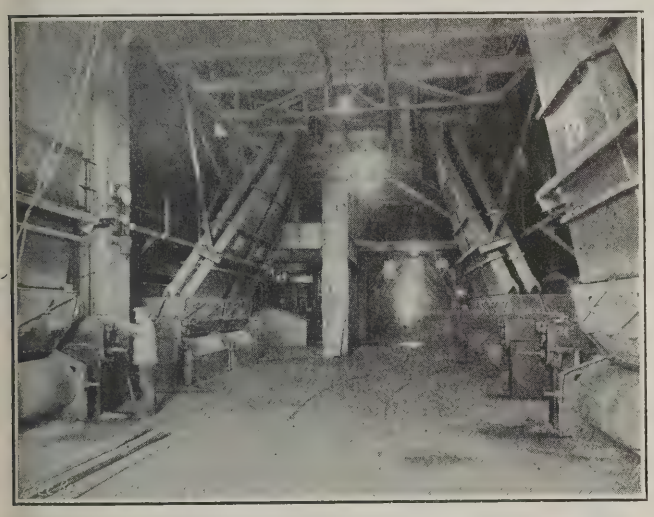


Fig. 5.—New Boiler House.

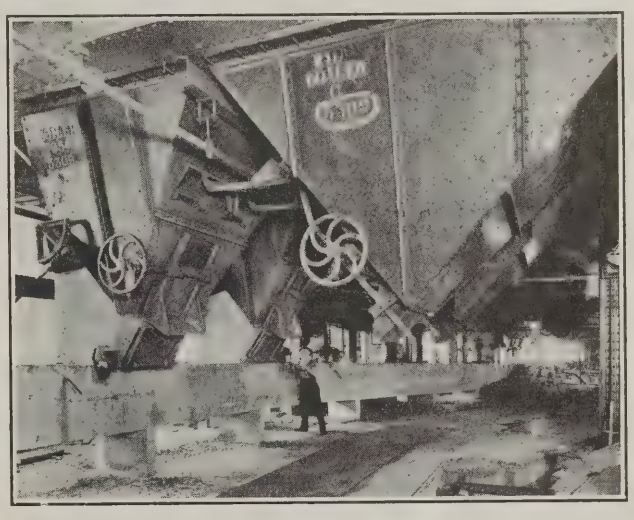


Fig. 6.—Ash Conveyor, Water-trough System.

and transported by means of a water sluice a distance of 350 ft. to a sump at the wharf front, where they can be handled by a grab crane, to be loaded into barge or wagon as required. The water is circulated by motor-driven centrifugal pumps in a pump house on the wharf front adjacent to the sump, the pumps drawing their water from the ash sump through a metal screen; a view of the sluice is shown in fig. 6.

The removal of the riddlings from the hoppers under the grates is by means of a system of ducts laid in the basement floor, whence they are blown by air to the top of the bunkers, at a height of 100 ft., where they mix with the fresh coal.

Coaling is done by two electric grab cranes of the horizontal luffing type on the wharf, which deliver into a hopper, whence the fuel is raised 90 ft. by a telpher and delivered to the bunkers, or deposited on the coal store as required, weighing being done by a track weigher, the rate of unloading being 150 tons per hour.

In conclusion, it may be remarked that work has already commenced on the adjacent site of the new Deptford (West) generating station, the contract for which was recently placed with Sir Wm. Arrol & Co., Ltd., by the London Power Co., which will in due course take over the Deptford (East) station, leaving the London Electric Supply Corporation, Ltd., to fulfil the functions of a distributor.

We are indebted to the company for the particulars and illustrations reproduced above.

* See Electrical Review, September 6th, 1926.

Single-Phase Induction Motor Starting Devices.

A brief review of the methods employed for starting single-phase induction machines, and a description of the Ferraris-Arno method.

By G. WINDRED.

THE problem of obtaining an appreciable torque from the single-phase induction motor during the starting period is one which has occupied the attention of designers of these machines for a number of years, in fact, since the introduction of the machine, and the number of devices evolved during this period is an indication of the extensive use of this type of motor.

This does not agree with the generally accepted impression that the single-phase motor has long since become of small importance, but it is not proposed to enter here into a discussion of this point.

The object of the present article is to discuss the relative merits and otherwise of the known forms of starting device, and to describe briefly a starting arrangement giving greatly superior characteristics to any of those at present in use. It should be mentioned that the device in question was evolved in connection with traction work, for which the advantages of using only a single line for the supply of power need no elaboration.

For the purpose of comparison it will be advisable to briefly review the subject of starting single-phase induction motors, and to describe some of the better-known methods of starting and their characteristics.

Torque of Single-phase Induction Motor.

In the first place, it is instructive to examine the conditions existing in the single-phase machine at standstill and during the accelerating period up to full speed, when the machine behaves in a similar manner to a shunt d.c. motor, and is quite satisfactory for ordinary service.

It is comparatively easy to show* that no torque is produced in the rotor of an induction machine excited only in one axis by a pure alternating wave of flux, these conditions being analogous to those existing in a standard single-phase machine with only one stator winding. To produce torque in the rotor, it is necessary, of course, that an e.m.f. be produced in the rotor conductors, and for this purpose it is necessary that a rotating stator flux shall exist. The only practical means by which a rotating flux can be produced in the single-phase machine consists of the provision of an auxiliary winding on the stator, displaced mechanically usually by about 90 deg. from the main or running winding. If the two circuits comprising this stator system are excited from the single-phase supply, the stator field which results is, of course, the resultant of the addition of two approximate sign waves stationary in space and displaced in phase from each other. This resultant is a pure rotating wave of flux of approximately sine formation, its actual shape and magnitude being dependent upon the displacement of the component fluxes. In order to secure the necessary space-phase displacement of these two fluxes, it is usual to employ resistance and reactance external to the motor windings. By this means it is possible to arrange the required phase displacement experimentally and standardise for the particular type of machine concerned.†

When the rotor has attained its maximum speed under the action of this rotating field, the currents produced by self-induction in the rotor give rise to a magnetic flux which is carried out of phase with the flux producing it by the rotation of the rotor. This flux may be considered to exist under the same conditions as that produced by the auxiliary or starting winding, which may therefore now be disconnected, the rotor continuing to run under the action of a rotating field, which is the resultant of the flux produced by the main or running winding, and the flux produced by the rotor conductors themselves and carried into space phase by the rotation of the rotor.

The actual methods employed in practice for the production of an auxiliary flux are of considerable number, each being usually adaptable to a certain form of operation or for certain starting conditions.

In the case of fractional horse-power motors, such as are sometimes employed for the operation of fans, &c., the "shading coil" method of starting gives quite satisfactory results. In this method a portion of the active stator iron is enclosed in a copper coil, which may be either in the form of a few turns of comparatively heavy gauge wire or a single ring of copper. Only one stator winding in addition to the "shading coils" is provided, and the flux produced by this winding induces in the portion of the stator iron enclosed in the "shading coil" a flux which has a different space-phase owing to the different circuit constants of the magnetic system in which it is induced. Under these conditions, the resultant field approximates to a rotating sine wave, and a torque is produced in the manner already discussed above.

The limitations of the "shading coil" method of starting are at once obvious. It is impossible to obtain any appreciable starting torque with the arrangement owing to the necessarily small pole area enclosed by the "shading coil," while the starting and operating efficiency are low on account of the additional losses introduced by the "shading coil," which must remain in circuit all the time the machine is running. For these reasons the sphere of use of this device is limited to machines of very low output, where only a small starting torque is required and the operating efficiency is not of great importance.

A development of the "shading-coil" device has found some practical application in the case of small motors. In this method of starting the shading winding, of heavy gauge wire, is distributed on the stator iron in the form of a second stator winding. For starting, current is switched on to the main or running winding, while the ends of the shading winding, which are brought out to terminals for the purpose, are short-circuited, either directly or through resistance or inductance. The motor now behaves in a similar

* *World Power*, October, 1926.

† See article on "Single-Phase Induction Motor and the Starting Problem," by T. W. Davies, Electrical Review, January 4th, 1924.

manner to the "shading-coil" machine, except that in the present case the auxiliary or starting flux is produced by a distributed winding, and the field form is accordingly better. When the rotor attains its maximum speed, the shading winding is open-circuited, and the losses incurred in this winding are therefore eliminated while the motor is running.

The starting torque obtainable with this device is appreciable, but on account of the very low starting efficiency, it is not suitable for machines other than those of low output, of the order of about 1 h.p.

Perhaps the most frequently used method of starting in practice is the "split-phase" method, about which much has been written, so that it is unnecessary to dwell at great length on its characteristics here.‡ In this system the stator carries a starting winding of smaller gauge wire than the running winding. For starting, the two windings are connected either in series or parallel, and a suitable arrangement of inductance and resistance is employed in these circuits to produce the required phase displacement of the respective fluxes. When full speed is reached, the starting winding is disconnected from the mains, and the resistance or inductance withdrawn from the running winding circuit, the running winding being then connected directly to the mains.

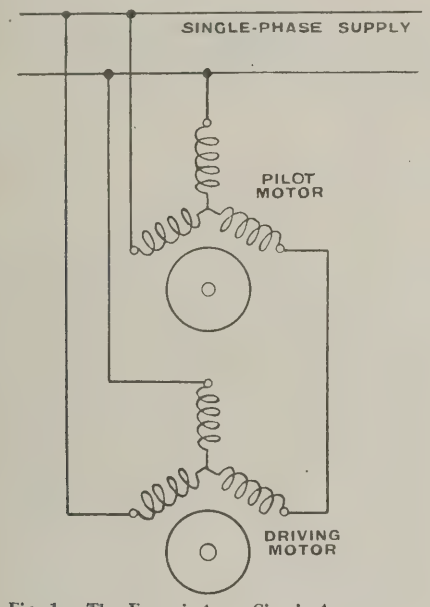


Fig. 1.—The Ferraris-Arno Circuit Arrangement.

The starting torque usually obtained with the split-phase method is of the order of 25 per cent. of the full-load value, with about twice the full-load current in the case of squirrel-cage machines, and about 50 per cent. of full-load torque on a twice full-load current in the case of slip-ring machines.

For small machines having rotors of small kinetic energy, and in cases where a starting current of from five to six times the full-load value is permissible, full-load torque at starting may be obtained by switching the motor direct on to the line. In this case the phase displacement of the motor fluxes is obtained by means of an inherently high-resistance starting winding.

It is seen, therefore, that this method of operation has sufficiently good characteristics to warrant its adoption in a number of cases where the required starting currents are permissible and the starting torques sufficiently high.

There are numerous practical cases, however, where the split-phase method of starting cannot conveniently be employed on account of the low starting torque corresponding to a reasonable starting current. In such cases it is usual to employ some form of single-phase commutator motor.

The commutator motor, however, for alternating current has not found the sphere of use in this country which its reputed features appear to warrant; while it is true that this state of affairs is largely due to engineers in general being loth to install a not thoroughly tried design, it cannot be overlooked that the existence of a commutator, particularly on an a.c. machine, presents practical difficulties.

‡ A recent paper on "The Starting of Single-Phase Induction Motors," by F. A. Lauper. *Journal* I.E.E., Vol. 65, No. 361, January, 1927, treats the subject exhaustively.

Operation by Ferraris-Arno Method.

The method of operation about to be described is entirely different from the majority in general use, and although practical examples of its application are comparatively few, if at all existent in this country, its operating characteristics are very much better than those of any of the better known methods. In this case also the small sphere of practical use may be attributed to the fact that the device has not been tried out to any extent in this country, so that consequently, as no test records and comparatively little descriptive matter are available, the reason for such a restricted sphere of use is apparent. In the Ferraris-Aruo system the main or driving motor is usually a three-phase machine, which may be of perfectly standard construction. Two of the stator terminals of this machine are connected to the single-phase mains, while the third terminal is connected to one of the terminals of a three-phase pilot motor whose remaining two terminals also connect to the single-phase mains. This circuit arrangement is shown in fig. 1. Means must be provided for starting the pilot motor from the single-phase mains, and this may be conveniently accomplished by some form of monocyclic device§, or alternatively by a commutator type auxiliary motor. The former method is, of course, preferable from the practical point of view.

When the pilot motor is running, the two stator phases connected to the single-phase supply provide the stator flux which, combining with the quadrature flux produced in the motor, as previously explained, gives rise to a rotating field analogous to that of an ordinary polyphase machine.

Under these conditions of operation an e.m.f. is induced in the idle phase of the pilot motor. This e.m.f. is in quadrature with the single-phase line e.m.f. owing to the fact that it is produced through the medium of the rotor system which, at synchronous, imparts a 90 deg. (electrical) displacement to the e.m.f. induced in the idle phase.

The quadrature e.m.f. is a power e.m.f. capable of producing the necessary flux in the third phase of the driving motor to render this machine self-starting, since under these conditions it is supplied with an unbalanced system of e.m.f.'s which give rise to a rotating flux in the stator winding, producing conditions analogous to those existing in a polyphase motor under normal operation.

The starting arrangements necessary for the driving motor in this system of operation are very simple, and may take the form of either a triple-pole switch or a plain star-delta starter for connecting the driving motor to its polyphase system of e.m.f.'s.

The starting torque obtainable with the arrangement is very much larger than in the case of an ordinary split-phase motor, and as an example, the following test is of interest:—

A 5-h.p. three-phase squirrel-cage motor was used as a pilot motor, being connected by two of its stator terminals to the single-phase supply. The idle phase of this machine was connected to one phase of a 35-h.p. squirrel-cage motor, the remaining two phases of which were connected to the single-phase supply.

The starting torque was measured by a spring balance, and with the stator winding star connected, normal connection being mesh, a torque of 26 per cent. of full-load torque was measured.

This figure is approximately half the torque which would have been developed by the driving motor on a direct three-phase system, and could, of course, have been increased by using a larger pilot motor.

The current taken from the line during the test was

§ *Ibid.*

slightly in excess of the full-load value, and the current from the pilot motor was half this value.

In the case of ordinary split-phase motors of the squirrel-cage type, 25 per cent. of full-load torque at starting, with a current of about twice the full-load value, are average figures, from which the advantages of the pilot motor method are very obvious.

As a further example of the operating characteristics of the pilot motor method of operation, practical instances of its application to heavy duty work might be cited. The method has given satisfactory service in its application to the main drive of cranes and similar heavy-duty apparatus, and in view of this fact it is difficult to decide on the reason for its very small sphere of use in this country.

Several examples of the application of the method, with slight modifications, to traction work occur in America, where the Norfolk and Virginian Railways employ main-line locomotives working on this system with quite satisfactory results.

In view of the foregoing remarks, it is evident that the arrangement has not obtained the sphere of use in this country which its superior characteristics warrant, and it is with the object of bringing the arrangement to the notice of the engineers concerned that the present article has been written, giving, in the author's belief, a description of the method and its application hitherto unpublished in this country.

In conclusion, the writer wishes to record his thanks to the General Electric Co., Ltd., for the test figures and much of the information contained in the foregoing.

A Radio-Telephone Loud-Speaker.

So much interest has been evinced in the different types of large-diaphragm and hornless loud-speaker at present in use that a suggested new form of diaphragm, together with some details of the method of its construction, will be welcomed by user and manufacturer alike.

By ERNEST W. BRAENDLE, A.M.I.E.E.

THE broadcast radio-telephone loud-speaker of the present day is rarely, if ever, to blame for the appalling noises so often presented to the unfortunate listener as "broadcast reception." Horns and other parts may be, and often are, the cause of a "hard" or "soft" quality being imparted to the sounds emitted, according to whether the upper or lower register is accentuated, but they do not account for unmusical noises. By far the worst offender in the production of these sounds is the receiving set's last stage of amplification, usually so inadequately designed to deal with the power its owner would like to get out of it. However, it is not intended to dissertate on the causes of distortion in amplifiers, but to present to those who have already mastered the subject the means whereby they may reap even more enjoyment, both for themselves and others, by the production of even better results.

Let us then assume that satisfactory amplification has been obtained, and that therefore all we require is to deal with the finer points, such as "timbre," "balance," and the "final result": by "timbre" we mean the quality of a sound, as compared to the original; since this depends on the correct reproduction not only of the initial note itself, but also of all the harmonics and overtones of which the sound is built up, it is essential that correct "balance" over the whole audible scale be obtained. The "final result" is attained mainly by utilising a loud-speaking device suited to the acoustic properties of the room in which it is placed. Of one thing readers may be assured, and that is the fact that the average transmission from the London (2 LO) broadcasting station, although not perfect, is extremely good, and fully warrants a much wanted improvement in the many minor considerations of reception.

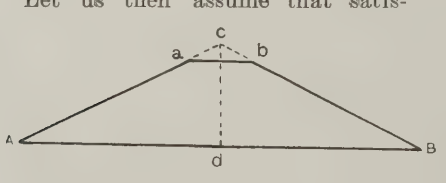


Fig. 1. - Sectional View of Cone.

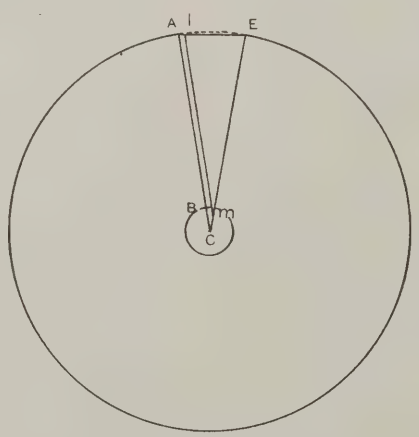


Fig. 2.—Method of Marking-out Diaphragm Sector.

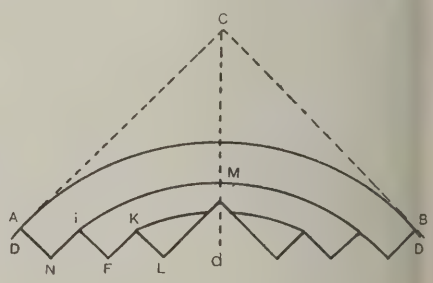


Fig. 3.—Sectional View of Pleated Diaphragm, Dotted Lines Represent Equivalent Cone.

In a search for these qualities, early experiments quickly eliminated the "horn" loud-speaker as never having satisfactory acoustic qualities without being both cumbersome and expensive. The "rigid cone" construction of paper diaphragm gave very good results, but, owing apparently to the large area over which "buckling" can take place, almost perfectly geometrical construction is necessary before it can be subjected to any great volume of sound. Another fault is that, although sufficiently "rigid," the cone lacks the "mobility" of its radially-pleated brother, which in turns lacks "rigidity." How then combine these two qualities? At first a "radially-pleated cone" was tried, but again, although sufficiently "mobile" and "rigid," it required too great care in construction to make it popular. The type at present in use consists virtually of a "cone" folded in upon itself, or a diaphragm pleated circumferentially (*i.e.*, in circles about the centre); it has given such satisfaction as to warrant its recommendation, despite the fact that

rather more work is entailed in its construction than in the case of the simple cone.

Since, in the final design, the pleated-paper diaphragm is backed by a cardboard cone, wherein is mounted the driving mechanism; and since it is advisable to understand the construction of a cone first before going on to the pleated diaphragm, a short description of cone design is as follows:—Fig. 1 represents a sectional view of a cone, wherein AB is the folded diameter, *cd* the height, and AC or BC the initial radius.

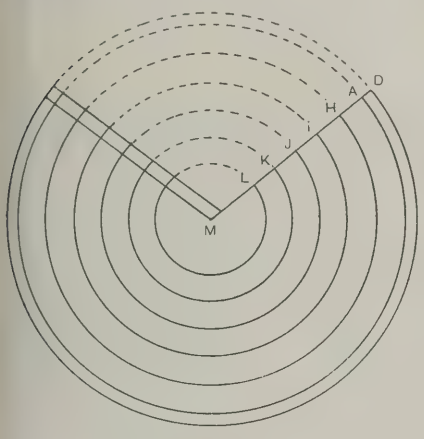


Fig. 4.—Diaphragm Marked for Folding.

To construct the cone, take a sufficiently large piece of paper (or cardboard) and describe a circle of radius equal to AC, which is given by the formula:—AC or BC $= \sqrt{(Ad)^2 \times (Cd)^2}$ or AC or BC = cosec $(\frac{1}{2} \wedge ACB) \times Ad$.

Next mark out a sector as in ACE (fig. 2), the arc AE being given by AE (fig. 2) $= 2\pi AC - \pi AB$ (fig. 1); or, since the angle of the sector to be removed is in the same proportion to the complete circle (*i.e.*, 360 deg.) as the length of the ARC removed is to the circumference, then AE/2πAC (fig. 2) = $\wedge$ ACE/360° (fig. 2), or $\wedge$ ACE (fig. 2) = 360 × AE/2πAC (fig. 1). Cut out the circle and remove the sector carefully, leaving a lip *lm* about $\frac{1}{4}$ in. wide for fixing; fold until the edge EC lies flat along AC, and glue firmly in place, thus forming a complete cone. Since, for the purpose of supporting the driving mechanism, it is necessary to remove the apex of the cone, thus leaving a hole of the diameter required, a circle with radius CB (fig. 2) is drawn before folding, and the resulting disk removed: the radius CB is given by CB (fig. 2) = $\frac{1}{2}$ (*a b*) × cosec $(\frac{1}{2} \wedge ACB)$ (fig. 1), where *a b* (fig. 1) represents the diameter of the movement to be inserted.

As previously stated, the circumferentially-pleated diaphragm is, in reality, nothing more than an ordinary cone folded back upon itself several times; some idea of it is obtained from fig. 3, which is a sectional view of the pleated diaphragm, the dotted lines representing the equivalent cone. From this figure it will be seen that the outer radius is still the same as for the cone, and is therefore found in the same way, but several other radii are now required to form the pleats at H, I, J, K and L. It was found convenient in practice to make the central apex M rather higher than the surrounding points A, I, K, and to decide first upon the height M*d* of the central cone and then upon the number of pleats to be formed. Fig. 4 shows a sheet of paper marked out with the various circles ML, MK, MJ, MI, MH, MA (MD is added as a fixing lip, the use of which will be explained later) which, when folded, will form the apexes M, L, K, J, I, H, A (fig. 3), there being two radii for each complete fold.

It has been pointed out that the radius MA (fig. 4) is equal to CA (fig. 3); hence, since the radius ML (fig. 4) is to CA (fig. 3) as the height *cd* is to M*d*, then ML = M*d* × CA/*cd*. Now H, I, J, K (fig. 4) are equal folds over the distance AL, and therefore this distance divided by five will give the remaining radii, the radius MD being $\frac{1}{2}$ in. longer than MA.

Draw the sector as for the cone, leaving the necessary fixing lip, and cut out; take a hard smooth-pointed pencil or stylus and go over each of the circles, pressing heavily, in order to bruise the paper along the lines, thus enabling the folding to be more easily dealt with. The actual manner of folding is a knack, and beyond pointing out that it is advisable to first lightly bend the folds in the directions required, helping them by lightly pinching them with the fingers, little more can be said to help the reader further; it will also be advisable to keep it on a clear flat surface whilst fixing.

There can be little use in attempting to describe the innumerable methods whereby the electrical mechanism may be attached to the diaphragm, nor is it necessary to discuss the different types of such mechanism at present on the market; therefore, only the particular method of mounting employed by the author in the final design will be described.

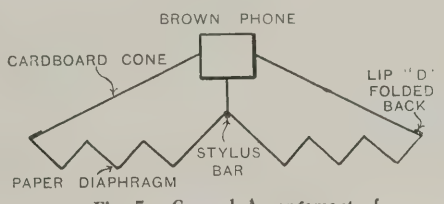


Fig. 5.—General Arrangement of Mechanism

The driving mechanism employed was a Brown A-type 'phone, with both diaphragm and anvil removed, mounted at the apex of a cardboard cone, on whose perimeter was mounted the pleated-paper diaphragm, the centre of the diaphragm being connected to the centre of the Brown reed by means of a metal stylus bar; some idea of the general arrangement may be obtained from fig. 5.

First make both cone and diaphragm separately, taking care that the folded diameter AB (fig. 1) of the cone is the same as the folded diameter AB (fig. 2) of the diaphragm. Drill out the centre hole of the ebonite ear-cap of the Brown 'phone to permit the free passage of the stylus bar, and insert the cap alone in the hole *a b* (fig. 1) of the cone; then fix in place with seccotine (thin carpenter's glue was used for all other fixings). Now fix the cone to the diaphragm in the manner suggested by the dotted lines in fig. 3, and allow the whole to set properly; the lip DD (fig. 3) is next slit radially about every half inch all the way round, an old safety-razor blade being employed, and the resultant pieces are

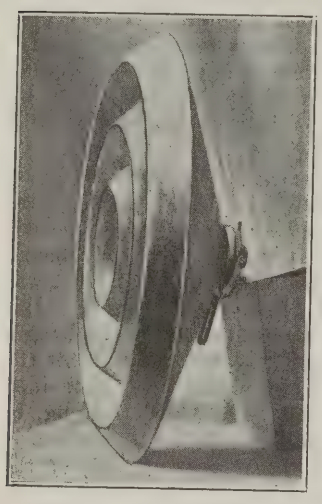


Fig. 6.—Impedance-frequency Graph.

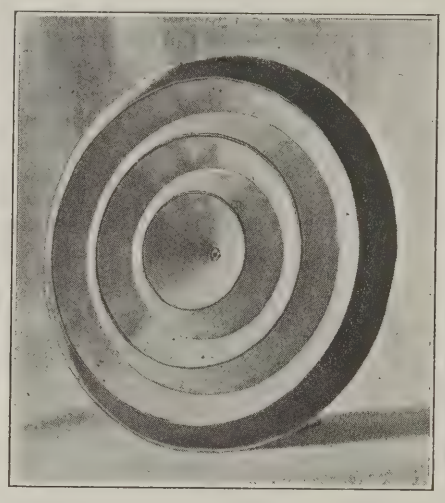
folded back over the cone and glued in place, thus making a firm airtight joint between the supporting cone and diaphragm. A piece of 18-gauge brass, or steel, wire is used for the stylus bar, which is fixed to the centre of the diaphragm by a small drop of glue, the other end of the stylus being held central in the ear-cap by pushing it through the centre of the now useless Brown diaphragm, which is temporarily inserted in the ear-cap for that purpose. Leave the whole for at least 24 hours to thoroughly set, then

remove the Brown diaphragm and screw in the movement until satisfactory contact is made between the stylus bar and the reed.

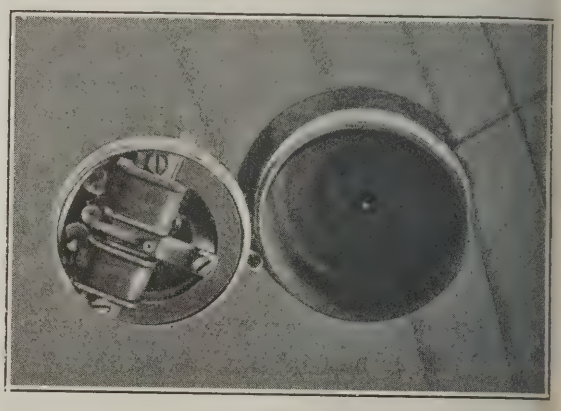
The loud-speaker is now ready for mounting and decorating in any manner desired, and if carefully made in the first place should amply repay the trouble expended on it. As regards suitable coatings both for decoration and preservation, the use of waterproof Indian ink decorated with gold or silver, or light transparent water-colours covered with a thin clear varnish, have proved quite successful.



Side view.



Front view.



Back view with mechanism removed, showing stylus bar.

Figs. 7, 8, and 9.—Braendle Pleated-cone Loud-speaker.

For the benefit of those who just wish to make one of these loud-speakers for themselves, without bothering about the methods employed to obtain the necessary measurements, those measurements required for the construction of a diaphragm and cone of 14 inches diameter are given in Tables I and II.*

Great care should be taken both in keeping carefully to these dimensions and in folding, since quite small errors will result not only in a poor finish, but in a quite unnecessary amount of trouble when fitting the cone and diaphragm together.

As regards the results obtainable with this form of loud-speaker, of the dimensions given, tests have shown that although sufficiently sensitive to compare very favourably with any first-class loud-speaker on the market, it is yet capable of handling sufficient volume to permit its use in a small hall without any deleterious effect. There is no "horn" effect and little or no directional quality, the sound in the room appearing to be quite general. One peculiar effect is that the intensity of sound, at the loud-speaker itself, appears weaker than when listened to some distance away; and it has been found beneficial to listen in the next room to that in which the loud-speaker is situated, not because of excessive intensity, but for the reason of obtaining both an acoustic blending and a psychological effect which go far in obtaining that "final result" mentioned earlier.

It is capable of reproducing a far greater range of audible frequencies with exceptionally good balance from top to bottom than any other type yet tried, and it is hoped that those readers who elect to try this form of loud-speaker for themselves will be as fortunate in their results as have been the author and those who have been kind enough to build models to his final design.

TABLE I.—Dimensions of Cardboard Cone.

Initial radius (AC fig. 1) = 7.725 inches.
Folded radius (*Ad* fig. 1) = 7.0 inches.
Initial radius (CB fig. 2) = 1.103 inches.
Folded radius = 1.0 inches.
Angle CAD radius (fig. 1) = 25° inches.
Angle of sector to be removed (ACE, fig. 2) = 33.7 deg.

TABLE II.—Dimensions of Pleated Paper Diaphragm.

Initial radius (MA, fig. 4) = 9.9 inches.
Initial radius (MH, fig. 4) = 8.49 inches.
Initial radius (MI, fig. 4) = 7.075 inches.
Initial radius (MJ, fig. 4) = 5.66 inches.
Initial radius (MK, fig. 4) = 4.245 inches.
Initial radius (ML, fig. 4) = 2.83 inches.
Angle of sector to be removed = 105.5 deg.

In conclusion, the author acknowledges his indebtedness to Messrs. Alfred Graham & Co. for the accompanying "graph" (fig. 6), and to others for their helpful suggestions.

* These are the dimensions of the loud-speaker shown in the accompanying illustrations, which is of a size suitable for indoor and outdoor use.

Electrical Manufacturing in Russia.

Alleged faulty construction of machines.

DESPITE the development of the electrical manufacturing industry in Russia during the past two or three years, as has been recorded in this journal at different times on the basis of information published in the Soviet newspapers, and as set forth by the reports of the growing value of the production year by year, the question has arisen whether or not this expansion has been accompanied by efficiency and the construction of reliable machines and plant. Many complaints have been made in the course of recent months concerning the shortage of certain inland raw and semi-finished materials on the one hand, while on the other, complaints have been expressed by customers respecting defects in machines and accessories supplied by the trusts. But it is only now that a collection of allegations has been published with regard to defective work and delays in the execution of orders, the information appearing in the *Ekon. Sjisn*, of Moscow, dated May 18th, and referring solely to the work carried out or intended to be executed by the "G.E.T." or State Electrical Trust, which now controls the whole of the heavy engineering branch. As the information throws

some light on the internal situation of this important branch, a few extracts from the newspaper in question will perhaps be of interest.

The Gus-Krustalny Combination, over two years ago, ordered from the G.E.T., transformers, motors, cables, &c., the prices quoted by the latter being comparatively normal, that is to say, double those of pre-war days. A considerable part of the equipment was not executed in accordance with technical requirements. As a consequence a batch of the 6,000-V motors (the general capacity of them exceeded 2,000 h.p.), which cost about 150,000 roubles, was rejected owing to faulty insulation of the windings. The same happened with 142 500-V motors, costing 120,000 roubles; these were refused on account of faulty bearings. No defects, however, were discovered in the remainder of the order.

Serious difficulties are said to have been caused by the non-execution of orders at the due time. The combination placed orders for 6,000-V motors to be delivered on May 1st, 1925. As those motors proved to be useless, the G.E.T. has promised to supply others by August, 1927, so that a delay of almost two years and a half will have taken place in the completion of the order. The unreliability of the trust is stated to have involved the combination in considerable loss. It had a contract with the Moscow supply undertaking (the M.O.G.E.S.) for the consumption of 8,000,000 kWh per annum, but in consequence of the absence of the equipment, it has been unable to fulfil the contract, and the supply authority is now claiming 151,000 roubles as a penalty. Moreover, the combination has suffered loss through having to use steam power instead of the cheaper electrical energy, and the total losses through the default of the Trust are put at over 300,000 roubles.

The Gospromtsvetmet, on December 9th, 1924, gave the Trust an order for the equipment for a transformer station of the value of 37,000 roubles, the period of delivery being fixed at eight months. The contract has not been carried out down to the present time, however. In March, 1925, this undertaking placed a new order with the Trust for delivery in ten months of two 300-h.p. motors, two liquid rheostats, &c. The motors and rheostats were delivered in March, 1926, but without any starting equipment, so that the plant was unserviceable. The order, however, was completed in April of the present year after representations had been made. The delays thus experienced forced the undertaking to purchase machines from abroad. As to the quality of the Russian machines, it is mentioned that the motors have a larger consumption of energy than is stipulated by technical rules; and cases are stated to have arisen when the motors at no load consumed more energy than when they were loaded. Complaints have also been made of the bad quality of the motor bearings, and of the construction of one uneconomical type of motor, as compared with the foreign practice of turning out special motors for particular purposes.

The Rezinotrest (Rubber Trust) is stated not to have ordered much from the Trust, as it has obtained considerable assistance from the equipment removed from Riga during the war period from the works of the Provodnik, including a large number of motors of different sizes. In a few cases, plant has been ordered from the Trust, but this has not always been delivered to time. Thus the Rubber Trust three years ago placed orders for oil-break switches, but the work has not been completed down to the present time, and the same applies to distributing boxes which were to have been supplied in March, 1926.

The Central Telegraph Office, according to a statement made by M. Rerberg, says that although machine construction is still a young branch in Russia, a number of reproaches has to be levelled at it, particularly with regard to motors. If small motors of up to 72 h.p. are ordered from the Trust, it is necessary to wait a year for delivery, which is excessive. Moreover, the prices of Russian motors are high. Thus, for instance, a motor of ½ h.p., which Berlin firms offer at 66 marks, is priced by the Russian Trust at the high figure of 250 roubles.

Results of the "W.O.B." Ballot.

A Bristol Lady wins the All-Electric Home.

THE announcement of the result of the ballot which formed the popular side of the E.D.A.-E.L.M.A. Campaign will set at rest the minds of those who have been building castles in the air, or imagining an all-electric home in the suburbs.

A Bristol lady (Miss E. Gardiner) was the winner of the first prize and thus had the opportunity to become the possessor of a well-designed all-electric house, but she preferred the alternative, a cheque for £2,000. Neither of these is to be scorned in these days of scarcity of houses and money. In accordance with the terms of the competition, Messrs. J. H. Winter & Co., Bristol, who supplied the booklet containing the ballot paper to Miss Gardiner, receive a cash prize of £25. In the same way the Mid-Cheshire Electricity Supply Co., Ltd., and the South Metropolitan Electric Light and Power Co., Ltd., receive £10 and £5 respectively for providing booklets to the second and third prize-winners. The shareholders of the South Metropolitan Co. can calculate what this means in the way of extra dividends.

If we are to be guided by the opinions of the 150,000 people whose ballot forms were tabulated, the merits of electric lighting in the home assume the following order:—It is convenient, clean, it saves work, is economical, safe, adaptable, reliable, simple to control, it preserves the sight, is fumeless, cheerful and artistic. However near cleanliness is to godliness, it is a long way behind convenience, securing only 28,299 votes against 44,787. Although Scotland was very active in the Campaign, sheer weight of numbers forced economy into the fourth place. The "highbrows" of the industry will derive gloomy satisfaction from the fact that the artistic value of electric lighting received only 943 votes.

We reproduce below the full list of prize-winners with the relevant details:—

FIRST PRIZE.

(A freehold house fully wired and equipped with electric lighting, cooking, heating and labour-saving devices; or, alternatively, a cheque for £2,000.)

Miss E. Gardiner, Bristol.

Booklet supplied by Messrs. J. H. Winter & Co., Bristol, who receive £25.

SECOND PRIZE.

(Electric lighting installation and/or electrical domestic appliances to the value of £200.)

Mrs. S. Gleave, Acton, near Northwich.

Booklet supplied by the Mid-Cheshire Electricity Supply Co., Ltd., which receives £10.

THIRD PRIZE.

(Electric lighting installation and/or electrical domestic appliances to the value of £100.)

Mr. H. G. A. Newman, Catford, S.E.6.

Booklet supplied by the South Metropolitan Electric Light & Power Co., Ltd., which receives £5.

OTHER PRIZES.

No. of Prize.	Nature of Prize.	Winner.	Supplier of Booklet.
4th	Appliances to the value of £50.	Miss J. Nicholson (Leigh, Lancs.).	Brown & Co., (Manchester).
5th	Appliances to the value of £25.	Mrs. Gardiner (Bristol).	J. H. Winter & Co., (Bristol).
6th	Appliances to the value of £10.	Mr. N. N. Spratt (Purley).	Croydon Electricity Supply Dept.
7th	Appliances to the value of £5.	Mrs. S. F. Spears (Wolverhampton).	B.E.D.A.
8th	ditto	Miss D. Dearden (Lr. Bebington, Ches.).	St. Helen's Electricity Dept.
9th	ditto	Mr. J. W. Ellison (Blackheath).	South Metrop't'n. E.L. & P. Co., Ltd.
10th	ditto	Mr. W. H. Hill (Bradford).	Bradford Electricity Department.
11th	ditto	Mr. D. L. Hughes (Bangor, N. Wales).	G. Tilston (Bangor).
12th	Appliances to the value of £2 10s.	Mrs. Hastie (Paisley).	R F. Cook (Paisley).
13th	ditto	Miss L. Montgomery (St. Helens).	J. Blaylock (St. Helens).
14th	ditto	Mr. E. Sparks (Teddington).	Bentall's, (Kingston-on-Thames).
15th	ditto	Miss S. Woods (Newnham, Cambridge).	Cambridge E.S. Co., Ltd.
16th	ditto	Mr G. S. Bullock (Shelton, Stoke).	Stoke-on-Trent Electricity Dept.
17th	ditto	Mr. A. S. Grice (Leicester).	Leicester Electricity Department.
18th	ditto	Mr. E. O. Mathias (Neath, Glam.).	Neath Electrical Co., Ltd.
19th	ditto	Mrs. Routh (Gt. Chesterford, Essex).	Baily, Grundy and Barrett, (Camb'ge)
20th	ditto	Miss I. W. Trace (Eastville, Bristol).	E. W. Palmer (Eastville, Bristol).
21st	ditto	Miss J. A. Patterson (Dalbeattie).	Dalbeattie E.L. and P. Co., Ltd.
22nd	ditto	Miss B. M. Housby (Ipswich).	Ipswich Electricity Department.
23rd	ditto	Mrs. A. Ashton (Prestwich, nr. M/R).	Manchester Electricity Dept.
24th	ditto	Mrs. F. M. Dodsworth (Heworth, Yorks.).	H. Etherington (York).
25th	ditto	Mr. S. R. Nixon (Sutton Coldfield, nr. B'ming'm.).	B.E.D.A.
26th	ditto	Mr. A. Weatherill (Doncaster).	Doncaster Electricity Dept.
27th	ditto	Mrs. A. Harwood (Maida Hill, W. 9).	Metropolitan E.S. Co, Ltd.
28th	ditto	Mrs. I. B. Jackson (Bickley, Kent).	E. Fellingham (Brighton).
29th	ditto	Mrs. McGardell (Glossop, nr. M/R).	Urban Electric Supply Co. Ltd.
30th	ditto	Mrs. E. C. Greaves (Palmers Green, N.13).	North Metropolitan E.P.S. Co.
31st	ditto	Major A. J. French (Chiswick, W.4).	Chiswick Electric Supply Co.
32nd	ditto	Mrs. Bryon (Basingstoke).	Basingstoke Electricity Dept.

A Lancashire Electricity Scheme.

Suggested application of the provisions of the Electricity (Supply) Act, 1926, to the South-East Lancashire Electricity District.

THE South-East Lancashire Electricity Advisory Board (Manchester), which commenced to function in 1923, controlling an area delimited by the Electricity Commission in 1920, in an endeavour to apply the general principles of the Electricity (Supply) Act, 1926 (so far as it understands them) to its own area, has drawn up a technical scheme for that purpose which it unanimously adopted at its meeting on May 24th, 1927, and at the same time adopted the following resolution:—"That the Board agree to afford facilities to, and co-operate with, the Commissioners in connection with the preparation of a scheme to be prepared by the Commissioners for this District."

From an integrated load curve prepared to indicate the maximum load on the whole of the undertakings within the S.E.L.E. District during the month November 27th to December 24th, 1925, and the calculated load factor at each undertaking, the following figures have been ascertained:—Maximum simultaneous demand on feeders (Tuesday, December 22nd, 4.30 p.m.)=313,823 kW. Energy delivered to feeders during the year ended December 31st, 1925 (annual load factor, 80.5 per cent.)=839,479,123 kWh. Energy sold=708,069,467 kWh. Summation of individual demand=323,839 kW. Diversity factor=1.032, or 3.2 per cent. If the normal growth of consumption continues, it will reach 525 kWh per head in 1940 (population, 3,559,500; kWh sold, 1,870,000,000). During 1923-24-25 the kWh sold amounted to approximately 80 per cent. of the total generated, on which basis the total generated in 1940 to provide for the above-estimated consumption will need to be 2,337,500,000 kWh; assuming a combined load factor for the generating plant of 31 per cent., the maximum simultaneous demand on the generating stations will be 862,000 kW.

The S.E.L.E. Advisory Board assumes that the potential demand in the comparatively large areas within its District of a rural character which have not yet been developed will be relatively small, and not materially affect its scheme; it has not taken cognisance of possible demands for railway supplies. It is suggested that the maximum demand should be allocated to 16 possible selected generating stations comprising: 14 existing ones of 450,000 kW total, 5 of which it is proposed to extend by 195,000 kW total; two new stations of 52,500 kW total are under construction, which it is proposed to extend by 75,000 kW total, and 4 new stations of 312,500 kW total are contemplated. Therefore, the plant installed would total 1,085,000 kW, and suggested extensions would mean a surplus of 223,000 kW, or 20 per cent. Of the 14 non-selected generating stations only 6 (50,000 kW total) would be utilised in case of emergency. The base load (172,400 kW, or 20 per cent. of the maximum) could, it is suggested, be allocated to 3 stations.

The total capital cost would be £12,878,307; the cost of 1,555,503 tons of fuel would be £1,244,402, or 1.57 lb. per kWh, while the total cost of delivery to the feeders in 1940 would be £3,064,335, or 0.3313d. per kWh.

In addition, the provision of 232.25 route miles of 33,000-volt transmission lines (of which 36.2 miles, costing £262,555, are already in existence) would be £1,677,033, and switchgear, transformers, protective gear, and cables would also cost £602,630. With few exceptions, the maximum transmission distance during the period of maximum demand would not exceed five miles.

Accordingly, the total annual cost of delivering energy into the areas of authorised undertakers in the S.E.L.E. District, omitting the administrative expenses of the Central Electricity Board, would be £3,064,335 (transmission accounting for £214,480), the energy delivered amounting to 2,108,975,000 kWh, of which 1,149,560,000 kWh would be for owners of selected stations; therefore, the cost per kWh to receiving undertakings would be 0.4023d.

The scheme contemplates the standardisation of the frequencies of all undertakings in the district, but the cost of doing so is not mentioned.

Technical considerations only have been dealt with, the rights of individual undertakers, ownership of plant, existing bulk-supply contracts, &c., having been ignored entirely. The S.E.L.E. Advisory Board has expressly refrained from putting the scheme forward as a recommendation within the meaning of its District Order of 1923, regarding it rather as indicative of a method of developing the area, provided that the Central Electricity Board could carry it into effect and that any claims of authorised undertakers for relief or compensation under the Act were duly met.

It is not suggested how the S.E.L.E. District is to be linked with surrounding areas and the national network.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

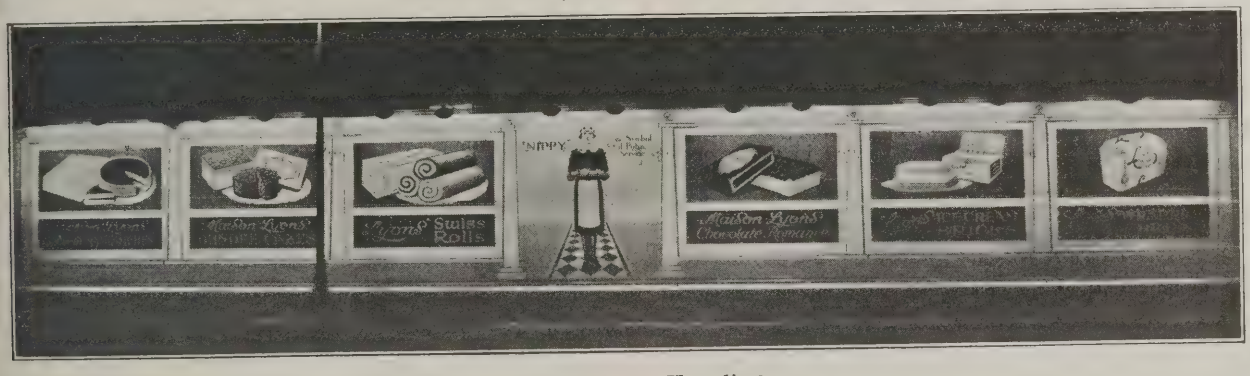
The A.E.U. Annual Conference.

The *Daily Telegraph* reports that Mr. J. T. Brownlie, president, speaking at the ninth annual meeting of the National Committee of the Amalgamated Engineering Union, recently, said he viewed with alarm the gradual falling-off in the membership of the union. Last year there was a decrease of 14,400. Referring to the Southern Railway contract going to Sweden, Mr. Brownlie said the company's explanation was that its action was directed against the ring in this country. He did not deny that rings existed, but they were part of the logical development of industry, and had to be recognised. He deprecated municipalities sheltering behind this action in buying in the cheapest market abroad, and giving the reason that they were spending ratepayers' money. He did not share that point of view.

The question of wages was discussed on May 25th, when the conference instructed the Executive Council to continue negotiations to secure an advance of wages in excess of the offer made by the employers on May 19th. It was provided that a ballot of members should be taken on any further offer. A resolution providing for setting up of a committee to examine the whole system of payment by results was rejected.

Hoarding Illumination.

By the courtesy of Messrs. J. Lyons & Co., Ltd., we are able to reproduce a night photograph of one of their hoardings. By means of floodlighting, this hoarding is made to give a 24-hour service. The installation comprises 14 "Benjamin" elliptical angle reflectors (two for each panel) with a 100-W lamp in each, spaced approximately five feet apart.



An Illuminated Hoarding.

French Radio Exhibition.

The fourth French wireless exhibition is to be held from October 28th to November 13th, in the Grand Palais, Paris. It is being organised under the auspices of the Syndicat Professionel des Industries Radio-Electriques, and the exhibits will be confined to members of that association.

A Report upon Esthonia.

The British Consul-General at Reval (Mr. H. Montgomery Grove) has prepared for the Department of Overseas Trade a report upon conditions in Esthonia (Stationery Office, 1s. net). Esthonia is a new republic with a rather eventful history; it is mainly an agricultural and pastoral country, and its population is only about 1,200,000. The last factor limits its importance as a market. In 1925 the imports of electrical machinery and apparatus were valued at 129 million Esthonian marks (about £645,000); of this Germany supplied goods to the value of 74 million E.mks. and Great Britain 9 millions, of which wires and cables account for 7 millions. Mr. Grove says that the use of electricity is increasing and also the demand for electrical goods. The question of the construction of the power station upon the Narva Falls is still not settled. Germany's trade with Esthonia is larger than Great Britain's for several reasons, but there is further scope for British goods, which are favourably regarded by the people of the country. The main obstacle to trade is the problem of credit.

Valve-making at Whiteley's.

For a period of 10 days, until June 10th, the GENERAL ELECTRIC CO., LTD., has transferred some of its radio valve-making machinery from the Osram Valve Works, Hammersmith, to the newly-opened wireless department at Messrs. Whiteley's. This will enable the numerous visitors to the stores to gain an idea of the delicate work involved in the production of valves.

A New Idea for the Window.

How often one hears such comments as "I didn't know that before" made by the user concerning some particular appliance which has caught the fancy! One can run through a list of domestic electrical appliances and find no difficulty in marking a round dozen about which a similar observation could be made by hundreds of the type whom it is our desire to interest in the all-electric home. Then why not the "Little Known Use" window? This opens up a new idea in display, with a considerable public interest at the end of it. There is plenty to put into the window, and one might start with the electric egg whisk, hot plate, massage vibrator, curling iron heater, millinery iron, shaving pot, pipe and cigarette lighter, and go on to the coffee percolator, hair dryer and dimmed night light. There should be plenty of space and no overcrowding, and an attractive background in colour as a set-off to the appliances. This is the place in which to describe the purpose of the display in a few words—"You can do *all* these operations electrically," or "Do it electrically in these delightful ways." The only other wording that is needed will be fixed to the inside of the window glass: "Your ideal domestic servants" will be found eminently appropriate and provocative. From this will depend a paper streamer directing the eye to each different appliance shown, the latter identified by name in each case, as "Egg Whisk," "Millinery Iron," and so on. In such ways will the required larger market be found for what are, comparatively speaking, little known applications of electric service. Hitherto they have been largely allowed to take care of themselves.

Electric Power in Industry.

The thirteenth preliminary report upon the 1924 Census of Production (*Board of Trade Journal*, May 26th), deals with trades connected with beverages. The brewing and malting trades reported 6,454 kW of generating plant (as compared with 2,884 kW in 1907) and electric motors aggregating 65,277 h.p., power for 57,530 h.p. of which was purchased. In the aerated waters, cider, vinegar, British wine and cognate trades there was 210 kW of generating plant (as against 191 kW in 1907), and there were motors totalling 7,886 h.p. (power for 7,555 h.p. purchased). The generating plant installed in the wholesale bottling trade rose from 144 kW in 1907 to 461 kW in 1924. The capacity of electric motors installed was 7,868 h.p., power for 7,502 h.p. of which was purchased.

Proposed French Tariff Revision.

The *Board of Trade Journal* for May 19th published a translation of the proposed revised tariff for goods imported into France. The new rates affect turbines, boilers, wires and cables, fans, electro-magnets, and other electrical apparatus.

Social Events.

The annual London G.E.C. social and athletic sports meeting will take place at the G.E.C. Sports Grounds, Wembley, on Saturday, June 11th, when amongst many other interesting items the various G.E.C. London championships will be decided.

The annual summer outing of the staff of the London Electric Wire Co. & Smiths, Ltd., was held on Saturday last, a very enjoyable day being spent at Worthing. The party travelled in three motor coaches.

Recent Contracts.

An important contract, covering the supply of all the outdoor and indoor switchgear required for the Perak River hydro-electric scheme in the Malay Peninsula, has been placed with the Metropolitan-Vickers Electrical Co., Ltd. The scheme, which is being undertaken by the Perak River Hydro-Electric Power Company, is a project for supplying electricity in the Kinta Valley tin mining district. It includes the provision of a main water-power station at Chenderoh with a 66,000-V transmission line extending about 65 miles to the South, fifteen sub-stations to distribute the power at 22,000 V and 6,600 V, and a stand-by steam power station at Malim Nawar near the southern end of the system. The switchgear to be supplied by the Metropolitan-Vickers Co. includes over a hundred oil circuit breakers and about 70 isolating switches for 66,000, 22,000 and 6,600 V, together with all the necessary constructional steelwork for outdoor installation. Twenty-eight of the 6,600-V circuit breakers, in seven sub-stations from which power will be supplied to consumers, will be motor operated and equipped with automatic reclosing devices for rapid restoration of service after temporary faults. The contract also includes the control board and switchgear for the station, accessories for the main power station and an 8-panel switchboard of 6,600-V metal-clad units for the steam power station at Malim Nawar.

The success of the electric cooking equipment installed by the General Electric Co., Ltd., in the M.S. *Pieter Corneliszoon Hooft* for the Stoomvart Maatschappij Nederland, has led to a further order to the company for a similar equipment for the sister ship *Chr. Huygens*.

A Profit-sharing Scheme.

MESSRS. HORACE GREEN & CO., LTD., Cononley, Keighley, held their fourteenth annual employés' meeting on May 6th, when 6 per cent. profit was distributed to the employés. Though this is less than in previous years, it is considered quite satisfactory under the conditions prevailing during the past year.

Radio Manufacturers and Wholesalers.

The Radio Manufacturers' Association states that it has received information which would lead to the inference that radio wholesalers in certain parts of the country are considering the formation of local wholesale associations. The R.M.A. is of opinion that any co-operative movement should be national and not local in character, as only in a national body can matters affecting the industry be viewed in their correct proportions. It adds that it would welcome the formation of a national body of wholesalers and would be willing to co-operate to the fullest possible extent.

A Successful A.E.G. Claim.

Before the Second Division of the Anglo-German Mixed Arbitral Tribunal on May 25th, the Allgemeine Elektricitäts Gesellschaft, Berlin, claimed the return of a sum of £414 deposited with the Government of Western Australia before the war as security in connection with a contract for switchgear, &c. It was stated for the respondents that owing to the non-fulfilment of the contract in consequence of the outbreak of war the Government was forced to pay £60,000 to get the equipment elsewhere, although the contract price was only about £13,000. It was urged that the claimants were not entitled to the return of the deposit because the conditions by which it would have become repayable never came into force The Tribunal held that the outbreak of war made it impossible for the claimants to carry out the contract and that there was nothing in the contract to justify the respondents retaining the deposit. It therefore awarded the amount claimed, with five per cent. interest from August 4th, 1914.

Canadian Order for Sweden.

The Allmänna Svenska Elektriska Aktiebolaget has recently obtained an order for two 16,000-h.p. generators for the extension of a Canadian hydro-electric power station to which the company had previously supplied complete machinery. The value of the order approaches Kr. 700,000.—*Reuter's Trade Service* (Stockholm).

New Municipal Showrooms.

Commodious new showrooms for the Electric Supply Department of the Birmingham Corporation were opened at Station Road, Solihull, recently, by Mr. H. K. Beale, the chairman of the Committee. At a luncheon following the ceremony, Mr. Beale said that the department had laid 37 miles of cable in the Olton, Shirley, and Solihull districts, representing an expenditure of £53,000, and there were now 570 consumers there.

Midland Building Trades Exhibition.

An exhibition which is being organised by the Birmingham and Midlands building trades is to be held at Bingley Hall, Birmingham, from September 5th to 17th next, during which conferences will be held on the most recent developments in the building and allied trades. An important part of the proceedings will be lectures and discussions upon electrical services for lighting, cooking, heating, the provision of hot water, &c.

Unemployment.

There was an increase of 8,710 in the number of unemployed during the week ended May 16th. The total at that date was 1,007,000, as compared with 998,290 on May 9th, and 1,612,740 on May 17th, 1926.

Trade Announcements.

To meet the requirements of expanding business the Glasgow branch of the three associated companies, the LONDON ELECTRIC WIRE CO. & SMITHS, LTD., the LIVERPOOL ELECTRIC CABLE CO., LTD., and FREDERICK SMITH & CO., have moved into more commodious premises at 74, York Street, Glasgow. (Telephone: Central 9002; telegrams: "Lewcos Glasgow.") Large stocks of all materials manufactured by the three companies will be available for immediate delivery.

MESSRS. F. THOMAS & CO. have opened larger showrooms at 189-191, Drummond Street, Hampstead Road, N.W.1, for the sale of lighting fittings, including glassware and alabaster bowls. Prices have been reduced as from June 1st.

The address of the CLARKSON THIMBLE TUBE BOILER CO., LTD., is now 613, Australia House, Strand, W.C.2. Telephone: Central 2882.

Mr. FRED G. CAVE, radio engineer, has opened new showroom premises at 102, Abington Street, Northampton.

MESSRS. BENNETT & BROWN, radio and electrical goods dealers, have opened new premises in Old Road West, Gravesend.

New Catalogues and Lists.

THE MILLNS ELECTRICAL CO., 17, Whitefriars Street, E.C.4.—Booklet P.669a, containing illustrated notes upon the firm's organ-blowing equipment and a long list of places in which it has been installed.

ALLOY WELDING PROCESSES, LTD., 14-16, Church Street, Islington, N.1.—Bulletin No. 52, describing the new "A.W.P." system of polyphase working, and illustrating the apparatus and its use.

MESSRS. HEYES & CO., LTD., Water-Heyes Electrical Works, Wigan.—Leaflets Nos. 8D and 8E, dealing respectively with a water- and gas-tight emergency switch, and a transformer switch plug. Illustrated.

BRITISH INSULATED CABLES, LTD., Prescot, Lancashire.—Catalogue P.209, for the use of electrical contractors, containing illustrated particulars of the "Helsby" twin wiring system, wires of various kinds, insulators, fuse-boxes, switch-fuses, jointing materials, &c.

MESSRS. WM. GEIPEL & CO., Vulcan Works, St. Thomas Street, S.E.1.—An illustrated pamphlet advertising Ward Leonard "Vitrohm" dimmers for theatre lighting.

The SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—Supplement to the company's radio catalogue, containing revised prices, alterations, and particulars of new lines.

The CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—Supplement to List No. 157, describing a new illuminated dial CO_2 indicator.

MESSRS. ROBERT HORNBY & CO., LTD., 77, Dean Street, Soho, W.1.—An illustrated catalogue and pamphlets dealing with "Siemens-Schuckert" electricity meters, including prepayment and time-switch types.

THE MACINTOSH CABLE CO., LTD., St. James's House, St. James's Street, S.W.1.—Three uniform lists, the first of a series, dealing respectively with "Maconite," trailing cable, and a bonding plate for lead-covered "Maconite." Fully illustrated and detailed.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—An illustrated and priced folder describing the "Benjamin" electric fire, which embodies several new features.

VAMPIRES, LTD., 435-437, Oxford Street, W.1.—Two illustrated pamphlets advertising the "Vampire" suction cleaner and the "Dandy" floor polisher.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—List Ma64, containing an illustrated description of the company's rotating standard testing set for a.c. meters. Priced.

HIGGS MOTORS, Witton, Birmingham.—May-June stock list of a.c. and d.c. motors. Priced.

The MULLARD WIRELESS SERVICE CO., LTD., 21, Denmark Street, W.C.2.—Pamphlets W.A.8, illustrating and describing the company's cone-type loud speaker; and W.A.9, dealing with "Mansbridge" condensers. Both pamphlets are priced.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—A circular, dealing with the "Pearl Elasta" lamp.

Bankruptcy Proceedings.

PAUL J. WHITE (trading as P. J. White & Co.), 5, Dyers Buildings, Holborn, W.C.—The public examination of this debtor was held on May 24th, at the London Bankruptcy Court, before Mr. Registrar Mellor. The statement of affairs showed liabilities of £6,067, and assets of £40. Replying to Mr. Gaine, Official Receiver, the debtor stated that he was born in Bohemia, and was naturalised in March, 1913, changing his name from Weiss to White. In September, 1919, he registered P. J. White & Co., Ltd., to deal in goods obtained from the Ministry of Munitions Disposals Board; that company went into voluntary liquidation in January, 1924. In July, 1922, he formed Radio Equipment, Ltd., with a nominal capital of £100, and was appointed a director of the company at a fee of £500 per annum; a compulsory winding-up order

was made against this company in March, 1926, its liabilities amounting to £6,586, including £821 owing to him. In October, 1923, he caused to be registered Radio Works, Ltd., with a nominal capital of £100; he became a director of this company, which went into voluntary liquidation in February, 1926. In February, 1925, he obtained an order from Lighting, Heating & Glass, Ltd., he then acting as selling agent for a German company, for 5,000 gross yards of flex at £2,600, the flex being made by an Austrian company; the failure of the purchaser to take up the flex as arranged ultimately led to the present proceedings. The debtor further stated that only two shares in Radio Equipment, Ltd., were issued, one to himself and one to another person, so that the failure of that company was practically his own failure. He was to have had one-fourth of the share capital of Radio Works, Ltd., but the shares were never issued. He did not agree that Radio Works, Ltd., was merely another alias adopted to enable him to carry on business. Asked about six bills of exchange given to him by Lighting, Heating & Glass, Ltd., in payment for the flex, the debtor admitted that when he handed the bills to Radio Equipment, Ltd., that concern was overdrawn at the bank to the extent of £250 (which overdraft he had guaranteed), the result being that the proceeds of the bills were partly used to discharge the overdraft. The Official Receiver said that it was a very improper proceeding on debtor's part, and debtor admitted that it was irregular. With regard to a claim for £109 made by the liquidator of Radio Works, Ltd., the debtor stated that after that company went into liquidation, 547 headphones were sold for £109, which was used for his own purposes. He explained that he and another person really constituted the company. He had not returned that £109 as a debt in his statement of affairs for the reason that he regarded it as a matter between that other person and himself. He attributed his failure and insolvency to his inability to recover from Radio Equipment, Ltd., the proceeds of the bills of exchange which he endorsed to them. It was further due to the fact that his expenditure had exceeded his income by £887 during the last two years. The examination was concluded.

W. N. Smart, electrician, formerly of 181, Windsor Road, and 17, 19 & 19a, Cross Street, Oldham.—Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Square, Preston, released May 16th.

D. E. Davies, wireless engineer, 19, Poulton Street, Kirkham, Lancaster.—Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Square, Preston, released May 16th.

J. G. F. Rennie, electrical engineer, 19, Bridge Street, Andover.—Trustee, Mr. T. Barton, Official Receiver, City Chambers, Catherine Street, Salisbury, released May 16th.

Mrs. H. Spencer (Spencer & Son), wireless and cycle dealer, 30, Watergate, Grantham.—Last day for proofs for dividend, June 8th. Trustee, Mr. L. A. West, Official Receiver, 4, Castle Place, Nottingham.

A. H. Duffin and G. Kershaw (A. H. Duffin & Co.), electrical engineers and contractors, Provincial Buildings, Conway Road, Colwyn Bay.—Supplemental dividend of 9d. in the £. Payable at the Official Receiver's office, St. Peter's Churchyard, The Cross, Chester.

F. Leng (F. Leng & Co.), electrical and mechanical engineer, 12, Godstone Road, Rotherham.—Receiving order made May 20th, on debtor's own petition.

I. Stephenson (I. Stephenson & Son), plumber and electrician, 36 & 37, Flowergate, Whitby.—Receiving order made May 19th, on debtor's own petition. First meeting, June 9th, at the Official Receiver's offices, 80, High Street, Stockton-on-Tees. Public examination, June 16th, at the Court House, Bridge Road, Stockton-on-Tees.

F. C. Gross, electrical engineer, 32, Windsor Road, St. Andrew's Park, and 71, North Road, Bishopston, Bristol.—Discharge suspended until July 29th, 1927.

J. A. Bosher, 33, High Street, Aberdare, electrical engineer and contractor.—Trustee, Mr. S. E. Clutterbuck, 31, Queen Street, Cardiff, released March 30th.

W. E. Owen (trading as Emlyn Owen & Co.), 1, Senghenydd Road, Cardiff, and Maesteg, wireless dealer.—Trustee, Mr. Ellis Owen, Official Receiver, 34, Park Place, Cardiff, released May 20th.

C. H. Kitching, 20, St. Hilda Street, 172, Beverley Road, and 42, Chariot Street, Hull, plumber and electrical engineer.—Last day for proofs for dividend, June 14th. Trustee: Mr. J. E. D. Stickney, Official Receiver, 37, Scale Lane, Hull.

E. Mortimer Lancaster, the Younger, 41, Virginia Road, Leeds, electrical engineer.—Receiving order made May 25th on debtor's own petition.

Company Liquidations.

A. W. Knight, Limited, Basinghall Street, E.C., radio engineers.—A meeting of creditors was held on May 24th at 65-66, Basinghall Street, E.C., when the chair was occupied by Mr. Rickard, the liquidator. An approximate statement of affairs was presented which showed liabilities of £1,324 and net assets of £143, leaving a deficiency so far as the creditors were concerned of £1,181, or a total deficiency as regarded contributories of £2,761. The chairman said that at the time of his appointment there was a possibility of being able to dispose of the business as a going concern, for a sum which would have met with the approval of the unsecured creditors. He had since received an offer of £75 for the assets. No resolutions were passed, and the matter therefore remains in the hands of the present liquidator. The following are creditors:—

	£		£
Edison Bell, Ltd. ...	416	Stevens, Col.	100
Schneider, —	84	Wilson, H. W.	294
Knight, —	45		

Messrs. Yates & Thom, Canal Foundry, Blackburn, engineers and boiler makers.—It is recommended that this company should go into voluntary liquidation. Sir Wm. Thom, principal of the concern, says that if this step is now taken the assets of the company will be fully preserved. In a letter to the shareholders, he states:—"The steady advance in the use of electricity, and the numerous large power stations erected in various parts of the country, are making great inroads into our business. This competition will continue and become more severe. For some time we have found it impossible to keep our men and machines working at anything like a reasonable production. Every endeavour has been made to find new manufactures to increase output, but without success. A turnover to a new branch of engineering would entail a large capital expenditure, coupled with considerable risk and doubtful results. The company is financially sound, but the general trading is being carried on at such a loss that a few more years under similar conditions will result in a loss to the shareholders, which to-day can be avoided."

District Lighting Supply, Ltd., 87, Tottenham Court Road, W., dealers in electrical and radio appliances.—A meeting of creditors was held recently, at the Cannon Street Hotel, when Mr. C. S. Steel, C.A., 34-36, Gresham Street, E.C., the liquidator in the voluntary liquidation of the company, presided. The chairman said that it had been impossible to prepare an accurate statement of affairs, but he estimated that the liabilities due to the trade amounted to £810, and there were loan creditors for £654. The only asset, so far as he could ascertain, was the stock valued at £350, which might realise from £200 to £250 on a forced realisation. The company was registered on May 22nd, 1925, with a nominal capital of £1,000, to acquire a business formerly owned by Mr. B. Apple, who traded under the style of the District Lighting Supply. From the inception of the company to the end of May, 1926, there was a loss on trading of £113. Mr. Steel said that upon purchase the goodwill was put down at £50, fixtures and fittings £200, and furniture, stock, &c., £750. The total of £1,000 was satisfied by the allotment of 1,000 shares of £1 each. The trade liabilities taken over amounted to £700. The directors of the company were Mr. Apple and his wife. The liquidator said that the case was unsatisfactory in some respects, and required a good deal of investigation. Mr. E. H. Hawkins proposed that unless a guaranteed offer of 10s. in the £ was forthcoming within fourteen days the liquidator should be requested to apply to the Court for the compulsory liquidation of the company, and the resolution was carried. The following are creditors:—

	£		£
Freedman, L.	309	Bryan, G. A.	49
Anglo Trading Co. ...	176	S.M.T. Gramophones ...	38
Notting Hill Loan & Investment Society ...	171	Artistic Lamp Shade Co.	36
Brown Bros., Ltd. ...	130	Eaton & Son	31
London Commercial and Electrical Stores ...	63	Foot, R. W.	30
Johnson Talking Machine Co.	50	Simpson & Taylor ...	29
		Sanders Electrical Co....	20
		Heath, S., & Sons, Ltd.	20

Electrical and Radio Distributors, Ltd., 71, Monks Park, Wembley.—A meeting of creditors was held on May 25th, at the offices of Mr. F. E. Anderson, I.A., 20, Bedford Row, W.C., the liquidator of the company. No statement of affairs was presented, but according to a balance sheet as at March 31st, 1927, it appeared that the authorised capital was £500, in shares of £1 each, and the fully-paid issued capital was £265. The company was registered on October 22nd last, and from then until the date of liquidation, the purchases were £1,135, the sales were £1,150, and there was a gross profit of £37, and a net loss of £326. The matter was left in the hands of Mr. Anderson as liquidator. The following are creditors:—

	£		£
Barnard Accumulator Co.	38	Beaver Electric Supply Co.	40
Sel-Ezi Wireless Supply Co.	31		

British Electrolytic Zinc (Isherwood Process), Ltd.—A meeting of members is called for July 1st, at Pinners Hall, Austin Friars, E.C., to hear an account of the winding up from the liquidator, Mr. E. Fairweather.

Holbrook's Electric Service Co., Ltd.—A meeting of creditors is called for June 8th, at the offices of Messrs. Chantry, Button & Co., 61-62, Lincoln's Inn Fields, W.C.2. Claims to be sent forthwith to the liquidator at the above address.

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UNITED ELECTRIC CAR CO., LTD., AND DICK, KERR & CO., LTD.—Meetings of members are called for June 28th, at Queen's House, Kingsway, W.C.2, to hear an account of the winding up from the liquidator, Mr. G. R. Freeman.

R.M.P., LTD.—Winding up voluntarily. Liquidator, Mr. N. A. Denson, 26, Corporation Street, Birmingham, appointed May 25th.

VEE CEE DRY CELL CO., LTD.—Winding up voluntarily. Liquidator, Mr. H. M. West, 1, Station Road, Reading. Meeting of creditors held June 1st.

HIGH SALVINGTON ELECTRIC SUPPLY CO., LTD.—Winding up voluntarily. Liquidator, Mr. R. Dixon. Meeting of creditors June 6th, at 37, Walbrook, E.C. Particulars of claims by June 3rd to Messrs. Marsh & Ferriman, Arundel House, Liverpool Gardens, Worthing, solicitors to the liquidator.

MEASUREMENT (AUSTRALIA), LTD.—Winding up voluntarily. Liquidators, Messrs. J. T. Fitz, Australia Street, Camperdown, Sydney, New South Wales, and A. Gordon, 7-17, Fitzalan Street, Kennington Road, S.E.11. Meeting of creditors held June 1st. (This notice is formal; all creditors have been, or will be, paid in full.)

Dissolutions of Partnership.

G. STARKS & CO., accumulator manufacturers, 22, Shirley Road, Southampton.—Mr. G. Starks and Mr. R. E. Jones have dissolved partnership.

SMITH & SNAPE, decorators and electrical engineers, 114, Devonshire Street, Sheffield.—Messrs. H. H. & S. Snape have dissolved partnership; the former is continuing the business.

H. G. HOAD, electrical engineers, Ashford, Middlesex.—Messrs. H. G. Hoad and F. R. J. Sears have dissolved partnership. Debts will be attended to by Mr. Sears.

ABINGDON WIRELESS SUPPLIES, manufacturers and dealers in wireless apparatus, Abingdon, Berks.—Messrs. E. S. Langford and A. E. Basford have dissolved partnership. Mr. Basford will attend to debts.

Book Notices.

"Kelly's Directory of the Merchants, Manufacturers and Shippers of the World." Two vols. (Pp. 4,541.) London: Kelly's Directories, Ltd. Price 64s., post free.—This is the 41st edition of the directory; it contains more than a million and a half names, and deals with over 20,000 places. Apart from this, all manner of commercial information is given, and reference is facilitated by a concise explanation of the arrangement of the matter. With the volumes is circulated a reproduction of a specimen proof page showing the great amount of revision which is necessitated by the changes of a year.

"The Marconi Short-wave 'Beam' System." Pp. 28; 25 figs. London: Marconi's Wireless Telegraph Co., Ltd.—This well-printed publication, though not containing anything new, is a useful *résumé* of the essential features of "beam" radio-telegraphy that should find a place in reference libraries. Written in a non-technical manner, it clearly outlines the system; the principal characteristics are illustrated by diagrams and photographs, and typical short-wave stations in this country are described.

"Faraday House Journal." Vol. XII, No. 3, Summer Term.—Besides news items, this number contains articles on "Super-tension Cables in Cast-iron Pipes," by Mr. G. W. Preston, and on "The Manufacture of Air-spaced Paper-covered Multiple-twin Telephone Cable," by Mr. E. N. Bronsdon, while Mr. D. W. Thorpe explains how one may add to one's income by "The Writing of Technical Articles."

"Science Abstracts (A. & B.). Vol. XXX. Part 5. May 25th, 1927. London: E. & F. N. Spon, Ltd. Price 3s. each.

"Scientific Papers of the U.S.A. Bureau of Standards." Vol. 21, No. 545. "Determination of the Magnetic Induction in Sheet Steel." Price 10 cents.

"National Research Council of Japan." Japanese Journal of Physics; Transactions and Abstracts. Vol. IV, No. 2. 1926-27.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVI, May, 1927. New York: The Institute. Price $1.

"Theory of Machines," by L. Toft and A. T. J. Kersey. Pp. ix+408; figs. 272. London: Sir Isaac Pitman & Sons. Price 12s. 6d. net.

Wire Manufacture in Chile.

In order to render Chile independent of foreign markets for many manufacturing elements, including those used in the electrification of railways and the lighting services, a concession has been granted for a factory to manufacture copper wire. Raw materials (copper ore and sulphuric acid) abound in Chile, and the factory will be able to produce copper wire of greatest purity. Insulated and non-insulated wire will be manufactured, also copper and brass plates and bars, tubing, wire ropes and concentric bare or insulated cables for high-pressure transmission. The factory will contain rolling, tubing, insulating and cutting machines, and at least one large wire-drawing machine.—*Reuter's Trade Service* (Santiago).

Span-wire Suspension.

Referring to the report recently abstracted in this journal on "The Problems of Public Lighting by Electricity," by Lieutenant-Commander Haydn T. Harrison, touching the public lighting in the City of London, in which it is asserted that the main streets of the City of London are the best examples of lighting in the world, the London Electric Firm reminds us that the lamp-lowering gear (both electric and gas) was supplied by it in 1911 and has been in continuous use ever since, with the minimum of cost for maintenance and repairs, and immunity from accidents. The gear consists of the makers' well-known contact suspension gear and a self-sustaining winch by means of which the lamps are suspended in the centre of the road, where the highest efficiency is obtained, and are first traversed along the wire to the side walk and then lowered so as not to interfere with wheeled traffic.

New Belgian Company.

A company has lately been formed at Machelen, Brussels with a capital of 2½ million francs and the title La Société Independante de Construction et d'Exploitation Radio-Electriques, to manufacture radio apparatus.

Works Visit.

On May 20th, a party of members of the Birmingham Electric Club paid a visit to the Siemens lamp works and certain shops of the English Electric Co., Ltd., at Preston. After luncheon at the Victoria and Station Hotel the party proceeded by motor-'bus to the electrical and car works of the English Electric Co., and afterwards made a thorough inspection of the lamp manufacturing processes. The guests were then conveyed to the Ashton Park Club for tea, after which a photograph was taken of the group on the steps of the club.

Sequestration.

E. MACKINTOSH, 57, Broughton Road, Edinburgh, electrical engineer.—Meeting of creditors held June 1st. Solicitor, Mr. R. F. Calder, 12, Gayfield Square, Edinburgh.

A New London Sign.

Mounted on the side of a tall building at the Trafalgar Square end of Whitehall is a new electric sign erected for the CHLORIDE ELECTRICAL STORAGE CO., LTD. The sign is 40 ft. long by 8 ft. high, and contains 434 lamps. A novel method of operation has been arranged. The first portion to operate is a star which flashes out Morse signals, spelling the word "Exide." On completion of the message, the border appears in red, followed in white, by the word "Exide," which is in turn succeeded by the slogan "The Long Life Battery."

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.	Price May 31st.	Fortnight's inc. or dec.
a Acid, Oxalic ... ... per lb.	5¾d.	...
a Ammoniac, Sal ... ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4¼d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£13 10s.	...
a Sulphur, Commercial ... ... ,,	£9 10s.	...
a ,, Roll ... ... ,,	£9 10s.	...
a Soda, Chlorate ... ... per lb.	3¼d to 3½d.	...
a ,, Crystals ... ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots... ... ... per ton.	£107 to £112	...
b ,, Wire ... ... per lb.	1/6 to 2/-	...
b ,, Sheet ... ... ,,	1/8 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net.	£256	...
Grade II ... ... ,, ,,	£174	...
Grade III... ... ... ,, ,,	£93	...
c Brass (rolled metal 2" to 12" basis) per lb.	9⅝d.	...
c ,, Tubes (solid drawn) ... ,,	11¼d. to 11⅝d.	...
c ,, Wire, basis ... ... ,,	9⅝d.	...
c Copper Tubes (solid drawn) ... ,,	1/0½	...
c ,, Bars (best selected) ... per ton.	£86	...
c ,, Sheet ... ... ,,	£86	...
c ,, Rod ... ... ,,	£86	...
d ,, (Electrolytic) Bars ... ,,	£60 5s.	27/6 dec.
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ... ,,	£70 5s.	27/6 dec.
d ,, ,, H.C. Wire per lb.	8⅝d.	1/8d. dec.
f Ebonite Rod ... ... ,,	2/8 to 2/6	...
f ,, Sheet ... ... ,,	2/3 to 2/6	...
n German Silver Wire ... ... ,,	2/2	...
h Gutta-percha, fine ... ... ,,	8/-	...
h India-rubber, Para fine ... ... ,,	1/6½	1½d. inc.
i Iron Pig (Cleveland No. 3.) ... per ton.	75/-	...
i ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English pig ... ... ,,	£25 15s.	10/- dec.
g Mercury ... ... per bot.	£22 10s. to £22 15s.	5/- dec.
e Mica (in original cases) small ... per lb.	3d. to 8/-	...
e ,, ,, medium ... ,,	4/- to 8/-	...
e ,, ,, large ... ... ,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	...
p ,, ,, rolled strip & sheet ,,	1/2½	...
p ,, ,, wire... ... ... ,,	1/3½	...
o Platinum ... ... per oz.	£23	...
d Silicium Bronze Wire ... ... per lb.	10½d.	...
r Steel, Magnet, in bars ... ... ,,	7½d.	...
n Tin, Block (English) ... ... per ton.	£288 10s. to £289	5/- inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

An Anglo-American Telephone Appointment.

Dr. H. R. Wright, managing director of Siemens Bros. and Co., Ltd., has joined the board of the British Columbia Telephone and Telegraph Co. (a Delaware (U.S.A.) Corporation with offices in Chicago), in which Siemens Bros. & Co., Ltd., hold a substantial financial interest. The British Columbia Telephone and Telegraph Co. owns a controlling interest in the British Columbia Telephone Co., Ltd., which operates nearly 100,000 telephones in British Columbia, with headquarters at Vancouver.

New French Company.

A company has been formed in Paris (10 Rue de la Fidelité) with the title La Société Rurale de Distribution d'Electricité, to establish hydro-electric plant in rural areas.

New Swiss Company.

The Gesellschaft für Elektrothermische Industrie Liesberg is the name of a company which has been formed at Barschwil (Solothurn) to manufacture electro-metallurgical and electro-chemical products.

Portuguese Duty on Irons.

The Portuguese Customs authorities have imposed an import duty (to take effect on July 1st), upon "electric smoothing irons," ranging from 0.30 to 0.10 gold escudos per kg.

For Sale.

Southampton Corporation Electricity Department has for disposal one 60-in. Davidson "Sirocco" induced draught fan complete with cover, &c., but without electric motor. Stafford County Mental Hospital invites offers for an electric lighting generating set. City of Sheffield Electric Supply Department has for disposal oil-cooled and air-cooled transformers, 0.75 to 1,000 kVA capacity. Darlington Corporation Electricity Committee invites offers for a 220/280-kW steam generating set. Sunderland electricity department has for disposal a quantity of second-hand meters. (See our advertisement pages to-day.)

Lighting and Power Notes.

Beckenham.—New Plant.—The Urban District Council has applied to the Electricity Commissioners and to the London and Home Counties Joint Electricity Authority for sanction to install a 1,500-kW set, cooling tower, boiler, and accessories, estimated to meet the requirements for the next ten years, in place of the 3,000-kW set previously proposed, but not approved of by the Joint Authority.

Birmingham.—New Electricity Tariff.—The City Council is to be asked to approve a recommendation of the Electric Supply Committee to introduce the "telephone system," as an alternative to the present flat-rate system of electricity charges. Under the new system, which, if approved, will be put into operation in September next, there will be a quarterly rental based upon ratable value, plus a charge of ¾d. per kWh for electricity used for all purposes. One meter and one wiring system will be installed for lighting, heating, cooking, &c. The scheme will be confined to private residences.

Year's Working.—The accounts of the Electricity Supply Department for the year ended March 31st last show a surplus of £172,000, as compared with £184,000 in the preceding year, and it is proposed to contribute £31,000 to the borough fund. A record number of new consumers (10,300) were connected to the mains during the year.

Blackburn.—Inquiry.—With reference to the note which appeared in our last issue under this heading, we are informed that Dr. S. L. Pearce is unable to comply with the Corporation's request to conduct an inquiry into the electricity undertaking owing to pressure of other business.

China.—Shanghai.—A net profit of Tls. 2,205,490 was realised by the Electricity Department of the Municipal Council in 1926. The total sales of electricity for all purposes were 408,245,810 kWh, and the revenue from sales of electricity, hire of motors, &c., was Tls. 10,051,221. The gross profit, after allowing for depreciation, was Tls. 3,930,539. There were 43,378 consumers at the end of the year, as compared with 38,932 at the end of 1925, an increase of 4,446. A total of 226,190 lamps were in service within the Settlement at the end of 1926.

Clitheroe.—Extension of Supply.—The Corporation has instructed its consulting engineer to prepare a scheme for the erection of an overhead cable to the districts of West Bradford, Grindleton and Waddington, consequent upon guarantees having been forthcoming for the £5,000 estimated capital expenditure.

Continental.—Belgium.—An agreement has recently been concluded between a number of electricity undertakings in eastern Belgium, comprised in the Groupement des Centrales Electriques de la Region de Charleroi, and several of the leading metallurgical concerns in the area whereby plant is to be installed for the utilisation of the waste gases from the ironworks for steam-raising purposes at the power stations.

Portugal.—A message from Lisbon states that the Union Electrica Portuguesa is completing the installation of a thermo-electric works of 10,000 h.p. The concern hopes that it will now be able to attract large industries which were not willing to engage themselves before being sure of receiving sufficient power.—*Reuter's Trade Service* (Madrid).

Italy.—A new 135,000-V h.p. transmission line has recently been completed and put into operation by the Società Idroelettrica Piemonte from its hydro-electric station on the Marmore at Covalou along the Aosta Valley to Turin, a distance of about 60 miles. Later the line will also be connected to the station recently completed by the company at Lys, and to the one in course of construction at Evançon. At present the line is only being used to transmit power at 75,000 V, but the higher pressure will be brought into use by the end of the present year.

Dartmouth.—Laying of h.p. Cable.—W. T. Henley's Telegraph Works Co., Ltd., has laid an 11,000-V h.p. cable, 550 yards in length, across the River Dart for the supply of electricity to the district.

Darwen.—Price Reduction.—The Electricity Committee has decided to reduce the charges for electricity by 10 per cent. to all consumers with the exception of those supplied under industrial power contracts.

Fishguard.—Proposed Electricity Scheme.—At a recent meeting of the Urban District Council, Mr. Parkington, of Newcastle Emlyn, promoter of the proposed local electricity scheme, presented his report. He suggested that the company to be formed should be given a tenure of 30 years, the Council to have an option of purchase at the end of 20 years. It was proposed that the charge to consumers should not exceed 10d. per kWh, and it was anticipated that as the demand for supply increased, the charge would be reduced. The minimum charge would be 15s. per annum. Three methods of supply had been considered, *viz.*, from the G.W.R. power station at the Harbour, a water-power scheme, or a power station at Fishguard. The first was the most feasible at present and could be worked quite satisfactorily. The Council decided that Mr. Parkington should prepare a final scheme for its approval before submitting the proposal to the Electricity Commissioners. It is hoped that a supply will be available by next winter.

Glasgow.—Refuse Plant.—The Corporation has given notice that an application has been made to the Electricity Commissioners for consent to establish at Helen Street, Govan, a generating station in connection with the refuse disposal works erected by the Corporation.

Progress during April.—Under the three-years' scheme of the Corporation Electricity Department, 75 houses were wired in April, making the total to date 3,553. Under the 10 years' hire-purchase scheme 153 houses were wired, making a total of 401. Applications for the hire of appliances numbered 146, bringing the total up to 14,895.

Greenock.—Extension of Supply.—Two years ago the Corporation was granted powers to supply electricity to Inverkip, Wemyss Bay, and the intervening area, and a report has now been submitted by the engineer giving details of a scheme for carrying out this extension, which it is estimated will cost £10,000.

Hornsey.—New Plant.—The Corporation has arranged for a formal gathering in connection with the extension of generating plant at the power station, on Saturday, July 16th, and Councillor Mrs. Everington will start up the new turbine.

Ilford.—Loans Sanctioned.—The Corporation Electricity Committee has received sanction to loans of £6,000 for mains, £1,295 for plant and kiosks, and £2,000 for wiring installations.

India.—Rangoon.—The Rangoon Tramways and Electric Supply Co. has now practically completed the scheme for modernising its power station at Ahlone. The last turbine installed, which will shortly be ready for trial, brings the total capacity of the station to 16,500 kW at normal rating, and it is anticipated that the generating plant will suffice to meet all demand for some years ahead. The work of raising the pressure on the feeders to 6,600 V is now practically completed, and work is now about to be undertaken to raise the pressure of the distribution mains from 150 V and 200 V to 230 V and 400 V.

Japan.—Electrical Development.—The Tokio Municipal Electric Bureau has commenced work on the construction of a steam power station at Shibaura, which will be put in operation by the end of the year. The initial plant will have a capacity of 10,000 kW, which will eventually be doubled.

It is reported that the Tokio Dento K.K. has a scheme in hand for the erection of a power station at Senju with a capacity of 25,000 kW, and one at Tsurumi with a capacity of 50,000 kW.

Lancaster.—Electricity Supply.—At the meeting of the Town Council on May 25th consent was given to a proposal of the Electricity Committee to spend £45.000 on changing over the system of supply in the centre of the town from d.c. to a.c., and on a new sub-station, offices, &c. The expenditure includes:—Purchase and equipment of premises in North Road for sub-station, showroom and offices, £8,000; plant and switchgear, £5,000; h.p. and l.p. feeder cables, £10,500; distributing cables, &c., £16,500; services, £5,000. It is estimated that it will take from three to five years to complete the change-over.

Littleborough.—SUPPLY TO HOUSING ESTATE.—The Electricity Committee has recommended to the Urban District Council that cables be laid immediately to the Dearnley housing estate for lighting and power and street-lighting purposes.

Liverpool.—RAILWAY SUPPLY.—Negotiations have resulted in the Liverpool Overhead Railway Co. deciding to take a supply of electricity at 520 V d.c. from the Corporation from the end of June.

Llandrindod Wells.—LOAN.—The Urban District Council has applied for sanction to a loan of £3,000 for mains, cookers, meters, &c.

Llansilin.—HYDRO-ELECTRIC SCHEME.—The new hydro-electric plant of the Llansilin Electricity Co., Ltd., was inaugurated on May 17th by Mr. Watkin Richards. At the turbine house Sir Watkin Williams Wynn started the turbine and switched on the current to the battery house in the village. At the battery house there is a stand-by plant.

Maidstone.—EXTENSION OF SUPPLY.—The Electricity Committee has recommended the Town Council, subject to obtaining the necessary powers, to extend the mains to Leeds Castle, at a cost of £4,320, the owner bearing the cost of cable, transformer, &c., on his premises, estimated to cost £1,100. The minimum revenue will be £846 a year for five years.

Maryport.—ELECTRICITY IN BULK.—The Urban District Council, after considering a proposal to take a supply of electricity in bulk from the Risehow Colliery Coking and By-Product Co., has asked the company if it will be prepared to pay half the cost of a Special Order if applied for by the Council.

Mexico.—ELECTRICAL DEVELOPMENT.—The Mexican Light and Power Co., which is a Canadian concern, has announced its intention of spending $14,000,000 on developments in Mexico.—*Reuter* (Mexico City).

Mid-Lancashire.—ELECTRICITY SUPPLY.—A meeting was held at Accrington on May 27th of representatives of various mid-Lancashire electricity authorities to consider the request of the Commissioners for returns showing the cost and the lowest price at which the various authorities could sell electricity. The returns will furnish the Commissioners with a comprehensive review of the mid-Lancashire electricity supply position.

Northern Ireland.—LURGAN (ARMAGH).—The Urban District Council has decided to install an additional 200-h.p. engine at its electricity works to meet the increasing demand for electricity.

Skipton.—PROPOSED PURCHASE OF UNDERTAKING.—At a recent meeting of the Council a letter was received from the Electrical Distribution of Yorkshire, Ltd., offering to take over the Council's electricity undertaking. The company expressed the opinion that considerable economy would be effected if arrangements could be made to cover the rural and urban districts of Skipton together. The offer included payment by the company of the reasonable costs of obtaining the necessary Order, together with the costs of the Council's original Order, meeting the loss already incurred on the Department, payment to the Council of the capital expenditure of the undertaking, less sinking fund, making an immediate reduction in the charges for electricity in the town, and the institution of an assisted wiring scheme. The Electricity Committee recommended that the Council should not entertain the company's offer, and it was decided to discuss the communication in committee.

Sudbury.—ELECTRICITY SUPPLY.—The East Anglian Electric Supply Co., Ltd., is arranging to obtain a bulk supply of electricity from Braintree, and a supply will be available in Sudbury this autumn. The company is experiencing some opposition from farmers within the area through which the mains have to pass, and it is probable that it will have to request the Ministry of Transport to hold an inquiry.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by Electricity Distribution of North Wales and District, Ltd., authorising it to supply electricity in the urban districts of Buckley, and the Wisbech Electric Light & Power Co., Ltd., to supply in the urban district of Walsoken.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them to be granted to the Urban District Council of Criccieth for the supply by the Electricity Distribution of North Wales and District, Ltd., of electricity in the urban district.

Tynemouth.—STREET LIGHTING.—The Corporation has decided to lay cables, at a cost of £1,850, for lighting by electricity the part of the coast road within the borough.

United States.—ELECTRICAL DEVELOPMENT.—According to *Electrical West*, two contracts covering four 33,333-kVA transformers and seven 25,000-kVA transformers respectively, for the Southern California Edison Co. have been placed with the Westinghouse Electric and Manufacturing Co. These units will be manufactured at the Sharon works for delivery during the coming spring and summer. The 33,333-kVA units are the largest single-phase transformers to be built from the standpoint of capacity. All of the units are to be single-phase, self-cooled, air-blast, for use on th 220-kV system of the Southern California Edison Co They will transform the voltage from 16 kV t 220 kV. Each transformer, completely set up, weighs mor than one hundred tons, and from the top of the high-voltag bushing to the ground measures 400 in. The seven 25,00(kVA transformers are for the Lighthipe sub-station and wi be used to connect 220-kV and 60-kV transmission systems They are similar in construction to the four larger units.

Tramway and Railway Notes.

Blackburn.—YEAR'S WORKING.—We have received fro Mr. J. H. Cowell, general manager of the Corporation tram way undertaking, a copy of his report, together with th statement of accounts, on the working of the undertakin for the year ended March 31st last. The total revenu amounted to £106,025, as compared with £113,156 in th preceding year. Working expenses were £79,294, as agains £83,667, leaving a gross profit of £26,731 (£29,489). Aft payment of capital charges and making contributions to th sinking and permanent-way renewals funds, there was a n surplus for the year of £10,590, as compared with £13,25 in 1925-26. A contribution of £5,000 was made to the boroug fund. The number of passengers carried fell from 16,994,8 to 16,152,313, and the car-miles run from 1,128,178 t 1,084,686, the falling off being almost entirely due to th general strike.

Cardiff.—PROVISIONAL ORDER.—The Unopposed Bills Com mittee of the House of Commons on Thursday last wee had before it for consideration a Bill to confirm a Provisiona Order granted by the Ministry of Transport sanctionin various small sections of tramway construction at Cardif The Ministry's representative stated there were four shor tramways proposed, one of which was a connecting line an the others extensions of existing systems. There had origi ally been two objections, but clauses had been inserted for th protection of the Cardiff Gas Co. and the Great Weste Railway Co. The Order was confirmed.

Japan.—TRAMWAY SCHEMES.—It is reported that the Oka yama Municipality is to establish an investigation departmen with a view to introducing a tramway service in the city The cost of the first section of the scheme is estimated a 1,500,000 yen.

Negotiations are in progress for purchasing the Enoshim electric tramway from the Tokio Dento K.K. by Messrs. Kadono and J. Yamamoto, who intend forming a compan with a capital of 5,000,000 yen for the running of the abov tramway, and then increasing the capital to 7,500,000 yen b amalgamating with Enoshima Dento K.K. It is also desire to further augment the capital to 15,000,000 yen with a vie to laying an electric tramway between Ofuna and Osaki.

London.—FARES.—The London County Council will, fro June 1st to September 30th, issue 6d. all-day tickets fo children under fourteen, which will entitle them to the sam privileges as those granted by the present 1s. tickets fo adults.

Manchester.—YEAR'S WORKING.—The report on the work ing of the Corporation tramway undertaking for the yea ended March 31st last shows that the traffic revenu amounted to £1,754,252, as compared with £1,783,484 in th previous year. The gross profit amounted to £305,863, an after meeting capital charges, &c., there was a net surplus o £45,327, as compared with £116,608 in 1925-26. The numbe of passengers carried fell by approximately 7,000,000. Th decrease in receipts, and the increased working costs ar accounted for by the general strike and the coal stoppage o last year.

Southern Railway Scheme.—Work is to commence im mediately on the widening of a portion of the main lin of the Southern Railway between Beckenham Junctio and Kent House station, including the raising and widenin of two bridges. The widening of the line for about half mile on the London side of Beckenham Junction will enabl four sets of rails to be provided to Kent House, and wil do away with the bottle-neck approach to the former station When the work is completed it will be possible to run a new service of electric trains between Victoria and Beckenham Junction, *via* Clapham Junction, Balham, Gipsy Hill, an Crystal Palace, which will form a link between Beckenham and the neighbourhood and many stations on the Central an Western sections of the Southern Railway. Alterations a Beckenham Junction station will consist chiefly in lengthen ing the "up" bay platform by about 200 feet to enable full length electric trains to be dealt with there. The tota cost of the scheme is estimated at £100,000.

Telegraph and Telephone Notes.

India.—PHONOGRAMS IN CALCUTTA.—It is proposed to introduce in Calcutta as an experimental measure a system which will provide facilities for telephone subscribers to send and receive telegrams in plain English by telephone. The subscriber will be required to pay an additional charge of two annas only per telegram transmitted, while received telegrams will be transmitted free of charge.

South Africa.—"BEAM" RADIO-TELEGRAPHY.—Marconi's Wireless Telegraph Co., Ltd., has completed preliminary tests with South Africa with the "beam" wireless stations which it is erecting at Bodmin and Bridgwater for the General Post Office. Further tests by the company under ordinary traffic conditions will commence immediately; should they prove satisfactory, the stations will be handed over to the General Post Office for the official seven days' trial. During the tests so far made by the Marconi Company, speeds of between 200 and 250 words per minute have been maintained over long periods daily.

United States.—SHORT-WAVE ARMY COMMUNICATION.—Short-wave transmitters are being used by the Army Signal Corps to circumvent static in the transmission of official messages over the Army radio net which connects the War Department with the Corps area headquarters and Army posts throughout the country. During the severe static months at least 75 per cent. of the Army telegraph business, both day and night, from Washington was transmitted by ten of the new sets that were installed, and they worked so well that more sets have been ordered, says *T. & T. Age*. The sets are crystal controlled and designed to operate in two frequency bands, one of approximately 4,000 to 4,500, the other of 8,000 to 9,100 kilocycles.

Radio Notes.

Austria.—NEW STATION.—After months of experiment and tests, the Innsbruck station is to be officially inaugurated on June 2nd. Normally it will relay the Vienna programmes.

Canada.—NEW STATION.—It is reported that the Ontario Government will shortly undertake the erection of a 1,000-watt broadcasting station near Toronto to be used by the Department of Agriculture for broadcasting lectures, weather reports, and possibly general entertainment.—*Reuter's Trade Service.*

United States.—TRANSMISSION PROBLEMS.—Developments in broadcast transmission are announced by the Westinghouse Electric Company, which claims that a system developed at KDKA eliminates three-quarters of the transmitting valves, permits of the broadcasting of a radio wave many times sharper than has heretofore been possible, and provides the same range and quality of transmission with less than half the usually required power input. The new system is regarded as important in offering solutions to many problems, including the possibility of a reduction of station interference and an opportunity to overcome static and local interference in receiver design, whilst an immediate effect noted by operators of receivers in the vicinity of KDKA is a lifting of the blanketing effect that usually surrounds high-power stations, due to the sharpness of the radiated wave. The new system is defined as "frequency modulation," instead of the present method of "power modulation"; heretofore the frequency band required for station operation has been 10 kilocycles, but in the new system the band has been cut to one-half kilocycle. It is explained that the 10-kilocycle separation between stations will still be required with present-type radio receivers, but the new system requires such sharp tuning as to eliminate the annoying interference set up by powerful stations operating on adjacent wave bands; also in transmission, instead of varying the amplitude or strength of the signal, as is present practice, Westinghouse engineers are maintaining constant strength of signal and are varying the frequency of the transmission by an amount usually not more than from 500 to 800 cycles, which they refer to as "frequency modulation." There has been a great reduction of the number of valves and power required; all modulator valves are eliminated, which (at KDKA) means 12 of the 10-kilowatt water-cooled type. In present-day methods of broadcasting, half the total energy supplied to the transmitter is absorbed and dissipated as heat, amounting to 80,000 watts; this energy is now saved and can be made available to increase the power of the transmitter if desired. So radical is the departure from present practice that engineers hesitate to forecast the improvements likely to result from the general application of the new system.

According to *Reuter's* agency, successful experiments indicate that approximately 1,900 stations can operate in exclusive channels at one time without sharing waves or "splitting" time, and the Company claims that the system will solve the congestion problem which the Radio Commission is now attempting to deal with, and will permit the operation of 300 applicants for licences in addition to the 680 stations already licensed.

RADIO INVESTMENTS.—The United States Department of Commerce has estimated unofficially that the total investment in radio in the United States was, on January 1st, 1927, approximately, $750,000,000, which figure is the estimated aggregate of the current value of the 6,500,000 receiving sets in use, and of the investment represented by the 700 or more broadcasting stations, the 2,550 manufacturing plants, and the 30,000 dealers, says *World Radio*.

POWER REDUCTION.—The Federal Radio Commission has directed all stations to announce their call letters and location once every 15 minutes at least. It has also ordered that all stations must not deviate more than half a kilocycle from the wavelengths assigned to them. Owing to constant complaints of interference caused by broadcasting stations using too much power within residential sections of Chicago, three of them have been directed to reduce their maximum power output to 500 watts, effective at once, and to use no more until further notice.

STATION NAMES.—A very friendly reception was given by members of the Federal Radio Commission to a suggestion of the National Association of Broadcasters that radio stations be named instead of merely listed by call letters. At the same time, members suggested that such a movement might come from the broadcasters and need not alter the present plan of classifying stations for licensing and regulation. A commissioner, Mr. Caldwell, said that there was a good deal of protest against the constant repetition of a combination of letters. He saw no objection to the use of a name by a station, though of course the licence would have to contain some method of registration by letter, or number. Radio inspectors were at present continuously testing the ability of each station to stay in its assigned radio channel and the announcement of the letters helped them to keep this check, but when the re-assignment of broadcasting channels had been made and radio transmission had settled down thoroughly the call letters might be dropped almost completely and the lawfully operating station use its name.—*Reuter's Trade Service* (Washington).

Reviews.

Electro-Organic Chemistry. By C. J. BROCKMAN, Associate Professor of Chemistry, University of Georgia, U.S.A. New York: John Wiley & Sons, Inc. London: Chapman and Hall, Ltd. Pp. xi+381; figs. 15. Price 25s. net.

The object of the volume under review is to give a critical and detailed account of the present position of the study of the vast number of organic reactions which may be accomplished by electrolytic methods, and to discuss the theories on which the practice is based. This illuminating volume offers an excellent and lucid survey of recent advances in this branch of scientific thought, and it also gives its readers the means of acquiring a really sound familiarity with the fundamental principles of the subject. Intricate electro-organic reactions are discussed, recording the degree of success which has been attained and the path whose pursuit offers the most promising results in extending the practical application of the science. The book is eminently practical, inasmuch as it informs those who are actively engaged in manipulative operations how certain results are obtained. Details of recently suggested operations are included, which, if brought into commercial use, would prove time saving, economic and of real utility. The treatment of the subject is remarkably complete, copious references being made to the original literature, including patent literature. The author has drawn his references from a very wide field, but the preponderance of American references is a very noticeable feature, which, no doubt, correctly reflects the activity of United States workers on this subject during recent years. The author meets the requirements of research workers and those who desire to make a more intensive study of the principles involved by adding hitherto unpublished information, numerous references to recent investigations, together with the sources of original contributions. A treatise of this nature, coming from such an authority as Dr. Brockman, who has himself played so important a part in the development of the subject, is an invaluable addition to the literature of electro-organic chemistry. The work has entailed a great deal of time and thought in its preparation, and is perhaps the most successful attempt that has yet been made to correlate the several theories and to deal exhaustively with the problems of the subject. The author is to be congratulated on his successful achievement.

The book is divided into two parts; the first part deals with reactions at the anode, being further divided into chapters on electrolytic oxidation, and the oxidation of ionised and non-ionised substances. The second part of the volume deals with reactions at the cathode, the individual chapters dealing, respectively, with electrolytic reduction, the reduction of aromatic nitro- and nitroso-compounds, the carbonyl group

and compounds containing arsenic, chlorine, sulphur, and mercury.

The passage of an electric current through an electrolyte either deposits a metal on the cathode or evolves hydrogen. The electrolytic hydrogen may become attached to an organic compound or it may remove oxygen or both. An example of the addition of hydrogen to a molecule is found in the case of the reduction of cinnamic and nitro-cinnamic acids, respectively. The best example of the removal of oxygen and in its place the substitution of hydrogen is in the reduction of nitro benzene. In the electrolytic oxidation of organic compounds in general, the materials to be oxidised consist of the depolariser; they are also poor conductors of electricity, hence they can seldom be used without the aid of an electrolyte. Since it is difficult to regulate the electrode potential for any one reaction, it is seldom that all the oxygen is absorbed by the depolariser; that which is not absorbed will therefore be evolved at the anode as a gas. The amount of oxygen absorbed by the depolariser depends on the nature of the depolariser, the current density, diffusion of the depolariser, dimensions of the anode surface, rate of agitation, the catalytic influence of added compounds, temperature, and the composition of the anode and the solvent. These factors may be considered as primary conditions, in that during the ordinary electrolysis, without any external changes brought about by the hand of the operator, they regulate the course of the electrolysis; the conditions of the operation may, however, be so changed as to modify the results very considerably.

Perhaps one of the most stimulating chapters in the book is that dealing with the subject of electro-chemical substitution, in which is found much useful information relating to the introduction of halogens into aromatic compounds, together with substitution in acid, neutral and alkaline solutions. The chapters devoted to the reduction of aromatic nitro-compounds are also to be commended for their clarity of statement, soundness of teaching, and admirable discussions of many imperfectly explained reactions. Evidently the whole problem interests the author very keenly. The concluding chapter reviews in a series of well-reasoned comments some special methods of electrolytic reduction of organic compounds containing arsenic, chlorine, sulphur, mercury, &c. The rapid advances that are being made at present in the chlorination of petroleum and the separation of the chlorinated products will probably lead to an entirely new group of intermediate compounds. With the development of new methods of preparation, commercial production may be in a position to accept electro-chemical methods for the treatment of some of these compounds; besides being valuable as solvents, these chlorinated compounds are also of use as intermediates in several industries.

The whole work is admirably condensed, modern aspects are included, and throughout the author has striven to explain intricate reactions in the simplest possible language. The book is replete with indications of probable lines of advance, and in this respect will make an appeal not only to the theorist, but also to the experimental worker. The volume is excellently paragraphed, written in a good literary style, is commendably free from inaccuracies, and is a valuable work of reference in both the theoretical and technical aspects of electro-organic chemistry. A comprehensive authors' and subject index is provided. The volume cannot fail to be of value to all organic chemists employed either in academic work or industry. The reader—like Jonathan in the day of battle, having tasted the wild honey in the wood—will find his eyes enlightened, and will pursue his studies in this wide branch of organic chemistry with added zest and pleasure.

Electric Switch and Controlling Gear. By C. C. GARRARD, Ph.D., M.I.E.E., A.Am.I.E.E. Pp. xiv + 783; figs. 649. London: Ernest Benn, Ltd. Price 63s. net.

The massive volume under notice is the third edition of Dr. Garrard's well-known book, which was originally introduced to the public in 1916, and which has now been revised and considerably enlarged in the process of being brought up-to-date by the inclusion of accounts of appliances and methods evolved since the original publication of the work. The general plan of the book remains unaltered, the numerous appliances described being grouped according to the functions they are designed to perform. Following a preliminary chapter dealing with materials, manufacturing methods and specifications, we find that appliances for breaking electric currents, such as switches, fuses and circuit breakers, are fully considered. The discussion of circuit breakers naturally leads to a consideration of means for the prevention of abnormal currents in circuits by the use of protective relays and other methods. In the new edition the work dealing with this branch of the subject has been enlarged by the inclusion of a considerable amount of matter concerning the biased systems of protection which have recently attracted attention. Chapters IV and V are devoted to a consideration of starting and regulating appliances, and these are followed by chapters dealing with the assembly of appliances for the formation of complete switchboards. A feature of the section dealing with switchboards is the consideration given to the circuit arrangements necessary for the control of the various types of machines, and we find that not only is due attention paid to the more common machines such as rotary convertors and balancers, but also to the less common appliances, such as phase advancers and rectifiers. The concluding chapter is concerned with appliances and methods for the protection of machines and circuits against abnormal conditions giving rise to excessive pressure. The book terminates with ten appendices concerned with the regulations issued by various controlling authorities so far as they relate to switchgear.

It would appear that a book on switchgear would be more difficult to successfully produce than one relating to almost any other branch of electrical engineering, since, on account of the number and variety of the appliances falling within its province, there must always be a great difficulty in preventing the text resolving itself into a mere description of the various pieces of apparatus concerned. Probably no one is better fitted to undertake the task than Dr. Garrard, who is able to draw upon his very large experience on both the technical and commercial sides of the subject in order to link together the descriptive parts of the book with useful and pertinent discussions concerning the principles involved. Thus, in the work before us, we find, for example, that the descriptions of the various appliances for the starting of squirrel-cage induction motors are accompanied by a very useful discussion, based on the scientific principles involved, of the relative merits of the several methods, and again, when dealing with protective systems, the degree of sensitiveness of each system is considered together with the reasons leading thereto.

The book is well printed, few errors being apparent, though one occurs in a prominent place on the loose cover, and the illustrations, both line and half-tone, are well chosen and reproduced.

The size and quality of the book have unfortunately resulted in a high price which we fear will tend to put it out of the reach of many students and junior engineers, and this is to be regretted since Dr. Garrard has done his work well and produced a book which is full of live and vital matters from beginning to end. It is likely to be a standard work of reference for many years to come.

The Director System of Automatic Telephony. By W. E. HUDSON, B.Sc. (Hon.), Whit. Sch., A.C.G.I. Pp. xii+157; figs. 73. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

This further contribution to the steadily growing literature on the subject of automatic telephony is designed for the use of linesmen, traffic officers, and telephone engineers, to enable them to obtain a knowledge of the system adopted by the British Post Office and now being introduced into certain of the larger towns. The author, who is a post office official, may therefore be assumed to write from practical experience of the system. The object of the book is to show how the principles of "step-by-step" selection are amplified to meet the requirements of large multi-exchange areas, in addition to which brief descriptions are given of the special facilities required for dealing with automatic-manual and manual-automatic traffic during the change-over period. In order to simplify the usually complex circuit diagrams the author adopts the "circuit element" drawing, in which "the contacts are separated from the relay coils and gathered up into a number of circuit elements, each element having one or more functions in the circuit operation." The advantage of this method is apparent when dealing with circuits having a large number of functions. The last two chapters of the book are devoted to "metering," and illustrations of exchange apparatus. Although the subject has been very greatly condensed, the book will prove a useful guide to those who are interested in the subject of the "Director" system of automatic telephony.

Données Numériques d'Electricité Magnetisme et Electrochimie. Edited by an International Committee. Pp. x + 143. London: Cambridge University Press. Price 77 fr. (bound), 56 fr. (stitched).

This is an extract from Vol. V of the "Tables Annuelles de Constantes et Données Numériques," and gives the data for the years 1917 to 1922 inclusive. It has a preface by Mr. G. Semenza, president of the International Electrotechnical Commission, who expresses the relief that the reader of a research feels nowadays when he is able to ascertain at once the very latest values that have been assigned for physical and chemical constants—contrasted with the uncertainty that so often hampered progress before these data were thus authoritatively brought together. Only by an international organisation could this end be achieved.

Without a collection of this kind the investigator could not possibly ascertain the state of knowledge of the subject in which he was interested, and consequently a great deal of overlapping would be inevitable. By cutting out this waste to a great extent, the work materially hastens progress; moreover, as Mr. Semenza remarks, it stimulates imagination and suggests new directions for exploration.

To review its contents is impossible; to commend them as indispensable to the research library is a duty, for they undoubtedly render valuable service to the scientific world.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—August 15th. Postmaster-General's Department. One 55-ton 3-motor-type electrically-operated overhead travelling crane. (A.X. 4727.)*

SYDNEY.—July 18th. Municipal Council. Boiler-house equipment for the Bunnerong power station. (B.X. 3531.)*

August 15th. Generator neutral earthing resistance. B.X. 3550.)*

Barton-on-Irwell.—June 7th. Barton and Urmston Joint Electricity Board. Static transformer sub-station, plant and cables. Specifications from Mr. J. A. Robertson, consulting engineer, 20, Brazennose Street, Manchester.

Dublin.—June 8th. Port and Docks Board. Two 200-yd. lengths of 0.4 sq. in. single, lead-covered, armoured, submarine cable, 660-V quality, in accordance with B.E.S. specification No. 7-1926.

Greenock.—June 17th. Corporation. Supply and erection of 11,000-V overhead transmission line and transformers. (See this issue.)

Hull.—June 16th. Electricity Department. Steel coal bunker and conveyor housing. (May 20th.)

Switchgear extensions. (May 27th.)

London.—STEPNEY.—July 11th. Electricity Supply Department. Boilers and boiler-house accessories, turbo-alternator, condenser, accessories, and switchgear. (See this issue.)

H.M. OFFICE OF WORKS. June 13th. Fuseboards and fuses. (See this issue.)

Manchester.—June 13th. Electricity Department. Seven 250-kVA static transformers. Mr. H. C. Lamb, chief engineer and manager, Town Hall, Manchester.

Marlborough. — Electricity Department. Additional underground feeder and overhead feeder. (May 27th.)

New Zealand.—WELLINGTON.—August 9th. Public Works Department. 1,500 suspension insulator strings and 470 strain insulator strings. (B.X. 3533.)*

Nottingham. — June 21st. Electricity Department. General stores for 12 months. (See this issue.)

Oldham.—June 11th. Electricity Department. Water-cooling towers, foundations, tanks, and circulating water pipes. (May 27th.)

Portsmouth. — Electricity Department. Transformers. (May 27th.)

Pudsey.—June 14th. Electric lighting installation at the School of Art. Specification from Education Department, County Hall, Wakefield.

Sheffield.—June 11th. Tramways and Motors Committee. Supply and erection of weighbridge. Mr. A. R. Fearnley, general manager, Division Street, Sheffield.

South Africa.—CAPE TOWN.—June 30th. South African Railways and Harbours Board. Gasfilled and vacuum lamps for 12 months. (B.X. 3518.)* Telegraph material. (B.X. 3519.)*

ELLIOTT (C.P.).—June 15th. Municipal Council. Electric lighting plant, including engines and dynamos, steel poles, copper wire, insulators, switchboard meters, house-service fuses and street-lighting brackets and suspension fittings.

EDENBURG (O.F.S.).—June 21st. Municipal Council. Electric lighting plant, including engines, dynamos, steel poles, &c.—*S.A. Mining and Engineering Journal.*

Southend-on-Sea.—July 6th. Light Railways and Electricity Department. L.p. and e.h.p. cables for 12 months. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Aberdeen.—Housing Committee.

Installation of electric lighting at the new houses (1,000) at Cattofield and Hilton.—Andrew M'Robb.

Australia.—MELBOURNE.—State Electricity Commission of Victoria.

H.p. water-tube boiler and accessory plant (£17,382).—Babcock & Wilcox, Ltd. —*Tenders.*

Barking Town.—Electricity Committee. Recommended: Erection of showrooms and offices in Ripple Road (£4,580).—H. Newell.

Birmingham.—Education Committee. Accepted:—

Electric lighting installation, Sladewell Road school.—S. R. Hare.

Electricity Committee. Accepted:—

Laying cable between Summer Lane generating station and Halesowen.—British Insulated Cables, Ltd.

Switchgear for various sub-stations.—General Electric Co., Ltd.

Bromley (Kent).—Education Committee. Accepted:—

Installing electric lighting at Burnt Ash school (£804, including a provisional sum of £250 for fittings and fixtures).—R. E. Knight.

Erith.—Urban Council. Accepted:—

Joint boxes (£549).—Callender's Cable and Construction Co., Ltd.

Switchgear (£319).—Johnson & Phillips, Ltd.

Glasgow.—Corporation. Accepted:—

Renewal of the main switchboard of the Pollokshaws Burgh Hall (£90).—W. Draper & Co.

Guildford.—Electricity Committee.

Three-phase switchboard:—

New Switchgear Construction Co., Ltd.	(Accepted)	**£760**
Crompton & Co., Ltd.		886
General Electric Co., Ltd.		898
English Electric Co., Ltd.		895
Ferguson, Pailin, Ltd.		906
Metropolitan-Vickers Electrical Co., Ltd. ...		908
British Thomson-Houston Co., Ltd.		948
A. Reyrolle & Co., Ltd.		967
Johnson & Phillips, Ltd.		1,010

Direct-current switch panels (£970).—Crompton & Co., Ltd.

Underground cables:—

Standard Telephones & Cables, Ltd.	(Accepted)	**£3,246**
W. T. Glover & Co., Ltd.		3,291
W. T. Henley's Telegraph Works Co., Ltd. ...		3,294
British Insulated Cables, Ltd.		3,304
Callenders Cable & Construction Co., Ltd. ...		3,344
Johnson & Phillips, Ltd.		3,365

Housing Committee.

Wiring 60 flats at Aldershot Road for electricity:—

Electrical Installations, Ltd. (Accepted) ...		**£294**
Bowden & Higlett, Ltd.		312
A. Meckonik		404

Government Contracts.—GENERAL POST OFFICE.—*Correction.*—We are informed by Messrs. Siemens Bros. & Co., Ltd., that they were awarded the contract for telephone exchange equipment for the head office and estate office of Messrs. Harrods, Ltd., and not the Relay Automatic Telephone Co., Ltd., as stated in our last issue. Our information was derived from the *Ministry of Labour Gazette.*

Grays.—Urban Council. Accepted:—

Rotary convertor, &c.—Crompton & Co., Ltd.

Hull.—Telephones Committee. Accepted:—

Cords.—L.P.S. Electrical Co., Ltd.

Health Committee. Accepted:—

Electrical equipment for radiant heat at vapour and electrical baths (£245).—Cox-Cavendish Electrical Co., Ltd.

Ilford.—Town Council. Accepted:—

1,500-kW motor-convertor (£4,306).—Metropolitan-Vickers Electrical Co., Ltd.

Switchgear (£1,470).—General Electric Co., Ltd.

Electricity Committee. Recommended:—

Switchgear for Ley Street works (£1,470).—General Electric Co., Ltd.

Joint boxes.—W. T. Henley's Telegraph Works Co., Ltd.

Lamps and house boxes.—W. Lucy & Co., Ltd.

Irish Free State.—DUBLIN.—Controller of Stores (Posts and Telegraphs).

Cases for switchboards.—Scott & Co.

Positive plates.—Hart Accumulator Co., Ltd.

Lead sleeves.—Farmiloe & Sons.

Zinc rods and zinc strip.—London Zinc Mills, Ltd. —*Irish Electrician.*

Kendal.—Board of Guardians. Accepted:—
Electric lighting at the Institution (£225).—R. Hadwin and Son.

London.—BATTERSEA.—Town Hall Committee. Recommended:—
Electric organ-blowing plant for Town Hall organ (£160).—William Hill & Son and Norman & Beard, Ltd.

METROPOLITAN WATER BOARD.—Accepted:—
Electrical fittings for Green Lanes pumping station; electric lighting conduit at Kempton Park station.—General Electric Co., Ltd.

METROPOLITAN ASYLUMS BOARD.—Works Committee.
Installation of electric power in laundry, &c.:—

T. Clarke & Co., Ltd. (Recommended.) ...	**£386**
Burdette & Co., Ltd.	433
E. Wendey	444
Douglas Electric Lighting & Power Co. ...	444
Smith & Hammond, Ltd.	447
Electracts, Ltd.	520
Alternative	573

Manchester.—Tramways Committee. Accepted:—
Trolley wire.—R. Johnson & Nephew, Ltd.
Tramway rail bonds.—Forest City Electric Co., Ltd.
Electricity Committee. Accepted:—
Replacement of 33,000-V cables and trifurcating boxes for the Barton house service transformers.—Pirelli-General Cable Works, Ltd.
Housing Committee. Accepted:—
Electric lighting of houses on various estates.—S. Dickinson and W. Spreadborough; Hanchett, Barratt and Currie.
Tramways Committee. Accepted:—
Maximum traction trucks.—Brush Electrical Engineering Co., Ltd.
Tramcar motors and controllers.—British Thomson-Houston Co., Ltd.
Tramcar motors.—General Electric Co., Ltd.
Tramway poles.—British Mannesmann Tube Co., Ltd.
Span wire brackets.—John Spencer, Ltd.
Steel girder tram rails.—Cargo Fleet Iron Co., Ltd.; Bolckow, Vaughan & Co., Ltd.

Salford.—Watch Committee. Recommended:—
Electric light installations at 16 firemen's dwellings at central station (£169).—Height Engineering Co.
Health Committee. Recommended:—
Electric light installation at Drinkwater Park hospital (£163).—Taylor & Son.

Seaham Harbour.—Housing Committee. Recommended:
Wiring 80 cottages for electricity (£266).—C. Doyle (Newcastle).

Stoke-on-Trent.—Electricity Committee. Accepted:—
Distributor wiring at the Abbey Hulton housing site (£327).—Barnett & Soans; Acres Wood housing site (£187).—Hawley & Ingram; and Tarleton Road housing site (£185).—Blackburn, Starling & Co., Ltd.
Housing Committee. Accepted:—
Electric wiring in houses on the Northwood Park estate (£447).—Tomlins, Ltd.

Forthcoming Events.

Optical Society.—Thursday, June 9th. Imperial College of Science, South Kensington, S.W. 7.30 p.m. Paper, "The Use of Photo-Electric Cells for Precision Photometry of Electric Lamps." Mr. T. H. Harrison.

Physical Society.—Friday, June 10th. Imperial College of Science, S. Kensington, S.W. 5 p.m. Ordinary meeting.

Heat Engine Trials Committee.—Friday, June 10th. Institution of Civil Engineers. 6 p.m. Discussion on the Report of the Special Committee on the results of Heat Engine Trials.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the name and address of makers of the following:—

Filaments for NERNST lamps.
230-volt lamps (believed imported) which are no larger than a motor-car headlight bulb.
BELMAPHONE electric buzzer.

We also have an inquiry for the present address of Messrs. William Pemberton & Sons, late of Imperial Buildings, Birmingham.

Notes.

An Important Committee Appointed.

At the moment of going to press we are informed that th Electricity Commissioners, in pursuance of the provisions Sub-section 3 of Section 48 of the Electricity (Supply) Ac 1926, and after consultation with associations representin local authorities who are authorised undertakers, contractor and persons engaged in the business of making and selling ele trical fittings, have appointed the following to be a committe to determine any question which may be raised under Sectio 48 of the Act as to the recognised retail or trade prices any electrical fittings and to advise and assist the person concerned as to the method of giving effect to the provision of the Section:—Mr. D. N. Dunlop, Chairman. Messrs R. W. L. Phillips, A. Nichols Moore, S. E. Fedden, F. W Purse, Councillor J. Moore, and Mr. A. C. Cramb, representin the Incorporated Municipal Electrical Association. Messrs H. H. Berry and J. S. Ramsden, representing the British Elec trical & Allied Manufacturers' Association. Mr. F. Winstanley representing the Electric Light Fixtures Association. Mr F. J. Collis, representing the Electrical Accessories Manufac turers' Association. Mr. C. W. Sully, representing the Elec tric Lamp Manufacturers' Association. Mr. W. F. Bishop representing the Cable Makers' Association. Messrs. A. G Beaver and G. Donovan, representing the Electrical Whole salers' Federation. Messrs. H. J. Miles, T. E. Alger, H Marryat, and L. C. Penwill, representing the Electrical Con tractors' Association. Messrs. J. Allen and W. Finlay, repre senting the Electrical Contractors' Association of Scotland.

Electricity Supply in Ayrshire.

The members of the Ayrshire Electricity Board recentl made an official inspection of their undertaking. In recen years there has been remarkable development in electricit production and distribution throughout the area, the outpu at Kilmarnock being upwards of 40 million kWh per annum there are 204 sub-stations and 121 miles of overhead trans mission lines. At a dinner in connection with the inspection Mr. W. C. Bexon, the engineer, said he did not think th Ayrshire Electricity Board need worry unduly about the opera tions of the Central Electricity Board. The Central Boar estimated that in 1932-34, by linking up, it would save o the whole a yearly sum of £175,603, of which £54,627 woul be a saving to Glasgow Corporation and the Clyde Valley Com pany, £45,756 a saving to Edinburgh Corporation, and £100,00 a saving to the West of Scotland belt, with the remainde to the other undertakings involved. He could not quite agre with the Central Board with respect to this point. To spen five millions in order to effect a saving of £175,000 a year di not appear to him to be altogether right, especially when hal of the capital would be spent on changing the frequency from 25 to 50 cycles. He did not see how the Ayrshire Board woul get any benefit from that. The Ayrshire Board, in 1932-34, was going to save £17,500, which was equivalent to .07d. per unit. On the basis of the present figures he did not see how the Central Board could close the station of the Ayrshire Board at Kilmarnock.

Fatalities.

On May 26th, William Yates, aged nine years, of Bargoed, climbed a mast conveying the cables from Bargoed power station to Taff Merthyr, and came into contact with the cables. He received a fatal shock at 11,000 V.

On May 24th, Mrs. Violet Rainford receiver a fatal shock. At the inquest it was stated that she was holding a reading lamp, the flex of which was defective; there was also a fault in the wireless headphones she was wearing at the time arising from the fraying of flexibles, and Mrs. Rainford was wearing steel-rimmed spectacles. The coroner's verdict was "that Mrs. Rainford died from an electric shock caused by the passing through her of a current, and that it was due to a defective flexible of the lamp standard and defectively wired wireless headphones." We refer to this fatality in our leading columns to day.

B.E.S.A. Publication.

The British Engineering Standards Association has recently issued a B.S.S. (No. 134-1927) for iron or steel tubular poles for telegraph and telephone purposes. It deals in a very complete manner with the full details of the construction of iron and steel telegraph poles, four types of which are recognised as standard, as follows: Type A, tapered tubular pole in two or three parts; type B, riveted (seam) tapered pole in multiple sections; type C, one- or two-piece pole in reduced parallel steps; and type D, multiple-section pole in parallel steps. Perhaps the most useful feature of the specification, apart from the constructional details, is the list of standard lengths and test loads, these being common to all four types of pole. Inasmuch as the overall lengths necessarily vary slightly according to the type of construction employed, a number of nominal overall lengths have been adopted as the basis of comparison between the various types. These range from 18 to 44 ft., and the crippling loads range from 300 to 2,200 lb. applied 6 inches from the top of the pole. The general clauses of the specification explain the assumptions

regarding ground-resistance which have been made for the purposes of calculating the test weights. A schedule of mechanical properties of and calculated stresses in the materials is given, followed by clauses dealing with the means to be employed for protecting the component parts of the poles from corrosion. The sectional clauses give full details of the methods of testing the poles and their bases, if any, together with very complete drawings and tables of dimensions of the component parts of the poles and of the accessories used with the poles. The specification is bound in cloth, and copies may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1, price 10s. 6d., post free 11s. 0d.

Floodlighting Handbook.

A recent publication of the E.L.M.A. Lighting Service Bureau, London (Electric Illumination Bulletin, Handbook No. 6, "Floodlighting"), is the result of a large number of tests and investigations which have been carried out in order to obtain data on the subject, and includes much useful information of a practical character concerning the planning of floodlight installations. It is shown that the beam from a parabolic reflector in practice is always somewhat divergent, due to the dimensions of the light source. The beam spread from the built-up mirrors with which many floodlight units are equipped nowadays is considerably greater than that obtained from a plain parabolic mirror, and it should be borne in mind that the spread is obtained at the expense of beam intensity, so that the use of mirror units is almost entirely confined to short-range projection. A method of obtaining definite asymmetrical distribution of light is outlined and involves the use of a "spreading glass," consisting of a sheet of clear glass ribbed on one side, the light being spread outward at right angles to the ribs. The various methods by which streakiness on the lighted surface, which usually results from the plain parabolic mirror, is avoided, are given. These include the use of diffusing mirrors, diffusing glass fronts, sectional mirrors, and white lamps. The beam spread from the plain parabolic mirror has been found to be 32 deg., from the diffusing parabolic mirror, 44 deg., and from the plain parabolic type with a diffusing front, 46 deg., in each case the fitting being equipped with a 250-W floodlight lamp. The co-efficient of utilisation is defined, among other characteristics of commercial floodlights, and this varies from 25-30 per cent. for the shallow parabolic plain mirror to 55-60 per cent. for the ribbed-mirror square-pattern flood lantern. Some interesting information on the constructional design of units is given, and the applications of floodlighting are dealt with at considerable length. The latter section of the work is particularly well illustrated.

The Ontario Hydro-Electric Power Commission.

The ninth annual report of the Hydro-Electric Power Commission of Ontario, which was presented to the Provincial Legislature recently, states that the financial results of operation during the year were very satisfactory. The Commission increased its power development from 808,398 h.p. to 928,032 h.p. The revenue from consumers reached a total of $20,555,179, which was sufficient to meet fixed charges, provide $4,295,894 for sinking funds, &c., and leave a surplus of $565,413. The report showed a notable increase in the number of rural transmission lines, 750 miles having been added during the year. The total rural mileage is now 2,300. The number of rural customers reached is 19,000, and the investment in rural lines totals $4,750,000, the revenue from this source being $743,133. The total of the public investment in the system amounted to $203,442,759, of which $155,769,665 is invested in the Niagara Falls System. The increase in power during the year occurred almost entirely in that system, which had 800,000 h.p. of plant in comparison with 683,646 h.p. last year. The total reserves held by the Commission for sinking fund, contingencies, &c., are $24,751,411, this fund having increased rapidly during recent years. Regarding the question of the future power supply for the eastern district, the report stated that plans were under consideration for supplying large blocks of 60-cycle power from the supply to be obtained under the contract entered into with the Gatineau Power Company for 260,000 h.p.

A Rural Electrification Scheme.

An interesting example of a rural electrification scheme is to be found in the installation recently completed at Preesall, near Lancaster. The United Alkali Company has established works on the outskirts of the village, and it is from the power house of those works that a bulk supply is provided by the company at 550 V, 50 cycles, 3-phase, through the medium of a kiosk-type sub-station. This contains two 50-kVA transformers which step up the pressure to 6,600 V, at which the supply is transmitted to the village, where it is received by two 50-kVA kiosk sub-stations for reducing the pressure to 416/240 V for distribution. The l.p. distribution system extends as far as Preesall Park on the south, and interconnects between the kiosk sub-station at Preesall and the one at Knott End, and finally terminates at the extreme limit of Knott End, including the Ferry Slip. The main distributors are sub-controlled by means of feeder pillars, one at Preesall and the other at Knott End, where the local distribution is split up. In addition to over 250 consumers who have already been connected to the mains, some 60 public street lamps are supplied from the system. These are connected directly to the local distributors, and each is controlled by means of a time switch. The system of charging is on a flat rate of 10d. per kWh for lighting and 2d. for power and heating. During the quarter ended September 30th, out of 18,000 kWh which were sold 14,300 kWh were for power and heating. The Preesall Council hires out electrical domestic appliances of all types, and it has at present about 30 electric cookers and 50 wash boilers connected to the mains. Several of the local farmers are using power for milk separating and other small-power requirements about the farm, and poultry farmers are also adopting the use of electricity in their cabins to increase the production of eggs. A special rate is charged for electricity for this purpose, provided it is used during certain restricted hours. The principal power consumer is the local flour mill, which has been converted from windmill operation to the electric drive. Three motors have been installed, totalling 45 h.p., and a special arrangement has been made to ensure that the supply will not be taken during periods of maximum peak loads. The contract for the complete scheme was placed with the Pirelli-General Cable Works, one of the associated undertakings of the General Electric Co., Ltd., by which the switchgear and transformer equipment was supplied.

Novel Electric Vehicles.

Our recent note on the subject of electric battery-driven street-lighting tower wagons (April 1st issue, page 523) has prompted Messrs. Electromobile, Ltd., to draw our attention to the fact that their associated company in America has built



A Street-lighting Tower Wagon.

a number of this type of vehicle, which can be supplied in this country when required. The accompanying illustration depicts such a wagon in the service of the Philadelphia Electric Co., U.S.A.

Appointments Vacant.

Assistant master in the Electrical Engineering and Physics Department of the L.C.C. School of Engineering and Navigation, Poplar, for the L.C.C. Permanent-way foreman for the Dundee Corporation tramways. Inspector of works (£6) for the Tilbury U.D.C. electricity scheme. Clerk of works (84s.) for the Llanfairfechan U.D.C. electricity scheme. Meter repairer for the Stepney Borough Council Electricity Department. Commercial assistant for the Borough of Colchester Electricity Department. Lecturer in electrical machinery for the L.C.C. Hackney Institute. (See our advertisement pages to-day.)

Electrical Development in Germany.

According to the report for 1926 of the Union of Electricity Works. the total capacity of the German works amounted to 5,700,000 kW, as compared with 5,000,000 kW for the previous year. The running of the works was normal, although sales of electricity for power purposes suffered considerably from the depression in industry. Only in the last months of the year did industrial consumption of power begin gradually to increase, and there was a rise in output from 11,700,000,000 kWh in 1925 to 12,100,000,000 kWh in 1926, or about 4 per cent. Contrary to industrial sales the use of electricity in homes increased considerably, and was large enough in many places to make up for the falling off in sales to industries.—*Reuter's Trade Service* (Essen).

Electrodeposition for Rust Protection.

At a meeting of the Electroplaters' and Depositors' Technical Society, which was held at the Northampton Polytechnic Institute on May 18th, Mr. S. Wernick, B.Sc., read a paper on "The Protective Effect of Metal Deposits on Iron." He said that the three important factors which concerned electrodeposition for rust protection were the nature of the protective metal, the thickness and condition of the deposit, and the conditions under which it had been deposited. So far as the first two points went, a useful guide was found in applying Nernst's solution pressure theory and the normal potentials of the metals commonly deposited. The same theory gave a good picture of the mechanism of the rusting of iron. Theoretically, of the metals which had been deposited, only zinc, chromium and possibly cadmium could be expected by acting anodically to the iron to act as rust preventives. The conditions of deposition were, however, extremely important factors: such factors as the preliminary treatment, porosity of the base metal, structure of the deposit, type of solution used, throwing power of the solution, mode of handling, and the final finish, all entered into the production of an efficient deposit. The throwing power of a solution was particularly important in the case of articles with sharp bends or deep recesses. This fact, together with the fine structure obtainable from cyanide solutions, accounted for the marked superiority of these baths over acid sulphate solutions in the case for example of zinc.

Electrolytic zinc was superior to zinc deposited in any other way on account of its great purity. Nickel could act as an efficient protector provided its thickness was at least 0.001 inch. Cobalt had given very good results with a copper underlay and had stood up better than a copper-nickel deposit. Cadmium was certainly comparable with zinc as a rust preventive. Chromium gave varying results mainly of a disappointing character—probably due to its proneness to passivity; a copper-nickel underlay gave improved results. In conclusion, he stressed the need for a standard corrosion test which should be laid down to render the results of different investigators comparable.

Phototelegraphy.

Photographs sent by radio are enlarged to nine times their original size by means of new receiving apparatus tested successfully by the Radio Corporation of America, according to the *T. & T. Age*, which explains that the paper used for receiving the pictures was made especially for the purpose. The actual enlarging is done by a small asbestos device attached to a rubber tube, through which hot air is constantly blown; a tiny opening at the end of the tube lets hot air blow on the paper, making a black mark. The pictures are made, however, by a second tube conveying cold air, the passage of which to the paper is controlled by radio signals; if the cold air passes in front of the current of hot air, it prevents the hot current from making a mark on the paper. Thus there is obtained the succession of black dots and lines and white spaces, which, when seen together, make the picture. The receiving marker moves across three times as far and up and down three times as far as in the original photograph.

Electric Smelting in Sweden.

A preliminary statement was recently made before the Varmland Mining Association concerning the trials which have been made at the Uddeholm works with the so-called Flodinska method of producing steel from ore briquettes. Since promising results were obtained in a small experimental furnace of from 200 to 300 kW, a furnace of from 1,500 to 2,000 kW has been constructed at Hagfors. This was in operation for an uninterrupted period of five weeks, and during this period a total of 395.7 tons of steel was produced from 921 tons of briquettes. The consumption of briquettes was high, but it has to be considered that the briquettes contain ore besides the requisite quantity of coal and limestone. The consumption of energy was about 2,700 kWh per ton, which is regarded as being low, as for electric pig iron the consumption is from 2,400 to 2,600 kWh. The consumption of electrodes averaged 11.6 kg. per ton, as compared with 6-7 kg. in the case of pig iron, but it is reckoned that the former rate is reducible. The analysis of the steel made was quite satisfactory; the material was rolled for various purposes, and rolled and cold-drawn tubes were also made from it. It would have been possible to keep the furnace in activity for a longer period than five weeks, but it had to be stopped on account of a scarcity of briquettes.

The Raxalp Cable Railway.

The electrically-operated suspended cable railway recently constructed to the summit of the Raxalp mountain in Austria opens up one of the most beautiful pleasure resorts in the neighbourhood of Vienna. In 1925 the Vienna Building Credit Bank approved of a scheme submitted by the Adolf Bleichert Co., of Leipzig, Germany, for the use of the system patented by Herr Ing. Zuegg, of Meran. The manufacture of the cables and the bulk of the material for the line was, however, entrusted to Austrian firms. The line is 1.34 miles in length, the difference in altitude between the lower and upper stations being 3,339 ft.; the valley station is 1,731 ft. above sea level and the summit 5,070 ft. Five cable supports have been provided, the first, fourth, and fifth being of the "gate" type, and the second and third ordinary towers, over 98 ft. high. The cable spans between supports, from the valley upwards, are, respectively, 656 ft., 1,968 ft., 2,624 ft., and 1,408 ft.; the final span is a short one, and tended to allow the cable to approach the upper station in an almost horizontal position. The average gradient of the line is 46.6 per cent., or nearly 1 in 2. The two cables are 50 mm. (approximately 2 in.) in diameter, and the total length of 7,216 ft. weighs approximately 25 tons. Each car has accommodation for 27 passengers, the line being operated in pendulum fashion with two ascending and two descending cars. The tension applied by means of heavy ferro-concrete blocks at the lower ends of the cables is one of the features of the system, reducing the number of supporting towers. The travel of the cars is effected by a 25-mm. haulage cable operated by electrically-driven winding gear at the summit station. In addition, there is a counter (ballast) cable and an auxiliary cable by means of which a small car can be run for emergency purposes. The cars are in telephone communication with both stations during their journey, and three independent brakes are provided. The cars are electrically lighted by means of accumulators, provision for charging which is made at the upper station. The normal speed of the cars ranges from 11 to a little over 13 ft. per second, so that the journey is completed in from 9 to 10 minutes. The operating plant at the summit station, which was supplied by the "Elin" Gesellschaft für Elektrische Industrie, of Vienna, comprises two 70-h.p. Diesel engines, only one of which is used at a time, the belt pulley between the two, which drives a 60-kW generator, being provided with a double clutch so that the dynamo can be connected up to either engine. Two motors operate the haulage cable, a main one of a continuous capacity of 64 h.p. and an emergency motor designed for a continuous output of 22 h.p.; a "buffer" plant, which includes a small generator and a 60-cell 370-amp.-hour battery of accumulators, not only takes up any excess of power on the downward journey, but also provides a reserve supply for the motors, and enables the engines to be run at a constant speed. There is also a small d.c. 110-V dynamo for various auxiliary purposes, while for lighting a 5-kW crude-oil engine and d.c. dynamo are also available. Many constructional difficulties had to be overcome, but the actual work of building the cable railway was carried through within twelve months.

Educational.

Loughborough College.—British Empire scholarships in the Faculty of Engineering, Loughborough College, which are tenable at Loughborough for the full period of the diploma course, have been awarded by the governors for 1927 as follows: G. Macleod (Stockport); W. H. Medcalf (Woodbridge), T. Marash (Scots' College, Galilee), J. le P. Webb (Cheltenham), R. G. Martin (Wyggeston), G. L. Ryan and F. Laurence (Loughborough Junior College). These scholarships are open to all British subjects resident in any part of the Empire, and are of the value of £75 per annum.

Manchester.—We have received the prospectus of the Municipal College of Technology for the summer evening classes, 1927. The classes, which will embody short courses of lectures and laboratory work, including electrical and mechanical engineering, will begin on Monday and Tuesday, June 13th and 14th.

Colour Lighting.

On May 24th members of the Junior Institution of Engineers attended a lecture and demonstration on colour lighting and its application to the stage, theatre, kinema, and so on, in the miniature theatre attached to the showrooms of Messrs. Holophane, Ltd. Mr. Gillespie Williams, the lecturer, demonstrated the effects which can be produced by the "Duo-Phantom" apparatus, Electrical Review, May 6th, 1927, p. 735, a recent Holophane production.

Volta Centenary Exhibition.

The King of Italy opened, on May 28th, an electrical exhibition at Como in commemoration of the centenary of the death of Alessandro Volta, the Italian scientist who evolved the Voltaic Pile, one of the most momentous contributions ever made to the technique of generating electricity. The exhibition is being held in the picturesque Villa Olmo at Como, and will continue until October. An international Telegraph and Telephone Congress will take place during the period of the exhibition. One of the most interesting contributions to the display of electrical devices is made by Senatore Marconi, who has loaned a valuable collection of apparatus, some of which was used in his earliest experiments in 1895, together with a number of transmitting and receiving instruments which were used in the early days of commercial wireless before the development of the thermionic valve. The Marconi Company is exhibiting a collection of photographs illustrating the evolution of wireless apparatus and wireless telegraph stations, together with a collection of modern wireless apparatus.

Association of Teachers in Technical Institutions.

The annual conference of this Association is to be held at Plymouth from June 4th to June 7th. It will be opened officially on Monday, June 6th, with a civic welcome by the Mayor of Plymouth. On the same day Mr. H. Hall will deliver his presidential address.

The New Carlisle Station.

The new generating station at Carlisle, which has been constructed at a cost of £230,000, was officially opened on Thursday last week by the mayor, Mr. Archibald Creighton. The Willow Holme station, which was described in our last issue, has been constructed with a view to supplying an area of twenty to thirty miles beyond the city's boundaries. The River Eden, which was Carlisle's protection in the days of the Border raids, is now one of its chief assets in the supply of electricity. Its minimum summer flow is 10 million gallons per hour, and the station's present need is 600,000 gal. per hour. The ceremony was attended by a large number of citizens and local manufacturers, and also representatives from the rural areas. At a celebration luncheon after the ceremony, Sir John Snell, chairman, Electricity Commissioners, the chief guest, said the Government had taken a particular interest in the Carlisle scheme, and if he might have the courage or audacity, he would hazard a suggestion as to Carlisle's possible future under the new Electricity (Supply) Act. The Commissioners had lost no time in surveying the country; they had already surveyed the industrial districts of Lancashire and Yorkshire, and Cumberland and Westmorland; a scheme for Central Scotland had already been published, and one for Central England was nearly ready for publication. The geographical position of Carlisle would hardly warrant the construction of a main arterial line to connect it with other systems. But, supposing that the L.M. & S. Railway Company determined, because of the heavy gradients with which it had to deal, to electrify its system, say from Derby and Preston on the south and Glasgow on the north, then, there would be a reason for an arterial line, which would pass through Carlisle or its immediate vicinity. If the L. & N.E. Railway decided to electrify its line between Newcastle and Carlisle there would be sound reason for electrical interconnection with the North-East Coast companies. Carlisle would have to extend its area of operations in the rural districts around, and the gap between the North-East Coast and Carlisle developments would be lessened. It would be extremely foolish to say that Carlisle would remain isolated.

Speaking of the development of electricity in the country, Sir John said that a conservative estimate of the consumption in the country amounted to six thousand million electrical units, but his own idea was that it would rise to six times that amount. The Government had decided upon a scheme of twenty-one thousand millions by 1940. Sir John paid a high tribute to the technical skill and ability of the city electrical engineer, Mr. C. W. Salt, M.I.E.E.

In reply to a toast, Mr. Salt said that in designing the station he had felt it his duty not to permit the question of abnormal high efficiency to become an obsession. He had found that with moderate-sized power units the saving due to reduced coal consumption was overweighted by the increased capital outlay without consideration of the probability of increased maintenance charge. This view applied to local conditions only. He had worked along the lines of introducing elasticity in the lay-out which would permit, when the occasion arose, of introducing plant which would give an overall higher thermal efficiency. The whole problem of economical electricity supply was not confined to generation and transmission; a third and very important factor was the consumer and his consuming devices. The co-operation of the consumer was essential to economical supply, and the sympathetic consideration of the consumer was helpful during the present stage of development when high capital charges for a temporary period might almost equal the advantages of lower working costs.

Sign Floodlighting.

An interesting example of electric floodlighting is to be seen at the Rugby works of the British Thomson-Houston Co., Ltd., where the method is applied to three large signs placed over the works. One of these, measuring 80 ft. in length, is floodlighted at night by a battery of six B.T.-H. projectors, arranged in a single row on a roof 50 ft. below the sign. A B.T.-H. monogram sign, measuring 18 ft. across the circle, is illuminated by a similar arrangement. A battery of six projectors in a single row is situated at a distance of 83 ft. from the sign. The third sign, 76 ft. long, is served by a similar battery 86 ft. away. All the projectors are provided with plain mirror reflectors and equipped with Mazda gasfilled projector lamps.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. P. N. RAND, who recently relinquished his appointment as general sales manager of the Metropolitan-Vickers Electrical Co., has been appointed to a similar post with the English Electric Co., and will take up his duties as soon as his present commitments permit. We understand that Mr. Rand was originally on the staff of Siemens Bros. Dynamo Works, which is now part of the English Electric organisation. He left them to join the British Westinghouse Electric & Manufacturing Co.

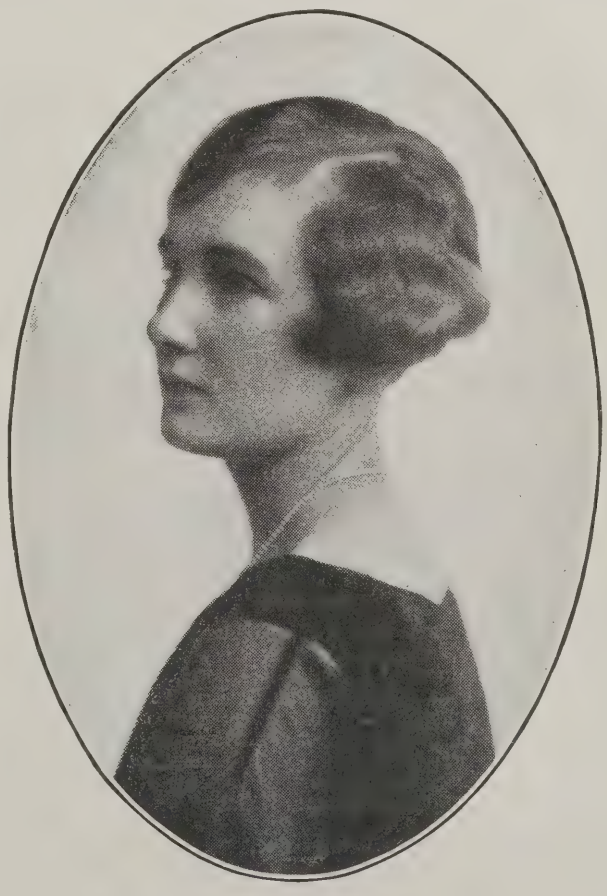
On May 16th, in the Upper Dining Room at the Metropolitan-Vickers works at Trafford Park, Captain Hilton presented to Mr. P. N. RAND a magnificent gold cigarette case and a white skunk motor rug, subscribed for by his many friends in the company. Captain Hilton referred to the valuable services Mr. Rand had rendered to the company and the regret that all who came in contact with him felt when it



Mr. P. N. Rand.

became known that he had decided to sever his long connection with it. Mr. Rand, in reply, remarked that he had recently had a tooth out, but of the two ordeals, would much prefer to have got this ceremony over and still have to face the dentist. Mr. Rand carries with him the heartiest good wishes for success in whatever direction his future activities may lie.

Miss EDNA GARDINER, who, as announced elsewhere in this issue, won the first prize in the E.D.A. ballot, is a typist in Bristol. The Electrical Development Association has sent us a portrait of Miss Gardiner, which is reproduced herewith.



Miss Edna Gardiner.
Winner of the E.D.A. Ballot Competition.

She has expressed a preference for the £2,000 cheque instead of the all-electric house, and says that she intends to invest the money and continue in business. Mrs. Gardiner, who won the fifth prize, is Miss Gardiner's mother; her father was not successful—but neither were many others of us.

On Saturday last a presentation was made to Mr. G. R. SPURR, who completed 21 years' service as electrical and tramway engineer to the Walthamstow Council last month. Councillor H. Frost, chairman of the Council, made the presentation on behalf of the staff and employés of the two departments. It took the form of a coffee service, a suit case, and pipe. Councillor Frost spoke in warmest praise of Mr. Spurr's service, and attributed the present satisfactory position of the undertaking largely to his technical and managerial skill. Mr. V. L. McEntee, chairman of the Electricity and Light Railway Committees, followed. Mrs. Spurr was presented with flowers by the only lady member of the staff. In his reply, Mr. Spurr recalled some lively incidents of the days of gas producer plant, and among other things mentioned that he had recently celebrated his silver wedding.

Mr. J. H. C. BROOKING, M.I.E.E., will shortly be leaving the St. Helens Cable & Rubber Co., Ltd., to join the Greenwich Cable Works, Ltd., of Crooms Hill Works, Greenwich, as managing director. For the present his home address is "The Milestone," Bath Road, Slough.

The Poplar Borough Council has expressed high appreciation of the services of the borough electrical engineer, the staff of his department, and other officers concerned in the excellent arrangements made on the occasion of the opening of the new generating station.

The Department of Overseas Trade announces that Mr. J. W. BRIGDEN has been appointed Trade Commissioner at Cape Town in succession to Major G. Fetherston, D.S.O., M.C. Mr. Brigden will sail for South Africa on June 10th. Mr. Brigden will be Junior Trade Commissioner and will have offices at Johannesburg (P.O. Box 839, Goldfields Buildings, Eloff Street). Mr. N. Elmslie is Senior Trade Commissioner, and has recently moved his headquarters from Johannesburg to Cape Town.

At the annual meeting of the National Joint Board of Employers and Members of Staff (Electricity Supply Industry) held on May 20th, Alderman W. WALKER, M.I.E.E. (Manchester) was appointed chairman for the eighth successive year, and Mr. A. W. CROMPTON, A.M.I.E.E., president of the Electrical Power Engineers' Association, was appointed vice-chairman.

As stated in our "Business Notices," Dr. H. R. WRIGHT, managing director Siemens Bros. & Co., Ltd., has joined the board of the British Columbia Telephone & Telegraph Co.

The Chesterfield Town Council is recommended to increase the salary of the borough electrical engineer from £700 to £800, with a maximum of £900; that of the tramway manager from £650 to £750, maximum £800; that of the station superintendent from £456 to a maximum £500; and that of the deputy tramway manager from £355 to £400, maximum £450.

Mr. W. J. H. WOOD, borough electrical engineer of Bolton, has been appointed engineer-in-chief to the County of London Electric Supply Co., Ltd., in succession to Mr. Archibald Page. In accepting Mr. Wood's resignation on May 27th, the Bolton Electricity Committee recorded its "great appreciation of the excellent and valuable services rendered by him in the department, which have resulted in the undertaking being successfully developed."

The marriage took place at the Parish Church, Ospringe, on May 25th, of Mr. E. F. BESWICK, manager for Messrs. Jabez Smith & Son, electricians, of Faversham, and Miss H. J. MITCHELL.

Obituary.—MR. J. J. S. MACLAREN.—The death occurred on May 24th, of Mr. James Joseph Stainton Maclaren, chairman of Carron Company, in his 85th year.

MR. J. H. WOODWARD.—We learn with great regret of the death of Mr. John Harold Woodward, a partner in the firm of Messrs. Preece, Cardew & Rider, consulting engineers, at the age of 62. Mr. Woodward was born in Macclesfield; his father was connected with the silk manufacturing industry. After spending a short time in his father's silk mill, he went, in 1882, to Owens College, Manchester, and took up engineering studies. He became specially interested in electrical work and in 1885 he joined the technical staff of Elwell-Parker, Ltd., at Wolverhampton, where Thomas Parker was developing various early dynamos, alternators, and secondary batteries. The company was absorbed by the Electric Construction Company in 1889, and the lay-out of the new works at Bushbury, Wolverhampton, was due to a great extent to Mr. Woodward. He designed much of the work for the electrification of the Liverpool Overhead Railway in 1890, and for other early electric railways and tramways. The first alternators used by the Metropolitan Electric Supply Company in Manchester Square and Rathbone Place, erected in 1889, were of his design. Subsequently, when Thomas Parker left the Electric Construction Company, Mr. Woodward went with him, and the works of Thomas Parker, Ltd., were developed also at Wolverhampton. In 1899, he joined Messrs. Preece & Cardew, and in 1909 he was made a partner in the firm which became Preece, Cardew, Snell & Rider, and later, on Sir John Snell's retirement, Preece, Cardew & Rider. Mr. Woodward was largely associated with the firm's lighting, tramway and railway work in this country, the Colonies, and foreign countries. He visited the United States, Australia, New Zealand, and South America. Among the electricity supply and tramway undertakings upon which he was recently engaged, were Wellington, Auckland, Dunedin, Sydney, Brisbane, Shanghai, Hong Kong, Buenos Aires, &c. Mr. Woodward was married in 1905 and he leaves a widow and one daughter.

MRS. HOADLEY.—We wish to express our sympathy with Mr. E. E. Hoadley, borough electrical engineer at Maidstone, whose wife passed away on May 26th in her 48th year. Mr. and Mrs. Hoadley celebrated their silver wedding in April last.

MR. C. LEHMANN.—Mr. Charles Lehmann, late of the Eastern Telegraph Co., Ltd., died at Vigo, Spain, aged 67 years, on May 18th.

MR. L. LILLEY.—The death is announced of Mr. Leonard Lilley, who was for the past 14 years on the staff of the General Electric Co., Ltd., at Witton. He was 41 years of age.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Regent Electrical Co., Ltd.—Private company. Registered May 25th. Capital, £400 in £1 shares. Objects:—To acquire the business of a dealer in electric lamps carried on by A. F. Lowe as "The Regent Electric Lamp Co." at 72, Finsbury Pavement, E.C. The permanent directors are:—A. F. Lowe, 128, Chestnut Avenue, E.17, estate agent; T. W. McEwen, 16, Briar Avenue, S.W.16, merchant. Solicitors: Bein & Lawrence, 72, Finsbury Pavement, E.C. Registered office: 72, Finsbury Pavement, E.C.2.

Auto-Electric Advertising Co., Ltd. — Private company. Registered May 23rd, with a nominal capital of £2,000 in 1s. shares. The objects are to carry on the business of advertising contractors and agents, manufacturers of and dealers in apparatus, appliances, plant and material employed by such contractors, electrical and general engineers, &c. The first directors are:—Sir Frank C. Meyer, Bt., M.P., 18, Lowndes Street, S.W.1. (director of British Industrial Corporation, Ltd.); Sir Alan Burgoyne, Fincher's House, Amersham, director of companies; H. Fitzpatrick, 24, Throgmorton Street, E.C.2; C. W. C. Lynfield, 82, North Gate, N.W., gentleman; I. Rapaport, 26, Belsize Lane, N.W.3; A. F. H. S. Simpson, C.M.G., Windham Club, St. James's Square, S.W.1. Qualification, 100 shares. Remuneration, £250 each per annum (chairman £350). Solicitors: Wild, Collins & Crosse, Kennans House, Crown Court, Cheapside, E.C.2.

Abbey Cables, Ltd.—Private company. Registered May 23rd. Capital, £2,000 in £1 shares (1,000 preferred ordinary and 1,000 ordinary). Objects: To carry on the business of manufacturers of and dealers in telegraphic, telephonic, and all other kinds of electric and other cables, &c. The subscribers (each with one share) are:—S. G. W. Norton, "Reo," Woodcote Valley Road, Purley, electrical engineer; A. Maguire, 36, Eaton Place, Belgravia, S.W., gentleman. Solicitors: Gordon, Gardiner, Carpenter & Co., 7, Serjeants' Inn, Temple, E.C.4.

R. A. Poole (London), Ltd.—Private company. Registered May 23rd. Capital, £1,000 in £1 shares. Objects: To acquire the business of a wholesale electrical supplier and distributor of electric lamps, wireless valves, wireless apparatus and accessories, motors and accessories, and electric cables, carried on by R. A. Poole, at 67, Goldhawk Road, Shepherd's Bush, W., as "Poole's Electric Lamp and Accessories Co." The directors are:—R. A. Poole, 67, Goldhawk Road, Shepherd's Bush, W.12; Mrs. M. K. Poole, 7, The Common, Ealing, W.5. Qualification, £10 shares. Solicitor: A. C. Jaques, 102, Colmore Row, Birmingham. Registered office: 67, Goldhawk Road, Shepherd's Bush, W.

Weenen, Goddard & Co., Ltd.—Private company. Registered May 26th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electrical engineers and contractors, &c. The permanent directors are:—H. H. Weenen, 22, S. James' Mansions, West Hampstead, N.W.6, electrical engineer; A. G. Goddard, "Westholme," 67, Rancliffe Road, East Ham, E.6, electrical engineer. Solicitors: Bartlett and Gluckstein, 199, Piccadilly, W.1.

Victor X-Ray Corporation, Ltd.—Private company. Registered May 21st. Capital, £1,000 in £1 shares. Objects: To manufacture and deal in Röntgen or X-ray electro-therapeutic, electro-surgical, scientific, chemical, medical or mechanical machinery, tools, instruments, appliances, and devices, &c. The company has the right of the trade mark "Victor," No. 370,638. The directors are:—L. M. Forsyth, Morley House, Regent Street, W.1, electrical engineer; J. F. Stewart, Crown House, Aldwych, W.C.2, secretary; V. J. Radbone, 268, St. James' Court, S.W.1, electrical engineer. Solicitor: A. R. Monks, Crown House, Aldwych, W.C.

W. D. Willson, Ltd.—Private company. Registered May 19th. Capital, £1,500 in £1 shares. To adopt an agreement with W. D. Willson, and to carry on the business of electric, telephonic, and wireless engineers, dealers in electrical and wireless fittings, &c. The first directors are:—W. D. Willson, 1, Fell Road, Croydon, electrical engineer (life director); A. A. Baster, 22, George Street, Croydon, incorporated accountant; Mrs. F. C. Willson, G. W. Adams, and J. McCarthy (addresses not stated). Qualification of life director, 200 ordinary shares; of other directors, £10. Registered office: 1, Fell Road, Croydon.

Triotron Radio Co., Ltd.—Private company. Registered May 27th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of thermionic valves. The subscribers (each with one share), are:—A. Kinge, 25, Glenburnie Road, Upper Tooting, S.W.17, clerk; A. W. Harwood, Police Station, Staines, Middlesex, clerk. J. Axelrad is first and permanent director. Qualification, 5 shares. Solicitors: Philip Conway Thomas & Co., 80, Rochester Row, S.W.1. Registered office: 80, Rochester Row, Westminster, S.W.1.

Official Returns of Electrical Companies.

Carmichael & Partners, Ltd.—Capital, £500 in £1 shares. Return dated August 31st, 1926 (filed March 21st, 1927). 52 shares taken up. £52 paid. Mortgages and charges, nil.

Hambling, Clapp & Co., Ltd.—Return dated November 18th, 1926. Capital at date of return: £1,000 in £1 shares (increased November 24th, 1926, to £2,500 in £1 shares). 472 shares taken up. £472 paid. Mortgages and charges, nil.

Tungstone Accumulator Co., Ltd.—Capital, £1,000 in £1 shares. Return dated September 29th, 1926 (filed March 21st, 1927). 500 shares taken up. £500 paid. Mortgages and charges, nil.

Spa Radio Co., Ltd.—Capital, £1000 in £1 shares. Return dated May 28th, 1926 (filed April 8th, 1927). 460 shares taken up. £460 paid. Mortgages and charges, nil.

Lancashire Telephone Systems, Ltd.—Return dated January 12th, 1927. Capital at date of return: £3,000 in £1 shares (increased March 15th, 1927, to £4,000 in £1 shares). 1,705 shares taken up. £1,705 paid. Mortgages and charges, £250.

Weald Electricity Supply Co., Ltd.—Capital, £40,000 in £1 shares. Return dated December 6th, 1926. 5,504 shares taken up. £1,504 paid. £4,000 considered as paid. Mortgages and charges at date of return, nil. Issued January 1st, 1927, £50,000 debentures (part of series of £100,000 authorised December 15th, 1926).

Carlisle and District Transport Co., Ltd. (formerly The City of Carlisle Electric Tramways Co., Ltd.).—Capital, £60,000 in £1 shares. Return dated March 1st, 1927. All shares taken up. £60,000 paid. Mortgages and charges, £40,000.

Chislehurst Electric Supply Co., Ltd.—Capital, £15,000 in £5 shares. Return dated April 25th, 1927. All shares taken up. £15,000 paid. Mortgages and charges, nil.

Automatic Coil Winder and Electrical Equipment Co., Ltd.—Capital, £10,000 in 8,000 ordinary and 2,000 deferred shares of £1 each. Return dated February 21st, 1927. All shares taken up. £3,000 paid. £7,000 considered as paid. Mortages and charges, £2,800.

Ventimotors, Ltd.—Capital, £8,000 in £1 shares. Return dated February 11th, 1927. All shares taken up. £8,000 paid. Mortgages and charges, nil.

Electron Co., Ltd.—Capital, £1,000 in £1 shares. Return dated March 14th, 1927. 970 shares taken up. £970 paid. Mortgages and charges, £3,500.

Lacy Patents Holding Co., Ltd.—Capital, £1,000 in 1s. shares. Return dated December 31st, 1926. All shares taken up. £1,000 considered as paid. Mortgages and charges, nil.

F. C. Brown (Electricity), Ltd.—Capital, £1,000 in £1 shares. Return dated December 15th, 1926 (filed March 25th, 1927). All shares taken up. £25 paid. £975 considered as paid. Mortgages and charges, nil.

Gauntletts, Ltd.—Capital, £40,000 in 35,000 cum. preference shares of £1 each and 200,000 ordinary shares of 6d. each. Return dated December 31st, 1926. All shares taken up. £25,000 paid on 25,000 preference shares. £15,000 considered as paid on 10,000 preference and 200,000 ordinary shares. Mortgages and charges, nil.

Neon Lights (1923), Ltd.—Capital, £30,000 in £1 shares. Return dated December 31st, 1926. 27,000 shares taken up. £12,000 paid. £15,000 considered as paid. Mortgages and charges, £1,500.

Automobile Electrical Repairers, Ltd.—N. J. Dodd, of Sardinia House, Sardinia Street, W.C.2, ceased to act as receiver or manager on May 16th, 1927.

Electrical Devices, Ltd.—S. A. S. Forster, C.A., of County Chambers, Middlesbrough, was appointed receiver on May 18th under powers contained in debenture dated January 5th, 1927.

Claremont, Johnson & Co., Ltd.—W. J. Hodge, of 26-27, Union Bank Buildings, Holborn Circus, E.C.1, ceased to act as receiver or manager on May 2nd, 1927.

Bedale and District Electric Supply Co., Ltd.—Particulars filed of £2,000 debentures authorised February 7th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Satisfaction in fall on May 14th, 1927, of debenture dated January 16th, 1920; debenture dated November 7th, 1921; and mortgage dated November 7th, 1921, securing £1,500, £600, and £2,100 respectively.

Clear Hooters, Ltd.—Particulars filed of £8,000 debentures authorised May 5th, 1927, charged on the company's undertaking and property (subject to first and second mortgage debentures issued or to be issued for sums not exceeding in the aggregate £2,200 and £1,000 respectively) the amount of the present issue being £5,250 7s. 4d.

Century Cables, Ltd.—Mortgage debenture dated May 11th, 1927, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders:—Sir Edward Nicholl, K.B., J.P., D.L., Littleton Park, near Shepperton; and R. G. Ellis, Netherside Hall, Skipton-in-Craven, Yorks.

Rose Bros. Electrical Co., Ltd.—S. G. Morris, of 6, Wardrobe Place, Doctors' Commons, E.C.4, was appointed receiver and manager on May 13th, 1927, under power contained in debenture dated August 23rd, 1921.

Uneeda Supplies Co., Ltd.—Particulars filed of £1,000 debentures authorised April 25th, 1927, charged on the company's property, present and future, the amount of the present issue being £400.

City Notes.

Eastern Telegraph Co., Ltd.

The annual meeting was held on May 24th. Sir John Denison-Pender, G.B.E. (chairman), who presided, referred to the death of Mr. A. R. Hardie, a director, who had been associated with the company for 55 years. Dealing with the report (ELECTRICAL REVIEW, May 20th, p. 810), the chairman said the results could be considered satisfactory in view of the depressing conditions which existed during the greater part of the year. They had received a contribution from one of their subsidiary companies of £206,500, and had thus been able to write off entirely the remaining balance of £493,000 in respect of expenditure on new cables and cable renewals. Nearly four and a half million pounds had been charged against the reserve fund since the Armistice in respect of new cables and cable renewals, and since the company was formed approximately twelve million pounds had been so charged. Their negotiations with the British and French administrations with regard to the direct line between Paris and London had been successfully concluded, and the new direct route was opened for service on March 1st last. Negotiations had practically been completed both with the Palestine and Egyptian administrations for the laying of a new cable between Egypt and Palestine. The negotiations with the Greek Government had been brought to a satisfactory conclusion, and they had been granted a concession for 50 years. Negotiations were recently re-opened with Turkey, and a convention had been agreed

upon and signed, and now only awaited ratification. It had been decided to lay further submarine cables between Alexandria and Port Said and underground lines between Port Said and Suez. The improved means of communication would enable them to install their direct regenerator system between London and India, with substantial benefits to the service. Thirty-one cables of the associated companies were now being operated by the regenerator system; this gave considerable increase in capacity with resultant gain in transmission times. Having carefully watched the development of wireless during the past 30 years, he (the chairman) had no cause to alter the opinion formed and expressed over that period that the cables would remain more reliable than the wireless service. The prospect of the return to normal trade conditions would counterbalance to a very large extent the present day competition with which they were faced, but the obvious solution, in the interests of the public and others, was co-operation in some form or another which would eliminate wasteful and unremunerative expenditure and, at the same time, provide a dual and alternative means of communication. Given a fair field for the unrestricted development of the cable industry, it would continue to prove itself the best and most reliable means of telegraphic communication.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The annual meeting was held on May 26th, under the presidency of Sir John Denison-Pender (chairman). In presenting the report (Electrical Review, May 20th, p. 811), the chairman said that the increase of £93,106 in the gross revenue was due to two "windfalls," not to be expected to recur. One of these represented refunds of income tax received from the Netherlands Indian Government, and the other was an amount which had been held in suspense pending the result of a lawsuit which was decided in favour of the company. The actual traffic receipts showed a decrease of £35,115, but in view of the disorganised trade conditions, the result could not be considered as unsatisfactory. In conformity with the action taken by the cable system worked by the Pacific Cable Board their tariff had been reduced. That reduction of tariff and the competitive "beam" service must naturally result in a certain loss of revenue. Their thanks were due to the Commonwealth Postal Department for the speedy construction of the new land-line between Adelaide and Perth, which was handed over to the company on March 25th last. Worked in conjunction with the duplicate Perth-Cocos cable, it had already proved itself a valuable adjunct to the system.

With the state of affairs at present ruling in China, it had been found impossible for the Great Northern Telegraph Company and themselves to continue negotiations with the Chinese Telegraph Administration, and these had been postponed until a more opportune time. China failed to pay the instalment of a loan which fell due on June 30th, 1922, and after extending every possible consideration and realising that affairs in China were not tending to become stabilised, but rather the reverse, the companies decided to exercise their lien, whereby amounts falling due to the Chinese Administration as its share of the revenue derived under the joint purse agreement had, since January, 1927, been retained by the companies and placed towards the liquidation of outstanding instalments. Interruptions of their cables had been few in number, and, owing to duplication throughout the system, quite immaterial.

Oriental Telephone and Electric Co., Ltd.

The report for the year ended December 31st last records a net revenue of £68,282, and after adding £14,219 brought forward and deducting interim dividends, there remains a balance of £58,735. After paying the final preference dividend it is proposed to distribute a final dividend of 6 per cent. on the ordinary shares (making 10 per cent., free of tax, for the year), together with a tax-free bonus of 2 per cent., leaving £17,812 to be carried forward. Satisfactory progress was made by the Singapore branch and the Hongkong Telephone Co., Ltd. The Mauritius branch again showed an adverse result, the increased rates not having been authorised yet. The heavy charges which had to be met by the Bombay Telephone Co., Ltd., precluded the payment of a dividend. The Bengal Telephone Corporation, Ltd., paid a dividend of 6 per cent. (free of Indian income tax), as against 2 per cent. The Madras Telephone Co., Ltd., repeated its dividend of 7 per cent., free of Indian tax, but the Rangoon Telephone Co., Ltd., was forced to reduce its dividend from 8 to 5 per cent., free of Indian tax, owing to special charges for depreciation. The Hongkong Company paid dividends amounting to 8 per cent., enabling the China and Japan Telephone Co. to pay 15 per cent., free of tax. The staff pension fund has now been instituted. Sir Thomas S. Catto, Bt., has been appointed to a vacancy on the board caused by the resignation of Mr. G. P. Ness. Meeting: To-day (Friday).

Lancashire Electric Light and Power Co., Ltd.

The annual meeting was held on May 23rd, Mr. A. Shepherd, W.S. (chairman) presiding. In presenting the report and accounts (Elec. Rev., May 20th, p. 810), the chairman said that a considerable amount of cables had been laid during the year; the capital expenditure amounted to over £467,000. The sales of energy had risen from 130,558,000 kWh to 146,580,000. The new Padiham station, which was put into operation in January this year, had proved very efficient; it would eventually be raised to 50,000 kW. Additional plant was necessary for the development of the southern part of the company's area, and the company had therefore purchased a site at Kearsley and had asked the Electricity Commissioners for permission to build a station there. The Commissioners had agreed to this, subject to a condition with which the company was willing to conform. The plans provided for a station housing four 31,250-kW sets, but arrangements had been made to provide for two further sets. It was hoped to have the first two sets ready for the winter of 1929-30. The initial capital cost was estimated at £875,000, and the cost with four sets installed at £1,645,000. Dealing with the progress of the company, the chairman said that since 1906 the revenue had risen from £5,300 to £582,300, the maximum demand from 2,060 kW to 60,340 kW, and the energy sold from 3,043,000 kWh to 146,580,000 kWh. After mentioning the issue of preference shares which was made in November last, the chairman said that for the purpose of providing funds for the construction of the Kearsley station it was intended to make an issue of debenture stock at a favourable opportunity.

Oliver Pell Control, Ltd.

Owing to the industrial conditions last year the turnover of this company declined from £92,292 to £67,856. The net profit was £1,520, and the addition of £7,281 brought forward makes available £8,801 After deducting the interim dividend on the 8 per cent. preference shares and writing off the preliminary expenses of a preference share issue, a balance of £5,846 is carried forward. At the annual meeting on May 18th, Mr. Charles Oliver (chairman) said that the directors were pleased that the results were so good as they were, in view of the conditions. The directors, who held the bulk of the ordinary shares, considered it advisable not to pay an ordinary dividend. In September last they entered the wireless trade and had already established a reputation; that branch had enabled them to show a profit. The turnover of the switch department showed an increase of 42 per cent., but that of the coil-winding department fell by 50 per cent. and mainly accounted for the fall in the revenue. They proposed to institute a bonus system for their workpeople when the state of trade warranted it. The new R.I. & Varley, Ltd., was to market the radio products of themselves and Radio Instruments, Ltd. .

Chili Telephone Co., Ltd.

The *Financial Times* reports that a circular has been issued to shareholders stating that half of the company's shares have been acquired by a purchaser at £8 per share, and that the same purchaser is prepared to buy all or any of the remaining shares at the same price. The directors make no recommendations. The company has an authorised capital of £1,000,000 in £5 shares. Our contemporary says that it is in a position to state that the buyer is Colonel Behn, acting on behalf of the International Telephone and Telegraph Corporation.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

The report for 1926 shows a balance to the credit of the profit and loss account of £140,582, and after providing for debenture interest there was a net loss of £531,210, which reduces the balance brought forward to £114,181. The report states that a revaluation of properties will have to be made, and in due course proposals for a reconstruction and the reduction of the company's capital will have to be made. Certain alterations in the articles are to be put forward at an extraordinary meeting to be held after the annual meeting on June 9th.

Mexican Light and Power Co., Ltd.

A meeting of the holders of the company's 5 per cent. second mortgage 50-year bonds was held last week, when Mr. E. R. Peacock, chairman of the Bondholders' Committee, explained a scheme for dealing with arrears of interest. He said that it was proposed to fund the arrears up to December 1st last by the allocation in respect of each £100 bond, £7 10s. in cash, and £50 par value of bonds of the same issue. The proposals were approved.

Electric Construction Co., Ltd.

The directors recommend a final ordinary dividend at the rate of 9 per cent. per annum, making 7½ per cent. for the year. This rate has been paid for several years, but since 1917-1918 a bonus of 2½ per cent. had also been distributed, but this is not repeated.

Penarth Electric Lighting Co., Ltd.

The net revenue for the past year was £11,075 (against £11,493). After adding £2,924 brought forward and providing for renewals, &c., it is proposed to place £2,000 to reserve and to pay an ordinary dividend of 7½ per cent., leaving £2,482 to be carried forward.

Reduction of Capital.

Premier Electric Welding Co., Ltd.—An extraordinary meeting is to be held on June 17th to consider resolutions for the reduction of the capital from £100,000 to £26,250. This is proposed to be effected by the cancellation of 12,800 unissued shares and of 14s. per share of the 87,500 issued £1 shares.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted :—

Constantinople Telephone Co.—£200,000 6 per cent. Obligation Bonds of £100 each, Nos. X10,001 to X12,000; and £95,436 6 per cent. certificates, Nos. 1 to 3,993 and 4,002 to 4,346 of £22 each (Bearer).

White (J. G.) & Co., Ltd.—360,000 ordinary shares of 4s. each fully paid Nos. 1 to 360,000.

The undermentioned securities have been ordered to be officially quoted :—

City of London Electric Lighting.—400,000 ordinary shares of £1 each, fully paid, Nos. 1,500,001 to 1,900,000.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

Baird Television Development.—400,000 deferred ordinary shares of 1s. each, fully paid, Nos. 100,001 to 500,000.

Electrical Finance and Securities.—Option certificates (to bearer) in respect of 20,000 ordinary shares at par, until January 1st, 1931.

Low Temperature Carbonisation.—1,516,569 shares of 2s. each, fully paid, Nos. 2,878,389 to 4,067,411 and 5,120,586 to 5,448,131.

White (J. G.) and Co.—360,000 ordinary shares of 4s. each, fully paid, Nos. 1 to 360,000.

Colombo Electric Tramways and Lighting Co., Ltd.

The report for the past year shows a net revenue of £123,413, and a balance, after providing for debenture interest, and adding the amount brought forward, of £175,696. From this £9,900 is transferred to general reserve and renewal fund, which has to be dealt with by writing off £9,900 to special renewal account. £60,000 is transferred to debenture stock redemption and account, and a dividend of 20 per cent., free of tax (as against 15 per cent.), is recommended, leaving £79,628 to be carried forward.

Pinchin, Johnson & Co., Ltd.

The usual dividend at the rate of 6½ per cent. per annum has been declared on the preference shares in respect of the half-year ending June 30th.

Glenfield & Kennedy, Ltd.

The profit for the past year fell from £77,657 to £59,762. The final ordinary dividend is 6 per cent., making 10 per cent. for the year, as for 1925-26.

British Columbia Electric Railway Co., Ltd.

The directors have declared a dividend of 4⅜ per cent., free of tax, on both the preferred and deferred ordinary stocks, as in 1926.

General Electric Co.

This American company has declared a quarterly dividend of $1, as against 75 cents, together with an extra dividend of $1.

British Thomson-Houston Co., Ltd.

The dividend on the 7 per cent. cumulative preference shares in respect of the half-year ended June 30th has been declared.

Western Telegraph Co., Ltd.

A third quarterly dividend of 5s. per share, free of tax, has been declared.

American Telephone and Telegraph Co.

The regular quarterly dividend of $2.25 has been declared.

German Companies.

The *High Frequency Machine Company for Wireless Telegraphy*, Berlin, reports net profits of 89,000 marks for 1926, as compared with 86,000 marks in the previous year, the dividend again being 8 per cent. A further sum was received during the year on the former holdings of Marconi shares. On the other hand, the satisfaction of the American claims was still uncertain, as compensation for radio stations has been struck out of the Bill now under consideration.

The *Lloyd Dynamo Works Company*, Bremen, states that it was impossible fully to occupy the plant in 1926 owing to the lack of orders for large machines, the low prices for small motors and the depression in the shipbuilding industry. A total loss of 929,000 marks is recorded as against one of 158,000 marks in 1925. It is proposed to extinguish the loss by a reduction of capital.

The *C. Lorenz Company*, Berlin, states that the turnover in 1926 showed an increase over the previous year, although at falling prices. The net profits amounted to 418,000 marks, as against 552,000 marks; the dividend is reduced from 8 per cent. to 6 per cent.

French Companies.

The *Société d'Electro-Métallurgie, Electro-Chimie et Aciéries Electriques d'Ugine* reports a net surplus of 10,660,000 fr. for 1926, including the balance forward, comparing with 9,000,000 fr. in the preceding year. It is intended to increase the dividend from 45 fr. per share to 50 fr.

The *Société Thomson-Houston* reports net profits of 27,245,000 fr. for 1926, the amount available with the balance brought forward being 30,326,000 fr. It is proposed to apply 15,000,000 fr. to the reserve redemption fund for buildings, plant and equipment, and 3,000,000 fr. to meeting fluctuations in the prices of raw materials, the balance of over 12,000,000 fr. being carried forward.

The *Compagnie D'Appareils Electriques et Compteurs Garnier*, Lyons, records net profits of 432,000 fr. for 1926, as compared with 402,000 fr. in the previous year; the dividend is increased from 75 fr. to 80 fr. per share.

Belgian Company.

The *Société d'Electricité et de Mécanique* (*Procédés Thomson-Houston et Carels*), Brussels, reports a net balance of 378,000 fr. for 1926, which has been carried forward. The directors state that the concentration of work on certain types of machines has permitted of a reduction in the prime costs and an improvement in the quality, the transformer department in particular having developed. The industrial installation branch continued to progress, but competition remained very keen.

Stocks and Shares.

Monday Evening.

Stock Exchange markets have recovered to a great extent from the disappointment experienced at the failure of the Bank rate to fall to 4 per cent. The depression in prices which was caused by the retention of the rate at 4½ per cent. became accentuated by the turn of Russian events. Moreover, the flood of new issues which hastened to get ahead of the Whitsun holidays left the markets with an *embarras de richesse*. So plentiful, however, is the supply of fresh money that the newcomers have found no difficulty in securing homes more permanent than those of stags and underwriters. It may give some idea of the volume of business which is being transacted to state that, on the last Stock Exchange account-day, the business in County of London Electric 5 per cent. debenture stock was alone sufficient to tax energies severely, and it was estimated that nearly half of the total issue of four million pounds must have changed hands on pay-day, May 26th. Investment demand is further illustrated by the rises that have occurred in the prices of cable stocks.

The group of South American telephone companies attracted a good deal of attention on a report, evidently well founded, to the effect that the International Telephone and Telegraph Co. of America can be regarded as the recent buyer whose support has caused such a rise in the prices of United River Plate Telephones and a few others. The International Telephone and Telegraph is also presumed to be the prospective purchaser who is offering to buy Chili Telephone shares from shareholders at £8 a share. The company states in a circular that half the shares have been acquired by a purchaser, and that he is prepared to buy all, or any, of the remaining issued shares at the same price. The offer had to be answered on the Wednesday in this week, and those who accept will receive cash against delivery of certificates on June 16th. The International Telephone and Telegraph Corporation is acting through Colonel Behn. It was only a couple of months ago that Montevideo Telephone shareholders received an offer of £2 a share from the same hand. International Telephone and Telegraph shares, of $100 each, have risen several points this week, to 144½.

On the strength of these developments, Venezuela Telephones, ordinary and preference alike, have risen several shillings during the past few days to 28s., and Bogota Telephones strengthened to 37s. 6d. Bogota is, of course, in Columbia, and the company is one whose shares have been introduced fairly lately into the Stock Exchange market. Anglo-Portuguese Telephones have risen to 21s. 6d. Lord St. Davids has retired from the board and chairmanship of the company, Sir Alexander Roger having taken his place. Sir Alexander is chairman of the Automatic Telephone Manufacturing Company, and the International Automatic Telephone, and director of several other concerns. It is understood that he has bought out some of the largest proprietors and has secured control of the Anglo-Portuguese Telephone Company on behalf of other interests. It is claimed that this deal will leave the control of the company in British hands, an obvious advantage at a time when Americans are actively engaged in endeavours to obtain a hold upon telephone companies in various parts of the world.

At the meeting of Siemens Bros. & Co., the chairman pointed out that the telephone industry is particularly suited to relieve the present industrial difficulties. For every million pounds spent by the Government on telephony, he said, employment was provided for approximately six thousand workpeople, while the national expenditure on telephones augmented the national revenue. Siemens are, it is scarcely necessary to say, very intimately connected with various branches connected with telephony. The shares at 27s. 6d. ex dividend show no actual change beyond the amount deducted for the dividend. Brush ordinary are also ex at 26s. 3d. Mr. Garcke said at the meeting that all the main departments of the company's business were kept well occupied throughout the past year. A disappointment is afforded by the dividend announcement of the Electric Construction

Company: no bonus is to be added to the 7½ per cent. rate paid for many years. From 1919 to 1925, an annual bonus of 2½ per cent. accompanied the dividend. No nominal change occurred in the price, but actually the market has weakened, and shares have been changing hands around 27s. 3d. Doubtless the report will debit the coal stoppage with causing the disappearance—it is expected to be only temporary—of the bonus. Henleys have come down 1s. to 88s. 9d., the cable equipment list being disposed to droop. British Aluminiums have shed a trifle, at 43s.

United River Plates touched 9 11/16ths, before the rise tempted shares to market, and the price reverted to 9⅜. Oriental Telephones spurted sharply to 56s. 3d., this showing a gain of 2s. 9d. The company is again paying 10 per cent., tax free, for the year, and the 1926 profit, £68,300, is about £1,200 more than that secured in 1925. Automatic Telephones are unaltered at 45s., but Internationals tread closely upon the heels of £2, which is higher on the week. There has been fairly persistent buying of Marconis up to 20s., and Canadian Marconis rose a little to 4s. 3d. bid.

Once more, a spectacular rise in Brazilian Tractions stands out as the chief feature in our price-lists. An advance of 7½ points has lifted the shares to 154, and the preferred sympathetically strengthened to 129. Explanation of the long-continued strength is crystallising into categorical rumour that each share is to be split into three, and that upon the latter the dividend will be 2½ per cent. This rate would be equal, of course, to 7½ per cent. upon the existing shares, now in receipt of 6 per cent. There seems to be sound reason for the assumption that, as regards the splitting scheme, rumour is likely to be correct. The company's earnings, also, are good enough to warrant hopes of increased distributions in the near future. Barcelona Trams have been less animated than of late, and now stand at 50. Sidros, in which interest has also subsided to some extent, are 15½. Mexican Light and Power preferred strengthened to a slight extent. The company is said to have announced its intention of spending 14 million dollars upon developments. Buenos Aires Lacroze 6½ per cent. debenture stock can be bought, free of stamp and fee, at its issue price of 96½, or a trifle less.

Of other new stocks, Electrical Finance and Securities 5½ per cent. debenture stock, which came out at 92½, is quoted at 1½ premium, and the 7 per cent. preference shares at a premium of 6d. each. Both can be bought in scrip form, thus saving the purchaser the cost of Government stamp. The same advantage applies to the new County of London Electric 5 per cent. debenture, the price of which is 97½—a premium of 1½ points.

British Columbia Electric preferred is 2½ higher at 121. Deduction of the interest from the price of Anglo-Argentine Tramways 5 per cent. debenture has left the stock at 70½, bringing the yield to £7 1s. 10d. per cent. on the money. The Shanghai Electric Construction Company did well last year, the dividend being maintained at 10 per cent., and the profits of £122,400, the highest since 1920, being £50,000 more than those of the previous year. The shares have risen 2s. 6d. to 37s. 6d. Colombo Electric Tramways and Lighting ordinary shares are to receive 20 per cent., tax free, against 15 per cent. in each of the two preceding years. The company's earnings have expanded in remarkable fashion.

Bournemouth and Poole ordinary show a tendency to rally, and have braced up to 56s. 9d. Lancashire Light and Power ordinary at 26s. are ex dividend. The chairman quoted eloquent figures, at the meeting last week, to indicate the strides taken by the company's gross revenue, and the sale of current, over the past 21 years. He mentioned that the new station near Burnley, which came into commercial operation last January, has already shown itself to be highly efficient. A net decline of 9d. has left Urban ordinary at 25s. ex dividend. In the list of London electricity supply shares no alterations have to be noted. The Penarth Electric Lighting Company has declared a dividend of 7½ per cent. on its ordinary shares.

The report of the Electricity Commissioners on the generation of electricity in this country for the year ended March 31st, 1926, is regarded in the market as being too belated for it to possess more than an academic interest.

Home Railway stocks are unbefriended. A dull depression has settled over the market. Electric issues have gone the same way as steam stocks. Districts and Metropolitans have declined. London Electric ordinary keeps about 59. Underground Electric Railways are steady. The various London tramways descriptions remain without alteration. Of the foreign tramways shares, La Plata ordinary dwindled to 4s. 6d., after being up to 5s.

The iron and steel market is somewhat subdued by the Armstrong, Whitworth report for 1926, disclosing a loss of £531,000. That the results would be bad had been assumed in advance, but the official figures did nothing to temper previous apprehensions. On the other hand, there are tangible proofs, in the shipping industry, of returning trade, and these serve to encourage hopefulness in respect of the present year. The rubber share market looks for a better price of raw rubber to develop during the new month of June, as the effects of the latest restriction come into practical play. Business in the Stock Exchange is nothing to write home about, as the schoolboys say, and the main interest in the city has centred less upon stock and share prices than upon those quoted from a little place called Epsom.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	1926.	Price May 30 1927.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£1	14	14	56/9	+1/3	4 18 7
Brompton Ordinary	1	10	8⅝	25/-	—	5 12 0
Charing Cross Ordinary	1	15	8½	25/-	—	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	8⅝	25/-	—	5 12 0
City of London	1	15	10	13⅜	—	5 1 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	30/6	—	5 5 0
County of London	1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/6	—	5 19 2
Elec. Supply Corporation	1	10	10	32/-	—	6 5 0
Kensington Ordinary	1	15	8	25/-	—	5 12 0
Lancs. Light and Power	1	7½	7½	26/-xd	—	5 15 5
London Electric	1	10	8½	24/-	—	5 16 8
do. do. 6% Pref.	5	6	6	5⅝	—	5 6 8
Metropolitan	1	11	8	29/-	—	4 16 7
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary	1	7	5	23/-	—	4 6 11
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	25/6	—	5 9 10
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1½	—	6 3 0
Urban Ordinary	1	7	7	25/-xd	—9d.	5 12 0
do. 6% Pref.	1	6	6	1⅛	—	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	29/6	—	5 8 4
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	,,	5	3	61	—1½	4 18 4
do. District	,,	3½	3½	61½	—1	5 13 10
Underground Electric	£1	Nil	1½	18/6	—	1 12 5
do. do. Income	Bonds	6	6	102	—	*5 17 8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 19 0
do. Def.	,,	1½	1½	24½	+⅛	6 3 9
Automatic Telephone	1	3	10	45/-	—	4 9 0
Chili Telephone	5	5	6	7⅛	—	3 17 5
Eastern Extension	10	10	10	18⅜	+⅛	*5 6 8
Eastern Tel. Ord.	Stock	10	10	181½	—	*5 10 2
Globe Tel. and T. Ord.	10	10	10	18⅝	—	*5 6 0
do. do. Pref.	10	6	6	11	—	5 8 1
Great Northern Tel.	10	20	20	29½	+1	6 16 6
Indo-European	25	8½	10	46½	—	*5 7 6
Marconi	1	Nil	Nil	18/9	—	... ...
Marconi-Marine	1	7½	8¾	27/-	—	6 9 8
Oriental Telephone Ord.	1	12	12	56/3	+2/9	*4 5 3
United R. Plate Tel.	5	8	8	9⅜	—	*4 5 4
Western Telegraph	10	10	10	17¾	+¼	*5 12 8
HOME AND FOREIGN TRAMS, &C.						
Anglo-Arg. Trams First Pref.	5	5½	5½	8½	—	7 17 2
do. do. 2nd Pref.	5	6	6	3⅛	—	8 2 8
do. do. 5% Deb.	Stock	5	5	70½xd	—	7 1 10
British Electric Traction Ord.	,,	8	—	148	—	5 8 1
do. do. 6% Pref.	,,	6	8	120½	—	6 12 10
Brazil Traction	100	5	6	154	+7½	3 18 0
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	89½	—	5 11 9
do. do. Preferred		6½	6½	121	+2½	5 3 4
do. do. Deferred	,,	8	—	158	—	*5 1 3
do. do. Deb.	,,	4½	4½	80½	—	5 5 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	7/9	—	Nil
London United Tram. Deb.	Stock	4	4	52½	—	7 12 5
Mexico Trams, 5% Bonds	—	5	5	81½	—	6 2 8
Mexican Light Common	100	Nil	Nil	44	—	Nil
do. Pref.	100	Nil	Nil	110½	+½	Nil
do. 1st Bonds	—	5	5	74½	—	6 14 3
Yorkshire (West Riding)	1	5	—	8/9	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	13	13	53/9	—	4 16 11
British Aluminium Ord.	1	12½	10	43/-	—9d.	4 13 0
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 6
British Insulated Ord.	1	15	15	67/6	—	4 8 11
Brush Ord.	1	10	10	26/3xd	—	7 12 4
Callenders	1	15	—	3 7/16	—	4 7 3
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	12/6	—	... ...
Edison-Swan	4/-	10	10	10/	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	7½	28/9	—	5 4 4
Enfield Cable Pref.	1	7½	7½	25/6	+6d.	5 17 8
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	3	—	12/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	1	20	—	88/9	—1/-	4 10 4
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1⅛	—	*4 9 0
Johnson & Phillips	1	17½	12½	2⅝	—	5 0 0
Met.-Vickers Ord.	1	8	8	27/6	—	5 11 4
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	7½	7½	27/6xd.	—	5 9 1
Telegraph Construction	12	10	10	28½	—	*4 4 2

* Dividends paid free of Income Tax.

The Incorporated Municipal Electrical Association.—II.

Annual Convention at Buxton.

ON Monday last the Palace Hotel, Buxton, became the official headquarters of the I.M.E.A., *pro tem.*, and the President, with members of the Council, there welcomed informally members and visitors attending the Convention. Next morning, at the Opera House in the Pavilion Gardens, His Worship the Mayor of Buxton (Councillor W. Goodwin, J.P.) extended to the members a cordial welcome, expressing the pleasure of his Corporation at receiving so important an Association, and referring briefly to the exhilarating air and medicinal waters which were at the disposal of the visitors. Moving a vote of thanks, the President, Mr. R. W. L. Phillips, M.I.E.E., on behalf of the Association, thanked the Mayor and Corporation for their efforts to ensure the comfortable accommodation of those attending the Convention (the total number. we understand, was no less than 890); Alderman W. E. Souter, chairman of the Bedford Electricity Committee, warmly seconded the motion, which was carried by acclamation. The president then proceeded to deliver his address, of which an abstract is given below.

Mr. Phillips commented on the incessant labour imposed upon himself and the Council during the past year by conferences and meetings in connection with the Electricity (Supply) Bill. After a pardonable expression of gratification at the success of municipal electricity supply undertakings in generating and selling electricity more cheaply than the companies did, and in establishing themselves in a very sound financial position, he rescued the Report of the Advisory Committee on Domestic Supplies of Electricity and Methods of Charge from the obscurity into which it had been thrown by the Electricity Bill, and drew attention to several of its recommendations which needed immediate settlement, especially the question of a domestic tariff suitable for universal adoption.

A vote of thanks was moved by Mr. A. J. Howard, of Taunton, a fellow pupil at Taunton with Mr. Phillips, and was seconded by Ald. H. Leese, of Stoke-on-Trent.

Afterwards the ladies joined Mrs. Phillips and partook of light refreshments, whilst the sterner sex heard and discussed a paper by Mr. W. C. Bexon, chief engineer, Ayrshire Electricity Board, on "Methods and Capital Costs of Distribution over an Extensive Area." The author dealt with the cost of constructing and tapping extra-high-pressure transmission lines (22,000 volts) to serve an area of 1,100 square miles, the construction and costs of open-air sub-stations, underground distribution, and overhead low-pressure distribution, and the regulation of long-distance transmission lines. He expressed a preference for duplicate feeders on the same poles, the latter being of wood, and regretted that the 1926 Act did nothing to remove the difficulty of obtaining wayleaves. Where necessary, however, he used steel towers. His experience of open-air sub-stations since 1918 had been very favourable. For distribution he found 3,300-V feeders most suitable, with transformer kiosks except where much switchgear was required, necessitating the use of a brick building. In villages the cost of distribution had to be a minimum; overhead mains were the only solution, but the present regulations almost put them out of court, and urgently needed revision. He doubted whether electricity would ever be available to the whole population at 1d. a unit, unless the many regulations were relaxed, and concluded with some suggestions to that end.

After the official photograph had been taken in the Pavilion Gardens, the members dispersed for luncheon. The afternoon was set apart for a special visit to the electrical exhibition, which was housed in the Pavilion Corridors. At the invitation of the Mayor, the visitors afterwards took tea in the Pavilion Gardens.

In the evening the President, supported by the Mayor of Bedford (Ald. Gilbert H. Barford, J.P.), and the chairman and members of the Bedford Electricity Committee, held a reception at the Palace Hotel.

The programme for Wednesday opened with a paper on "Recent Developments in Power Plant Design, and their Effects on the Economy of Generation," by Mr. T. Roles, M.I.E.E., City Electrical Engineer, Bradford, and a discussion thereon; afterwards Rotarians were invited to attend a special Rotary Luncheon at the Buxton Hydro. For the afternoon a visit to the Derwent Valley Waterworks by motor coach was planned, the route lying through Millers Dale, Tideswell, and Hathersage, and returning *via* Castleton, Peak Forest, and Dove Holes.

On Thursday, Mr. H. H. Berry was to read a paper on "Electrified Homes of Great Britain and Ireland, with special reference to the Heating Question"; the afternoon was set apart for the annual meetings of committee representatives and members of the A.M.E.E. respectively, whilst members of the E.A.W. and other ladies attending the Convention were invited by Dr. and Mrs. Ferranti to visit Baslow Hall, which is electrically equipped throughout. In the evening the annual dinner of the Association was to take place at the Pavilion.

Presidential Address.

By R. W. L. Phillips.

(Engineer and Manager, Bedford Corporation Electricity Department.)—(*Abstract.*)

I HAVE recently had before me a careful analysis of a large amount of data which show that municipal supply undertakings so manage their business as to be able to generate and sell at a lower cost than other supply undertakings, and, partly owing to the system of dealing with capital, they are to-day for the most part in a very sound financial position. All will agree that this is in some measure due to the versatile set of men who for the last thirty or forty years have given of their best to the industry: men who, as the necessity arose, emerged from the engineer to the business manager.

The complete accomplishment of the co-operation between the supply and electrical contracting branches of the industry is a problem which, I think, is approaching solution. This co-operation started with the agreement which led to the inclusion of Clause 48 in the Electricity (Supply) Bill, an agreement made possible by the excellent spirit evinced by all parties to the negotiations, which it is hoped will be maintained and strengthened in operating under the clause.

Another important publication that made its appearance during the year, which, had it not been overshadowed by the Government Bill, would have received much more attention, was the Report of the Advisory Committee appointed by the Electricity Commissioners on Domestic Supplies of Electricity and Methods of Charge.

All engaged in the industry are convinced that the development of domestic supply is of great importance. Consumers who are being connected to the mains at the present time in very large numbers, at a greater rate than has been known

before, are mostly residents in the smaller types of houses, which cost practically the same amount to connect as the larger ones already connected to the mains, but produce very much less revenue. The effect on the cost of supply of the revenue per service has often been demonstrated, and it must be the endeavour of all to encourage the individual consumer to use more electricity, and to do so as rapidly as possible.

A great obstacle to progress in the path of domestic electrification is the high resistance to change that is met with in the British household. We know that we can introduce into these households methods which will enormously increase efficiency and comfort as compared with present methods, but find the utmost difficulty in persuading the people to give our methods a full and sufficient trial. The Advisory Committee's Report has carefully analysed the question of domestic supply, and a detailed study will, I think, assist in approaching the difficulties which have arisen and may arise in the future.

The daily Press gave some the impression that the passing of the 1926 Act would render possible a cheap supply of electricity in all areas. In some areas it is difficult to find revenue sufficient to warrant the capital expenditure on the mains required, so that even at the moderate tariffs existing, and even if electricity cost nothing to generate, the business is often impracticable. It is evident that this fact was well to the fore during the deliberations of the Advisory Committee, as a number of the recommendations are directed towards reducing the cost of transmitting and distributing mains.

The question of wayleaves for overhead lines, in many cases, is the principal difficulty to be overcome. In rural England one has no sooner planned a nice straight line across country than it is found that, in only a few miles, there are scores of different owners to deal with, and consequently scores of wayleaves to negotiate. Each owner generally requires a different consideration for granting the privilege, and sometimes it is necessary to divert the line and so increase the cost. Provided the line does not interfere with the amenities of his land to any extent, the owner should not be in a position to demand exorbitant consideration. Within my experience, in many cases it has been cheaper or but little more expensive to put the cable underground.

Some of the points raised in the Advisory Committee's Report are taken care of by Section 48 of the 1926 Act, by which all municipalities are given powers to sell. I am able to state, on the authority of the Minister of Transport, that this Section authorises, by implication, the provision of showrooms and a reasonable expenditure on advertising and other forms of publicity work.

Perhaps the most important matter that the Advisory Committee considered was the question of a suitable domestic tariff for general adoption. The Committee examined in detail some 13 different methods, and yet was unable to select one as being sufficiently perfect for universal use. Having regard to the fact that the Commissioners have power to fix a tariff for the country, it is time that the industry made up its mind as to what it wants.

As so many methods of determining the fixed-charge portion of the tariff seem to have proved more or less successful, one could almost argue that the actual method to be adopted in any particular case is not of very great importance. If anything, the evidence in the Report leans towards the adoption of floor area as possibly the favourite method, and it is significant that floor area also plays some part in the determination of the ordinary assessable value of domestic hereditaments, but this method has some staunch opponents.

Attention is called to the fact that any alternative flat rate must be high, but I do not think it is always realised that this should refer to the heating as well as to the lighting rate. For instance, it is no use offering a two-part tariff to replace, say, a lighting rate of 6d. and a heating rate of 1d., unless the unit charge of the two-part tariff is less than 1d., otherwise there will be no inducement for increasing the use of apparatus already in use on the 1d. rate. There is a distinct difficulty in this connection when introducing for the first time a two-part tariff, especially in areas where the lighting and heating rates are low. The raising of both these charges merely to introduce an alternative tariff creates a suspicion in the minds of consumers, difficult to allay, which militates against the new tariff, and I think this difficulty has been one of the chief obstacles to its introduction.

It would be of immense benefit to the whole industry if one system of charging could be adopted throughout the country, and this benefit would be increased enormously if the unit charge could be standardised, leaving each undertaking to determine the fixed-charge factor according to the cost obtaining in the district. When national generation is established there should be no great difficulty in this. All catalogues, advertisements, and other propaganda literature would then be able definitely to state the actual cost per hour, day, week or year, of the apparatus described, irrespective of the district in which it is to be used, which would undoubtedly foster the use of all types of domestic apparatus.

Most of the matters touching upon overhead lines could possibly be settled by a conference between the Electricity Commissioners, the Postmaster-General, and the supply authorities, and I have reason to believe that this can easily be arranged by application to the Electricity Commissioners, but it should be taken in hand forthwith. A number of the improvements suggested could be settled first by agreement between certain parties, and if necessary a short Bill could be introduced to ratify them. I therefore suggest that this Association introduce into its work for the coming year the consideration of the best way of setting this machinery in motion.

Of equal importance is the question of the terms and conditions upon which a bulk supply will be available to those undertakings which are to cease generating. The terms examined so far vary in different undertakings to such an extent as to render analysis an absurdity. Most of them adopt the usual method of charging a fixed price per kilowatt of maximum demand with an added unit charge, but the prices charged vary from 15s. to six guineas per kilowatt per annum and from 0.35d. to 0.75d. per unit. Moreover, the methods of determining the maximum demand seem to be only limited by the number of undertakings. There is no doubt that this point must receive the very careful consideration of all concerned, as it is obvious that a false step may lead to a state of affairs which may seriously cripple the development of electricity supply, particularly when it is necessary to offer special rates to consumers to suit special conditions.

Many of these vital points nowadays seem to be prejudged and settled without reference to the industry concerned, and I think it is the duty of the Bulk Supply Committee to get to work as quickly as possible and take the necessary steps to formulate standard procedure.

Our hon. secretary, Mr. Alex. C. Cramb, must on this occasion be especially congratulated and thanked for bringing to a successful conclusion what has been his object for so many years, *viz.*, the securing to all municipalities of the powers to sell. It is almost entirely due to his determination and good work that this clause was secured in the 1926 Act.

Distribution over an Extensive Area.

Methods and Capital Costs.

By WILLIAM C. BEXON.

(*Abstract.*)

THE author pictures an electricity works supplying in its own particular township; between 20 and 25 miles away are other towns having populations of between 11,000 and 30,000, which have no electricity supply. The country intervening is sparsely populated, but there are a number of villages, an occasional large works, and a number of collieries. The paper gives details and approximate costs of supplying this large area.

Extra-High-Pressure Transmission Lines.

Underground cables at pressures of 33,000 volts and above have yet to be proved reliable, and in transmitting energy over large areas, it is almost impossible to have overhead construction throughout; telephone and telegraph wires are



Fig. 1.—P.O. Line-Guarding System.

met with, and at these points underground cables have to be laid. The Post Office authorities may, however, agree to an overhead transmission line, provided a very expensive and unsightly system of guarding is erected. The guarding shown in fig. 1 had to be erected for the purpose of protecting only nine overhead telegraph wires.

From data available voltages of 22,000 to 25,000 are shown to be the most economical for a radius of 25 miles, and a voltage of 11,000 for a radius of 10 miles, which bears out the old rule of 1,000 volts per mile. Cables manufactured for 22,000 and 25,000 volts have proved reliable.

An engineer, in designing an e.h.p. distribution scheme over a large area—and in this paper the author is dealing with an area of 1,100 square miles—has to make an estimate of the maximum load. The transmission lines must be designed to deal with an anticipated load, and at a reasonable capital expenditure. Continuity of the supply is a very important factor. The objection to separate feeders is the high capital cost, and, in the author's opinion and experience, a duplicate feeder on the same poles is the most economical.

Six-wire line construction on "A" poles is easily effected, and at a minimum cost. The capital cost per mile of such a line, for a working pressure of 22,000 volts, erected under the latest electricity regulations, and allowing for one heavy angle, two light angles, and four duplicating straight-line poles, is as follows:—

Norwegian fir poles, 40 ft. long, insulators, &c.	£492	0	0
Copper wire No. 1/0s.	491	0	0
Erection of poles	58	0	0
Running out and hanging copper	25	0	0
Straining and binding in	31	0	0
	£1,097	0	0

Total cost per mile—say £1,100 0 0.

For a 3-wire line construction, the capital cost would be £720 per mile. Therefore for the same capacity of line the ratio is £1,100 as against £1,440 per mile. If the lines were designed for a working pressure of 11,000 volts there would be a deduction of approximately £20 per mile.

The cost of lattice masts is very much in excess of that of wooden poles. Farmers object to the concrete foundation and demand a very much higher wayleave rental. In addition, these masts require to be painted annually, and they show serious signs of deterioration in acid and salt atmosphere.

The Kay pole, fig. 2, which is made up of steel tubes, is free from rivets, bolts and nuts, but owing to the amount of land taken up by the four legs, *viz.*, 18 sq. ft., delay often occurs in obtaining wayleaves, and a considerable sum in excess of the wayleaves for an "A" pole is asked.

The most difficult factor is obtaining the necessary wayleaves. The Electricity (Supply) Act, 1926, does not give any better facilities for obtaining wayleaves than previous Acts, which are practically of no use. The farmer puts forward every possible objection. The author has found the following arrangement to work satisfactorily: the Authority pays for all damage done due to the erection of the poles, &c.; if the farmer requires a supply the Authority runs a service line into his premises free of expense to him, but he in return frees the Authority from all annual wayleaves and other expenses.

Another difficulty in connection with wayleaves is that the farmer invariably wishes as many poles as possible to be placed on the hedge line, and this is often impossible. The Road Authorities stipulate that any structure shall not be less than 25 ft. from the centre of the road. It is necessary, therefore, to place the poles in the cropping fields. Again, should the Post Office have lines running along a roadway the Lighting Authority cannot erect lines on the opposite side of the road, as the Post Office stipulates that the distance between its lines and those of the Lighting Authority must not be less than a distance equal to one and a half times the height of the highest wire, and as roads are not often of such a width the power lines have to be erected in the fields.

Unfortunately, from the revenue point of view, a farm supply is small considering the amount of capital involved in giving the supply. The author has taken at random the consumption of 73 farms, and the total consumption for 12 months amounted to 63,558 units, which gave an average annual revenue from each farm of £11 16s. 3d.

Tapping E.H.P. Transmission Lines.

A reasonably cheap method of giving a supply to a farm is by using a pole transformer; the capital cost of a 20-kVA supply under this scheme would be £150.

Fig. 3 shows a 50-kVA transformer mounted on a 4-member structure, and supplying eight farms, all situated within a radius of 1½ miles. The type of fuse employed in this gear is merely a small fuse wire passed through a glass tube, filled up with sand and sealed at both ends. It is inserted between two horns. When a fault occurs the fuse is blown to atoms, but the cost of replacing is almost infinitesimal.

The same arrangement of tapping transmission lines to supply villages can be adopted. The author has had experience of this type of tapping for a number of years, and it has proved quite reliable.

In long-distance transmission lines for supplying townships it is advisable to have disconnecting points at intervals, so that should a fault occur it can be localised more readily; the isolating station and transformer station for the supply to a village can be on the same structure, fig. 4, costing, with a 200-kVA transformer, £662. The isolating switches are operated from the ground level.

Open-Air Sub-Stations.

It is advisable to make the system of supply standard in all townships and villages in the one area with a view of minimising spares, and to have the smallest amount of stock. For a town of 20,000 inhabitants 3-phase, 4-wire is the most economical system, with 415 volts between phases, and 240 volts between phase and neutral. To give a supply to consumers in townships situated 20 miles from the power station, at the same rate as rules near the power station, every possible method of minimisng the capital costs must be taken.

If there is but little switchgear required, an open-air substation will suffice, but where there is to be large distribution

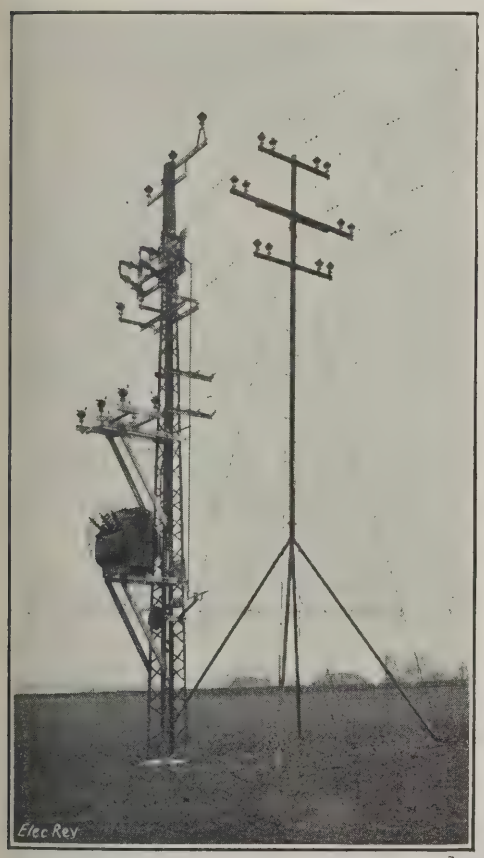


Fig. 2.—Kay Pole and Transformer.

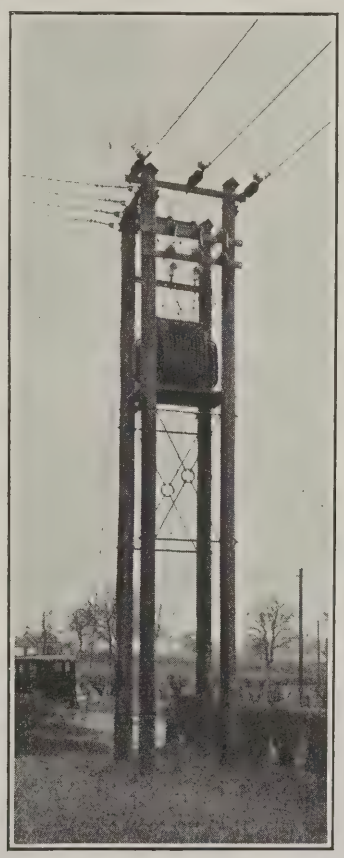


Fig. 3.—Four-Member Pole and Transformer.

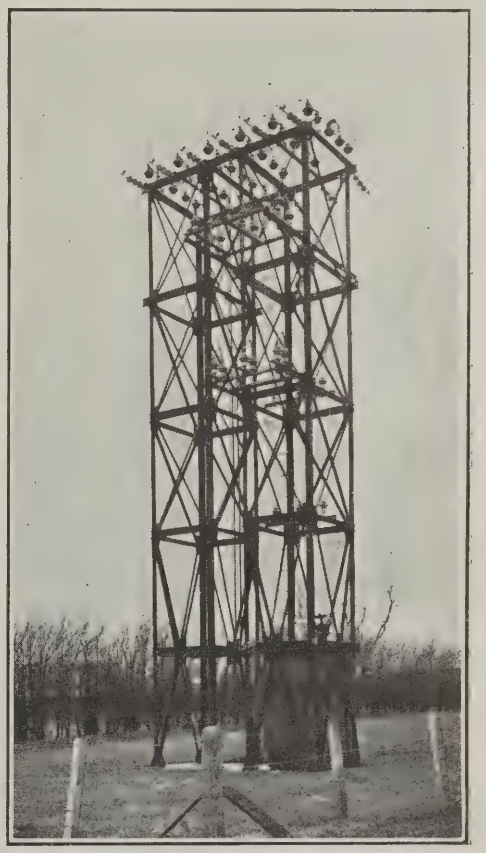


Fig. 4.—Isolating Tower Station.

control from the sub station, one of the brick type would be as economical. Fig. 5 shows an open-air sub-station, 22,000/11,000 volts, 3-phase, consisting of two feeders in, two feeders out, two 1,500-kVA transformers (one of which is a spare). It is built up of "H" beams.

The total cost of this sub-station, excluding transformers, is £1,351.

The total amount of land occupied is 76½ square yards, and a minimum rental of £1 per annum is asked for. To build a brick sub-station to house the above apparatus would increase the capital cost considerably.

The chief disadvantage of the open-air sub-station is that inspection of the transformers can only be undertaken in dry weather. Nevertheless, the advantages of an open-air sub-station far outweigh the disadvantages. The author has had this type of sub-station under his supervision since 1918, and very little trouble has been experienced.

Underground Distribution.

In the author's opinion it is uneconomical to have a low-pressure feeder and distribution system in a town, owing to the amount of copper required to overcome voltage drop. A 3,300-volt, 3-phase feeder system meets practically all cases.

An approximate price per mile for supplying and laying cables (allowing a maximum voltage drop of 100 volts) for 3,300-volt cable, suitable for a route length of three miles; 6,600-volt cable, for six miles; and 11,000-volt cable for 10 miles, at a power factor of 85 per cent., is as follows (these prices do not include excavating and reinstating):—

3-core Lead Covered and Armoured Cable.

Carrying capacity in kW.	Size of cable.	Price per mile.
3,300-volt—		
500	.075	£1,056 0 0
1,000	.15	1,435 0 0
1,500	.25	1,906 13 4
6,600-volt—		
500	.04	1,122 0 0
1,000	.075	1,371 6 8
1,500	.10	1,532 13 4
11,000-volt—		
500	.04	1,349 6 8
1,000	.04	1,349 6 8
1,500	.06	1,481 6 8

The tapping of a 3,300-volt system can be done at a minimum capital cost. A 3,300-volt, 3-phase, 3-way, disconnecting pillar, and cast-iron transformer kiosk, erected on the footpath in a main thoroughfare, and housing a 100-kVA, 3-phase transformer, costs £331 inclusive.

In view of the fact that consumers are now making much more use of heating and cooking apparatus, it is advisable to have the neutral the same size as the other cores, and this adds very little to the cost.

Another advantage of the 3,300-volt, 3-phase system is that reliable motors of large size can be built for the voltage, and the switchgear (which takes up very little space) is also inexpensive. The pressure of 3,300 volts is also useful for collieries, more particularly for pumping.

The domestic supply is increasing considerably year by year, and with a system of high-pressure feeder distribution, which can be tapped at little expense, the engineer need not fear pressure drop.

A typical lay-out of a distribution system, fig. 7, is, roughly, as follows: From the main e.h.p. sub-station a ring-main is run direct through all the kiosks and back into the main sub-station. The low-pressure 4-core mains are also run, and interconnected with the various kiosks. Under this system of distribution the pressure is equalised in all the districts, and the tappings—both on the high- and low-pressure feeders—can be made when extra transformers are required.

In a small town having a population of 8,000, whose chief industry is shipbuilding, the demand from the shipyards is approximately 1,750 kW. The only other load in the area is small power, and the usual domestic load. It was found that the cheapest method would be to run an 11,000-volt feeder to the shipyard, and also to have a 3,300-volt ring-main distribution system. The 11,000-volt feeder was interconnected with a 3,300-volt ring-main by a transformer. The consumers, at their own expense, built the sub-station, and allowed the use of it for supplying other consumers in the district. This is a standard arrangement with consumers who require a special e.h.p. supply.

By having two or three pressures of supply the cost of sub-stations is increased. A sub-station capable of housing two 11,000-volt incoming feeder panels, one 11,000-volt outgoing feeder panel, one 11,000-volt transformer panel; two 3,300-volt outgoing feeder panels, and two 3,300-volt transformer panels, is a two-floor building, 16 ft. by 14 ft. by 20 ft. The 11,000-volt switchgear is of the ordinary draw-out cubicle type, and the 3,300-volt switchgear is of the ironclad draw-out type. The sub-station also contains a low-pressure distribution board and two 300 kVA transformers. The cost of the two-floor sub-station, excluding the transformers, is £1,064. Where land is difficult to obtain the two-floor sub-station minimises the difficulty.

In the case of a single-floor 11,000/3,300-volt brick sub-station, the building is 14 ft. by 14 ft. by 14 ft., with a concrete roof, and houses the following plant:—

Two 11,000-volt truck feeder switches.
One 11,000-volt transformer feeder switch.
Three 3,300-volt ironclad 3-phase feeder switches.
One 500-kVA transformer, 11,000/3,300 volts.

The cost of the sub-station complete would be £1,206.

Fig. 6 shows a simple brick sub-station which houses two 250-kVA transformers, 11,000 V.

To reduce sub-station capital costs, sheet-steel sub-stations have been developed. The capital cost of this type, of 200-kVA capacity, including h.p. and l.p. switchgear, is approximately £600. The approximate dimensions are 8 ft. 6 in. by 7 ft. 6 in. by 7 ft. The local authority may object to a construction such as this being erected in a residential or shopping area, but this type of sub-station will be useful in some areas.

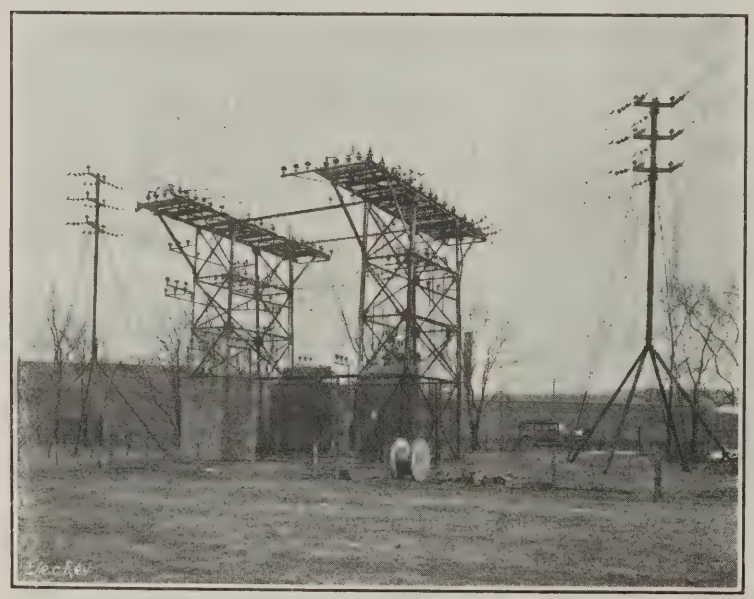


Fig. 5.—Out-door Sub-station, 22,000-11,000 V.



Fig. 6.—Simple Brick Sub-station.

In the author's opinion it is somewhat absurd for the Authority to have a set of fuses, and the consumer a similar set within three feet of them. Why one set would not suffice it is difficult to understand.

Overhead Low-Pressure Distribution.

Distribution in small villages is an entirely different matter from distribution in towns. There are no large shops and practically no power. The shops are closed early, and the consumption is exceptionally small. The cost of distribution must, therefore, be at the minimum. Overhead distribution is the only solution, but the present regulations almost put out of court overhead distribution in some small villages, and the sooner these are altered the better for the supply industry and the consumer.

For many years overhead tramway systems have been in existence working at 500 V. There are no rules stipulating that an earth wire must be used in case the wire should fall, and the number of serious accidents is practically negligible.

Some of the conditions stipulated in the Electricity Com-

missioners' Regulations, 1923, particularly Clause 13, are unnecessary, and the Post Office will not allow bare wires over its own lines unless the Lighting Authority agrees to pay for alterations and protection.

The cost of overhead distribution, 3-phase, 4-wire, using No. 2/0 copper, is approximately £600 per mile. The cost of an overhead service, using No. 6 copper, is £2 12s. (twin), and £5 3s. (4-wire).

To minimise the cost the author stipulates that the work by the Authority shall terminate on the chimney of the building; from this point the consumer, at his own expense, must, through his electrical contractor, provide and erect the necessary wiring from the overhead line.

The following particulars are of a village having a population

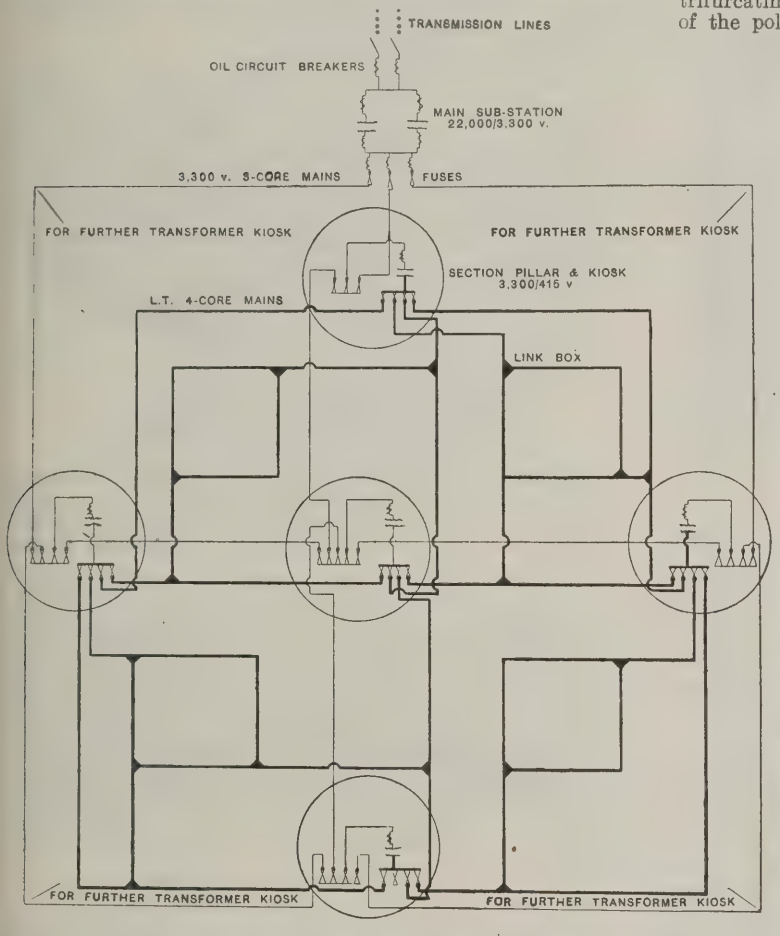


Fig. 7.—Typical Layout for h.p. and l.p. Systems.

of approximately 4,000. The total length of distribution through the streets was 2 miles 1,600 yards, and the capital cost in giving the supply was £2,924, excluding meters, made up as follows:—

One open-air sub-station, complete ...	£122	0	0
One 100-kVA transformer	242	0	0
Overhead distribution	1,810	0	0
Services	750	0	0

At the end of the first year the number of consumers was 254, and the revenue £732, an average per consumer of £2 17s. 8d. Had underground cable been adopted in place of overhead lines the capital expenditure would have been £4,750, and with reinstatement costs, a further sum of £1,000.

Quite a different type of village consists of practically one street. There are 50 consumers, and the total consumption for 12 months was as follows: Lighting, 10,723 units; heating, 20,457 units; power, 5,666 units.

The revenue was £497, an average of almost £10 per consumer.

Regulation on Long Transmission Lines.

Pressure drop on an e.h.p. line is not so serious a question if the whole of the lines are on the ring system, but to supply an area as is suggested in this paper the undertakers cannot afford to interconnect all their lines almost at the commencement of the scheme, but must wait until the lines are earning a reasonable revenue, and also, if possible, until the interconnecting lines can be used, not only as part of the ring system, but as feeders; *i.e.*, it is not advisable to run the interconnecting lines until there are a sufficient number of consumers *en route*.

An induction regulator, situated in the power station, having a 10 per cent. buck and boost, will give ample voltage regulation to allow for the voltage drop on the transmission line. A double-wound regulator does not seriously affect the power factor; its efficiency is approximately 95 per cent.

Increasing the pressure at the power station to give a correct voltage at the farthest point means that the pressure at less distance from the station is high, but this condition can be obviated by installing tapping transformers in the sub-stations *en route*. With the latest type of tapping switch, operated from the outside of the tank of the transformer, it is a simple matter to alter the tapping. The transformers should have tappings giving a range of variation of not less than plus or minus 5 per cent.

Manufacturers have now put on the market an automatic regulating-type transformer which will be of great service in keeping the correct pressure in the outer districts.

Overhead Line Troubles.

One of the greatest weaknesses in overhead lines is the trifurcating boxes. These were usually erected at the top of the pole, and it was impossible to inspect them until the

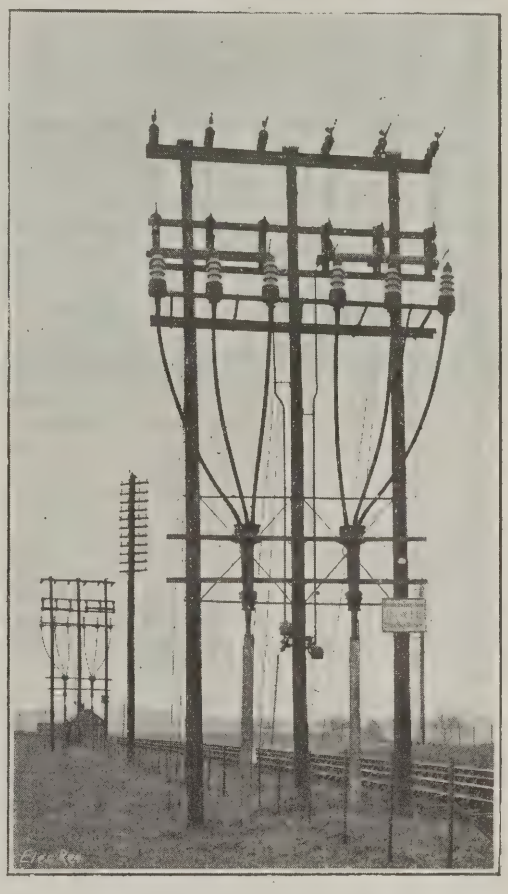


Fig. 8.—22,000-V Pole with special Dividing Boxes.

lines had been made dead. If a fault occurs on one of the boxes on a 6-wire line then both lines have to be shut down until the box is repaired. The author, in conjunction with one of his assistants, designed and patented a box which has minimised these troubles. Instead of the dividing box being erected at the top of the pole, a small sealing end box, terminating the underground cable, is erected 10 to 12 feet up the pole. Special lead-covered cambric tails are run from this sealing box to the top of the pole, and the cables terminate in porcelain sealing ends, fig. 8. This type of box has been in use for the last four years, and no breakdown has yet occurred. The boxes can be inspected easily, and should one break down it can be repaired without curtailing the whole of the supply on the 6-wire line.

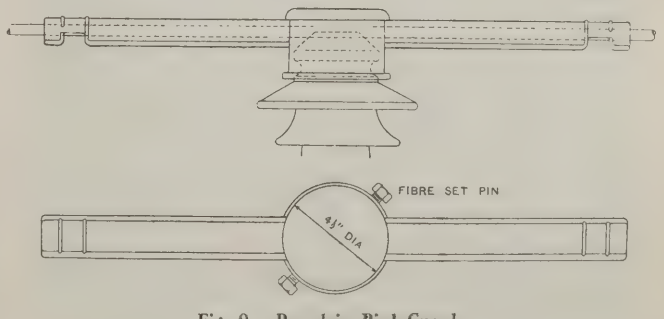


Fig. 9.—Porcelain Bird Guard.

Lightning surges give rise to flash-overs on the line, and when once established will be maintained by the power from the alternator. The flash-over takes place usually where the clearances to earth are the least. This is minimised by the use of aluminium lightning arrestors, which, preferably, should be at both ends of the lines.

The failures of insulators would be comparatively few provided the insulators were those manufactured in this country and recommended by the manufacturers for the specific duties, and not as recommended by any association.

Probably the greatest number of failures of overhead transmission lines are caused by crows. Fig. 9 shows a bird guard which should overcome this difficulty. It is made of porcelain and is in three pieces. It can be erected quickly.

Another disturbance caused by crows is when a large flock rests on the entire length of a span; immediately one starts the whole flock flies off, and invariably a short circuit takes place. Sometimes the birds themselves cause a short circuit, and sometimes the lower wire swings and touches the higher one immediately the weight has gone off the wire. To overcome this difficulty the wires should not be in a direct vertical plane. If the middle cross-arm is 4½ ft. longer than the top arm and 3½ ft. longer than the lower arm, the middle wire is not in a vertical plane with either the top or the lower one.

Sleet causes unequal loading, and, therefore, unequal sag in the different spans. If the lines are in the same vertical plane they are liable to touch; by extending the arm this trouble is obviated.

The politicians and the Press, during the period when the Electricity Bill was going through its various stages, stated that an electricity supply would be available at 1d. per unit to every person irrespective of whether his or her residence was situated in a town or in the wilds of the country, but, with the many regulations which electricity authorities have to contend with—the first cost in obtaining wayleaves, coupled with the initial capital cost in giving a supply of energy—the author is not so optimistic as to believe that the day will come when supply will be given at this price.

There is no doubt, however, that the cost would be decidedly less if electricity authorities had the same privileges as the Post Office, and I fail to see why that should not be so, considering that from the points of view of health and cleanliness and cheapness of production, which is necessary to compete in foreign markets, electricity is as important as, if not more important than, telegraphs or telephones.

So long as electricity authorities are governed by so many regulations, and meet innumerable difficulties in obtaining wayleaves, electricity in the outlying districts and small townships will not replace the coal fire. If, however, the regulations were minimised, and more facilities given to the electricity authorities, they would be in a better position to provide a cheap supply; and as the figures given in this paper indicate, if more use were made of electricity for heating and cooking in the villages, the financial results would be decidedly better.

The question of interlinking power stations is now being considered by the Government with a view of reducing generating costs. Many collieries have their own stations, and are able to generate at very low cost owing to the fact that they burn a fuel of a very inferior quality. If these stations, which often have ample spare plant, were connected to the public transmission lines, it would tend to reduce the capital and the working costs, and make full use of a fuel which cannot be sold. Furthermore, by taking a supply from a colliery, or any other private source, an area can be developed until the revenue is sufficient to warrant the extension of the transmission lines to it.

The revenue figures given in this paper are based on the following charges: Lighting, 6d. and 5½d. per unit; heating and cooking, 1½d. per unit. Alternatively, 10 per cent. of the assessed value of the house per annum, plus 1d. per unit for all units consumed.

In this paper the author has mentioned hindrances and difficulties in giving a supply over large areas; the following suggestions to overcome these are made, all of which should result in cheapening the electricity supply:—

(*a*) Statutory rights should be given to electricity authorities to erect transmission lines through agricultural country, after submitting plans to the Electricity Commissioners. The present method of giving notice, and later having an inquiry, causes considerable delay and should be abolished.

(*b*) A statutory wayleave rental of 1s. per pole per annum to the landlord should be made compulsory throughout the country.

(*c*) A statutory wayleave rental of 1s. per pole per annum in grass, 1s. 6d. in corn, and 2s. 6d. in green crops should be given to the tenant.

(*d*) Statutory powers should be given to electricity authorities to erect section boxes and kiosks in public thoroughfares.

(*e*) Any expenses incurred by an electricity authority in removing works, *viz.*, underground cables, transmission lines, section boxes, &c., on account of alterations to a street, &c., by the local authority should be repaid to the electricity authority by the local authority.

(*f*) Electricity authorities should be relieved of all rates and taxes on transmission lines in areas from which no revenue is derived.

(*g*) The rule of paying to the Post Office Authorities a proportion of the cost of laying its works underground when it is second-comer should be cancelled.

(*h*) The Post Office condition that power lines must be not less than a pole-and-a-half distance from telegraph lines should be cancelled.

(*i*) Facilities should be given to electricity authorities to erect poles along the roadside.

The I.M.E.A. Exhibition.

AS in previous years, an exhibition of electrical apparatus is being held this year in connection with the Convention at Buxton. It is arranged in the Pavilion, where about 30 stands are to be seen. Domestic apparatus forms the predominant feature of the display, almost every firm showing some sort of heating or cooking appliances.

The show of METRO-VICK SUPPLIES, LTD., is particularly interesting. A new type of "Cosmos" boiling plate and a new "Cosmos" cooker are to be seen, in addition to a complete range of domestic electrical appliances, including new 1- and 3-kW flat-bar radiant fires which have been produced to meet the demand following the introduction of the 2-kW type last year. "Cosmos" fans, the "Emvee" lampholder, and a range of Harcourt electric light fittings are also included in this exhibit.

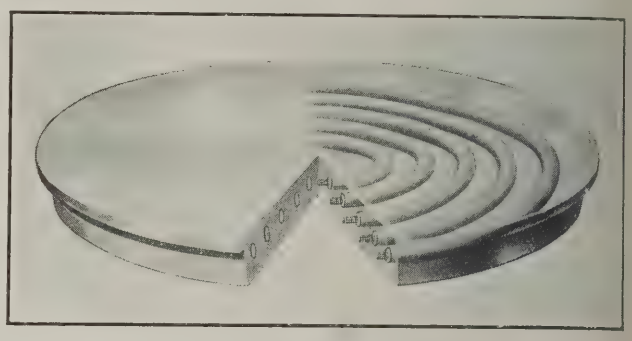


Fig. 1.—New Boiling Plate; Cast-in Elements.

Continued investigation by the M.-V. research department into the possibilities revealed by the discovery of crystalline magnesium oxide has resulted in a further improvement in the construction of the elements for the "Cosmos" plates.

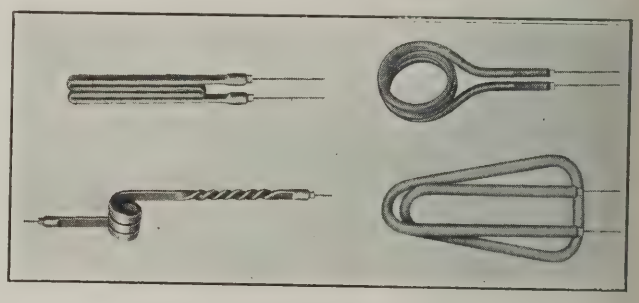


Fig. 2.—Twisted Tubular Elements.

The new plate is manufactured by a process which ensures the building of a complete wall of crystalline magnesium oxide around and in close contact with the heating element, but it has the distinct and important advantage that there is an appreciable reduction in weight as a result of the adoption

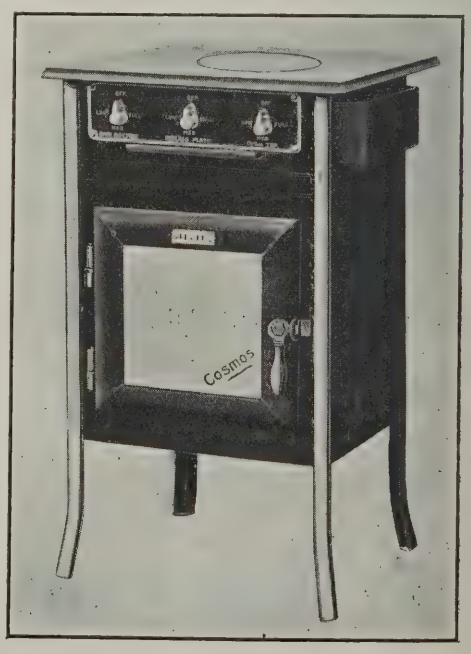


Fig. 3.—New "Cosmos" Cooker.

of cast-in tubular elements, fig. 1; consequently the stored heat is less than in the case of the previous type of plate,

ELECTRICAL REVIEW, June 18th, 1926, p. 935. In order to minimise the space and weight it was found advantageous to insert the magnesium tube containing the heating element into an outer metal tube or covering before converting the magnesium into crystalline magnesium oxide. Perfect thermal conduction is claimed to be ensured between the heating coil and the inner surface of the outer metal tube through a layer of even thickness of electrical insulation around the element coil. It is claimed that a tubular element constructed in this fashion can be formed, coiled, twisted or flattened into any shape, fig. 2, without damage to the insulation.

A new self-contained table stand boiling plate is mounted

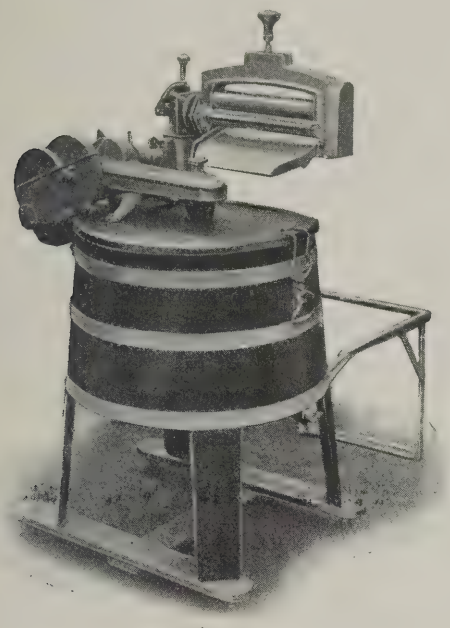


Fig. 4.—Electric Washing Machine.

on a black enamelled stand, with a nickel-plated top plate, fitted with a three-heat rotary pointer switch and fuses. It can be supplied either with a 6¼-in. boiling plate, 1,200 W, or an 8½-in. plate, 2,000 W.

The latest addition to the range of "Cosmos" cookers is the new small model, fig. 3, which is specially designed to meet the increasing demand for an efficient cooker for small houses, bungalows, flats, and so on. The overall dimensions are 22 in. by 17 in. by 33 in. high.

The oven is fitted with a removable single-unit lining. The elements are placed at the top and bottom of the oven. The grill is situated in the centre of the top element of the oven. This cooker is supplied in two models, one with one 8½-in. boiling plate, the other with a 6¼-in. and a 4¼-in. plates.

MESSRS. BURNLEY COMPONENTS, LTD., are showing a new electric washing machine, fig. 4, which they have designed specially for hire-purchase and hire schemes. It is constructed of a cypress wood tub in which a dolly is rotated to and fro by means of a motor, the dolly making 110 half-strokes per minute. A rubber roller type wringer is fitted to the machine, and the usual reverse movements are provided for. The washer is mounted on castors, and is easy to move about. A folding tub rack is fitted on the side to permit a basket or another tub to be placed within easy reach. The



Fig. 5.—An Electric Wagon.

makers are also showing the "Burco De Luxe" wash boiler, together with their housing scheme type of boiler.

The electric vehicle shown in fig. 5, which is being demonstrated at Buxton, is being exhibited by MESSRS. ELECTRICARS, LTD., by whom it was designed and built chiefly for house-refuse collection, but it may be used, with suitable bodies, for general purposes.

An unusually light chassis construction has been adopted, and also a light battery housing, driver's cab and shield. The makers guarantee the vehicle to carry an overload of 25 per cent. The normal capacity of the vehicle is 30 cwt., and its gross weight, when fitted with an all-steel tipping body and the electrical gear, is such that the road tax is only £13 per annum.

(To be continued.)

Electrical Imports of Spain.

THE following figures, showing the imports of electrical goods into Spain in 1926, are taken from the recently issued trade statistics. The totals for 1925 are given for purposes of comparison, and notes of increases or decreases added.

	1925. Quantities. 100 kg.	1926. Quantities. 100 kg.	Inc. or dec. 100 kg.
Dynamos, motors, transformers, switchgear, &c.—			
Total	52,902	41,985	−10,917
From Germany	14,817	11,348	− 3,469
,, United States	10,163	4,456	− 5,707
,, France	7,300	9,690	+ 2,390
,, Great Britain	5,311	2,389	− 2,922
,, Sweden	2,392	3,469	+ 1,077
,, Belgium	2,388	1,025	− 1,363
,, Switzerland	1,851	6,811	+ 4,960
Self-contained generating sets—			
Total	3,397	2,285	− 1,112
From Germany	1,334	613	− 721
,, France	1,264	469	− 795
,, Great Britain	348	479	+ 131
,, United States	154	94	− 60
Switchboards—			
Total	1,332	977	− 355
From Germany	383	206	− 177
,, United States	274	136	− 138
,, France	240	425	+ 185
,, Great Britain	173	76	− 97
Electrical fittings (switches, lampholders, &c.)—			
Total	7,810	5,408	− 2,402
From United States	2,981	1,281	− 1,700
,, Germany	1,816	1,490	− 326
,, Great Britain	1,219	488	− 731
Electrical measuring instruments and parts thereof—			
Total	1,991	1,558	− 433
From Germany	1,243	824	− 419
,, France	251	218	− 33
,, Switzerland	379	328	− 51
,, Great Britain	44	5	− 39
Stoves, heaters, cookers, irons, &c.—			
Total	568	408	− 160
From Germany	157	68	− 89
,, Switzerland	230	139	− 91
Accumulators, dry batteries, and parts—			
Total	7,618	5,527	− 2,091
From Denmark	1,672	1,130	− 542
,, Germany	1,121	936	− 185
,, Great Britain	1,036	537	− 499
,, United States	966	1,451	+ 485
,, France	917	975	+ 58
,, Norway	501	38	− 463
Wires and cables—			
Total	13,037	31,411	+18,374
From Great Britain	4,926	21,005	+16,079
,, Germany	4,293	3,113	− 1,180
,, France	1,542	5,652	+ 4,110
,, United States	880	16	− 864
Incandescent electric lamps—			
Total	666	818	+ 152
From Holland	411	731	+ 320
,, Great Britain	77	12	− 65
,, France	5	28	+ 23

	1925. Quantities. 100 kg.	1926. Quantities. 100 kg.	Inc. or dec. 100 kg.
Telegraph and telephone switchboards and apparatus—			
Total	3,647	5,818	+ 2,171
From France	979	662	− 317
,, Belgium	655	3,932	+ 3,277
,, Germany	598	141	− 457
,, Great Britain	534	267	− 267
,, United States	397	372	− 25
,, Sweden	355	340	− 15
Electric mercury vapour lamps, searchlights, &c.—			
Total	82	57	− 25
From United States	33	8	− 25
,, France	12	15	+ 3
Arc lamps and parts, &c.—			
Total	15	58	+ 43
From Germany	10	11	+ 1
,, France	3	16	+ 13
,, Holland	1	—	− 1
Carbons, other electrodes, &c.—			
Total	3,486	5,378	+ 1,892
From United States	1,181	2,432	+ 1,251
,, Great Britain	1,002	742	− 260
,, Germany	773	769	− 4
,, France	44	957	+ 913
Insulating tapes, fabrics, and tubes—			
Total	8,159	4,750	− 3,409
From United States	4,906	3,944	− 962
,, Germany	3,127	212	− 2,915
,, Great Britain	22	16	− 6
,, Switzerland	13	8	− 5

Conditions in Switzerland.

Electrical Manufacturers Cut Prices.

A REPORT on the economic and financial conditions in Switzerland, dated February, 1927, has been published by the Department of Overseas Trade through the Stationery Office (1s. 6d. net). It was prepared by Mr. R. A. C. Sperling, C.B., the British Minister at Berne, who says that the hopes of improvement during the past year were not fulfilled. The home market was flooded with cheap foreign goods, while Swiss producers were forced to accept unremunerative prices to keep their hold on foreign markets. Among the adverse factors were the British coal dispute, which curtailed this country's purchasing power; the fall in the Latin exchanges; and the incidence of the new British and German tariffs instituted in 1925. Half of the introduction is devoted to advice to British traders with regard to the Swiss market. It is again pointed out that openings certainly exist for British goods, but certain "trade points" must be attended to. Briefly, these are as follows:—Adaptation of goods to local requirements; through quotations, either f.o.r. duty paid or c.i.f., and in Swiss francs, should always be given if possible; correspondence should be in French, or, if possible, in German, in cases where German is employed; catalogues and lists should be in French or German, and the metric system should be used; resident agents should be employed, and separate agents for the German and French-speaking parts are desirable; travellers with a good knowledge of the two languages should be sent out frequently; and the desirability of advertising should not be overlooked.

Electrical Industry and Foreign Trade.

As in the machinery industry, there was a falling off in the electrical industry during the latter part of last year. The orders placed by the Federal Railways on account of electrification were an important factor in increasing the year's turnover. The present electrification programme, however, will be completed in 1928, and many manufacturers are now looking about for a substitute for this source of orders. There was a smaller demand for standard apparatus such as small dynamos and motors, transformers, switchgear, &c., and this trend was sufficiently pronounced to create misgivings as to the near future. The policy of Swiss manufacturers was towards further price reduction, notwithstanding unfavourable local manufacturing conditions, in order to meet keen foreign competition. The high quality of Swiss electrical products is a great asset, states Mr. Sperling, which opened the road in 1926 to not a few technical successes, the financial side of which was jeopardised in many cases by price-cutting.

The imports of electrical equipment during 1926 totalled 2,043 tons, valued at 16 million fr., an increase of 365 tons as compared with 1925. They consisted principally of accumulators (380 tons), telegraph and telephone apparatus (433 tons), insulators (296 tons), dynamo-electric machines (410 tons), and unspecified apparatus (491 tons). The main sources of supply were Germany, France, Italy, Great Britain, and Belgium. The exports consisted of 7,649 tons of dynamo-electric machinery, valued at 27 million francs, which went to Spain, France, Germany, Brazil and other South American countries, the Dutch Indies, &c.; and of 2,134 tons of apparatus (chiefly meters and unspecified goods), valued at 24 million francs, sent to France, Belgium, Great Britain, Germany, Holland, Czecho-Slovakia, Argentina, &c.

Water Power Development.

At the end of 1925 the rating of hydro-electric plant actually installed was 1,859,000 h.p., and during last year a further 41,000 h.p. was put into service, while 320,000 h.p. was under construction. It is stated that the present development represents about one-fourth of the total water-power resources of the country. The largest works under construction are a railway power station of 115,800 h.p., and one of 100,000 h.p., being built by the Oberhasli (Bernese Oberland) Power Supply Co.; the former was to be completed this spring, and the other is expected to be finished in 1929-30. The output of Swiss electricity works during 1926 is put at about 4,000 million kWh, or about 80 per cent. of the maximum available output. Of this about 775 million kWh was exported, and a similar amount used in the electrochemical and metallurgical industry, while about 200 million kWh was consumed for traction purposes. Exports of electrical power are being looked upon as an increasingly valuable source of national revenue, and the steps taken by the Federal authorities to bring about a more healthy state in export conditions are now bearing fruit. Contracts on an exchange basis were concluded in 1926 by some power companies for the export of surplus summer output, and the import in winter of power produced by "thermic" stations abroad. The annual power consumption is stated to be about 1,000 kWh per head of the population.

Railway Electrification.

The bulk of the work carried out on the Swiss Federal Railways during the past year consisted of electrification and the reconstruction and improvement of stations and track equipment. With the growth of motor transport competition and heavy wages and salaries, the financial situation is giving cause for anxiety and expenses are being cut down all round. The 1927 Budget allowance for electrification, &c., has been reduced by about 17 per cent. as compared with 1926; the actual sum allotted to electrification is 29.9 million francs; 22.5 millions is allotted for the purchase of electric locomotives and 5.3 millions for motor coaches. In January last the Federal Railways operated 1,053 km. of electrified normal gauge lines, 138 km. having been opened to single-phase electric traction in 1926-27. A further 229 km. was to be completed by last month (May), and by the end of the year another 205 km. was to be put into operation. The railways have at present about 280 electric locomotives and 25 motor coaches.

Communications and Broadcasting.

The Swiss administration concentrated most of its activities on the development of the telephone system, which at the end of 1926 served 161,689 subscribers with 210,484—an increase of 7,946 subscribers and 10,278 lines since 1925. Numerous inland trunk services, mostly underground, were put into operation in 1926, and several new international connections were established. Direct communication, by means of three circuits, was to be opened between London and Switzerland this spring. Automatic exchanges with an ultimate capacity of 10,000 lines were completed at Berne and Basle, while two similar exchanges are being installed at Zurich. Automatic sub-exchanges and satellite exchanges are also being erected at various points. Telegraphic traffic continues to decrease and several inland lines were put out of circuit in 1926; two new international lines were opened, however.

New broadcasting stations were opened at Berne in November, 1925, and Basle in June, 1926, thus bringing the total for Switzerland to five stations. The Lausanne station was re-equipped and improved in 1926. At the end of the year there were 51,194 licensed receiving sets; the increase since January was nearly 18,000. The stations at Berne, Basle, Geneva and Lausanne are now working together, the programme of each of these stations in turn being relayed by the others. The Swiss Marconi Company's station at Berne-Muenchenbuchsee dealt with more than 500,000 telegrams in 1926, *i.e.*, an increase of over 100,000 since 1925. A short-wave transmitter will be added shortly to the two high-speed and one broadcasting transmitters already installed.

Swiss Hydro-Electric Development.

According to the Swiss Press, at the end of 1926 the hydro-electric development of the country amounted to 1,867,000 h.p. Of this total 46 per cent. was developed by private undertakings, 17 per cent. by local authorities, 26 per cent. by Cantonal and other authorities, and 11 per cent. by the Swiss Federal railway authorities. The important new plants completed during last year included the Ober-Ems station of the Illsee-Turtmann Gesellschaft and the Reichenbach station of the Reichenbach Elektrowerke Gesellschaft of Meiringen. New stations in course of construction and extensions to existing stations will, when completed, bring the total capacity of hydro-electric plants up to 2,241,000 h.p.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

An Electric Welding Plant.

An electric welding plant which has recently been shipped to Ceylon, and which will be used for track-repair work on the Columbo tramways, has some unusual features. The set, fig. 1, was built by the Parsons Oil Engine Co., Ltd., Town Quay Works, Southampton, in conjunction with the Equipment & Engineering Co., Ltd., Norfolk Street, Strand, London, W.C.1. It comprises a standard 14- to 16-h.p. Parsons

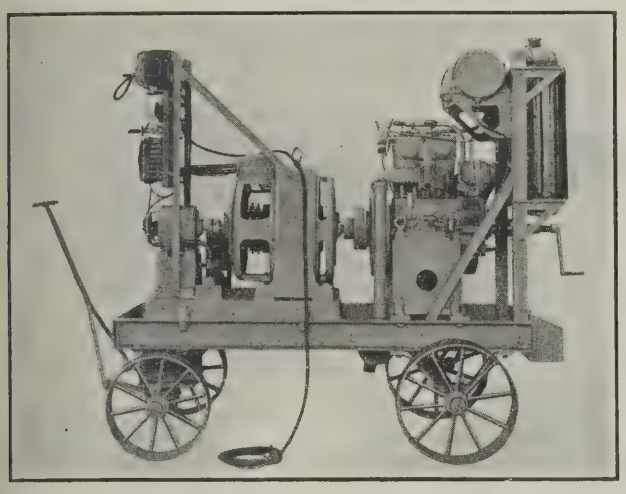


Fig. 1.—Electric Welding Set.

petrol engine, 1,000 r.p.m., fitted with a fuel tank and radiator, directly coupled to a welding generator and exciter, the whole outfit being mounted upon a welded-steel frame. The generator has a differential compound winding of an unusual design. An adjustable divertor path for the series winding is provided, and consists of an externally placed high-inductance electro magnet. Upon striking the welding arc the bulk of the heavy current is forced round the reverse series turns upon the generator and the open-circuit voltage descends much quicker than with the usual control of tapped series turns. The advantages claimed for this control are greatly reduced strain upon the plant generally, a much more flexible welding arc, and less liability of the metallic electrode to adhere to the work. The complete switchgear is mounted upon the iron uprights above the exciter and contains all the requisite instruments to control the plant, including an adjustable air-cooled reactance with a laminated core.

A Tropical-Climate Fan.

A recent production of the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2, is the pulsating ceiling fan, fig. 2, for use in tropical climates, which is claimed to not only keep the air circulating freely, but, in

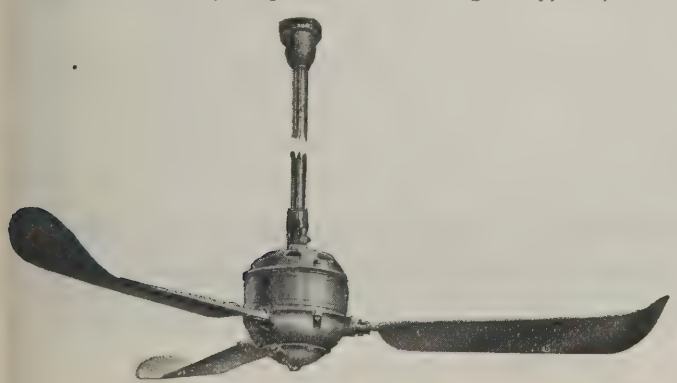


Fig. 2.—Pulsating Ceiling Fan.

addition, to deliver an intermittent volume of cooling air every five seconds, in a similar manner to the old-fashioned curtain punkah. This effect is brought about by a system of gears which varies the pitch of the blades as the fan rotates. The intermittent draught allows the body to perspire between the cooling periods, thereby inducing a healthy physiological effect.

The motor is of the semi-enclosed induction type, fitted with a ball thrust bearing running in oil, and the windings are specially insulated. The fan is claimed to be practically noiseless. The loading is from 120 to 125 W on voltages between 100 and 250, single-phase, 50 cycles. The three specially designed blades are made of aluminium-sheet formed into a definite contour which, it is claimed, ensures the minimum of slip and gives the highest possible volumetric efficiency. The sweep of the blades is 60 in. and the speed 190 r.p.m. The total weight is 57 lb., and the length of the down rod is 60 in. A standard finish of white enamel and nickel plate gives a very pleasing appearance. The blades are frosted to prevent flickering while rotating.

Electrically-operated Switchgear.

Messrs. Johnson & Phillips, Ltd., Charlton, London, S.E.7, have recently completed a number of electrically-operated oil circuit breakers, for use in a large London traction sub-station, which present a number of interesting features. They are designed to carry 300 A at a working pressure of 11,000 V, with a guaranteed rupturing capacity of 300,000 kVA. Each breaker consists of three single-pole units, mechanically coupled. Fig. 3 shows a breaker with the tanks removed; it will be seen that there is no operating mechanism near the terminals, which enables large clearances to be obtained without unduly increasing the overall dimensions. The fixed contacts are insulated with porcelain, and the moving blades by means of moulded micanite. The con-

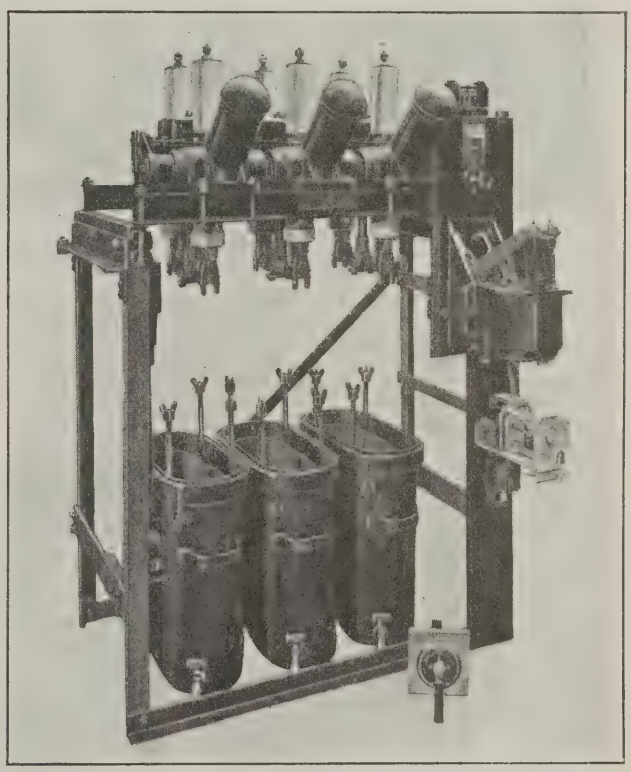


Fig. 3.—Electrically-Operated Circuit Breaker.

tacts are of the timed multiple-break type, made under license from the Electrical Research Association. The arcing fingers are of large thermal capacity and in pairs, one finger of each pair being on either side of the moving blade; they are so arranged that the contact pressure is increased by electro-magnetic effect under fault conditions. The fingers part at different points of the current wave, thereby increasing the possibility of one pair opening near the zero point of the wave when conditions for breaking the arc are more favourable than at other points of the cycle. The operating mechanism is of the solenoid type, governed by a contactor operated from the control switch. The contactor takes the control of the breaker out of the hands of the operator as soon as the control switch is closed, and ensures that the time interval before the breaker closes is constant. This time interval is small, due to the speed of operation of the solenoid mechanism, and synchronising is thereby simplified. The contactor switch for the solenoid has four breaks in series and avoids the usual dash-pot time lag, which is very indefinite in operation and requires constant attention. The mechanism is free to trip under fault conditions at any point of the travel after the arc tips touch, but "pumping" is impossible. Baffled vent pipes prevent oil throwing, and there is a large air cushion above the oil surface. Accelerating springs give a quick break, shock and rebound being absorbed by an oil dash-pot buffer.

A Window-Dressing Competition.

Effective "Hoover" Displays.

WE have received from MESSRS. HOOVER, LTD., a report upon the results of their 1927 window-dressing competition, together with photographs of the prize-winning windows. The competition entries were thoroughly representative of all branches of the "Hoover" dealer connection—large departmental stores, electricians, furnishing houses, hardwaremen, &c.

A very beautiful display arranged by Messrs. Bacon and Curtis, Ltd., of Bournemouth, took the first prize. In this, the connection between spring and the "Hoover" was the theme. The floor of the window was covered with turf, from which sprang "a host of golden daffodils," while overhead was a bower of blossoms creating the real vernal atmosphere. On one side of the window stood an unobtrusive "Hoover," and the display was completed by a series of neat cards and window posters. We regret that the photograph does not do justice to the window, and therefore cannot be reproduced.

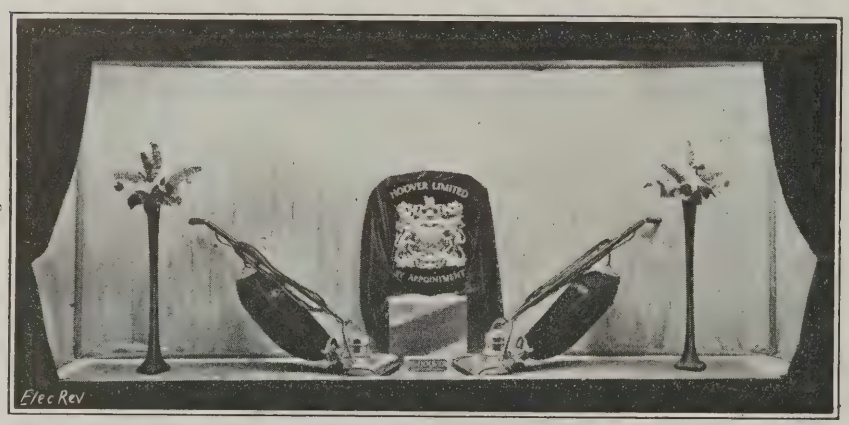


Fig. 1.—The Bradford Electricity Department's Display.

The Bradford Corporation Electricity Department was awarded the second prize for a window of which simplicity was the keynote. As will be seen from fig. 1, the display consisted of draped Royal Arms supported by two "Hoovers," and flanked by two tall vases containing lilac sprays, which were just sufficient to suggest the season of the year. A white background and concealed lighting did the rest.

The third prize was taken by Messrs. Arnolds, Ltd., Great Yarmouth, for a very ingenious arrangement. A latticed window contained a central sheet announcing "A Wonderful New Invention of War—Captures a Million Prisoners a Minute." For intervals of a few minutes throughout the day this sheet was raised to show a "Hoover" and its accessories, cards explaining that the reference to "prisoners" applied to germs. Inside the shop seats were provided for demonstrations of the machine.

A more elaborate entry was that of Messrs. Walker Bros., Birmingham, who took the fourth prize for the window depicted in fig. 2. The *pièce de résistance* was a "Hoover" in a blaze of glory and an announcement that "The 'Hoover' brings Sunshine to the Home." In the rear six cards dealt with six points regarding the cost and virtues of the cleaner. In the two side panels and the outer windows further examples of the machines appeared, and the whole assembly was well lighted, giving the utmost value to it.

Consolation prizes were awarded to Messrs. Ray & Miles, Ltd. (Liverpool), the Northampton Electric Light and Power Co., Ltd., the Negus Electrical Co. (Cambridge), Messrs. John Barnes and Co., Ltd. (Finchley Road, N.W.), and Messrs. Flashman's (Folkestone).

More attention is now being given to the necessity of making an effective display in the shop window. It is remarkable how excellent a show can be made in a small space when proper attention and ingenuity are brought to bear upon the problem. Some windows contain a mass of material which has been allowed to fall together in more or less chaotic state. Instead of arresting the attention of possible purchasers, it is apt to weary—even to annoy! A few things well shown are sometimes better than a thousand. They make the people think—they make them talk, both preliminaries to buying! Such examples as those dealt with above show how it can be done. While large stores and contractors with big windows and spacious premises can afford to employ skilled experts to display their wares to best advantage, smaller businesses have to make the best they can out of the limited resources that are at their command, but it is wonderful what the "small" man or woman and one assistant can do by careful and artistic planning after a critical or interested inspection of the windows of other traders who are great on the point of display.



Fig. 2.—Messrs. Walker Brothers' Window.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The London and Home Counties Electricity (No. 2) Bill.

When the proceedings before the Committee dealing with this Bill were resumed on May 24th, Mr. WROTTESLEY, K.C. (for the Barnes U.D.C.) questioned Mr. Rider, suggesting that in view of the proposal of the London Power Co. to erect a station adjacent to the area, there was no necessity for the Joint Electricity Authority's projected station; and that if the latter station were erected there was a possibility of its being unremunerative. Mr. Rider replied that the station would not be erected until there was practically an assured load; he believed the North Metropolitan Co. would take a good supply. The Chairman intervened to remind Mr. Wrottesley that the Committee was guided to a great extent by the fact that the Electricity Commissioners were satisfied that at least one riverside station in the West of London was necessary. Counsel replied that he aimed at showing that only one station was necessary. Mr. Rider agreed that the Authority would not be able to supply the London Power Co.'s customers, except by agreement with the company, but there would be a linking up with the company and reciprocal supplies. The western part of the Authority's area could be supplied more economically from Chiswick than from Battersea. It was important to look very far ahead; he did not anticipate any deficiencies in the meantime, however. Mr. Rider admitted that in his report last year he did not have the erection of a large station at Battersea in mind. The effect of that station would be that the development at Chiswick would not be so rapid as would otherwise be the case. He pointed out, however, that the development of the demand was more rapid than had been anticipated. Mr. WROTTESLEY suggested that it would be better if the Chiswick station were erected some years hence, but Mr. RIDER said that if the opportunity of acquiring the site was not taken it might be lost altogether; he could not agree that an alternative site at Hurlingham would be as suitable.

The Hon. EVAN CHARTERIS, K.C., for the London Power Co., said that in view of Mr. Rider's evidence as to the desirability of constructing the stations at Battersea and Chiswick concurrently he did not propose to cross-examine him.

The Committee adjourned until the following day, when Mr. RIDER, in reply to questions, said that he did not think that it would be cheaper to deliver coal by water than by rail. He also said that the coal storage arrangements would not pollute the river, nor would the station be detrimental to any building in the vicinity. Mr. ROWAND HARKER, for Concrete Agregates, Ltd., said that his clients had received certain rights in connection with the site. The CHAIRMAN said that the erection of the station was of greater public importance, and compensation would be paid if necessary. Mr. HARKER protested, and left the committee room. In re-examination, Mr. RIDER said that the use of electricity instead of coal for domestic purposes would lead to less pollution of the atmosphere. He said that the plant of the local authorities could not be increased without the Electricity Commissioners' permission, and the Central Board could compel them to take a supply from Chiswick if it was cheaper. If the two proposed stations were constructed together, transmission systems with a minimum of mains could be arranged.

Mr. W. CASH, C.A., gave evidence regarding the finances of the Authority, and said that it was at present empowered to borrow up to £7,000,000. The London County Council was prepared to guarantee interest on a loan of £1,000,000 at least, provided the Commissioners were satisfied that the scheme was the best from a technical point of view. The Authority would have no difficulty in borrowing money; the net rate would be 5¼ per cent. Sir HOWARD FRANK, surveyor, supported the promoters' contention that the amenities of the district would not be adversely affected, and he pointed out that the station would make a great difference to the ratable value of Chiswick.

On May 26th, the Committee visited the site, and when the proceedings were resumed in the afternoon Mr. JAMES SWINBURNE, F.R.S., gave evidence that if the furnaces were properly designed there would be no emission of smoke, and the gases would not be harmful. He would not agree that the depth of water in the river would at times be insufficient for the station, and said that the discharge of condensing water into the river would not raise its temperature appreciably.

On May 27th, Mr. E. WILLIS, architect, surveyor, and engineer to the Chiswick U.D.C., gave evidence in support of the Bill, and said that his Council had passed a resolution favouring the erection of the station on the Duke's Meadows site. Steps had been taken to preserve the amenities of the district and he was confident that no nuisance would arise. The Council was convinced of the necessity for the station, and also considered the effect upon the ratable value of the district.

Sir DUNCAN WATSON, J.P., chairman of the Joint Electricity Authority and member of the Central Electricity Board, explained the powers and duties of the Authority, and gave evidence showing the necessity for the station, without which, he said, the Authority would be unable to carry on. If the station were erected the Electricity Commissioners would be able to withhold permission for the extension of small stations which at present they had to give. He quoted the number of applications for extensions which had been made by supply authorities in the area between November, 1925, and March, 1927. The aggregate amount of plant involved was 508,876 kW and sanctions representing 300,000 kW had been granted to date.

Mr. WROTTESLEY said that the witness had not included the London Power Co.'s application to erect a station at Battersea in his list; Sir Duncan replied that if the station was sanctioned the company would probably install plant at Battersea instead of Deptford. Witness further stated that not one municipality had told the Authority that it would not shut down its station to take a bulk supply. The question of shutting down plant was one for the Central Board to deal with. Asked if one municipality had agreed to take a bulk supply, Sir Duncan repeated his statement that he did not know of one authority who would refuse to do so. Replying to further questions, witness said that while the London Power Co. could demand a supply from the Joint Authority, the latter could not demand a supply from the company.

The Committee adjourned until May 30th.

On that day Mr. H. P. MCMILLAN (for the London Power Co.) said that the company's application for permission to erect a power station at Battersea was before the Electricity Commissioners, who would hold an inquiry. The company was in no way hostile to the Authority's proposals, but the Committee had to consider the electrical interests of the whole of the area. It was the concern of the company to see that nothing was done which would prejudice its application. Two different tribunals were dealing with the applications, which was a disadvantage. It was hoped that steps would be taken by which any decision of the Committee would not prejudice the company's position. He suggested that Sir John Snell might be asked to give his views.

Sir DUNCAN WATSON, in the resumption of his cross-examination by Mr. Wrottesley, said that he was satisfied that the whole of the output of the Battersea station would be taken by the ten constituent companies of the London Power Co., and that there was a need for both stations. It was not desirable to extend existing stations. He admitted that in supplying some of the central districts the extra cost of transmission from Chiswick might be sufficient to turn the scale in favour of the Battersea station.

Mr. S. L. PEARCE (engineer-in-chief to the London Power Co.) gave evidence as to the need for the two stations, pointing out that the increase of the demand for electricity in the area was more rapid than the growth of population.

The Committee adjourned until May 31st.

Washington Radio Conference.

On May 23rd, Viscount WOLMER informed Mr. Hore-Belisha that the Radio-telegraph Conference to be held at Washington would deal with certain aspects of broadcasting, and various proposals would be considered having for their object the reduction of interference between the broadcasting services and other wireless services.

Yorkshire Electric Power Bill.

This Bill has been read a second time in the House of Commons.

Special Orders Approved.

Special Orders have been approved relating to part of the rural district of Darlington, Durham, and part of the rural district of Croft, North Riding; part of the urban district of Tilbury, Essex, and the amendment of the Romford and District Electric Lighting Order, 1913; the borough of Ludlow, Salop; the burgh of Peterhead, Aberdeen; the urban district of Burnham-on-Crouch and part of the rural district of Maldon, Essex; the urban district of Axminster, the parishes of Axminster Hamlets and Chardstock, Devon, and the borough of Chard and the parish of Chard, Somerset; the parish of Dockenfield and part of the parish of Frensham, Surrey, and the parishes of Bentley, Coldrey, and Froyle, and part of the parish of Binstead, Southampton; and a Special Order authorising the Crowborough District Gas and Electricity Company to raise additional capital for electricity purposes.

Electric Railways.

On May 25th, Colonel ASHLEY informed Sir John Power that at December 31st, 1919, 821 track miles were worked, either wholly or partly by electric traction in this country, compared with 1,241 track miles at December 31st, 1926. The corresponding figure at December 31st, 1913, was 502 track miles.

General Interconnection.

On May 25th, Sir JOHN POWER asked the Minister of Transport when the Central Electricity Board expected to commence the construction of the general interconnection system.

Colonel ASHLEY said that under the provisions of the Electricity (Supply) Act, 1926, the Central Board was not in a position to commence works in any area until a scheme had been adopted for that area, and schemes could only be adopted after they had been received by the Board from the Electricity Commissioners and the statutory procedure as to publication and consideration of objections had been carried out. In those circumstances it was not yet possible to say at what date actual construction would begin.

"Beam" Wireless.

On May 26th, Viscount WOLMER informed Capt. Fraser that the beam stations for communication with South Africa were expected to be ready for the official tests in the course of the next few weeks. If the tests were successful, the stations would be taken over by the Post Office and a wireless telegraph service with South Africa would be opened. It was impossible at that stage to say whether the stations would be fully occupied with telegraph traffic, but it seemed doubtful whether a directional station was likely to be as suitable for purposes of Imperial broadcasting as a station capable of transmitting in all directions.

Imperial Broadcasting.

On May 26th, Capt. FRASER asked if the Government would make a grant to the British Broadcasting Corporation to enable it to establish and maintain a short-wave wireless transmitter to relay existing programmes to the Empire or parts of the Empire in order that such a project might be proceeded with immediately without hindering the development of the Corporation's new British scheme.

Viscount WOLMER said that the British Broadcasting Corporation had been given authority to conduct experiments in short-wave transmission, and he understood that it was its intention to carry out those experiments before putting forward any proposals for a service to distant countries. The incidence of the cost of such a service, if it should be found to be practicable, would be a matter for settlement between the Corporation and the Dominions and Colonies concerned.

Adjournment.—The House of Commons was to adjourn yesterday (Thursday) for the Whitsun recess, until June 13th.

Train Collision Report.

The report on the official inquiry into the causes of the collision between two passenger trains which occurred in February last on the L. & N.E. Railway, near Hull, has now been issued. A passenger train from Withernsea to Hull was approaching Paragon station on the incoming line when it came into head-on collision with a train from Hull to Scarborough. It is concluded that the Scarborough train was diverted to the wrong line as the result of the signalman inadvertently moving the wrong points, which were electro-pneumatically operated.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Cheap Electricity.

Mr. Mountain's plea for simpler tariffs will awaken interested support in many technical and lay breasts, but has he not considered that present-day tariffs were *evolved* from the old and apparently innocuous flat-rate? The peculiar difficulties and limitations of the electricity supply industry have always made the apportionment of charges and the assurance of an adequate and fairly-spread return a difficult problem. To fix a flat rate in the case of a particular consumer at a particular period is more or less straightforward; but to expect that rate to remain a fair one to both supply undertaking and consumer is out of the question in view of the changing conditions of industry in general, changes in the consumer's own conditions, and in the electricity supply industry itself.

The double tariff gave the consumer the opportunity of buying energy at a cheaper rate during "off-peak" periods: a choice of two flat rates. Many consumers, however, require supply only during an eight-hour day, so that they cannot avail themselves of the cheaper rate. They may be required to pay an annual "stand-by" or "minimum" charge, but why should this be regarded as an impost? Connection to a source of supply is at hand, and a supply undertaking cannot be expected to provide this gratis (and perhaps have but a dubious chance of selling energy). If (as happens) the consumer has his own generating plant, he can often quite readily and economically take kWh up to the amount of the annual or other charge; certainly he is "slow" if he does not. Where such charge can operate hardly is in the case of, say, a small colliery that is nearly worked out, and cannot bring the value of energy consumption up to the figure, much, obviously, depending on the proportion.

There are, of course, qualifying factors in tariff agreements such as a coal clause—which is not in the least mysterious, and (or so one imagines) ought to be regarded as evidence that there can be truth in economic relations as well as in advertising. We come to the two-part tariff, which has received legislative blessing—a fact which, to many minds, is by no means a guarantee of ultimate probity! The payment of a small rate per kWh on the energy consumption is, of course, quite straightforward, and its actual value may be welcomed. But the kW fixed charge is suspect. Why should it be? The consumer is, in fact, reserving for his own use plant capacity up to the value shown by the max.-demand indicator; to that extent he is a shareholder liable to the various capital and other expenses met with in generation and distribution. If this is understood, the method should appear just and straightforward. Naturally, the consumer can query the actual amount of the kW charge, but he must accept this just as he accepts the many hidden charges in a ton of pig iron or a penny tram-ride.

All the foregoing tariff schemes are not difficult of comprehension by anybody; they are quite obvious, and, moreover, an alert and inquiring consumer can check his accounts and his day-to-day electricity expenses by watching the meters.

It is when power-factor is taken into account that difficulties arise—mainly owing to its nature and implications being (as is inevitable) so non-apparent to lay, and to many engineering, minds. Should there be a sine meter, it can be made evident simply that the slower this meter advances relatively to the energy meter, the better is the p.f.; if need be, a table can enable the alert (though possibly non-technical) consumer to follow his power expenses. The two-part tariff with a kVA charge can obviously be rather more suspect than one with a kW charge—but only if the latter is vaguely understood, or if a perilous dissertation upon technical terms is undertaken. On the whole, it appears that the two-part tariff, as a tariff, is the best scheme introduced up to the present—especially when a monthly, rather than a quarterly or yearly, maximum demand is stipulated.

A great deal depends upon the attitude of the consumer to the supply authority. Belonging to one of several classes, he may be entirely trustful, or at any rate quietly acquiescent, in whatever tariff scheme is put into operation—and may take no interest in his periodic power requirements; he may be slightly dubious, but feel reassured if occasionally called on; he may be non-technical and temperamentally distrustful—a "holy terror"; he may understand electro-technical matters to a dangerously small extent—and be a plaguey nuisance; and he may really comprehend arrangements and (though naturally requiring occasional treatment) be generally satisfied, and intelligently aim at bettering his load and economic conditions.

The technical and diplomatic work in relation to the income of a supply undertaking is hardly that of a sinecure. In tariff agreements and in their actual operation the cards are put on the table, and the consumer is not always so entirely helpless as he (or others) would have one believe. This open attitude is merely in keeping with our times.

G. E. Moore.

Newcastle-on-Tyne, *March 21st*, 1927.

The Ideal Wiring System.

In view of the recent article on "The Ideal Wiring System," perhaps the enclosed samples will be of interest to you and your readers. This wiring has only been installed a matter of three years or so, in a perfectly dry house, and was only in contact with the plaster beneath the floor, *i.e.*, in the interstices between the laths. This is only one of the samples of the many breakdowns of the so-called metal-sheathed systems that have been replaced by St. Helen's C.T.S. cable. The former were perfectly bonded.

J. Dean.

Aberystwyth, *May 27th*, 1927.

[The samples sent us show the lead sheathing corroded completely through and exposing the insulating covering of the conductors at one place; in other cases, the action was in progress, but the sheathing had not been fully penetrated. It is well known that lead sheathing should not be laid in contact with plaster.—EDS. ELEC. REV.]

A Mysterious Occurrence.

The mysterious occurrence mentioned by "W.H.M." in your issue of May 27th may be due to the oil siphoning or creeping through the cables which enter the transformer.

Probably the oil had crept as far as the switch, and the act of switching-off on the Saturday started the action by dislodging some tape round the cable end. If "W.H.M." examines the backs of his switchboards he may find evidence of the outflow.

Taking the week-end as 40 hours, and the loss as 100 gallons, this is equivalent to 2½ gallons per hour, or one pint every three minutes. I find it is quite easy to obtain a flow of this amount, especially through a large l.p. cable. If the cables to the transformer are as old as the oil (10 years), there has been plenty of time for the oil to find its way down the inner layer of insulation and the small spaces between the strands.

It is impossible to diagnose the trouble exactly without seeing the transformer and the type of cable exit, but if the tank is perfectly sound, and the top of the windings is anywhere near the cable lugs so that a film of oil could pass, I should certainly suspect the cables. It will be interesting to know whether "W.H.M." finds traces of oil at the switchboard ends of the cable.

J. F. Hinsley.

Birmingham, *May 28th*, 1927.

[It is difficult to imagine that this is the correct explanation of the occurrence, but perhaps the suggestion may afford a clue to the true one.—EDS. ELEC. REV.]

Electromobiles.

As the secretary of this Association, which caters for users, manufacturers, garages and charging stations, and all other interested parties, I am frequently asked: "Why is it that electromobiles are not used to a greater extent in this country, if they possess the many undeniable advantages over other methods of town, &c., transport?"

You have frequently espoused the cause of electromobiles through the medium of your valuable periodical, which has a wide circulation among all classes, and it would be interesting to have the views of your readers through your "Correspondence" columns as to the difficulties prospective users anticipate, and those encountered by existing users.

The main obstacle appears to be the lack of a cheap and abundant supply of d.c. electrical energy for charging batteries.

I do not consider that any charging station is worthy of being registered as such unless the maximum figure of one penny per unit delivered into the battery is adhered to. There are already supplies available under this price. The first cost of the batteries and the electromobiles is another feature which presents itself to prospective users. How is this to be reduced? Can one obtain an electromobile under £200?

The Electromobile Association.

London, *May 30th*, 1927. (J. C. ELVY, *Secretary.*)

Magneto Repairs.

I shall be greatly obliged if any reader will kindly give me the following information:—

1. Names and addresses of firms which manufacture machines and the necessary equipment for winding magneto armatures.

2. If and where it is possible to obtain the necessary data for winding armatures of various makes of magnetos, and the correct method of carrying out the work.

May 28th, 1927. **Magneto.**

The "Old Cromptonians."

We have received from Mr. M. Whitgift, hon. treasurer and assistant secretary, the latest issue of the journal of the Association of "Old Cromptonians." This contains reminiscences by Messrs. G. M. Clarke and E. J. Fox, "Chelmsford Notes," and a complete list of members (186). A recent portrait of Col. Crompton is also included.

Legal.

Triumph Trust, Ltd., v. Frahm.

IN the Mayor's and City of London Court, before Judge Shewell Cooper, on May 26th, a claim was made by the Triumph Trust, Ltd., Old Broad Street, against Mr. P. H. Frahm, Littlehampton, for £5, representing five monthly instalments of £1 due under a hire-purchase agreement made in February, 1926. It was stated that the defendant purchased a wireless set from the General Radio Co., Ltd., and entered into a form of agreement with the plaintiffs, who were a financial company, to pay by instalments. In reply to the plaintiffs' requests for payment, defendant had set up a contention that £50 was due to him from the General Radio Co., Ltd., on account of commission on sales of radio sets in and around Littlehampton. Plaintiffs were not concerned with that matter as they had merely taken the part of discounters in the transaction. The defendant set up a counter-claim for £50, and said that after replying to an advertisement by the General Radio Co., an arrangement was come to whereby he was appointed district agent for an area in the neighbourhood of Littlehampton, and was to receive a commission of 25s. on every wireless receiving set installed by the General Radio Co. in that district, whether as a result of his introduction or not. It was necessary that he should have a set for demonstration purposes, and he paid £5 on account, and signed the agreement now produced by the plaintiffs. He believed that about 50 receiving sets had been sold in his district. Judge Shewell Cooper said that his remedy was to proceed against the General Radio Co., Ltd., and not the plaintiffs, and gave judgment for the plaintiffs on the claim and counter-claim, with costs.

The Dublin and Lucan Electric Railway Co.

IN the High Court, Dublin, on May 23rd, application was made for the confirmation of the sale of the undertaking of the Dublin and Lucan Electric Railway Co. (in liquidation) to the Dublin United Tramways Co., Ltd., for the sum of £12,500 in pursuance of an agreement between the two companies. The official liquidator (Mr. D. McDowall Grosart) also asked for an inquiry to ascertain the amount of prior charges. Counsel for the Dublin Tramways Co. said that there would be a claim against the company for electricity supplied. The Judge ordered the Dublin Tramways Co. to lodge the sum of £12,000 with the liquidator and directed the inquiry to be made.

British Thomson-Houston Co., Ltd., v. Star Electric Lamp Co.

MR. JUSTICE CLAUSON, in the Chancery Division on May 27th, in default of defence, entered judgment for the British Thomson-Houston Co., Ltd., in an action against the Star Electric Lamp Co., of Newcastle, to restrain defendants from selling or dealing in articles made in infringement of the plaintiffs' letters patent 10918 of 1913, relating to gasfilled electric lamps.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

27,420. "Induction electric furnaces." Ajax Electrothermic Corporation. February 14th, 1925. (247,519.)

27,518. "Automatic telephone system." H. Baron (F. Aldendorff). November 2nd, 1925. (270,055.)

30,476. "Asymmetric electric couples for rectifying alternating current and like purposes." S. Ruben. December 2nd, 1925. (270,362.)

1926.

625. "Electric inductance apparatus." Siemens Bros. & Co., Ltd., and C. R. Riber. January 8th, 1926. (270,370.)

705. "Sound-reproducing apparatus." British Thomson-Houston Co., Ltd., A. P. Young and J. Hutt. January 9th, 1926. (270,371.)

3,010. "Electrical measuring instruments." G. Wall, W. Trelford, R. P. Cartwright, A. R. Dunton and Metropolitan-Vickers Electrical Co., Ltd. February 2nd, 1926. (270,377.)

3,139. "Switching arrangements for electrical machines." Siemens Bros. and Co., Ltd., and V. Turner. February 3rd, 1926. (270,380.)

3,145. "Electric couplings for valves, coils, and the like of wireless apparatus." Dr. M. Libermann. February 11th, 1925. (257,549.)

3,228. "Alternating-current dynamo-electric machines." H. De Pistoye. February 4th, 1926. (270,384.)

3,240. "Trunking system of radio distribution." E. F. Colladay. February 14th, 1925. (247,550.)

3,242. "Cap fittings for electric lamps." W. Dawson. February 4th, 1926. (270,385.)

3,247. "Sound-reproducing apparatus." British Thomson-Houston Co., Ltd. October 28th, 1925. (260,537.)

3,276. "Headlights for automobiles and the like." A. L. Strange. February 4th, 1926. (270,388.)

3,419. "Thermionic valves or holders for thermionic valves." F. J. Willmott. February 6th, 1926. (Cognate application 7,347/26.) (270,400.)

3,435. "Radio-receiving apparatus." M. Wallace. April 27th, 1925. (251,240.)

3,529. "Protective arrangements for alternating current electric circuits." A. Reyrolle & Co., Ltd., and R. W. Biles. February 8th, 1926. (270,410.)

3,546. "Inductance coils particularly for use in connection with radio apparatus." Igranic Electric Co., Ltd., and W. K. Alford. February 8th, 1926. (270,411.)

3,568. "Electric apparatus for boiling and like purposes." W. Guy-Pell and W. West. February 8th, 1926. (270,414.)

3,585. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. February 11th, 1925. (247,555.)

3,689. "Systems of electric motor control." British Thomson-Houston Co., Ltd., and R. D. Given. February 9th, 1926. (270,419.)

3,690. "High-potential insulated conductors." British Thomson-Houston Co., Ltd., and H. C. Heath. February 9th, 1926. (270,420.)

3,691. "Devices for emitting and receiving sound." N. W. McLachlan. February 9th, 1926. (270,421.)

3,846. "Electric lighting, heating, and ventilating of railway vehicles." J. Stone & Co., Ltd., and A. H. Darker. February 10th, 1926. (270,426.)

4,424. "Lighting apparatus." R. I. Atherton. February 16th, 1926. (270,434.)

4,856. "Dynamo-electric machines." J. S. Peck, J. A. Kuyser, and Metropolitan-Vickers Electrical Co., Ltd. February 19th, 1926. (Cognate application 8,654/1926.) (270,438.)

5,280. "Electrical condensers." V. Magyar. February 24th, 1926. (270,445.)

5,610. "Electrical machines with commutators." General Electric Co., Ltd., and A. E. Angold. February 27th, 1926. (270,447.)

5,912. "Audible signalling devices." A. E. White (Sparks-Withington Co.). March 2nd, 1926. (270,449.)

6,086. "Electric switching devices." F. Davies and L. D. MacGregor. March 4th, 1926. (270,451.)

7,030. "Circuit interrupters." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. March 13th, 1926. (270,456.)

7,278. "Sound-amplifying devices." D. F. Walker. March 16th, 1926. (Addition to 235,259.) (270,457.)

7,972. "Sectional electrical bus-bars." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. March 23rd, 1926. (270,462.)

9,866. "Loaded four-wire conductors." Siemens & Halske Akt.-Ges. May 8th, 1925. (251,957.)

11,581. "High-tensionless wireless receiver." W. W. Sparey. May 29th, 1926. (270,486.)

11,890. "Circuit arrangements for generating electric oscillations." H. Wade (Naamlooze Vennootschap Philips' Glocilampenfabrieken). May 6th, 1926. (270,488.)

14,263. "Switches for electric flashlight apparatus." A. Woosnam (Svenska Aktiebolaget Gasaccumulator). June 7th, 1926. (270,507.)

14,304. "Construction of dynamo-electric machinery." Harland Engineering Co., Ltd., and A. S. Murdoch. June 7th, 1926. (270,508.)

15,073. "Insulating, protecting, and indicating device for dry cells and the like." M. Sinsinovici. May 8th, 1926. (270,511.)

15,687. "Method of preventing evaporation and oxidation of heated electrolytes." Dr. A. L. Mond (F. Warlimont). June 22nd, 1926. (270,514.)

15,851. "Searchlights." H. Eckschlager. June 24th, 1926. (270,516.)

17,750. "Imitation fires." Automatic Telephone Manufacturing Co., Ltd., and C. H. Archer. July 15th, 1926. (270,522.)

19,432. "Ceiling rose or like electric fitting." E. Reed. August 6th, 1926. (270,530.)

19,752. "Thermionic valve circuits." Soc. Française Radio Electrique. August 10th, 1925. (256,653.)

20,111. "Wireless signalling." C. P. Allinson. August 14th, 1926. (270,531.)

20,305. "Electric insulation board and method of making the same." D. M. Sutherland, Junr. August 17th, 1926. (270,535.)

20,406. "Methods of reducing noise in telephone circuits." Standard Telephones & Cables, Ltd. October 7th, 1925. (259,546.)

20,536. "Vacuum tubes." Dr. S. Loewe. August 25th, 1925. (257,604.)

20,751. "Thermally-operated switches or circuit breakers for protecting electric circuits." Calor Elektrizitäts-Akt.-Ges. and O. Dreyer. August 23rd, 1926. (270,540.)

21,584. "Guide roller for the cables of electric laundry irons." A. Machler and W. Werner. September 1st, 1926. (270,544.)

23,063. "Galvanic mass production." Langbein-Pfanhauser-Werke Akt.-Ges. February 20th, 1926. (266,285.)

26,547. "Electrical protective systems." Metropolitan-Vickers Electrical Co., Ltd. January 16th, 1926. (264,454.)

28,048. "Primary voltaic cells." Compagnie Française pour l'Exploitation des Procédes Thomson Houston. November 12th, 1925. (261,371.)

28,408. "Reflecting devices for advertising signs, signals, and the like." A. H. Brackensey and Franco-British Electrical Co., Ltd. November 11th, 1926. (270,571.)

29,217. "Carriers for accumulators and the like." K. J. Horstmann. November 19th. 1926. (270,575.)

31,735. "Electric cut-outs and the like." W. T. Henley's Telegraph Works Co., Ltd., W. H. Nichols, and E. Moor. December 14th, 1926. (270,594.)

1927.

217. "Electrode carriers for electric furnaces." Akt.-Ges. Brown, Boveri et Cie. January 7th, 1926. (264,157.)

517. "Electric high-tension switches." Metropolitan-Vickers Electrical Co., Ltd. January 14th, 1926. (264,484.)

1,745. "Wireless telegraphy and telephony receiving outfit for mounting on motor vehicles." G. Gailly and C. Les Enfants. October 23rd, 1926. (270,608.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from May 25th :—

Gestetner. No. 470,048. Class 6. Electrically-driven duplicating machines and parts thereof.—D. Gestetner, Ltd., Fawley Road, Tottenham Hale, N.17.

V.D.E. (lettering and design). No. 460,704. Class 7. Machinery of all kinds No. 460,705. Class 8. Philosophical and scientific instruments and apparatus for useful purposes. No. 460,707. Class 11. Instruments, apparatus and contrivances for surgical or curative purposes. No. 460,708. Class 6. Metal goods.—Verband Deutscher Elektrotechniker, Berlin. (British representatives: Edward Evans & Co., 27, Chancery Lane, W.C.2.)

Gecovalve. No. 476,214. Class 8. Valves for use in radio-telephony and telegraphy.—General Electric Co., Ltd.

Elima. No. 480,025. All goods in Class 8.—A. Hartley, 37, Standish Street, Burnley.

Zendix. No. 479,101. Class 11. Electric appliances for surgical or curative use, &c.—R. A. Shortland, trading as Shortland Bros., 10, New Brown Street, Manchester.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERYSTWYTH.—Casino Hotel, Marine Terrace (£80,000); T. Huntingdon & Co., builders, London.

ARMTHORPE.—Business stores, for the Doncaster Co-operative Society; T. H. Johnson, architect, 20, Priory Place, Doncaster.

AUSTRALIA (ADELAIDE).—Improvements, Memorial Hospital; Board of Trustees. Theatre and shops, Rundle Street; Hoyt's Theatres, Ltd. Additions, Film Exchange; Famous Lasky Film Service, Ltd.

AYLESBURY.—County offices, for Bucks. C.C.; county architect.

AYR.—Picture theatre, tea room, and offices, for Scottish Cinema and Variety Theatres, Ltd. (£10,000); the secretary.

AYRSHIRE.—R.C. School (£8,000), at Irvine; clerk, Education Authority, Ayr.

BASINGSTOKE.—Nurses' home, Park Prewett Mental Hospital, for Hants. C.C.; Gutteridge & Gutteridge, architects, 9, Portland Street, Southampton.

BELPER.—Sewage disposal works; surveyor to R.D.C.

BIRMINGHAM.—Picture house, Soho Road and Booth Street, Handsworth, for H. A. Barber, estate agent, 5 and 6, Grosvenor Chambers, Broad Street Corner.

BLACKPOOL.—Houses (50), for the T.C.; H. Hibbert & Sons, builders, Barnsley.

BOLTON.—School, Castle Hill, Tonge Moor; Director of Education.

BOURNEMOUTH.—Church, Wootton Gardens, with electric lighting and heating work, for the Strict Baptist trustees; the secretary.

BOURNEMOUTH.—Wesleyan Church, Winton (£15,000); George Shears & Son, builders.

BUCKINGHAM.—Milk factory, for the London Co-operative Society; T. J. Walker, builder, Winslow.

BURSLEM.—Drill hall, for Staffs. Territorial Army Association; the secretary, Stafford.

CHESHIRE.—Mental hospital accommodation, Upton and Parkside; Committees of County Council.

CHORLEY.—Roman Catholic Central School; Catholic trustees.

CHRISTCHURCH.—Extension of the casual wards, for the Bournemouth and Christchurch Board of Guardians; P. C. Ford, clerk to the Board.

CLATTERBRIDGE.—Extensions, Isolation Hospital; Wirral Joint Hospital Board.

COATBRIDGE.—Sewage works; Corporation engineer.

COVENTRY.—Housing scheme (74), Gulson Road and Harnall Lane; E. H. Ford, city engineer, Council House.

CREWE.—Secondary school extensions, for Cheshire E.C.; F. A. Browne, county architect, Newgate Street, Chester.

CROYDON.—Cinema, Woodside Grange, Addiscombe, with electrical work (£28,500); W. L. Griffiths, architect, London.

DEAL.—Band pavilion (£9,000), for the T.C.; borough surveyor.

DENBIGHSHIRE.—Mental deficiency home (£120,000), for the C.C.; the clerk, Wrexham.

DOUGLAS (ISLE OF MAN).—Housing scheme (66), Olympia Estate, for the T.C.; J. E. Teare, architect, 46, Athol Street.

EDINBURGH.—352 houses at Gorgie Road, for Corporation; city architect.

EXHALL ASH.—Elementary school (£17,500); Warwickshire Education Committee.

HAMPSHIRE.—Equipment of small holdings (£45,000); County Agricultural Committee.

HARLINGTON (HOUNSLOW).—School (£16,500), for Middlesex E.C.; Sir B. S. Gott, secretary, Westminster Guildhall.

HARROW WEALD.—Secondary school, for Middlesex E.C.; Sir B. S. Gott, secretary, Westminster Guildhall.

HECKMONDWIKE.—Co-operative stores, Six Lane Ends; Stead & Walshaw, architects.

HERNE BAY.—Joint Hospital; Herne Bay and Whitstable U.D.C.'s. Municipal offices, for U.D.C.; Prof. A. E. Richardson, assessor.

HIGH WYCOMBE.—Factory, Desborough Park Road, for Lidgley Bros. Factory, Bellfield Approach, for C. H. and S. Keen. Factory extensions, Oxford Road, for Marechal Ruchon & Co., and Totteridge Avenue, for E. Turner.

INDIA (BOMBAY).—Hospital at Mahim; Sir Leslie Wilson's Hospital Fund and Corporation.

IRISH FREE STATE (LIMERICK).—New dock for the Harbour Commissioners; T. F. O'Sullivan, Harbour engineer.

KETTERING.—Hospital extensions (£13,000), for the Joint Hospital Board; the clerk.

LONDON (HACKNEY, E.).—Additions, chocolate factory, Farleigh Road; W. Hennessey & Sons.

(E.C.).—Buildings, 50-51, Little Surrey Street; Premier Press, Ltd.

(HIGHGATE, N.).—Extensions, Highgate School, Southwood Lane; A. E. Munby, 9, Old Square, Lincoln's Inn.

(HOLBORN, W.C.).—Telephone Exchange, Grays Inn Road; Office of Works.

(BATTERSEA, S.W.).—Conversion of Southlands College into elementary school; L.C.C. Education Committee.

(PUTNEY, S.W.).—Additions, Royston Works, Upper Richmond Road; Simmons Bros.

(REGENTS PARK, S.W.).—New wing, Bedford College for Women; Principal.

(STREATHAM, S.W.).—Shops, restaurant and flats, 68-70, Streatham Hill; Rice & Son.

(ACTON, W.).—Technical institute and school (£50,263), for Middlesex E.C.; Sir B. S. Gott, secretary, Westminster Guildhall.

MARCH.—County hall extension, Isle of Ely; county surveyor.

MILFORD HAVEN.—Central school; Pembroke Education Committee. Sanitary block, County School; Pembrokeshire Education Committee.

NEWCASTLE.—100 houses, High Heaton, for Corporation; J. Jacob Paget. Baths, Armstrong Road (£42,500); city engineer.

NORTHAMPTON.—Extensions, town and county school; Education Committee. Additional 84 houses, Weedon Road Estate, for the T.C.; A. Fidler, borough engineer.

ONGAR (ESSEX).—Housing scheme (32), for the R.D.C.; P. R. B. Pearce, surveyor.

PENKULL (STAFFS.).—Development of Garden Village for Stoke-on-Trent Tenants, Ltd.; W. Campbell & Sons, architects.

PENRITH.—Bottling stores, Roper Street; Glassons Brews, Ltd.

PENZANCE.—Scheme for 190 houses, York House Estate; borough engineer.

PERTH.—Stores and workshops for T. Love & Sons, cabinetmakers, St. John's Place; the manager. Repairing factory for Messrs. Norwells' Perth Footwear, Ltd., 47, High Street; the manager.

PLYMOUTH.—United Methodist Church; trustees. Maternity wards, Alexandra Homes, St. Michael's Terrace; Committee.

PORTSLADE.—Electricity for lighting and power; Petersfield Laundry.

ROCHDALE.—Super cinema and café, Wet Rake, Drake Street (£30,000); for Roach Dale Amusements, Ltd.

SCOTLAND.—1,000 steel houses, for various authorities in middle and west Scotland; Second Scottish National Housing Company (Housing Trust), Ltd.

SEAHAM HARBOUR.—72 houses, Carr House Estate; U.D.C. surveyor.

SHIPSTON.—Electric lighting, Police Station and Court; Worcestershire Standing Joint Committee.

SKEGBY.—Elementary school (£16,500); Notts. Education Committee.

SOUTHGATE.—56 houses, Barrow Close; Church Army Housing, Ltd.

STIRLING.—Picture house at 48, Queen Street; Messrs. Menzies Bros., 15, Orchard Place.

STOKE-ON-TRENT.—150 houses for Michelin Tyre Co., Ltd.; city architect.

STOURBRIDGE.—Girls' secondary school (£26,424), for Worcestershire E.C.; A. H. Guest, Ltd., builders, Coalbournbrook Wharf. Extensions to Grammar School (£7,500), for the Governors; the clerk.

STRATFORD-ON-AVON.—Extensions, Grammar School (£20,000); Governors.

THRAPSTON.—Secondary school for girls; Northants Education Committee.

TORQUAY.—Wesleyan Church, Union Street (£23,160); R. F. Yeo & Son, builders. Telephone exchange, Westhill; Office of Works.

TYNEMOUTH.—Electricity supply, new premises in Mariners Lane; British Petroleum Co., Ltd. 56 tenements, Percy Street; Corporation housing architect.

WALLASEY.—Joint mental hospital; Corporations at Wallasey, Birkenhead, and Chester.

WARWICK.—Extensions, county offices, Warwickshire; county architect.

WELSHPOOL.—County offices (£10,000), for Montgomeryshire C.C.; C. S. Thornley, architect, Liverpool.

The
Electrical Review

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Contents:

	PAGE
The Trading Clause	913
The I.M.E.A. Convention	914
The Birthday Honours	914
Stourport Electric Power Station (*illus.*)	915
Our Overseas Electrical Markets (*illus.*)	918
E.H.P. Transmission, by G. W. Preston	919
The Power Supply of Wireless Sets	921
The Shops Hours Bill, by W. Eric Jackson	922
Cheaper Wiring	923
A Russian Electrical Manufacturing Concession	924
Business and Industrial Notes	925
Lighting and Power Notes	929
Tramway and Railway Notes	931
Telegraph and Telephone Notes	932
Radio Notes	932
Contract Information	933
Forthcoming Events	934
Notes	934
Institution Notes	937
Our Personal Column	937
Financial Section—	
New Companies Registered	938
Official Returns of Electrical Companies	938
City Notes	940
Financial Section—*continued.*	
Stocks and Shares	941
The Incorporated Municipal Electrical Association.—III (*illus.*)	943
Distribution over an Extensive Area (Discussion)	944
Recent Developments in Power Plant Design	944
The I.M.E.A. Exhibition	948
Reviews	949
High-Frequency Electric Furnaces (*illus.*)	949
Electrical Calculator Charts (*illus.*)	950
Selected Radio-Telephone Apparatus (*illus.*)	951
Correspondence—	
Energy Consumption in Small Houses	952
The Ideal Wiring System	952
Metal-clad Draw-out Switchgear	952
A Mysterious Occurrence	953
Single-phase Induction Motor Starting Devices	953
The Preservation of Historical Electrical Plant	953
Cheap Electricity	953
Parliamentary News	954
Legal	954
The Danish Electrical Industry	954
Published Specifications	955
Trade-mark Applications	955
New Work for Contractors	956

The Trading Clause.

THE announcement of the names of the gentlemen who have been approved by the Electricity Commissioners as members of the Committee which is to deal with the celebrated Section 48 of the Electricity (Supply) Act, reached us too late for us to make any comment upon the matter in our last issue. We were obliged to be content with the mere statement of the *personnel* and its objective, which is "to determine any question which may be raised under Section 48 of the Act as to the recognised retail or trade prices of any electrical fittings and to advise and assist the persons concerned as to the method of giving effect to the provisions of the Section."

Twenty representatives of the various sections of the industry and trade who have an interest in the aforesaid matter will be presided over by Mr. D. N. Dunlop, Director of the B.E.A.M.A. The municipalities, the electrical manufacturers, electric light fixtures and accessories manufacturers, the electric lamp-makers, the cable-makers, the wholesalers, and the electrical contractors, will all be there, while the Scottish electrical contractors have two representatives of their very own.

Those who are familiar with the long struggle that has taken place in the industry know only too well how difficult and at times almost despairing has been the problem of bringing a spirit of compromise into existence. They will be quite ready to allot praise wherever it may be due for heroic efforts made to remove stumbling blocks that have persistently appeared in the pathway of negotiation, and a number of names given in the list of members of the new committee might be selected by us here for the purpose of giving credit to several gentlemen whose services proved particularly useful in bringing matters to the present promising position. Mr. Phillips, in his presidential address to the I.M.E.A., singled out Mr. A. C. Cramb as the one to be especially congratulated

for services rendered to the municipal electricity supply interests by bringing the question of selling powers to a successful conclusion. If there had been spokesmen on behalf of the manufacturers and the contractors, other names would have been mentioned as having exercised no less important or less assiduous influence in their own particular sphere both inside electrical circles as tactful negotiators and outside as diplomatic representatives. But while expressing gratification at the setting-up of the Committee and satisfaction with its *personnel*, let us not imagine that our work is finished. In actual fact it is only about to begin. Mr. Phillips, whom we quoted last week, remarked that "he thought" that the problem of the complete accomplishment of co-operation between the supply and electrical contracting branches of the industry was "approaching solution." Memory, if nothing more, must make us all equally guarded, however optimistic we may be. But we can at any rate take heart from the fact that the spirit of co-operation has led us thus far and "the excellent spirit evinced by all parties to the negotiations" fructuated in Section 48. Without that spirit there could have been no such clause—perhaps we do not all know how near we came to actually losing it; and if one thing is more certain than another now that we have it, it is that that spirit of co-operation which has stood us in such good stead must, as Mr. Phillips remarked, be maintained and strengthened in operating the Section.

There have been few more important electrical committees appointed in recent years, and none can do more than this one to smooth out the way for fuller domestic electrical development. That there will be many difficulties to meet is certain, but if this Committee cannot find a way to overcome them no other body of men can do so. Specialised experts as they are, however, not one of them will be able to contribute to the practical solution of the problem if he fail in respect of the spirit of co-operation.

The I.M.E.A. Convention.

THE fact that the annual Convention of the Incorporated Municipal Electrical Association which was held last week was the thirty-second of its order did not deter a speaker at the dinner from referring to the infancy of electricity; but the record attendance bore witness to the constantly growing vigour and importance of the industry, suggesting that it was at least approaching maturity. Mr. R. W. L. Phillips, retiring after an exceptionally strenuous year of office, is to be congratulated upon the very successful Convention over which he has presided, and his successor, Mr. F. W. Purse, is likewise to be congratulated upon attaining a position which will afford him the fullest opportunity to employ his undoubted talents in the interests of the Association and of the electricity supply industry.

The papers and discussions at the Buxton Conference were of a high order, on the whole, and will provide much food for thought. Mr. W. C. Bexon's able and comprehensive review of the problem of electricity supply over a large area was particularly useful in view of the developments foreshadowed under the Government scheme, especially in respect of the difficulties that the supply engineer has to contend with, and the convenient list of much-needed amendments which he appended to his paper was cordially approved in the discussion. It is singular that whilst the Government scheme was specifically designed to hasten the provision of a cheap and universal supply of electricity, no attempt was made in the Electricity (Supply) Bill to clear the obstacles out of the way, although attention had been repeatedly drawn to the importance of this matter. Whilst further legislation is not likely to be introduced for some considerable time, much could be done by the Electricity Commissioners, not only relaxing the stringency of their regulations, but also, as Captain J. M. Donaldson suggested, by providing explanatory memoranda and official documents; where a local engineer or manager can make little headway against misguided opposition, a Government department can bring powerful influence to bear without either exceeding its powers or incurring expense.

Mr. T. Roles passed in review the many new developments in the design of generating plant which have taken shape during the past ten years, and which, though slowly carried into effect, bid fair to produce fundamental changes in central-station practice. We have already referred to the experimental character of some of the new departures, which has caused the designers of new power stations supplying large communities to adhere to standard practice for the sake of unquestionable reliability and continuity of service, a consideration of the utmost importance; but history teaches that progress must inevitably continue, and Mr. Roles himself has the proud distinction of leading the way in this country with the 1,100-lb. per sq. in. steam plant that he is installing at Bradford. All the more credit attaches to this bold step in view of the difficulty experienced by engineers in municipal service in securing authority to depart from the beaten track, and the Bradford Electricity Committee deserves the thanks of the electrical engineering industry for adopting so progressive and enterprising a policy. Mr. Roles quoted from the admirable paper read by Mr. H. L. Guy before the Institution of Mechanical Engineers, on "The Economic Value of Increased Steam Pressure," which we judged to be of so much importance that we recently reproduced almost the whole of it in our pages.

Mr. H. H. Berry read his paper on the "Electrified Homes of Great Britain" with, we believe, the spirit of a martyr, for it was common knowledge that the policy which he advocated was highly distasteful to many of the members—being, in fact, described as anti-propaganda; however, he was not roughly handled, and the discussion was notable for the enthusiasm and ability displayed by the women who took part in it. We think the I.M.E.A. is doing good service by inviting the Electrical Association for Women to participate in the Convention; the E.A.W. is still a newcomer in the electrical field, and its members keenly appreciate the opportunity of conferring with the senior Association and expressing their views on domestic electricity supply in public debate.

The Birthday Honours.

THOUGH electricity and electrical developments have occupied a foremost place amongst public questions and affairs during the past year, nobody will accuse the powers that be of distributing the King's Birthday honours with a prodigal hand to those connected with either the science or the industry. In conferring the distinction of Order of Merit upon Sir C. A. Parsons, F.R.S., His Majesty has given further national recognition to the genius and achievement of an engineer whose work has been of immense value not only to British power station engineering, but has contributed magnificently to the glory and prestige of British engineers wherever the turbine has found its way on or by land and sea. In every engineering circle there will be full approval and satisfaction at the inclusion of Sir Charles Parsons in the number of those who wear the rare and much-coveted Order of Merit. To some it may seem that it has come later than it should, but the timeliness of it in view of the national trust in new power-station activity is beyond question. The second outstanding electrical name in the Birthday List is connected with the commercial rather than the engineering side of electricity development—we refer to Sir Harry Benedetto Renwick, K.B.E., who is made a Baronet "for political and public services in connection with electricity schemes" (to quote *The Times*). Sir Harry is the chairman of the County of London Electric Supply Co., Ltd., which owns the Barking power station, which was opened by His Majesty. We give the names of other gentlemen who have received recognition of their public and other services in this year's List, in our "Personal" column.

Stourport Electric Power Station.

A new 25-cycle capital generating station capable of extension to an ultimate capacity of 250,000 kW, designed to serve, in conjunction with other plant, the Central England district, a scheme for which is being prepared by the Electricity Commission.

INCORPORATED in 1903, the Shropshire, Worcestershire and Staffordshire Electric Power Co. has grown to be amongst the largest undertakings of its kind in this country. Its distribution area includes both rural and industrial districts, covering practically the whole of Worcestershire, the southern portion of Shropshire, and portions of South Staffordshire; it has further been entrusted with the task of supplying electricity in the "Avon Valley" area, which includes parts of north Gloucestershire and south-west Warwickshire, a total of about 1,412 sq. miles. To meet the increasing needs of the area a new capital station at Stourport was formally inaugurated on June 2nd by Mr. Stanley Baldwin, Prime Minister, in the presence of a distinguished gathering numbering some 1,500 persons, who were received by Mr. E. Garcke, chairman of directors, Mr. W. G. Bond, managing director, and Mr. J. T. H. Legge, chief engineer, of the Company.

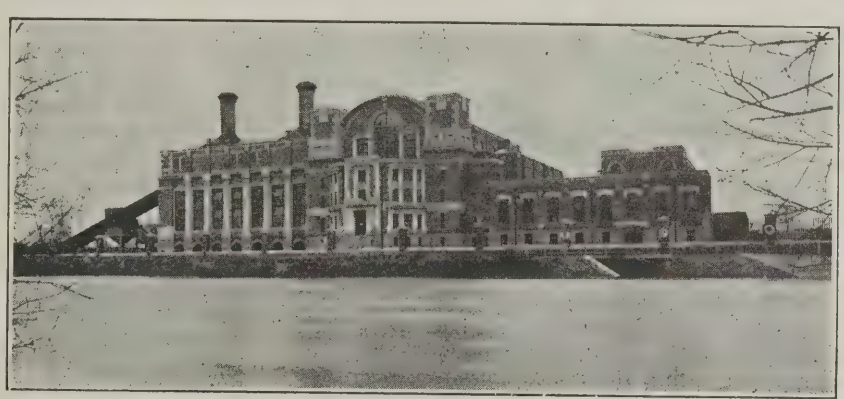


Fig. 1.—The New Stourport Generating Station.

river, whilst the amount of water available will permit of the plant being developed to a capacity of 250,000 kW without the use of cooling towers; a minimum of 240 million gallons per day is obtainable. Resting on sandstone rock 14 ft. below the surface of the ground, the foundations consist of Raymond piles (composed of concrete poured into reinforced steel shells previously driven on mandrels) in groups, the tops of which are bound together by reinforced-concrete beams, on which a reinforced-concrete raft is superimposed in sections to allow for expansion which is expected to result from the periodical saturation of the ground when the river flow is at its maximum. The steel-framed brick superstructure has ferro-concrete floors and the roofs are supported on "Siegwart" pre-cast hollow concrete beams.

The building work was carried out by the Mitchell Conveyor and Transporter Co., Ltd., which also supplied the coal- and ash-handling installations, each unit

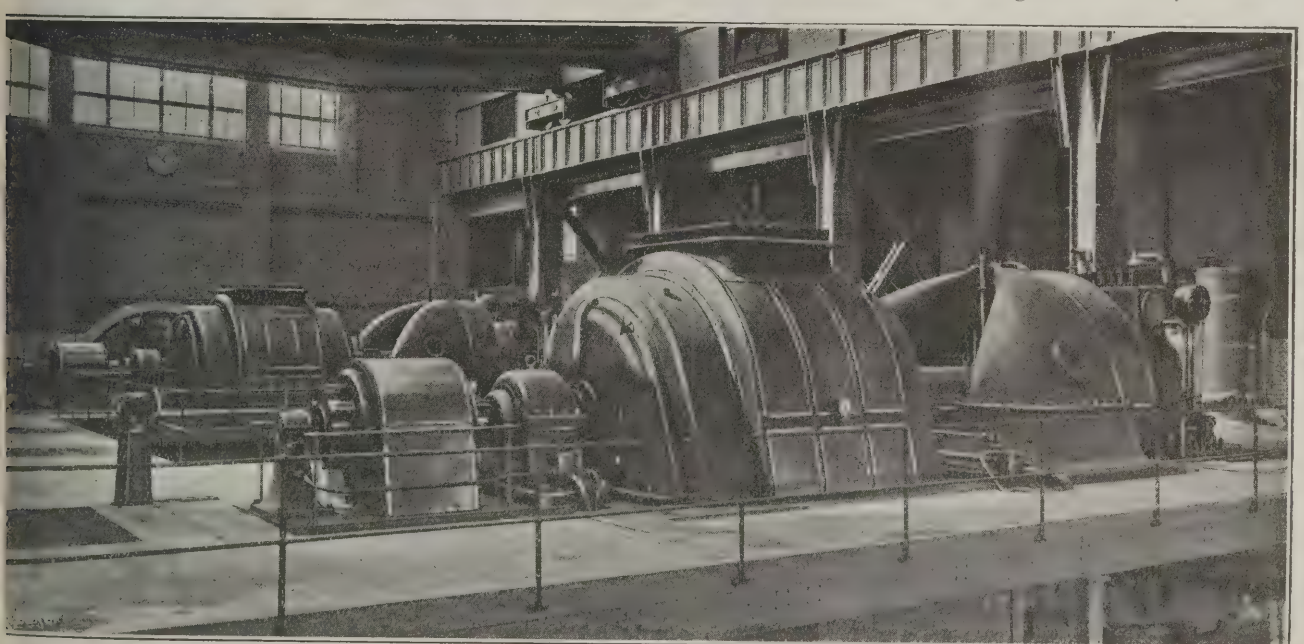


Fig. 2.—The First Two 25-cycle, 3-phase, 1,500-r.p.m., 5,500-V, 18,000-kW Steam Turbo-generators Installed.

The 32-acre site of the station, with 20 adjoining acres affording access to the docks of the Staffordshire and Worcestershire Canal Co. and the Great Western Railway, at the confluence of the Rivers Stour and Severn, is favourably situated for the delivery of fuel from the Midland coal fields *via* canal, railway, and

of which can handle 50 tons per hour, but slight modification will increase its capacity to 100 tons per hour. The coal is unloaded from barges in the canal basin by grabs operated from two travelling jib cranes, discharging on to two collecting conveyors running parallel to the quay, through receiving hoppers on to a second

series of ball-bearing 24-in. belts that carry the coal over the public road to a transit storage bunker; the cranes are electrically driven, the hoisting, slueing, and travelling motions being each operated by a separate motor. The 250-ton ferro-concrete transit bunker, which is divided longitudinally to hold two classes of coal, feeds the coal through chutes to wagons drawn by

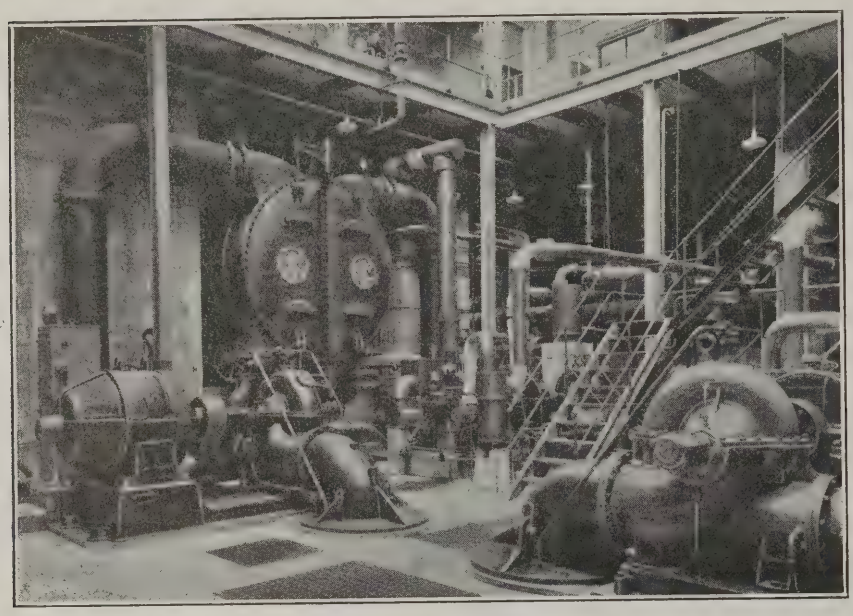


Fig. 3.—A 25,000-sq. ft. Condenser and Auxiliary Plant.

"English Electric" storage battery locomotives having a speed of over six miles per hour and capable of hauling a loaded train of 18 tons weight on a 30-in. gauge track to the storage ground adjoining the boiler house. At this point the wagons discharge through hoppers at ground level on to the storage conveyor by means of which the coal is stored by a butterfly stacker fed from the main conveyor that feeds the raised hopper, by means of which reclaimed coal is returned to wagons. A re-claiming travelling jib grab crane runs parallel to the stacking conveyors and is used for trimming the coal and also for re-discharging either to wagons or direct to the boiler house covered inclined conveyors. Automatic weighers are fitted at each point where it is required to know the amount of coal passing, whether into stock, from stock, into the bunkers, or from the barges. All ash leaves the dumping bars through hoppers into a water trough, from which it is carried by a drag link conveyor to a special hopper for transferring to ash wagons.

The steam-raising equipment, supplied by the Stirling Boiler Co., Ltd., comprises four "tri-drum" water-tube boilers with Stirling superheaters and Babcock & Wilcox economisers. The feed-water system is closed, Weir pumps being used and the make-up evaporated, with preliminary heaters supplied with steam bled from the turbines; provision is also made for utilising live steam from the boilers for this purpose. At a temperature of 150 deg. F. the water enters the economisers and is raised to 250 deg. F. before entering the boilers, a steady feed being maintained by Cope automatic regulators. Each boiler has 10,000 sq. ft. of heating surface, and is normally capable of evaporating 60,000 lb. of water per hour to steam at 350 lb. per sq. in. pressure, superheated to 686 deg. F.; under overload conditions, the four boilers are capable of supplying 320,000 lb. of steam per hour at the aforementioned pressure and temperature, and under each are two Babcock & Wilcox component-type chain-grate stokers, with a combined grate area of 324 sq. ft. One "Sirocco" forced-draught and one induced-draught fan are fitted per boiler and the flue gases pass through Davidson dust collectors situated at the bases of the two chimneys.

In addition, each boiler is equipped with six pressure jet oil burners, designed to obtain 30 per cent. of the normal evaporation of the boiler. One of these burners is fitted in the front of each mechanical stoker, and so arranged that sufficient temperature can at any time be obtained for the ignition of low-grade fuel. The oil installation is primarily incorporated to meet sudden demands for steam, thereby dispensing with the necessity of keeping stand-by boilers. Avery automatic weighing machines are provided on each stoker hopper, specially designed for weighing wet slack; besides Diamond soot blowers, soot pockets are also being provided from which the flue dust will be extracted by Smith & Yates suction plant. Special attention has been paid to the incorporation of instruments on a panel at the front of each boiler with the starters and shunt regulators for the motor fans situated immediately beneath.

The turbo-generators in the first section of the station were supplied by the British Thomson-Houston Co., Ltd., and consist of two main sets each of 18,000 kW and a house-service set of 750 kW capacity. Each of the main single-cylinder turbines of the impulse 17-stage type runs at 1,500 r.p.m. and drives an alternator having a maximum continuous rating of 22,500 kVA, 80 per cent. power factor, generating three-phase current at 25 cycles, 5,500 volts. Mounted on each alternator shaft is an auxilliary shunt-wound d.c. generator rated at 250 kW, 460 volts, connected through a control pillar to the auxiliary circuits for the condenser pumps, thus each turbo set is self-contained and is provided with an auxiliary turbine-driven oil pump, a main governor arranged for motor operation at 230 volts d.c. and an emergency governor with an electrical tripping device on the switchboard. Each alternator is provided with a direct-coupled exciter, and the stator frame is hollow in section, the space between the outer

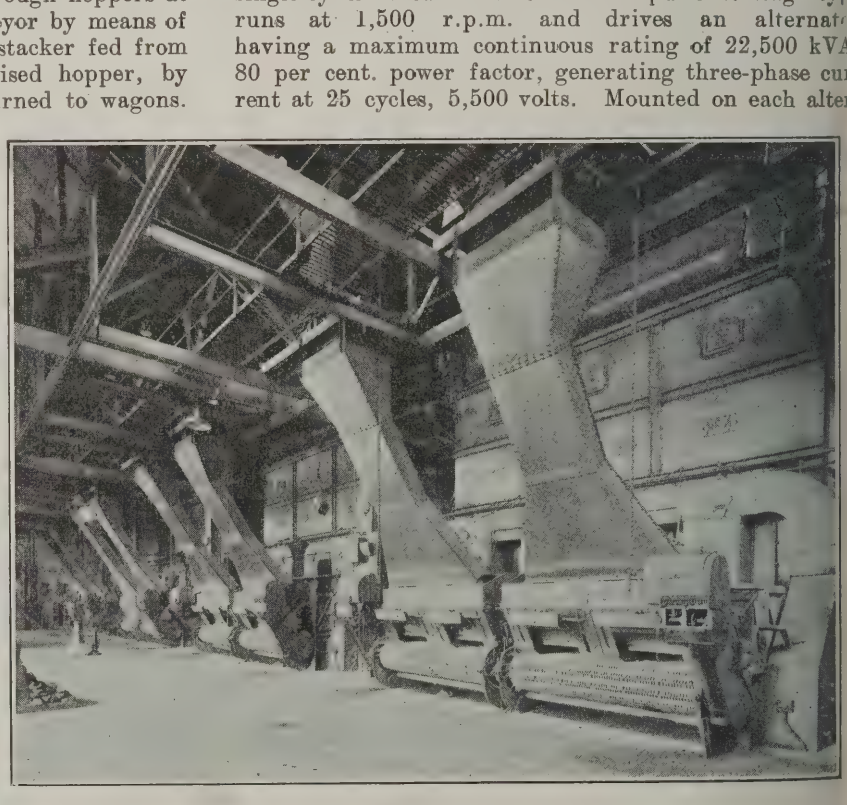


Fig. 4.—The four 60,000-lb. "Tri-drum" Boilers.

hell and the core laminations forming a chamber from which the heated air passes to the coolers in the foundation. A complete system of distance-temperature thermometers was supplied by the Cambridge Instrument Company, Limited.

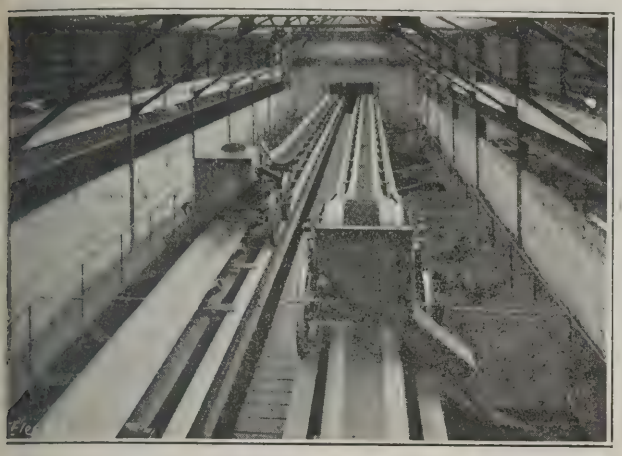


Fig. 5.—Boiler-house Coal Conveyors over Bunkers.

All the condensing plant was manufactured by Cole, Marhant & Morley, td., to maintain a 9-in. vacuum when ealing with 150,000 b. of steam per hour ith circulating ater at the rate of ,050,000 gallons er hour at a temerature of 55 deg. '. Each condenser as a cooling surface f 25,000 sq. ft. and s of the two-flow ype, with divided ater heads, so that ne half of the tubes an be cleaned without shutting down he plant. Each is

460 volts, and the other by a small vertical turbine. There are two Mather & Platt circulating-water pumps, each capable of dealing with 63,000 gallons of water per hour; one is driven by a d.c. motor rated at 138 b.h.p., 460 volts, and arranged for speed variation from 615-685 r.p.m.; the other is driven by a B.T.-H. turbine rated at 138 b.h.p., 6,000 r.p.m., geared down to the pump speed of 650 r.p.m., and exhausting against 20 lb. absolute back pressure into the low-pressure heater in conjunction with the steam tapped from the main turbine. The two Weir condensate extraction pumps for each set are driven by a d.c. motor and a steam turbine, which also exhausts into the heater steam range: they discharge into the closed feed system; when the condensate temperature is 73 deg. F., the temperature rise due to passing through the air extractor heater is 7 deg., the temperature rise due to passing through the drain cooler heater is 2 deg., and the temperature rise due to passing through the main feed heater is 68 deg., the temperature of the condensate entering the boiler feed pumps being 150 deg. F.; feed heat can also be provided from the bleeder belt of the main turbine at 11 lb. per sq. in. absolute. Each plant is provided with a Weir evaporator for supplying make-up water to

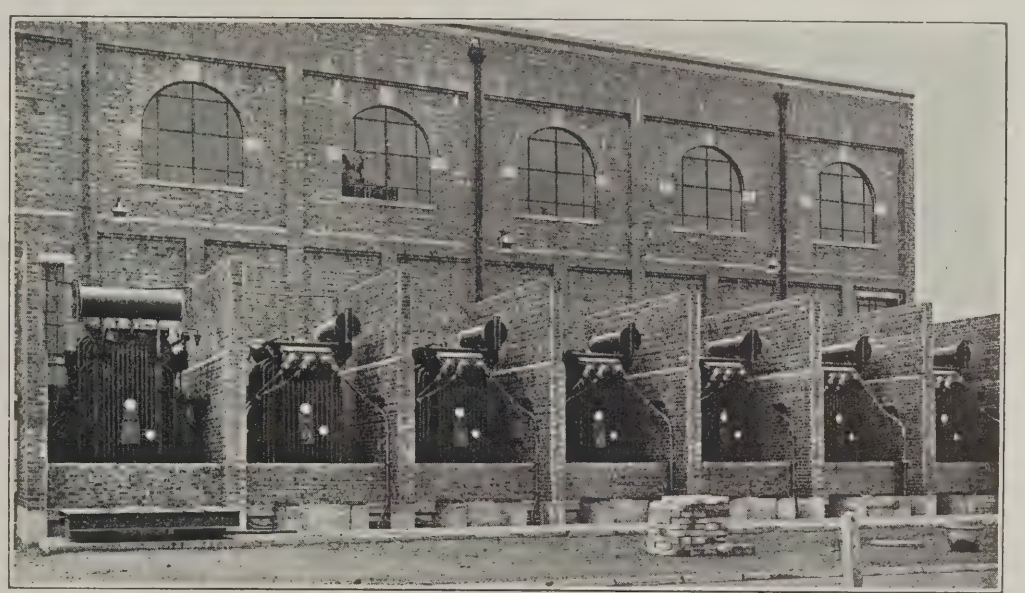


Fig. 6.—Three-phase 33,000/11,000-volt Outdoor-type Transformers.



Fig. 7.—Main 33- and 11-kV Oil Switchgear Control Room.

rovided with a duplicate set of steam-jet Delas air exactors. The extraction and lift pumps are also in uplicate, one being driven by a 32-h.p. d.c. motor at

the system, the duty being 7,500 lb. of water per hour; steam is tapped off the high-pressure ends of the main turbines at a gauge pressure of 70 lb., but in the event of this supply not being available an auxiliary connection to each evaporator can be used for operating on live steam at 325 lb. pressure. A "cushion" tank is provided between the condenser and boilers; all drain recovery is led to this tank, which is connected to the top of the main condenser by a 3-in. pipe delivering make-up to the main condenser for de-aeration, after which such water is passed to the closed-feed system proper.

(To be concluded.)

Our Overseas Electrical Markets.

Trend of import trade of Australia, New Zealand, India, and Africa. Factors affecting purchasing power.

IN continuation of the survey of our principal overseas electrical markets which appeared in the ELECTRICAL REVIEW of January 21st, 1927, it is now possible to show the position during a further period of three or four months. The countries covered are Australia, New Zealand, India, and the Union of South Africa. With regard to Australia, greater detail can now be given than was available when the former survey was made; in addition to charting the trend of the import trade in cable and wire, that in dynamo-electric machines, filament lamps, and telegraph and telephone material is also recorded in fig. 1 since July of last year. Taken as a whole, it will be seen that the Commonwealth's import trade in electrical material is well maintained. The feature of New Zealand's record (fig. 2) is the high total of electrical machinery and

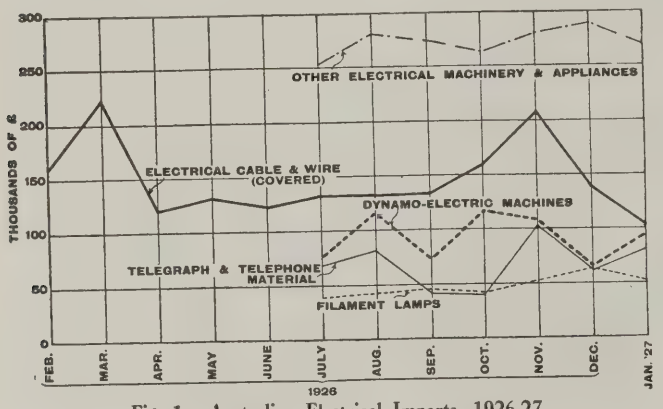


Fig. 1.—Australian Electrical Imports, 1926-27.

equipment in December last, a smaller vertical scale is used for the total; only in one month (*i.e.*, March, 1925) during at least the past eighteen months has this level been surpassed. New Zealand's imports of telephones and accessories also reveal a healthy and regular upward tendency.

In India's electrical trade it is noticeable that while great Britain maintains her predominant position in

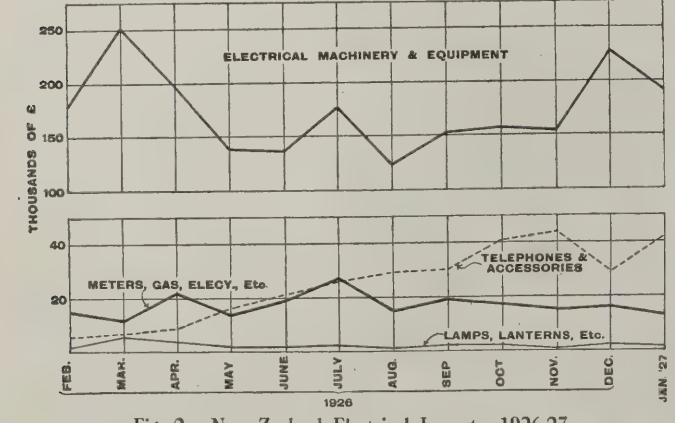


Fig. 2.—New Zealand Electrical Imports, 1926-27.

the imports of telegraph, telephone, and other apparatus (fig. 3), without either Germany or the United States gaining any considerable permanent success; there are signs that the United States is still obtaining some good contracts for machinery (fig. 4). For convenience, in figs. 3 and 4, the sections showing the shares of Germany and the United States are on a larger vertical scale than those showing the total values and Great Britain's share.

With regard to the imports of the Union of South Africa (fig. 5), the noteworthy feature is the steady upward trend since the autumn.

It is hoped that a study of these charts will furnish manufacturers and exporters with some useful indications as to whether they have been obtaining their fair share of the business that is offering in these markets.

It will also be of utility to review factors affecting the general purchasing power of these countries.

Australia.

The natural increase in population in Australia according to the latest statistics, is now the greatest in

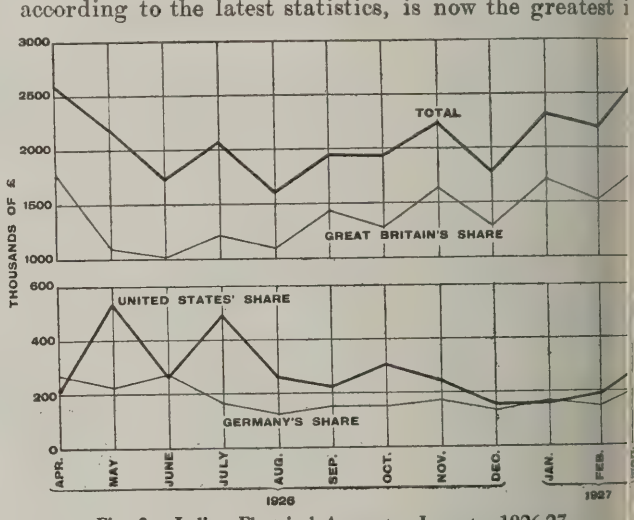


Fig. 3.—Indian Electrical Apparatus Imports, 1926-27.

the world relatively to the population. Wool growing continues to prosper, the number of sheep shorn in the 1926-27 season being 51,880,000, as compared with 45,550,000 in the previous year and 41,320,000 in 1924-25, and the average clip 8.8 lb. per sheep shorn as compared with 8.1 lb. and 8.25 lb. respectively. Producers have been fairly well satisfied so far with

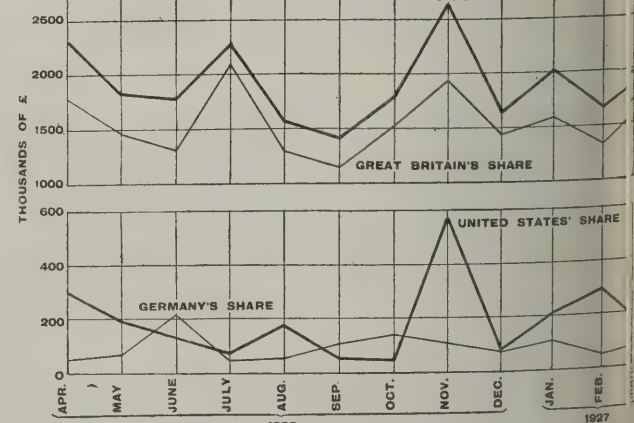


Fig. 4.—Indian Electrical Machinery Imports, 1926-27.

the prices realised. Although there has been a more than usually large adverse balance in the foreign trade of the Commonwealth, it is expected that, during the next few months, this will be much reduced owing to the large quantities of raw materials available for export. The 44-hour working week which is being introduced is a factor which will influence the prospects of import trade, as it will increase production costs. It

elieved also that it will reduce output. While the pre-ent wide gap between exports and imports exists, the ankers are inclined to curtail credits in order to check nports as far as possible.

The prospects for the wheat harvest are, on the whole, ood, the forecast for South Australia showing a larger ield in bushels per acre than in the previous season, ith a small increase in acreage. The estimate for Vestern Australia is also favourable, while that for

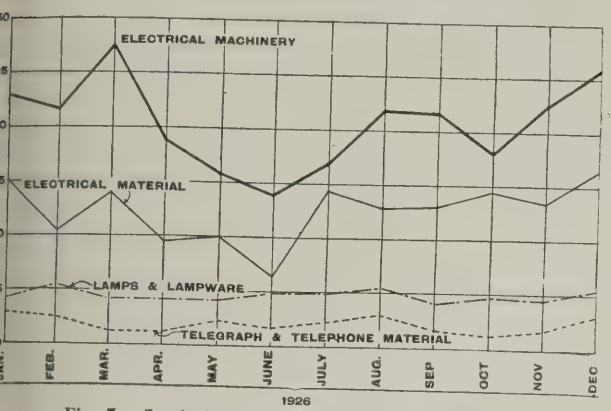


Fig. 5.—South African Electrical Imports, 1926.

ew South Wales is 9 million bushels more than in 25-26. Railway receipts have been advancing, while th the Commonwealth and State revenues are re-rted to be well ahead of estimates.

New Zealand.

Although the import market of New Zealand is quiet ing to large stocks, the position on the whole appears be quite sound. A very satisfactory return is being eived from the wool crop, but the prices of meat and ry produce are a little disappointing. New Zea-d's exports during the first two months of the year alled £10,221,000 in value, and her imports ,304,000. The corresponding figures for the same nths of 1926 were £9,369,000 and £8,951,000.

Unemployment generally in March showed a small in-ase compared with February, and a considerable ance compared with about twelve months previously; the engineering and mechanical trades, however, re was a decrease in March compared with February. avourable feature is the decline in mid-February of points in the index number of the cost of food, which, ever, is still 46 per cent. over that for July, 1914, while including clothing and rent, the expenditure of 20s. before the war went as far as 32s. 6d. in February this year.

South Africa.

In South Africa the recent mining developments are now favourably affecting trade both wholesale and retail. The gold output for April, although showing a decrease on the previous month, was better than in April last year. The agricultural outlook is satisfactory in both the Transvaal and the Free State, and in the drought area in the West and South there has recently been a moderate rainfall. Business in iron and steel during April was brisk, and employment was good in the building trades and in industry generally. In the motor trade, which is an excellent barometer of the purchasing power of the country, improved sales are reported from Cape Town; while Johannesburg, Durban, and East London are buying much as usual; in Port Elizabeth, according to the report of the National Bank of South Africa, Ltd., sales of cheap cars are excellent.

The South African Railway Administration is making provision for handling more traffic in 1927-29 than in 1926-27. Mr. Malan, the Minister, recently stated that the railway workshops and machinery must be remodelled and extended and brought up to date; £15,000,000 has been mentioned as the sum to be spent.

India.

In India, the purchasing power of the ryot is improving, and he is more ready to spend than at any time during the past two or three years. Further improvement is expected to result from the Government schemes for encouraging cultivation. Meanwhile, this season's cotton crop is short in quantity and lower in value than the last. Jute also is yielding less favourable results, but, while the grain crops are doubtful, the exports of tea are satisfactory, and the oilseed crops promise well.

During the current financial year it is hoped to complete 900 miles of new railways at an expenditure of about £10,000,000. Details are believed to have been worked out and are expected to be issued shortly of a scheme for the electrification of the suburban services of the Eastern Bengal railway. The conversion of the North Western railway is proceeding, the next parts to be undertaken being Lyallpur, Sukkur, and Rohri.

A cable from the United States Trade Commissioner in Calcutta reports that the engineering trade is improving.

E.H.P. Transmission.

Some considerations on the possible causes of faults on e.h.p. cables and systems, referring particularly to 33,000-V belted-type cable.

By G. W. PRESTON.

PER-pressure transmission is of ever-increasing importance; not only are high voltages essential for the transmission of moderate nts of power over long distances, they would seem desirable for the transmission of very large nts over comparatively short distances. If the proves to be the case and a great multiplicity of is to be avoided, it will lead to the development ger sizes of cable than are generally employed at t.

le three-core super-pressure cables of .35-sq. in. have been laid, .25 sq. in. is more generally looked upon as being a desirable size. On account of the greater overall diameter of the larger sizes of cable, and of their greater rigidity, the employment of some sort of metallic binder on the cores would seem to be essential, both from the point of view of the mechanical support which it would give to the paper to prevent puckering, and of the increased potential gradient, with a reduction of dielectric thickness, made possible by the presence of such a metallic wrapping, potential gradients of as much as 5,000 volts per mm. being possible.

Unfortunately the performance of the ordinary type

of belted three-core, 33,000-V cable (I do not refer to cables of the "H" or "S.L." types) has not been entirely satisfactory during the past few years. While a considerable amount of research work has been carried out in the laboratory in an endeavour to produce a satisfactory 33,000-V cable, it has become increasingly evident that certain factors in the breakdown of such a cable in service have not as yet been reproducible in the laboratory.

Although the greatest care is exercised both in manufacture and in the subsequent handling of the cable, which is subjected to thorough d.c. and a.c. pressure tests, due precaution being taken that such tests are not injurious to the cable, after thus having been proved capable of withstanding at least twice its ordinary working pressure it breaks down after only a few months of service.

It is evident from the fact that a period of time elapses before breakdown occurs, that some time-voltage relationship exists with which the cumulative effects of frequent surges and pressure rises, due to switching operations or faults on other branches of the system, combine to produce a gradual deterioration of the dielectric. The fact that a cable is frequently not loaded to its fullest extent until some time after it is put into service may in some measure also account for this lapse of time. The damaging effects of a fault on other cables connected to the same system are especially evident in the case of a cable running in parallel with the faulty one, a fault on the one cable being frequently followed by a fault on the other. It is possible that the shock thus sustained by the second cable might have no permanent effect if the cable were allowed to rest for a short period. The reverse to this usually occurs, the cable being called upon to carry the combined loads of the two cables while the fault is being repaired.

Not only may damage be caused by pressure surges when a fault occurs, but so large are the forces brought into play by the sudden dissipation of the enormous amounts of energy that, even with the most sensitive protective devices, permanent damage is probably caused to the sound portions of the faulty cable.

It has been found that 33,000-V cables have proved particularly liable to failure where they have been laid in cast-iron pipes. These failures have occurred not only in the pipes, but in their vicinity, and could be due to a number of causes. The cable may be mechanically damaged during pulling operations, this being particularly liable to occur when the pipe run is not straight, especially if the deviation is in two planes simultaneously. In such cases there is a danger of the cores being separated and voids formed at the weakest point of the dielectric.

The dissipation of heat from the cable in the pipe is less than when the cable is laid direct in the ground, and although it is common practice to lay cable of larger section in pipes, the lower thermal conductivity of the air in the pipe combined with the fact that the cables are usually laid at a greater depth, often in concrete, at points where pipes are used, may account for a rise of temperature at these points. Such an increase of temperature would have an adverse effect upon the dielectric, and would cause an increased expansion of the coppers, which, if no provision were made to counteract it, might produce a distortion of the cores.

It is just possible, however, that the explanation is purely electrical. On the occurrence of a fault, a heavy out-of-balance current would flow, setting up a magnetic field external to the cable. Under these conditions the sudden rush of current encountering an increased reactance due to the inductance of the iron pipe surrounding the cable might cause a sudden rise of pressure in the cable at these points, resulting in damage to the dielectric. Although this might not produce immediate failure, it would lead to a breakdown soon after the cable was again put into service.

A considerable number of failures have been found to occur at times of light load, such as at week-ends and in the early morning. The cause of this is not very clear, though it is evidently due to the cooling of th cable at these times. The contraction of the impregna ing compound may cause it to drain away from portion of the dielectric where deterioration has alread commenced, thus encouraging the extension of charrin and the eventual linking-up of two such spots, causin final breakdown. Secondly, as the cable cools, it possible that the contraction causes a reduction of th internal pressure of the compound, and any air in th dielectric becomes more easily ionised, resulting i breakdown at a previously weakened spot.

Some investigators have noted that the internal di charge in a high-voltage cable under test has bee clearly audible, it having been possible to note th period of the test at which this has occurred. It woul be interesting to conduct a series of tests to determir the effect on this audible period of discharge of mai taining the compound in the cable at various pressure

The question of the exact composition of the impre nating compound is a matter on which great differenc of opinion exist. A compound should be sufficientl viscous to prevent any undue flow on gradients, whic sets up a danger of the high points of the cable drai ing dry, the head of compound at the same time exer ing considerable pressure on the lower portions of th lead sheathing. While impregnation is somewhat mo difficult with a viscous compound, more compound ca be retained finally in the paper, and it is less liable to expelled under the influence of the electric field. Th compound, if expelled, however, must be sufficient mobile to flow back again as soon as the stresses a relaxed.

The mobility of a fluid type of compound, if proper taken into account, could be turned to effective use, ar would seem to possess decided advantages. If adequa provision is made by installing reservoir and diaphrag joints on all gradients, and the lead sheath is effective strengthened, the compound in the cable can be mai tained under a definite pressure.

Fluid compound under pressure would have benefici effects on the insulation. It would be less liable to e pulsion from the paper, and would require a minimu period of relaxed electrical pressure to refill the insul tion. At all places the cable would be well filled wi compound, and any voids caused by the distortion the cores during laying or by heating and cooling wou tend to fill up. The compact between the cores a packings would be greatly improved, a point of gre importance in view of the stresses to which these pc tions of the cable are subjected. Any air included the insulation would be maintained under pressure a the ionisation potential increased.

The fluid-compound idea can be further develope the cable being provided with definite oil ducts a actually filled with a fluid compound under pressure *situ*, after the cable has been laid. The cable may, course, be so strengthened by the addition of metal binders as to reduce the risk of distorting the cores the puckering of the paper to a minimum, though su cables as of the "H" or "S.L." types and the o mentioned above tend rather to counteract the effect core distortion than to prevent it.

The fact that in many cases faults have occurred groups, being confined to comparatively short lengt of the total run, might be accounted for in several wa Adverse local conditions at these places, both from t point of view of laying and of subsequent performan are probably the chief factors in these failures. T possibility of the lengths of cable affected bei of faulty manufacture would account for a number faults occurring on the same factory lengths, thou the local effects of one fault on another are in all p bability more largely responsible. A theory th peculiarities of the system as a whole might ren certain points particularly susceptible to transient d turbances is at present without confirmation.

Fortunately the jointing of 33,000-V cables to-d presents little difficulty, the failure of well designed a carefully made joints being very rare.

The Power Supply of Wireless Sets.

An account of the experiences of an engineer when choosing a high-voltage battery eliminator for his wireless set: almost any of the better-class instruments will operate the average receiver with satisfaction.

By G. F. J.

INSPIRED by some notes in the REVIEW on the subject of the power supply for broadcast radio-telephone receivers, we tentatively decided to try an "eliminator" in place of batteries for energising the valve-plate circuit of a receiving set.

Inquiry from radio manufacturers and dealers in the City revealed a wide choice available, ranging in price from about £3 15s. to £12. (A.c. mains only being available where the set is operated, these notes will, of course, apply directly to that type.)

Eliminator No. 1.—We were first much impressed by the product of a Leicester firm, priced at about £8. We called on a dealer in the centre of the City, and asked to have one demonstrated: the dealer did not seem over-keen, but finally connected the instrument to a 4-valve receiver working on the local station. Results seemed good, but when reception from other stations was attempted, a certain amount of hum was heard. When it was pointed out to the dealer, he admitted it, and gave the vague explanation of "the trams" and "lift motors a door or so away" as the cause.

On requesting permission to try one on our own set, it was declined, with the remark that the manufacturers would not allow retailers to have goods on approval and, in all fairness, they could not allow their customers to do so. The assistant did not know the a.c. consumption of the instrument, or the life of the valve used for rectification, or the maximum d.c. output.

However, another dealer was found in a neighbouring town who was also a keen experimenter, and he gave us the chance of testing one at home. The a.c. consumption was found to be about 20 watts, the maximum output at 100 volts was 15 milliamperes, and there was a single fixed "detector tap" at between 50 and 55 volts; it was a half-wave rectifier, the valve in use being of the U.4 Marconi type. The results with our set were very good, but full volume was not obtained owing to the fact that it takes about 22 milliamperes at 120 volts. No hum was perceptible, except when the set was on the verge of oscillation. The range of the set was only very slightly inferior to that usual when "super" dry batteries were employed. The absence of means of regulation of the detector voltage was rather a disadvantage. (This has been rectified in later model.)

Eliminator No. 2.—The second instrument tested was manufactured by a Sheffield firm, and priced at about £7. It appeared to be a two-valve full-wave (or bi-phase, as the term seems to be) rectifier. It had five positive terminals, and the voltage of each increased as the rheostat was turned towards the "on" position. The maximum output could not be accurately measured when the particular instrument was on test, but there was not enough to give full volume to the cone-type speaker usually used. The demand on the a.c. side was 25 watts, and there was no hum, but when also tested on a resistance-capacity coupled set the hum was very bad. (It has since been found that this feature is common to most eliminators, but the trouble can usually be obviated by replacing the grid leaks of the coupling condensers in the set by audio-frequency chokes). In passing, radio valve makers deprecate voltage regulation by decreasing the voltage of the rectifier-valve filament. It is claimed that this increases the impedance, causing heating of the anode, and consequent decrease of valve life owing to release of occluded gases.

Eliminator No. 3.—A large advertisement in the pages of the REVIEW directed our attention to a different type of instrument, which does not employ thermionic valves, but a special gas-discharge tube. Arrangements were made to try one of this type: it is housed in a metal case (which may be earthed if desired) and has a fully variable detector tap of about 7 to 60 volts, or slightly more. The amplifier voltage is given as 135 V, and the maximum output *at this voltage* is given as 25 mA. A neon tube functions as a voltage regulator, and if more than 25 milliamperes be taken, it will cease to glow, and the voltage will drop to about 100 at 30 mA. On the a.c. side the consumption is 8 watts, as near as could be measured; there was no hum whatever, and the range of the set seemed to be as good as usual.

The disadvantage of this instrument is its high price (£10 15s.), but this is probably set off by cheaper running costs and absence of valve replacements. The tube, of course, will last as long as the vacuum in it, and, provided that care in the selection of the glass is taken, this could be several years. Unfortunately, the price would not permit of our purchasing this one, otherwise we would certainly have bought it at once; in fact, in a year or so's time, we may still do so. By the way, "bi-phase" rectification is used in this case.

Eliminator No. 4 was made by a Manchester firm, and had two thermionic valves of the DU.5 type arranged for two-wave rectification. The price was about £8, and taps were provided at 60 volts, 150 volts, and a variable one in 20-volt steps, from 20 to 150 volts. A number of grid-bias taps were also provided, but were not used. The output (maximum) at 150 volts was of the order of 25 mA, and the input current about 20 watts. The instrument gave very good results on the whole, though a faint ripple could be heard superposed on the higher notes of a soprano, or those of a wind instrument; it was not objectionable and could only be detected with difficulty. This firm has since introduced a new model, with voltages as above, but a claimed output of 70 mA. The price also has been reduced to £6 15s. (See footnote.)

Postponement.—After a trial over a day or two, we decided not to do anything definite about this model. There were rumours of something better still (the later model mentioned) and, meanwhile, a set of high-voltage accumulators was returned to the dealer by the purchaser of such an instrument. The opportunity seemed too good to be missed; the price was right, and the condition good, so a bargain was made on the spot. The problem of charging was overcome by installing two DU.5 valves in parallel, filaments heated by means of an ordinary bell transformer, and a two-throw switch with four poles to connect the battery to the charger and close the mains circuit, or to the set, as

desired. This charges at 30 milliamperes, and when the set is disconnected for the night, the charger comes into operation until the set is required again. (The set is used about 36 hours per week on the average, and dry batteries were found somewhat costly.)

Conclusions.—However, these notes are primarily on the "eliminator," and we may sum up by saying that almost any of the better-class instruments will give satisfaction on the average set, taking between 10 and 20 milliamperes; for a smaller output, "super" dry batteries are satisfactory; if larger, high-voltage accumulators are desirable.

The note on resistance-capacity coupled sets (above) has been borne out since by experience; if the set is of a "supersonic" type, only a test can tell whether a battery eliminator will be satisfactory. We are fully aware that many other types are available, apart from those described above, but we have only mentioned those personally tested; the number was restricted by the attitude of the average radio dealer, who expects one to purchase an instrument costing upwards of £5, without reference to whether it will, or will not, work under certain conditions—or even at all, in a very few cases.

Kits of parts for home construction are available in some cases, usually priced somewhere about £2 less than the complete instrument. It is questionable whether home construction is worth the saving; it is much easier to persuade the manufacturer to "service" the complete thing in case of any trouble, than the parts, however carefully assembled. We have by no means exhausted our trials, but have had to postpone them for a few months; meanwhile, perhaps the results of our inquiries will interest readers who also saw the notes on the power supply for radio receivers. So far, our ideal is No. 3, though the price may take some little scraping together; we are also going to test the improved model of No. 4, as soon as the dealer can obtain one. The promised output of 70 mA seems very desirable, for it will mean that a valve of the "super power" type can be operated with a minimum of expenditure.

The new indirectly-heated cathode valves also show a large degree of attractiveness. We seem to be approaching the day when a radio set having a choice of, say, two programmes will be built to run entirely from the mains; a single three-position switch, giving A, B and "off," the only control necessary. The only thing we lack at present is the alternative programmes!

Note.—Since writing the above notes, we have had an opportunity of testing one of the improved type mentioned above, by the Manchester firm. It is now priced at £6 15s (valves extra), the same voltage arrangements are made as on the older model. The maximum output is 70 milliamperes and full-wave rectification is used; the input on the a.c. side is approximately 18 watts. This instrument is much better than the older model; there is no trace of hum when a pair of headphones is connected to the 4-valve receiver used, even when the set is oscillating.

The moderate price and large output have persuaded us to place an order for one of this type. The valves are priced at 15s. each, and should last 1,500 hours. Since we pay about 0.8d. per kWh for our energy (on the inclusive domestic rate) the running cost for the 36 hours per week on the average during which the set is in use will not be heavy, perhaps 2s. 6d. per year. The valves should last a year, giving a total maintenance cost of 32s. 6d. per annum in this case. Add to this the interest on £6 15s., and the grand total (at 5 per cent.) comes to 39s. 3d., which will certainly be cheaper than "super" dry batteries, three per year of 120 volts, at £2 2s. 6d. each, total £6 7s. 6d.

In certain cases a royalty of 12s. 6d. is payable on eliminators.

The Shops Hours Bill.

Important Alterations Proposed.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

IT has long been felt that some revision of the Shops Hours Acts is desirable. At present the majority of shops are regulated by three Acts, and in every case two of these at least apply. Now a further Act is foreshadowed by the introduction of the Shops Hours Bill in the House of Commons.

It may be felt in some quarters that it is rather a pity that the Legislature has not seen fit to cancel all the existing statutes dealing with shops and co-ordinate the law in one comprehensive Act. The Bill does not propose such drastic revision. All that is suggested by it is a limitation of hours of work, regulation of the payment of overtime, and amendment of certain important definitions.

The main purpose of the Shops Acts is not so much to enforce early closing as to ensure reasonable working hours for employés. The present Acts do this by providing that every employé shall have his weekly half-holiday, and by providing that shops shall shut at regulated hours; but, except in the case of young persons under 18, no provision is made as to the hours of daily work. Hence at present a shop assistant may work 14 hours on five days a week and be within the law so long as on the sixth day he ceases work at 1.30 p.m. The provision that shops shall shut at 7 p.m. may be some safeguard to assistants so long as the shop opens at a reasonable hour, but the law has not dealt with early opening. Hence a tobacconist has been held to be quite within his rights in closing at 8 p.m. and opening again at five minutes past midnight. The same applies to shops selling electrical goods.

The new Bill, in Section 1, goes to the root of the whole matter. Henceforth no assistant is to work more than 48 hours a week, exclusive of meals. This provision will probably be much criticised in many quarters. It means that assistants may work from 9 a.m. until 7 p.m. on five days a week and from 9 till 12 on Saturday (or Wednesday). The extension hour on Friday will be impossible unless assistants are given time for tea on each day of the week. The present law contains no such regulation as to hours, except in the case of "young persons," who at present must not work more than 74 hours a week, including meal times. If the Bill passes, young persons and adults will all be on the same 48-hour footing. The shop-keeper must produce a list showing the hours per day for each assistant, and keep the list in a conspicuous place in the shop. A further provision is that if any assistant works partly in the shop and partly in a factory or workshop, the total number of hours worked altogether must not exceed the limit of hours laid down in the Factory and Workshop Act.

As regards overtime, the Bill states that for the first half-hour payment is to be made at ordinary rates, for a further period beyond this, time and a half is

to be paid; and on Sundays and public holidays double time. Overtime is to be reckoned in half hours, any period less than half an hour being reckoned as half an hour. The Bill therefore recognises the need for overtime, but criticism will doubtless be levelled at the suggestion for reckoning 10 or 15 minutes' overtime as half an hour.

The interesting part of the Bill, from the legal standpoint, is the amendment of the definitions of "shop" and "shop assistant." A shop means any premises, or any part of any premises, where any *wholesale* or retail trade is carried on, or which is used in connection with the carrying on of wholesale or retail trade, but not a factory or workshop. It appears, then, that any premises where things are bought and sold is a shop for the purposes of the Bill. The inclusion of wholesale premises is an innovation which will probably make little difference in most cases to the hours, but it will impose on wholesalers the duty of rearranging their staff to fit in with the Bill where necessary, and in every case the list of hours mentioned above will have to be made out and displayed. The definition is very wide and will, of course, include a dispatch and packing department, and very possibly the office. This is borne out by the definition of "shop assistant" who, in the Bill, is described as any person wholly or mainly employed in connection with any shop for the serving of customers or receipt of orders or collection, dispatch, and delivery of goods, or in any clerical capacity. Accordingly, clerks, accountants, carmen, messengers, and very probably commercial travellers are shop assistants, as well as counter hands, for they are all employed in connection with a "shop" in one or other of the capacities above mentioned.

Substantially these are the effects of the proposed amendments. The Bill still leaves untouched the somewhat complicated position of a shop in which two trades are carried on. Closing orders will continue to be made by the local authorities, regulating the hours of closing for different classes of shops. Difficulty has often been felt in the case of a shop which sells articles applicable to more than one trade. Electrical dealers sell lighting equipment, radio apparatus, and motoring accessories. Are they to close on the day appointed for hardware, for musical supplies, or for ironmongery? In cases where a shop has two departments, an electrical side and, for example, a furnishing side, the shop must shut on the electrical side on the day for such shops, but need not shut on the furnishing side if such shops are given a different day. Where an article is common to two trades, it may be sold by exempted trades at all hours, but non-exempted trades may not sell it after hours. Take, for instance, acid for accumulators. Sold by an ironmonger after hours, it would be a breach of the law; sold by a chemist when ironmongers were shut, but during the extended hours for chemists, it would be quite legal; sold by a motor dealer at any hour it would be legal. The question is not so much whether an article is hardware, musical supplies, or motor accessories. A trader must not trade at all beyond the hours laid down for that particular class of shop. There may seem some inequality in this, and the inequality may become even more apparent when wholesale houses are brought within the Shops Acts; but such is the law, and the only remedies are either to prevent the proposed amendments and to seek an alteration of the existing Acts, or to have each business put into several classes by carrying on in each shop several distinct trades so that articles common to all those trades may be sold at all hours.

Cheaper Wiring.

The Petty Objections of Urban and Rural District Council Authorities.

By H. W. C.

IN spite of the I.E.E. Rules, &c., no definitely recognised standard exists which can be used to settle any disagreement which may arise between the supply authority and the contractor. The former is all-powerful, and can in many cases make things decidedly unpleasant for a contractor who offends it. If it is not convenient to supply, say, a heating load in a particular spot, the slightest excuse will be used as an objection. The policy of cheap wiring is subject to different views in many quarters, and woe betide a strange contractor who does not comply with the letter of the I.E.E. Rules or the pet theories of the supply company's district engineer! I came across one who required wiring to be rated on the 1,000-amp. per sq. in. rule for a load of 10 amperes! Tactful nursing of the supply engineer's complaint brought about the waiving of this point, and wiring at the I.E.E. ratings for small cable was then accepted as satisfactory.

It is considered in many quarters that the I.E.E. Rules are far too stringent, and form a hindrance to popular electrical development. One such instance is the separate fusing of each heating point installed for the use of radiators. In many suburban dwelling-houses one 2-kW portable radiator with plugs in five of the rooms serves a very useful purpose. Where this equipment answers all the requirements, the cost of a 50-amp. main switch, 50-amp. mains from switch to fuseboard, and five separate circuits of, say, 7/22 s.w.g. cable, would be out of proportion to that of the apparatus installed.

Some contractors have overcome the difficulty by the use of a central plug and very long lengths of flex. But flexible cable at best is not very desirable, and I consider that a looped-in system can in many cases serve the purpose well, without involving undue risk. I once came across a small urban district council which required such an installation to be carried out in accordance with the strict letter of the law, and refused to connect up to any looped-in system, but yet fitted a 10-ampere meter to the circuit, which, it demanded, should consist of cable not smaller than 7/16 s.w.g. I have often wondered how much business is lost through such stringent rulings.

In spite of the campaign for the development of electricity, I strongly believe that many small concerns, for reasons best known to themselves, will not be bothered with heating and cooking loads. In several places the tariffs are by no means encouraging, and this seems to indicate that my suspicion is well founded. The retailers and distributors of electricity can undo many of the most ambitious schemes of the Electrical Development Association.

Before a contractor of repute can quote with certainty or compete with others in a strange area, he

has to make himself acquainted with the whims of the local supply authority. There is no compulsion for any supply authority to accept even the I.E.E. installation rules, and the many devices that are brought out to aid economy are being defeated by conservative opposition.

The minds of such authorities are often undecided as to the use of switches at plug points. Unless plug and switch are interlocked, the purpose of the switch alongside a plug point is often defeated. Where apparatus is provided with switches to control all elements, the cost of a switch, if it is not going to be double pole, may as well be saved. This is especially true of circuits not exceeding 10 A capacity at 240 V a.c. Here the arc consequent on breaking full current at the plug points is not severe, and it is a rare occurrence for a short circuit to result between the poles.

To stabilise business and to make the procedure a definite matter for the contractor, a set of regulations should be printed and made available on demand, by each authority, or a set of minimum requirements should be drawn up, which would be capable of universal application. These would represent the average practice of all parts of the country, and all should be compelled by legislation to observe them as final. The I.E.E. Rules are not sufficiently flexible to cover all the different types of installations of one class. The wide difference of opinion and storm of protest that the last issue of rules provoked are surely indicative of the need of adjustment. The stringency of these rules has brought about a very natural result: average practice in the class dealt with shows a surprising lack of uniformity, and the regulations are honoured more in the breach than the observance.

The procedure for obtaining the connection of supply, or the extension of installations, is by no means uniform, though here it must be said that each authority states more or less definitely what it requires.

The allocation of service costs has often decided the question of a proposed installation to the disadvantage of the supply company.

The description of the usual standing charge as "meter rental" is somewhat of a misnomer, and its interpretation is a matter for tactful decision when dealing with the individual parties concerned.

Delays in meeting new demands are often a cause of dissatisfaction. These few points, together with those mentioned by other authors, show very forcibly the need for some control over the conservative, and in many instances exasperating, quibbles of petty urban and rural electricity authorities.

The relative reliability of underground cables and overhead lines has recently been considered with direct reference to continuity of service. Stoppages of supply are inevitable, but the number of stoppages per annum in some cases is far from reasonable. The reliability of service is often a matter of bad or good organisation, and the majority of private companies in this connection show a marked difference in the management of their undertakings and in courtesy towards their consumers.

A Russian Electrical Manufacturing Concession.

Agreement with a Swedish Company.

It was mentioned in this journal some time ago that negotiations were proceeding between the Allmänna Svenska Elektriska Aktiebolaget and the Soviet authorities with a view to the former embarking upon the construction of electrical machinery, &c., in Russia. It is stated by Director Edström, of Vasteras, that the company during the war started the erection of manufacturing works at Yaroslaff, but the work naturally stopped on the outbreak of the revolution. It is now intended, among other matters, to put this particular works into operation, apart from the contracts which have been carried out in Sweden and those which still remain to be executed for Russian account.

The negotiations have been conducted for Swedish interests by Mr. E. Lindgren, who now becomes the principal of the Russian works, and the concession was signed by the Soviet Concessions Commission in Moscow on May 25th in the presence, it is said, of the Swedish Minister in that city. Under the concession, the A.S.E.A. is granted the right to construct, equip and work in the town of Yaroslaff an electrical engineering works for the construction of alternating-current machines of a size of from ¼ to 700 h.p., the concession being for a period of 35 years.

According to the details published in the official organ of the Council of Labour and Defence of May 26th, the company is placed under the obligation to begin the construction and equipment of the works within a period of three months in order that their productive capacity may be 2,000 tons in the year 1929-30 and 4,000 tons in the following year. The importation of the necessary equipment for the works, free of import duties, will be permitted for a period of four years, and the right is also granted to import basic and raw materials necessary for production, on the payment of import duties and licence fees, but only on condition that such products cannot be furnished within the limits of Russia.

The agreement provides for the importation by the company of some electrotechnical articles from abroad and their sale within the country. However, this right of sale is restricted to State and co-operative organisations and share companies in which State capital is interested. The profits resulting from such sales are not to be sent out of the country, but must be invested in the concession undertaking. In return for the grant of the concession, the company will pay to the Government a share in the value of the products sold in accordance with a scale provided for in the agreement, but the amount of this is not specified in the Moscow newspaper. In the event of the net profits of the undertaking exceeding this scale, the agreement provides that a supplementary share shall be paid to the Government. All taxes and imposts will be paid by the concessionnaire company on the same level as in the case of State undertakings which are conducted on a commercial basis.

On the expiration of the concession all the undertakings, in good condition and in accordance with the productive capacity which was reached during the last two years, will pass free of charge and clear of debt into the possession of the Government, which will only pay to the concessionnaire the unredeemed part of the expenditure incurred by the company in the last

five years, subject to the proviso that such outlay has been carried out in agreement with the Government.

Apart from the preceding information from an official Russian source, it may be noted that, according to a statement ascribed to Mr. Edström, the agreement also contains a clause that the company has the right of employing Swedish workmen and has a free hand in this matter.

Since the preceding notes were written some further information has become available as a result of the return from Moscow to Sweden of Mr. A. Linden, deputy managing director of the A.S.E.A., who is reported to have stated that it is the works which the company started in Yaroslaff in 1916 which is now to be completed. This works was never nationalised and the company all the time has maintained connections with Russia through its office in Leningrad and consequently has a good knowledge of the economic development in the Soviet Union. According to the agreement, the company will turn out exclusively standard motors for alternating current of sizes up to 700 h.p., and the capacity of the works will be about 30,000 motors per annum of an average size of 10 to 12 h.p. Mr. Linden is further reported to have stated that special engineers, foremen and workmen will be transferred from Sweden to the Russian works. The profits of the undertaking up to 25 per cent. per annum will be retained by the A.S.E.A., while out of the surplus over this amount a part will pass to the Russian Government according to a fixed scale; and the company will have the right to transfer the profits abroad. (This, however, does not agree with the Russian version, as given above.) In order to carry out the scheme Mr Linden states that it is intended to form a special Swedish company with a share capital of Kr. 10,000,000 to which the concession and the works will be transferred. Besides having the right to import into Russia a certain quantity of semi-finished products, the company is authorised to import manufactures made at the company's works in Sweden to be sold at current prices, and as a result of the agreement the company will now be able to take advantage of its former investments in Russia, which are unofficially stated to amount to Kr. 10,000,000.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Wages in the Electrical Contracting Industry.

The National Federated Electrical Association informs us that the variation in the cost of living since the last announcement justifies a reduction of 27½ per cent. in the basic rates of wages in the electrical contracting industry. The new rates, which will come into effect on the second pay day in June, and will remain in force up to and including the period covered by the first pay day in October, are as follows, the existing rates being shown in parentheses:—Grade A, 1s. 9¾d. (1s. 10¾d.); Grade B, 1s. 7½d. (1s. 8½d.); Grade C, 1s. 6¼d. (1s. 7d.); and Grade D, 1s. 4¾d. (1s. 5¼d.). Mates' wages are at the rate of 80 per cent. of the journeymen's rates.

Wages in the Engineering Industry.

In pursuance of the instructions of the National Committee of the Amalgamated Engineering Union to continue negotiations for increased wages with the Engineering Employers' Federation, the Executive of the union has asked for a further conference with the employers. This has been agreed to, and will be held on June 14th. It is the intention of the A.E.U. to submit any offer which may be made to a ballot of its members.

Recent Contracts.

JACKSON BOILERS, LTD., Leeds and Westminster, have recently received many important orders for electrically-heated boilers. Among these is an installation at the Carlton Theatre, Haymarket, S.W.1. Fitted in the servery attached to the stalls bar is a "Jackson" boiler fitted with coffee-making machine and milk container. During the evening performances at the theatre this installation is used principally to provide coffee and hot milk, but during the matinées it is also required to supply boiling water for tea-making. The machine is self-feeding direct from the cold water main, whilst the current is automatically switched on or off according to the demands on the apparatus. In the balcony bar there is a "Jackson" café fountain boiler, automatically controlled as described above, which is used to supply the boiling water for matinée teas.

In connection with the recently-inaugurated electric lighting scheme at Tobermory, Island of Mull, the HART ACCUMULATOR CO., LTD., supplied a battery of 122 11-plate cells.

There has been delivered at the power station of the Glasgow District subway railway, operated by the Corporation Tramway Department, the second of two steel cables, each nearly seven miles in length, 56 tons in weight, and nearly 1½ in. in diameter. The first cable which was delivered a month ago, was manufactured by MESSRS. J. & E. WRIGHT, LTD., Birmingham, and the second by MESSRS. R. S. NEWALL & SON, LTD., Liverpool. The cables replace those at present used for hauling the subway trams and have no joint or splice all through their respective lengths.

Municipalities and Foreign Cables.

At a recent meeting of the Coventry Town Council a report was presented by the Electricity Committee recommending that the Council should rescind its decision that the lowest British tender for cables should be accepted, and that the Committee should be allowed to purchase low-pressure cable in "the open market." After some discussion a resolution giving the recommendations effect was carried by a large majority. During the discussion it was pointed out that a "fair wages" clause was inserted in all contracts with British firms, while the payment of fair wages by foreign manufacturers could not be assured. For the Electricity Committee it was stated that it considered its patriotism was being traded upon.

The subject of foreign cables was raised at the meeting of the Doncaster Town Council last week, when the Electricity Committee reported the acceptance of a tender for Dutch cables put in by Messrs. Hogan & Wardrop. The price (£2,621) was said to be £822 less than the lowest British tender. The chairman of the Committee (Ald. E. Dowson) said that three years ago tenders for about £1,500 worth of British cable exhibited differences of as much as £200, but now the offers were all practically the same. The Committee was willing to deal with British manufacturers if they quoted reasonable prices. Ald. Dowson also said that the Dutch company concerned conformed to trade union rates of wages and hours and was thus on a level with British firms.

A Notice to Travellers.

Travellers calling on Messrs. J. A. Crabtree & Co., Ltd., the well-known firm of Walsall electric switch manufacturers, are advised to be honest in their own interests. Outside the inquiry office of the company there appears the following notice: "We find that many representatives (and particularly those introducing new lines) refuse to state their business, claiming that they wish to see the principals on important private business. In future, principals will terminate immediately ordinary business interviews obtained under such false pretexts and representatives are warned that any possibility of future business will be seriously prejudiced by their action."

The Enforcement of Wage Agreements.

At the annual meeting, on June 2nd, of the Association of Joint Industrial Councils and Interim Reconstruction Committees, it was reported that the Minister of Labour had written to all Industrial Councils asking them for their considered opinions of the proposal to give legal force in the whole of the industry concerned to wage agreements arrived at by the Councils.

Social Events.

A golf match between Edinburgh electrical men (the "Jocks") and Newcastle electrical men (the "Geordies") took place at Goswick Golf Course, Northumberland, on May 30th, 1927. Mr. Walter Finlay brought ten players from Edinburgh, and a party of eighteen went up from Newcastle. Ten games were played, the "Geordies" winning by six games to three, with one game halved.

The eighth annual sports meeting of the London establishments of the General Electric Co., Ltd., is being held to-morrow (Saturday) at the G.E.C. Sports Ground, Wembley.

On the following Saturday (June 18th), the Hackbridge Electric Construction Co., Ltd., is holding its third annual athletic meeting at the works ground, Hersham, Walton-on-Thames.

The French Electrical Industry.

M. Zetter, delegate of the General Syndicate of Electrical Construction, has communicated to the *Journée Industrielle* the results of the inquiry which he has made into the position of the different groups belonging to the Syndicate. The Syndicate of Electrical Machine Manufacturers reports that the reduction in business is from 20 to 40 per cent. Unemployment is small, but working hours have been reduced by from five to ten hours a week. The Syndicate of Manufacturers of Electric Accumulators, Batteries and Carbons announces that in this branch of industry the tonnage of orders has not decreased very much. On the other hand, the margin of profits has been considerably lessened, and the Syndicate attributes this to insufficient Customs protection for these manufactures. The Syndicate of Manufactures of Insulators for Electricity, &c., says that the crisis that followed the revalorisation of the franc has resulted in a 20 per cent. decrease in production and sales, as compared with August and September last year. The number of workers has been reduced in a similar proportion. It may be said, however, that present conditions approximate those of last year.

The Chamber of Constructors of Meters, &c., says that this industry has experienced a decline in business without precedent during the past few months and business is still below normal. Better business was done during the first six months of 1926, and several manufacturers were able to spread deliveries over a long period, keeping unemployment low; it still amounts, however, to about 10 per cent. The lamp industry reports decreased sales, mainly due to the fact that stocks have not been replenished in expectation of a decrease in prices. The Chamber of the Iron and Steel and Associated Industries of the Department of the Rhone and Region (Electricity Group) reports that there had been a rather large decrease in orders and price inquiries up to January 15th. Since March 15th, however, there has been a slight revival at most establishments.—*Reuter's Trade Service* (Paris).

The British Export Society.

British Industries states that Col. the Hon. F. Vernon Willey presided at the annual luncheon of this Society on May 18th. In welcoming the gathering, which consisted largely of those engaged in the export trade, Col. Willey referred to the objects of the Society which are, briefly, "to secure the more efficient marketing of British goods overseas by encouraging practical co-operation between exporters and by acting as a clearing house for the mutual exchange of ideas, information and experiences." He said he was encouraged to see what a large proportion of the younger men were members of the Society. There was a great field for its activities and energies, for he was convinced that our industrial problem had ceased to be one of production, and had become one of distribution.

An Important Indian Contract.

A £300,000 order in connection with the main-line electrification of the Great Indian Peninsula Railway (Indian State Railways) has been placed with Messrs. W. T. Henley's Telegraph Works Co., Ltd. It comprises the supply and erection of 269 miles of overhead line on lattice steel towers. The conductors, of steel-cored aluminium, are for a working pressure of 110,000 V. Two parallel double-circuit lines will be run from Kalyan power station to Kalyan, a distance of 2½ miles. From there, two parallel single-circuit lines, one on each side of the railway track, will be run in a northerly direction to Igatpuri, 50 miles away, and two parallel single-circuit lines in a southerly direction to Kirkee, 82 miles away. These lines will supply electricity to the railway from Igatpuri to Poona.

"Amplion" on the Continent.

Graham Amplion, Ltd., has sent us a list of Continental events for which the "Amplion" public speech and band repeater equipment has been or is being installed. Among these is an important tennis event at Knocke, Belgium.

Merchandise Marks Applications.

The Board of Trade has referred to the Standing Committee (General Merchandise) applications for Orders in Council to be made requiring indications of origin in the case of, *inter alia*, electric lamp-holders, wall plugs, switches, and similar household fittings and metal parts thereof. Representatives of any interests substantially affected by any of these applications who desire to be heard in opposition should communicate with the secretary to the Committee, Mr. E. W. Reardon, New Public Offices, Great George Street, S.W.1, not later than June 24th.

Unemployment.

The reduction of the number of registered unemployed to 978,200 during the week ended May 23rd brought the total to the lowest level since 1920. The decrease during the week was 28,820. The total upon the corresponding date of last year was 1,597,679, but this was just after the general strike, and the coal dispute was in progress.

Trade Discount Abuse.

The Medical Supply Association, Ltd., of Gray's Inn Road, W.C.1, informs us that it having come to its notice that a municipal electricity supply undertaking in the provinces had been abusing the wholesale discounts given to the trade by passing the benefit of such discounts on to the retail consumer, it recently wrote to the engineer objecting to this abuse. The company wished it to be distinctly understood that the trade discount was intended for the benefit of the trader, and that it was a breach of trading conditions for it to be passed on.

A Polish Offer.

The *Chamber of Commerce Journal* states that the Polish weekly journal *Prezemysl i Handel* offers to insert free of charge, under the heading of "Trade Opportunities," inquiries from British firms as to trade activities in Poland, such as offers of goods, demands for goods, agencies, &c. Those interested should address such items to the Editor of the *Prezemysl i Handel*, c/o the Polish Ministry of Industry and Commerce, Warsaw.

Irish Free State Electrical Imports.

The Irish Free State Ministry of Industry and Commerce has now issued detailed figures of imports for the whole of the past year, comparing them with 1925. From these we have compiled the appended table showing the value of the total imports of electrical machinery and apparatus into the Free State and the amount attributed to the United Kingdom as country of shipment, but not necessarily of manufacture:—

			U.K. Share.	
	1926.	1925.	1926.	1925.
	£	£	£	£
Electric wires and cables	115,545	123,620	62,848	92,367
Telegraph and telephone instruments and apparatus ...	40,430	28,691	35,788	27,909
Electric lamps and parts	56,995	58,917	52,645	56,878
Batteries and accumulators	39,014	36,418	34,575	34,048
Radio sets and parts	90,211	84,966	86,085	83,125
Other electrical goods and apparatus ...	108,054	70,703	75,462	67,455
Generators	28,953	18,042	11,665	13,822
Motors	37,822	23,465	21,090	22,811
Other electrical machinery	85,740	73,873	72,966	63,261
Totals ...	£602,764	£518,895	£453,124	£461,676

It will be seen that, with the exception of electric lamps, and electric wires and cables, the importation of all classes of goods showed a marked advance over 1925, the total representing an increase of £83,869. Of the imports £453,124, or approximately 75 per cent., came from ports of the United Kingdom, leaving £149,640 for foreign countries. Of this balance the bulk (£133,933) is credited to Germany, £4,430 to Belgium, and £11,277 to "other countries."

A French Electrical Exhibition.

Under the auspices of the Association Française pour le Developpement des Travaux Publiques and the electrical section of the Association Amicale des Anciens Elèves de l'Ecole Centrale of Paris, the fourth exhibition of electricity and its applications is to be held in that city in July next. The exhibition, of which particulars can be obtained at the Association Française, 60, Rue de Londres, Paris, will include sections for electro-chemistry, electro-metallurgy, electrolysis, &c.

A Russian Order Canard.

At a meeting of the Preston Town Council on May 16th, the bulk of unemployment in the town was attributed to the shortage of orders at the English Electric Co.'s works, and it was stated that by the abrogation of the trading agreement with Russia the company would lose an order over £2,000,000 in value. The English Electric Co., Ltd., assures us that it has no knowledge of any such order.

Local Exhibition.

Eastbourne.—The Corporation Electricity Committee has decided to hold an electrical exhibition in the Manor House grounds during the period of the forthcoming flower show.

"Putting Price in its Place."

An address bearing this title was delivered by Mr. A. F. Waller, managing director of the National Electrical Manufacturers' Association (U.S.A.), at the recent annual meeting of the Association. After illustrations of the fact that price is not the only consideration, taken from such widely-separated directions as lamp equipment and insurance, he proceeded to adapt his deductions to the electrical industry, stating that "the system described, with variations to suit, may be used in connection with buying or selling almost any kind of apparatus imaginable. I have applied it to the purchase of sand-blasting machinery, electric furnaces, electric motors, bank stock, and automobiles. It puts price in its place simply because it makes price one of a number of essential points entering into a definite transaction. When the high and low extremes in competitive bids have been established, the interest immediately centres upon the spread in price. What features exist to justify the difference? It is desirable to consider this difference not only in dollars, but in per cent. . . . On the question of the purchase or sale of material, anyone can do it who will first find out what are the essential points, and then take the trouble to get exact information in regard to them. Every salesman or sales engineer who has to sell goods in a competitive market should personally and individually compile information of this kind regarding certain key sizes of the line he handles, comparing them with the competition he has to meet. Such a study serves several purposes, among which are:—1. Informing himself as to the actual work he has in hand. 2. Selling his product to himself on an 'index' basis. 3. Development of a realisation that price in its place is only one necessary item relating to a transaction, and not the predominating feature."

Unemployment in Germany.

The Berlin correspondent of *The Times* says that the number of persons in receipt of unemployment relief in Germany on May 15th was 972,000, as compared with 1,217,000 on April 15th, a decrease of 20 per cent.

The Swedish Ericsson Company.

The report of the Telefon Aktiebolag L.M. Ericsson states that 1926 was characterised by favourable activity. The stock of orders increased from a value of 14.9 million kronen in 1925 to 19.3 millions last year, while the deliveries rose from 15.7 millions to 19.1 millions in the two years respectively, and the number of persons employed from 2,288 to 2,834. As a result of the extent of the orders, the services of the company's foreign works were utilised in a greater measure for the completion from Stockholm of deliveries to foreign customers. The foreign subsidiary and sale companies showed progress with the exception of the French works and the Polish sales company, which had to contend with specially keen competition on the part of foreign makers. The report states that the French company was unable to compete with other French works. As a consequence an agreement was made at the beginning of 1927 with one of the largest French electricity companies, which has entered as a shareholder in the Société des Téléphones Ericsson, and in connection with this step the share capital of the French company has been doubled.

Book Notices.

"Touring by Motor Coach" (100 pp. and map), Lancashire United Transport & Power Co., Ltd., price 6d.—This annual publication is an indication of the advent of summer; it contains copious notes and illustrations of beauty spots within the wide area covered by the company's services.

"Technologic Papers of the U.S.A. Bureau of Standards." Vol. 21, No. 335, "Thermal Expansion of Graphite" (5 cents).

"Electric Wiring Diagrams for Motor Vehicles." By M. A. Todd. Third Edition. Pp. iv + 241; figs. 241. London: E. & F. N. Spon, Ltd. Price, 4s. 6d. net.

"Alternating Current and Electrical Engineering," by P. Kemp. Third edition. Pp. xi+575; figs. 423. London: Macmillan & Co., Ltd. Price 15s.

Scientific Papers of the U.S.A. Bureau of Standards.—Vol. 21, No. 546, "Magnetic Reluctivity Relationship." Vol. 22, No. 547, "A Spectrophotometric Analysis of the Lovibond Glasses."

"Magneto Manual," by H. R. Langman. Pp. x + 221; figs. 85. Price 7s. 6d. net. "Domestic Electric Heating," by E. G. Solomon. Pp. vii+116; figs. 50. Price 3s. 6d. net. "Modern Ignition," by H. H. U. Cross. Pp. 144; figs. 58. Price 4s. net. London: Crosby Lockwood & Son.

A new edition (two volumes) of "Steam and Gas Turbines," by A. Stodola and L. C. Lœwenstein, is announced by the McGraw-Hill Publishing Co., Ltd., London, to appear on July 1st. The price as from that date is £3 15s. net, but for all orders placed before July 1st it will be £3.

"Dielectric Phenomena," by S. Whitehead. Pp. 176+42 diagrams. London: Ernest Benn, Ltd. Price 12s. 6d. net.

Fires.

The Times reports that the works of the Whitfield Electrical Company, Ltd., Park Street, Barnet, were destroyed by fire on June 2nd.

Fire broke out at the works of the Mirrlees Watson Co., Ltd., Glasgow, on June 5th. The outbreak originated in an open yard which was stacked with valuable patterns, and spread to four separate buildings, including a large joiners' shop The firemen prevented the flames from reaching the power station of the Corporation underground railway. No casualties are reported. The damage is estimated at £20,000.

New Swiss Company.

The Emerit Gesellschaft is the name of a new concern which has been formed at Birmensdorf, Zurich, to manufacture electrical insulating material under the patents of Herr Max Haefeli, of Basle.

Patent Application.

Application has been made for the restoration of Patent No. 193,604 of 1922, granted to F. C. Raphael, for "Improvements in electric fittings and means for fixing same.

Trade Announcements.

The London sales organisation of Newtons' Dynamo Works will, from July 1st, be removed from 219, Tottenham Court Road, W.1, the address of Messrs. Baxter & Caunter, Ltd., to 224, Shaftesbury Avenue, W.C.2, which is the office of the firm's associated company, Messrs. Joseph Lucas, Ltd. Mr. S. G. Mundy, formerly with Messrs. Baxter & Caunter, will be in charge of the organisation. The telephone number of the new address will be: Regent 8033 (three lines).

Metro-Vick Supplies, Ltd., 155, Charing Cross Road, W.C.2, announces that no deliveries of material will be made from the afternoon of June 17th until June 20th inclusive, as its London offices, stores, trade counter and showroom will be closed for annual stocktaking.

Messrs. J. Macgregor & Co. state that they have registered the name "Usym" No. 480,113 (Class 13) for the lamps supplied by them.

Messrs. Frederick Thomas & Co., Hampstead, N.W.1, have opened at 9, Charlotte Square, Newcastle-on-Tyne, a trade showroom, where a large range of their electrical fittings are displayed.

Catalogues and Lists.

Messrs. Wingrove & Rogers, Ltd. (British Electrical Vehicles), 63, Queen Victoria Street, E.C.4.—An illustrated folder depicting "B.E.V." electric locomotives and trucks in use in various parts of Australia.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—June calendar-blotter, illustrating and describing the "No. 154" electric wash-boiler.

Messrs. Hugh J. Scott (Belfast), Ltd., Ravenhill Avenue, Belfast.—Stock lists of a.c. motors and d.c. motors and generators. Priced.

Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow. — June calendar-blotter advertising the "M. & C." gate-end loader for electrical or pneumatic power.

The Variable Speed Gear, Ltd., 6, Broadway, S.W.1.—An illustrated brochure describing a variable delivery pump of improved design.

Messrs. Herbert Morris, Ltd., Loughborough.—Book 33, containing illustrated particulars and prices of the company's goods-handling equipment.

Brook Motors, Ltd., Empress Works, Huddersfield.—Booklet No. 158, giving particulars and prices of "Brook" motors for mine use.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, S.E.18.—Pamphlet 550A, describing some of the special features of the mounting arrangements used for selectors and relay sets in the automatic telephone equipment for London exchanges.

Hopkinson Induction Motors, Willesden Lane, North Acton, W.3.—June stock list of squirrel-cage and slip-ring motors.

Messrs. Wheeler & Sons (Engineering), Ltd., St. Stephen's House, Westminster, S.W.1.—A pamphlet describing the company's "Eleconomic" radiators. Illustrated and priced.

Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.—Leaflet No. 82, advertising the company's battery charger for high-tension accumulators. Priced.

The Mullard Wireless Service Co., Ltd., Denmark Street, W.C.2.—Four illustrated and priced leaflets dealing with the construction and performance of the company's U.15, V.U. 150, S.4 and S.6, and U.12 valves.

Z Electric Lamp & Supplies Co., Ltd., 73, Newman Street, Oxford Street, W.1.—A list announcing reduced prices of the company's wires and cables.

Messrs. Marelli & Co., Ltd., 19 and 20, Garlick Hill, Queen Victoria Street, E.C.4.—Pamphlets Nos. L/711, 722, and 733, describing many examples of the company's fans, including domestic, office, cabin, railway carriage and other types.

The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.1.—A coloured poster announcing the company's new 2-V valves. Priced.

The Runbaken Magneto Co., Tipping Street, Ardwick, Manchester.—A priced and illustrated leaflet describing two radio battery chargers (a.c. type).

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—Publication No. 86/8, dealing with the use of batteries in connection with "safety lighting" in kinemas. Also a blue and sepia photogravure poster advertising "Exide Monobloc" batteries.

THE L. P. S. ELECTRICAL CO., LTD., Avenue Road, Acton, W.3.—A pamphlet illustrating the company's universal test and battery clips. Priced.

THE ATHOL ENGINEERING CO., Seymour Road, Crumpsall, Manchester.—A circular letter announcing reductions in the prices of various radio components.

MESSRS. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.C.2.—June price list of electrical equipment and accessories of numerous types, including domestic appliances.

THE LONDON ELECTRIC WIRE CO. & SMITHS, LTD., Playhouse Yard, Golden Lane, E.C.1.—A list announcing reduced prices of "Litz" wire of various sizes.

THE AEROGEN CO., LTD., 36, Bolsover Street, Great Portland Street, W.1.—An illustrated brochure dealing with the "Kiesselbach" high-pressure thermal storage for boiler plant. The company holds the sole licence for the manufacture and sale of the plant in this country.

THE HART ACCUMULATOR CO., LTD., Stratford, E.15.—June calendar blotter advertising the company's batteries.

Bankruptcy Proceedings.

FRANCIS HUSBAND, "The Hollies," Sandpit Lane, St. Albans, engineer.—The public examination of this debtor was held recently at the Court House, St. Albans. The statement of affairs showed gross liabilities of £4,109, of which £4,074 was expected to rank, while the assets, estimated to realise £35, were all absorbed by preferential claims. Debtor attributed his failure to liability under guarantees on behalf of a limited company, judgments obtained against him under a building contract entered into by his wife, expenses of his wife's illness, bad debts and unemployment. In 1915 he and another formed a limited company with a nominal capital of £1,000 to carry on business as electrical engineers and manufacturers, debtor being allotted 700 £1 shares partly for £350 cash and partly as consideration for services to be rendered; he was appointed managing director of the company. In February, 1920, the concern went into voluntary liquidation. It had been successful at first, but later a slump occurred. Debtor was liable for debts amounting to £3,134 as guarantor on behalf of the company. The liquidator had stated that the assets of the company had been insufficient to meet the debenture holder's claims. Debtor said that between 1921 and 1926, with the exception of a few months' employment as an engineer, and while he was engaged on a contract for the supply of switchboards, he was without remunerative employment. In July, 1926, judgment was obtained against him for the balance of the purchase price of his house, which had since been taken possession of by the mortgagees. He regarded the purchase of this house as his wife's transaction. In November, 1926, a further judgment was obtained against him. The examination was adjourned.

L. BELL, trading as Charles Bell, Joseph Street, Bradford, mechanical and electrical engineer.—The public examination of this debtor was held recently at the County Court, Bradford. The statement of affairs showed ranking liabilities of £3,067, and there was a deficiency of £1,360. Debtor attributed his failure to bad trade, the coal strike, and insufficient capital. He stated that he commenced working with his father and uncle as mechanical and electrical engineers. For two years during the war he worked at various shell-filling factories, and on the death of his uncle returned to the firm. Subsequently the business was formed into a limited company with a nominal capital of £15,000. In February, 1926, the company went into voluntary liquidation and a dividend of 7s. 6d. in the £ was paid. Debtor then took over the stock, machinery and plant from the liquidators and commenced business on his own account. To enable him to pay the purchase price his father advanced him £1,680 on loan. He had since borrowed a further £150 from his father. During his trading the business showed a net loss of £184, and he became aware of his position early in January last. The examination was adjourned.

A. L. WEEKES, 13, Crescent Road, Luton, electrical engineer. The public examination of this debtor was held recently at the Court House, Luton. The statement of affairs showed liabilities of £527 and a deficiency of £524. Debtor stated that he commenced business on his own account in 1905, raising about £6,000 on a reversionary interest. In 1916 the business was formed into a company with an authorised capital of £10,000. Debtor realised the whole of his personal estate to pay off a bank overdraft of £10,000 in 1924, and the company then went into voluntary liquidation. The business was sold for £4,500, and the company was afterwards reconstructed. Debtor was appointed managing director, but subsequently he left that position. The examination was adjourned.

E. G. BATT, electrical engineer, 20, Iverna Gardens, Kensington, and Magnet House, Kingsway, W.C.—This bankrupt, who failed last November, applied on June 1st at the London Bankruptcy Court for an order of discharge. Mr. Walter Boyle, Senior Official Receiver, reported that the provable debt amounted to £2,911, and no assets were disclosed. The applicant, except from 1916 to 1919, when he was serving in the army, had been employed since 1915 as engineer to an electrical company, at a salary latterly of £720 per annum. He attributed his insolvency to his own personal extravagance. The application was opposed by the Official Receiver on statutory grounds, including unjustifiable extravagance in living. After hearing Mr. Stable on behalf of the bankrupt, Mr. Registrar Warmington granted an immediate discharge subject to a judgment for £300, to be satisfied by a cash payment and revoked an existing order under which the bankrupt had to pay £100 per annum for the benefit of the creditors.

E. MACKINTOSH, electrical engineer, 57, Broughton Road, Edinburgh.—The estates of the above-named debtor were sequestrated by the Sheriff of Peebles on May 23rd; a meeting to elect a trustee and commissioners was held at 18, George Street, Edinburgh, on June 1st. Particulars of claims by September 23rd. Mr. R. F. Calder, agent, 12, Gayfield Square, Edinburgh.

E. M. LANCASTER, electrical engineer, 21, Hanover Lane, Leeds.—First meeting June 13th, at the Official Receiver's office, 24, Lower Bond Street, Leeds; public examination, June 28th, at the County Court House, Leeds.

H. L. SMITH, electrician, 156, Tredegar Road, Bow, E.—Application for discharge to be heard at Carey Street, W.C., on June 28th.

J. F. LYONS, electrical engineer, 25, Palmerston Street, and Front Street, Consett, Durham.—Trustee, Mr. C. Woollett, Official Receiver, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne, released July 27th, 1926.

B. G. THOMPKINS, radio engineer, Armstrong's Buildings, Stanley, Durham.—Trustee, Mr. R. W. Cave, Official Receiver, 81, St. Mary's Place, Newcastle-on-Tyne, released May 26th.

F. LENG (F. Leng & Co.), electrical and mechanical engineer, 12, Godstone Road, Rotherham.—First meeting to be held to-day (Friday) at the Official Receiver's offices, Figtree Lane, Sheffield. Public examination, July 7th, at the County Court Hall, Sheffield.

W. K. COXON (separate estate), trading with E. R. Weare as Western Manufacturing Co., wireless apparatus manufacturer, Nurshill, Lydney, Glos.—First and final dividend of 4s. 2½d. in the £ payable June 20th at 78, New Oxford Street, W.C.1.

G. C. LAZENBY, wireless engineer, 29, Old Town Street, Plymouth.—Receiving order made June 2nd, on debtor's own petition.

Company Liquidations.

CONRADI & BRAUN, LTD., radio manufacturers, 52, Theobald's Road, W.C.1.—A meeting of creditors was held on May 31st at the offices of Messrs. Fincham, Partridge and Co., 3, Warwick Court, Gray's Inn, W.C. Mr. F. W. Fincham, the liquidator in the voluntary liquidation of the company, reported that the liabilities were £1,181, all due to unsecured creditors. There were net assets of £1,137, leaving a deficiency, so far as the creditors were concerned, of £44. The company was registered in March, 1925, with a capital of £3,000, and acquired a business previously carried on by Mr. Braun. The assets were valued at £4,493, including £1,000 for goodwill. The liabilities were £1,495, leaving a surplus of £2,998. The company agreed to discharge the liabilities and the vendor was allotted fully-paid shares of the value of £2,998. The company continued the business and had had a fairly good turnover. Accounts for the period from October, 1924, to July, 1925, showed sales of £8,500 and a gross profit of £1,717. During the 12 months to July, 1926, the sales were £11,900, and the gross profit £2,964. Since August 1st of last year the sales had fallen off, and had only totalled £6,600, with a gross profit of £965. After allowing for all the expenses, there was a total net loss of £1,335. In May, in order to safeguard the assets, a resolution for voluntary liquidation was passed. There were only two shareholders, Mr. L. F. Braun and Mr. F. S. Conradi; they had been directors since the inception of the company. The chairman stated that the creditors would receive a substantial dividend, and the assets were not charged in any way. He did not think that there was any possibility of selling the business as a going concern. He proposed to close down the establishment at the end of that week, and realise the assets as quickly as possible. It was decided to confirm the voluntary liquidation of the company, with Mr. Fincham as liquidator.

SPRINGFIELD ELECTRIC MOTORS, LTD.—A meeting of members is called for July 1st at the offices of Messrs. Hepworth and Chadwick, 14, Butts Court, Albion Street, Leeds, to hear an account of the winding up from the liquidator, Mr. V. Walton.

S. M. F. ELECTRICAL SUPPLIES, LTD.—A meeting of members is called for July 2nd at 43, Oozells Street North, Birmingham, to hear an account of the winding up from the liquidator, Mr. E. J. Milton.

Yates & Thom, Ltd., Blackburn.—A resolution for the voluntary liquidation of the company was passed at a meeting of shareholders on May 31st; a liquidator is to be appointed at a confirmatory meeting to be held at the end of this month. The chairman, Sir William Thom, said that the company would pay 20s. in the £ to creditors, shareholders, and stockholders. It is stated that the company intends to pay off the preference shares on June 30th, and at the same time to pay 10s. on account to the ordinary shareholders.

Correcta Light Co., Ltd.—Winding up voluntarily. Liquidator, Mr. C. A. Charlier.

Electrical Wholesale Supplies (Leicester), Ltd.—Winding up voluntarily. A meeting of creditors is called for June 14th at the offices of the liquidator. Particulars of claims by June 30th, to the liquidator, Mr. J. A. Hopps, 25, Friar Lane, Leicester.

Private Arrangements.

T. C. Price, wireless dealer, Horse Street, Dowlais, Glam.—A meeting of creditors was held on May 26th, when the representative of the General Electric Co., Ltd., was elected to the chair. The statement of affairs presented showed ranking liabilities of £621 and assets of £165, leaving a deficiency of £456. The debtor commenced business as an electrician in 1923, and later started a wireless business. During the year ended May, 1926, his turnover was £1,700, whilst during the year to May last the sales were £1,409. The expenses had aggregated approximately £600 per annum, that figure including drawings of £270. Debtor's wife and mother-in-law were shown as cash creditors, but it was stated that their claims would probably be withdrawn. A recent fire caused damage to the extent of about £45, but only £20 was received from the insurance company. A deed of assignment had previously been executed. On behalf of the debtor an offer was made of a composition, and a resolution was passed agreeing to accept 10s. in the £, payable in three instalments. It was also decided that Messrs. S. E. Clutterbuck and J. Williams should be appointed joint trustees, with a committee consisting of the representatives of the General Electric Co., Ltd., the South Wales Wireless Co., and Messrs. Capel and Co. The following are creditors:—

	£		£
Siemens Bros. & Co., Ltd.	23	Marconiphone Co., Ltd.	34
South Wales Wireless Co., Ltd.	44	Houghton-Butcher, Ltd.	24
Sloan Electrical Co., Ltd.	45	General Electric Co., Ltd.	39
Oldham & Sons, Ltd. ...	29	Brown Bros., Ltd. ...	37

Edward Pincott, trading as E. Pincott & Co., electrical and wireless engineers, 91, Queen Street, Exeter.—A meeting of creditors was held recently at the offices of Messrs. Popplejon, Appleby & Hawkins, 4, Charterhouse Square, E.C., when an approximate statement of affairs was submitted by Mr. E. H. Hawkins, which showed liabilities to the trade of £2,084, and cash creditors for £401. The net assets were £1,155. It was stated that three suppliers had levied execution, whilst other proceedings were threatened. A deed had been executed to Mr. Hawkins to protect the assets. The debtor attributed his present position largely to losses which he sustained on a branch business at Taunton, which had now been disposed of. The debtor estimated those losses at approximately £700, and he had also suffered through ill-health during the last three years. The cash creditors were relatives, and their claims would be withdrawn if the estate was dealt with under the deed. A resolution was passed confirming the deed with Mr. Hawkins as trustee, whilst a committee was also appointed, consisting of the representatives of the Chloride Electrical Storage Co., Ltd., the Sloan Electrical Co., Ltd., and Callender's Cable and Construction Co., Ltd. The following are creditors:—

	£		£
Sloan Electrical Co., Ltd.	156	General Electric Co., Ltd.	42
Siemens Bros. & Co., Ltd.	53	S. G. Brown, Ltd. ...	48
W. C. Hands & Sons ...	21	Walsall Hardware Mfg. Co., Ltd.	88
British Thomson-Houston Co., Ltd.	27	S.T. Valves, Ltd. ...	25
Granic Electric Co., Ltd.	26	Chloride Electrical Storage Co., Ltd.	302
Automobile Accessories, Ltd.	94	Callender's Cable & Construction Co., Ltd. ...	153
Metro-Vick Supplies, Ltd.	31	Falk, Stadelmann and Co., Ltd.	62
Wholesale Fittings Co.	150	Simplex Conduits, Ltd.	118

G. R. Hinks, 74, Gravelly Hill North, Erdington, Birmingham, wireless dealer, &c.—At a recent meeting of creditors a statement of affairs was presented which showed liabilities of £381 due to unsecured creditors, and net assets of £83, leaving a deficiency of £298. It was stated that the debtor was at one time in the employ of a firm of wholesale dealers in Birmingham, but started trading on his own account in February, 1925, with little or no capital. The profits had not been sufficient to meet the expenses. In addition to the business, the debtor had been travelling on commission. He had been pressed by creditors, and in order to protect the estate a deed of assignment had already been executed to Mr. F. Sharratt, C.A., 174, Corporation Street, Birmingham. The business had been advertised for sale, and it was hoped that it would be disposed of at a figure which would allow of a reasonable dividend being paid to the creditors. The deed already executed was confirmed.

J. Murray Young, electrical engineer, 9, Foundry Lane, Perth.—A meeting of creditors was held recently at the offices of Mr. J. T. Douglas, solicitor, Perth, when a statement of affairs was submitted which disclosed liabilities of £401 and net assets of £94, leaving a deficiency of £307. The statement therefore showed an apparent dividend of 4s. 8d. in the £, subject to expenses of realisation, &c. It was stated that a trust deed had already been executed by the debtor, and it was decided to confirm it. A committee of inspection was also appointed, consisting of Mr. C. E. P. White (representing Messrs. Frew & Co., Ltd., Perth), Mr. J. McDavid, and Mr. R. Scott Dempster.

Dissolutions of Partnership.

Green Lane Wireless Stores, retailers of wireless apparatus and accessories, 54, Green Lane, Derby.—Messrs. P. and F. W. Whitehead have dissolved partnership. Mr. F. W. Whitehead will attend to debts and continue the business.

Alan Bantock & Co., electrical contractors, 34, Greenside Road, Shepherd's Bush, W.12.—Mr. A. Bantock, Mr. W. Henson, and Mr. T. E. Russell have dissolved partnership. Mr. Bantock will attend to debts and continue the business.

Ackerman & Crawford, electrical and mechanical engineers, 32, Hockliffe Street, Leighton Buzzard.—Mr. A. C. Ackerman and Mr. R. K. Crawford have dissolved partnership.

For Sale.

By order of the Official Receiver of the Southern Counties Electric Light and Power Supply, Ltd. (in liquidation), Messrs. Senior & Godwin invite offers for one 50-h.p. semi-Diesel crude-oil engine, with air compressor, starter and fittings. West Central Merchandise Mart will sell by auction on June 29th, at 10, Red Lion Passage, W.C.1, cables and flex. (See our advertisement pages to-day.)

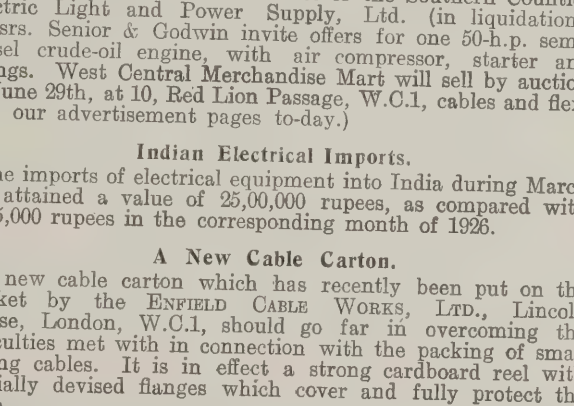
Indian Electrical Imports.

The imports of electrical equipment into India during March last attained a value of 25,00,000 rupees, as compared with 25,65,000 rupees in the corresponding month of 1926.

A New Cable Carton.

A new cable carton which has recently been put on the market by the Enfield Cable Works, Ltd., Lincoln House, London, W.C.1, should go far in overcoming the difficulties met with in connection with the packing of small wiring cables. It is in effect a strong cardboard reel with specially devised flanges which cover and fully protect the cable.

The flanges have slightly flexible cardboard rims, each extending half the distance between the two flanges, with rolled edges meeting in the centre and forming "lips." The rims are placed at right angles to the flanges, and have sufficient resilience to ensure a dust-tight joint at their meeting edges,



"Enfield" Cable Carton.

while allowing the easy withdrawal of the wire. As the cable is fed out the "lips" close, the unwound length being retained on the reel, and remaining always under cover of the rims. The cable draws out without kinking, and each turn is centralised on the reel as it is drawn out. It is claimed that it is impossible for the wire to become entangled by several turns slipping the reel and causing an unnecessary quantity of wire to slack off. The carton is sent out with an outer protecting wrapper around the rims, which the wireman simply tears off. Each carton carries a black or red label, according to the colour of the cable inside.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, June 8th:—Copper (electrolytic) bars, £60 10s., 5s. inc.; ditto ditto sheets, no change; ditto ditto wire rods, £70 10s., 5s. inc.; ditto ditto h.c. wire, 8 15/16d., 1/16d. inc.

Messrs. James & Shakespeare report, June 8th:—No change in the prices of copper bars (best selected), sheet and rod; English pig lead, £26 10s., 15s. inc.

Messrs. Edward Till & Co. report, June 8th:—No change in the price of India-rubber, Para fine.

Lighting and Power Notes.

Australia.—BRISBANE (Q.).—The report on the working of the City Council's electricity undertaking (general manager: Mr. J. H. Hindman) for the year ended December 31st, 1926, shows a total revenue of £163,496, and expenditure, including interest, depreciation and renewals, of £141,646, leaving a net surplus of £21,850. The greater portion of the energy required is obtained in bulk from the Brisbane City Electric Light Co., Ltd. The sales of electricity amounted to 7,231,607 kWh, and the average price obtained was 5.453d. per kWh. During the year 12 miles of h.p. and 40 miles of l.p. mains were erected and 21 distribution transformers installed, increasing the total capacity to 1,825 kVA. A publicity department was inaugurated during the year with a view to increasing the demand for supply, and a deferred payment system was introduced.

Barrow.—ELECTRICITY EXTENSIONS.—At a meeting of the Town Council on May 31st it was reported that the Electricity Commissioners had not only sanctioned the extension of the Corporation electricity works, at a cost of £60,000, but had now sanctioned the loan. The £60,000 is made up as follows:—6,000-kW turbo-alternator, switchgear, pipework, and auxiliary plant, £30,000; boiler and auxiliary plant, £16,750; coal-handling plant and bunkers, £3,000; cooling tower and foundations, £2,000; pipework, £2,500; engine-room cranes, £750; contingencies, £5,000.

Birkenhead.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to the following loans:—£1,979 for the provision of a transformer station at Moreton; £1,495 for a transformer station at the Plymyard Estate, Eastham, and £5,558 for kiosks, transformers, and switchgear.

MAINS EXTENSIONS.—The Committee is to carry out extensions of mains at a cost of £3,845.

Blackburn.—INQUIRY.—In view of Dr. S. L. Pearce's inability to conduct the proposed inquiry into the administration of the Electricity Department, the Corporation has invited Mr. A. H. Dykes, consulting engineer, to do it.

Burnley.—ELECTRICITY SUPPLY.—The borough electrical engineer has been authorised to lay an e.h.p. feeder from the sub-station to the kiosk at Habergham Pit at an estimated cost of £3,200, and a feeder from the sub-station to Stephenson Street, at an estimated cost of £540.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Montreal Island Power Co., Ltd., has been formed for the purpose of developing a water-power site on the Rivieres des Praires, about seven miles from Montreal. With a head of 26 ft., it is estimated that the plant to be constructed will be capable of developing 65,000 h.p. Work on the new plant will be started at once, and 40,000 h.p. will be available for delivery by the end of 1929. The output will be increased to 65,000 h.p. as required. All distribution problems have been eliminated by a long-term contract with the Montreal Light, Heat and Power Consolidated for purchase by this company of all power available.

Continental.—LUXEMBURG.—From the recently-issued report of the Compagnie Luxembourgeoise d'Electricité, principal attention was given last year to the construction of h.p. transmission lines for electricity supply in the Belgian provinces of Namur and Luxemburg. In the Namur province the main transmission line between On and Monceau, about 32 miles, is now in operation, together with three branches, totalling about 18 miles. In Luxemburg province a line is in use between On and Champlon, a distance of nearly 25 miles, together with four branches aggregating 13 miles. It is expected that the erection of the h.p. lines will be completed this year, and the company is now laying the l.p. distribution system.

BELGIUM.—In the recently-issued annual report of the Société des Centrales Electriques des Flandres, the directors state that as a result of the satisfactory results obtained with the experimental high-pressure boiler and turbine installed some time ago at Langerbrugge, they have decided to alter the whole of the steam-raising plant to the high-pressure system. With this object in view they have given orders for three boilers each capable of producing 99,000 lb. of steam per hour at a pressure of 796 lb. per sq. in., and at a temperature of 450 deg. C., and a first-stage single-casing turbo-generator of 66,000 kW capacity, at 3,000 r.p.m. The steam from this turbine will be afterwards utilised in three existing 284-lb. per sq. in. 6,600-kW turbo-generators. When the new plant is installed the Langerbrugge power station will have a total capacity of 38,000 kW, and its steam efficiency will be about 23 per cent.

BULGARIA.—The General Council of Tirnovo has decided to arrange an international competition for the electrification of the department of Tirnovo. Special attention will be paid to the question of cost and the system of electrification. Detailed regulations for the competition are being prepared, and projects must be received before January 1st, 1928. Two prizes will be awarded.—*Reuter's Trade Service* (Sofia).

Doncaster.—LOAN SANCTIONED.—The Electricity Commissioners have sanctioned the borrowing by the Town Council of £5,951 for sub-station building, mains, services, plant and meters.

Epsom.—LOAN SANCTIONED.—The Urban District Council has received sanction to a loan of £3,100 for laying mains on the Horton housing estate.

Eastbourne.—ELECTRICITY SUPPLY.—The Corporation Electricity Committee has received a letter from the Electricity Commissioners intimating that, as the result of further consideration, they are not satisfied that the proposal to lay a single-phase, 11,000-V main is one which can be approved. They state that, having regard to the developments which will take place in the course of the next two or three years they are of opinion that the Council should provide for a 3-core ring main in order to bring its system into line with modern practice, and introduce a 3-phase system of supply. The Committee has decided to inform the Commissioners that it is prepared to recommend the adoption of a 3-core main and that, having regard to the urgency of the matter, they be asked to sanction the borrowing of the amount required for the h.p. cable for the ring main, *viz.*, £10,413, as soon as possible, and that the electrical engineer submit a revised application on the lines indicated.

Grampian Electricity Scheme.—EXTENSION OF TIME.—The *Financial News* reports that the Grampian Electricity Supply Co. has presented a petition to the Secretary of State for Scotland asking him to issue a Provisional Order extending for five years, from August 4th next, the time stipulated in 1924 within which the company must acquire the necessary land in the counties of Perth and Inverness for the construction of the generating stations and other works required for the completion of the Grampian Electricity Scheme.

Guildford.—LOANS.—The Corporation Electricity Committee is applying for sanction to the borrowing of the following sums:—Mains, £7,500; meters, £2,500; public lamps, £500.

Haslingden.—BULK SUPPLY CHARGE.—The Corporation has asked for a reconsideration of the price charged by Accrington for electricity supplied in bulk. Mr. Clegg (borough electrical engineer) is conferring with the officials concerned regarding the terms of the existing agreement.

Isle of Wight.—REVOCATION OF ORDER.—The Minister of Transport has revoked the Newport, Ryde and Sandown, and Shanklin Electricity (Bulk Supply) Special Order, 1925, the revocation to take effect from May 27th.

Leeds.—NEW ELECTRICITY CHARGES.—The Corporation Electricity Committee has recommended the following new charges for electricity for heating purposes:—First 2,000 kWh per quarter, 1½d. per kWh; next 1,000 kWh, 1½d.; next 2,000 kWh 1d.; over 5,000 kWh 0.9d. per kWh.

PROPOSED SUBWAYS.—At a joint meeting of the Corporation Committees consideration was given to a proposal to construct subways to carry the cables and pipes of all the city's services and it was decided that the city engineer should obtain information on the subject.

London.—LEWISHAM.—The Borough Council has accepted the offer of the South Metropolitan Electric Light & Power Co. to install electric lighting at 34 houses at Grove Park and for public lighting. Each house is to have a prepayment meter, and the charges are to be 6d. per kWh, or 8½d. per kWh inclusive of rental of wiring, plain fittings, lamps, and one heating plug, or 1½d. per kWh with complete wiring fittings, &c., and an additional charge per week of 1s. 2d. for a five-roomed house, and 1s. 1d. for a four-roomed house. For street lighting the charge is to be £4 15s. per 80 c.p. lamp per annum.

ST. MARYLEBONE.—The Borough Council has received sanction to the borrowing of £8,400 for transformers and switchgear.

KENSINGTON.—The Highways Committee of the Borough Council has renewed an agreement with the Notting Hill Electric Lighting Co., Ltd., for the supply of electrical energy for the lighting of street lamps at the rate of 1½d. per kWh for the period up to 1931. The Committee has also considered further extensions of electric street lighting and has recommended arrangements for the conversion from gas to electricity of an additional 396 lamps in the borough.

Manchester.—YEAR'S WORKING.—We have received from Mr. H. C. Lamb, chief electrical engineer and manager of the Corporation electricity undertaking, a copy of the abstract of accounts and report on the working of the undertaking for the year ended March 31st last. The total revenue amounted to £1,643,137, as compared with £1,426,238 in the preceding year. Working expenses increased from £789,313 to £984,107, for which the coal dispute was largely responsible, leaving a gross surplus of £659,031 (£636,925). From this surplus the following charges had to be met:—Interest, £256,199; sinking fund, £286,465; income tax, £75,708. The net profit was therefore £40,659, as compared with £32,857 in 1925-26. The capital expenditure during the year amounted to £524,441, the chief items being £329,030 for mains, and £84,692 for transformers and distributing stations. The total now expended on the undertaking stands at £9,141,156. The sales of electrical

energy increased from 300,440,765 to 323,547,741 kWh, and the electricity not accounted for amounted to 59,292,019 kWh, or 14.41 per cent., of the total generated (411,475,210 kWh). The maximum supply demanded was 140,860 kW, an increase of 4,750 kW. The average price obtained per kWh showed a slight increase from 1.12d. to 1.20d. No additions were made to the plant at Barton power station, but substantial advancement was made on preparatory work for the extensions now in progress, which will include a 40,000-kW turbo-alternator. Five new sub-stations were put into commission during the year, and extensions were carried out at 18 other stations. The mains laid amounted to 56 miles, bringing the total to approximately 820 miles. Good progress was made in the development of the cooker hiring scheme, and the number of cookers installed during the year was 1,533, bringing the total up to 3,029.

PROGRESS DURING APRIL.—During the month of April the electricity undertaking showed an increase in connections of 3,136 kW, bringing the total to 319,744 kW; and the number of applications received for supply, including consumers for additional supplies, was 964, representing a total of 2,771 kW. The number of hired cookers connected increased by 146, bringing the total actually on circuit to 3,175. Applications for the hire of cookers totalled 131. Two new sub-stations were put into commission at Blackley and at the works of Messrs. R. & J. Dempster, Ltd., and additional plant was installed at three existing stations.

Newark-on-Trent.—ELECTRICITY AGREEMENT.—The Town Council has entered into an agreement with Messrs. Ransome and Marles Bearing Co., Ltd., to supply a minimum of 850,000 kWh per annum.

New Zealand.—MANGAHAO SCHEME.—The *Electrical Engineer of Australia and New Zealand* states that interesting figures illustrating how the demand for electricity is growing in New Zealand appear in a recent issue of *Board and Council*. They refer to the Mangahao scheme, but may be taken as typical of conditions throughout the Dominion. So great has been the success of the scheme that the estimated power demand at the end of five years has already been exceeded, though the first bulk supply was commenced less than three years ago. These demands have severely strained the capacity of the Mangahao hydro-electric station, particularly as the season has been dry and the full water storage is not yet complete. At certain periods the station has had to be assisted by the steam plant of the Wellington City Council and by crude oil plants run by some of the local authorities.

Oldham.—LOANS—The Corporation Electricity Committee is applying for sanction to the following loans:—Superstructure, £36,575; structural steelwork, £19,500; switchgear, £41,000; economisers, £27,300; overhead travelling crane, £3,100; miscellaneous, including engineering, architects', and legal charges, £15,000; civil engineering work being carried out by direct labour—expenditure to March 25th, 1927, £8,500.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—YORKTOWN AND BLACKWATER.—*The Yorktown and Blackwater Gas and Electricity Co.*—Power: Reduced to a flat rate of 4½d. per kWh.

HEYWOOD.—The charges for electricity have been reduced to those prevailing prior to the coal dispute.

Sheffield.—ELECTRICITY EXTENSIONS.—During May the Electric Supply Committee approved extensions of mains for general distribution purposes at a cost of £11,032.

Shipley.—INAUGURATION OF PLANT.—The new plant which has been installed at the Urban District Council's electricity works is to be formally inaugurated on June 30th.

South Africa.—CAPE TOWN.—According to the *South African Engineer*, the City Council has given its approval to a proposal by the Electricity Supply Commission to build a small hydro-electric generating station near sea level almost immediately below the Steenbras waterworks tunnel exit at Gordon's Bay. This will be fed into the Commission's rural supply transmission system at its sub-station at the Cape Explosives Works, Somerset West. The station will probably contain, in the first instance, three 600-kW sets. The Commission will bear all costs involved in putting the scheme to operation.

The authority of the ratepayers has been received to raise a loan of £500,000 for extensions to the city electricity undertaking during the ensuing three years. The loan is made up as follows:—Land and buildings, £30,000; machinery, £77,750; distribution, £382,250.

South-East Lancashire Electricity Advisory Board.—GLOSSOP.—The Engineering Advisory Committee has received communication from the Glossop Urban Electric Supply Co., Ltd., regarding a proposal to obtain a bulk supply of electricity, and has recommended the company to approach the Mossley, Hyde, Mossley, and Dukinfield Tramways and Electricity Board for a bulk supply.

FRINGE ORDERS.—The Board has been recommended to support the applications for Fringe Orders by Altrincham Electric Supply, Ltd., to supply in Ringway, and Buxton Corporation to supply in Chapel-en-le-Frith.

LEIGH BULK SUPPLY.—The Lancashire Electric Power Co., Ltd., proposes to lay a 33,000-V cable from Hill Top sub-station to a sub-station to be erected at Kirkhall Lane, for the purposes of supplying electricity in bulk to Leigh Corporation. The estimated cost of the scheme is £42,450, made up as follows:—Cable, £32,000; switchgear at Kirkhall sub-station, £3,200; two 4,000-kVA transformers, £6,000; sub-station building, £1,250. The Engineering Advisory Committee has recommended the Board to approve the proposal.

NEW MILLS.—Application is being made by the New Mills Urban District Council for a Special Order to supply electricity in its area, and the Board has been recommended to support the application.

STOCKPORT.—The Committee has received a report from Stockport Corporation on proposed extensions to its Millgate power station. The report states that the Millgate site is capable of being developed to a capacity of from 130,000 to 140,000 kW. The cost of the first section is estimated at £257,620, and would include one 25,000-kW turbo-alternator and four 50,000-lb. boilers. This section would raise the capacity of the station to 57,000 kW. The estimated cost of the whole extensions is £900,000. The Committee has requested the Corporation to furnish particulars which are usually submitted by undertakers in connection with applications for extensions and new stations, and has decided to inspect the station. The minutes of the proceedings of the Engineering Advisory Committee have been approved by the Board.

Special Orders.—Application has been made to the Electricity Commissioners by the Silsden Urban District Council to amend the Silsden Special Order authorising the Council to take over from the Yorkshire Electric Power Co. the supply of electricity in the area outlined in the Order.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising Scarborough Corporation to supply electricity in the urban districts of Scalby and Filey and the rural district of Scarborough, and Chester City Council to supply in the urban district of Tarwin and part of the rural district of Tarwin.

Staveley.—NEW PLANT.—The Staveley Coal and Iron Co. last week installed the second of three 7,000-h.p. gas engines for the generation of electricity for private and public use in the district. Each engine will generate 5,000 kW, and is driven by blast furnace gases, while the exhaust gases are used for producing steam.

Stoke-on-Trent.—ELECTRICITY SUPPLY.—The Corporation Electricity Committee has agreed to give Messrs. Johnson Bros., Ltd., a 3-phase supply at the Imperial and Hanley Potteries, and to lay a 4-core distributor from Franklyn Street sub-station at a cost of £1,300.

The Committee has had correspondence with Mr. T. Riley, electrical contractor of Tunstall respecting a supply to Basford Hall estate, and has decided to lay the necessary mains to the houses subject to the payment by owners or occupiers of £15 per house.

Stourport.—STATION INAUGURATION.—The new generating station of the Shropshire, Worcestershire and Staffordshire Electric Power Co., which is described elsewhere in this issue, was formally inaugurated on June 2nd by the Prime Minister, in the presence of about 1,500 people, who included all the members of the Central Electricity Board and many other distinguished engineers. On arrival of the special train from London the visitors found the town beflagged for the occasion. Following his speech of welcome, Mr. E. Garcke, chairman of the company, presented Mr. and Mrs. Stanley Baldwin with souvenirs of the occasion. The Premier, in the course of his address said: "It has been one of the dreams of my life for many years to see electricity brought into our rural districts in the hope that one day we may find, at any rate, parts of England where electricity plays as great a part in the daily life of the poorest people as it does in Sweden and Switzerland. Apart from cheap production, the chief difficulty lies in bringing together producer and consumer. The country people must be told what electricity can do for them."

Mr. Baldwin described the new station as an integral part of the scheme approved by the Electricity Commissioners for the South-West and Midland districts. The next scheme of the Electricity Board would deal with Central England—a difficult district because it contained highly industrialised portions and an enormous rural area. He was told that the supply from Stourport would go as far as Cheltenham and Tewkesbury, Gloucester, and the Forest of Dean. That would be a natural link with the great industrial area of South Wales, and Stourport would be an essential part of the main arterial system of transmission which must be constructed from end to end of Great Britain.

Sir John F. C. Snell, chairman of the Electricity Commission, and Viscount Ednam also spoke. The proceedings were amplified by B.T.H. loud-speakers and broadcast by the B.B.C. The band of the 8th Battalion of the Worcestershire Regiment provided music during the afternoon, and tea was served in marquees on the lawn.

Tramway and Railway Notes.

Blackburn.—FARES.—The Corporation Tramways Committee has decided to inaugurate as an experiment penny fares for a period of six months on all sections of the tramway.

Continental.—SWITZERLAND.—The directors of the Berne-Neuenburg railway have decided on the electrification of the line. To finance the work the authorities of the Canton of Berne are providing a loan of £88,400, and the Swiss Government one of £136,000, while several other cantonal and local authorities are assisting in the scheme.

Glasgow.—NEW CARS.—The Corporation Tramways Committee has asked the manager, in preparing the specification for the construction of the 50 new cars to be purchased, to confer with the deputation appointed to inspect various tramway systems, and thereafter submit the specification to the sub-committee.

Gravesend.—PROPOSED ABANDONMENT OF TRAMWAYS.—In connection with the proposal of the Gravesend and Northfleet Electric Tramways, Ltd., to abandon the tramways in Gravesend and Northfleet and substitute motor-'buses, Mr. H. H. Brown, town clerk of Gravesend, has had interviews with the representatives of the company with regard to the reinstatement of the roads, &c., and the Highways Committee has recommended that the company be informed that the local authorities are not prepared to consider any offer involving preferential treatment for running of 'buses and adhere to their refusal to accept the company's offer of £2,500, and that if this is its final word they will have no alternative but to lodge a petition against the confirmation of the Provisional Order.

Leeds.—TRAMWAY SCHEME.—The Corporation Tramways Committee is considering a scheme for the construction of sleeper tramway track in lieu of the existing paved track in York Road from Harehills Lane to East End Park.

YEAR'S WORKING.—The accounts of the Corporation tramway undertaking for the year ended March 31st last show a net surplus of £50,736.

Manchester.—YEAR'S WORKING.—We have received from Mr. H. Mattinson, general manager and chief engineer of the Corporation tramway undertaking, a copy of the annual report, together with the abstract of accounts for the year ended March 31st last. The revenue account records a total income of £1,757,522, as compared with £1,787,711 in the preceding year, the decrease being due to the general strike, which was responsible for a loss in revenue of £46,000, and an estimated actual net loss of £26,000. The working expenditure amounted to £1,451,659, as against £1,395,192, leaving a gross profit of £305,863 (£392,519), to which was added interest on investments, &c., unemployment grants, and a balance from the Parcels Department, making a total of £335,814. There was a deficit on the motor-omnibus service, however, of £5,943, leaving £329,871 for disposal. This was dealt with as follows:—Interest, £111,677; debt redemption, £110,321; street improvements—interest and sinking fund, £8,908; rent of leased lines, £27,062; income tax, £26,575. The net surplus was, therefore, £45,328, which was transferred to the renewals account. The previous year's working resulted in a surplus of £116,608. The capital expenditure during the year amounted to £192,897, the chief items being £83,779 for depôt buildings, and £69,003 for rolling stock. The total now spent on the undertaking is £3,767,286. The number of passengers carried decreased from 317,644,753 to 310,559,874, for which the general strike was also responsible, but the car miles run rose from 22,567,759 to 22,783,254. The total revenue per car mile fell from 19.012d. to 18.514d., and the total consumption of electricity increased from 43,261,942 to 43,900,518 kWh. Reconstruction of permanent way was carried out in 22 streets.

Salford.—TRACK CONSTRUCTION.—The Corporation Tramways Committee is seeking approval to lay down the necessary tramway track and construct overhead equipment required to make a connection between the tramway of the Swinton and Pendlebury Urban District Council (now leased to the Corporation) and the light railway of the Barton-upon-Irwell Rural District Council (now leased to the South Lancashire Tramways Co.). The cost is estimated at £4,000.

South Africa.—THE NATAL ELECTRIFICATION.—The Minister of Railways, in introducing his estimates, gave the House some interesting information regarding the results obtained from the electrification of the Natal main line. According to the *South African Engineer*, under electrification the traffic capacity of the Natal main line had increased to 26,700 tons, compared with a limit of 22,000 tons under steam. With additional engines a capacity of 30,000 tons could be handled. The financial results of electrification showed that during the three months July to September, 1926—the first three months of the entire electrified section—there was a surplus of £129,548, whereas the surplus during the corresponding period of 1924, and the last three months under steam working, was £117,364. The extent to which electrification has increased the surplus, after providing for interest on capital and all other charges, is equal to £50,000 per annum.

Telegraph and Telephone Notes.

Bulgaria.—RADIO-TELEGRAPHY.—The Commission appoint to examine the tenders for the construction of wirel stations has recommended that the contract be given to t English Marconi Co., the price being 33 million lev or about £50,000, and the Minister of Posts and Telegrap has confirmed the decision. Two German firms a one French firm also competed for the contract.—*Reut* (Sofia).

Among the apparatus to be installed at the st tions, which will be at Sofia, will be a high-speed transmitt with anode power of 10 kW and a wave-length range b tween 36 and 72 metres. It will be used for communicati with stations which are operated in England by Marcon Wireless Telegraph Co., and through which Sofia will be touch with the principal cities of the world. The Sofia st tions will also contain a high-speed long-wave combin telegraph and telephone transmitter for communication wi Vienna, with a wave range of from 2,000 to 4,000 metre and all the necessary electricity supply equipment and reser generating plant will be installed under the contract. F the receiving station a set of high-speed commercial r ceivers with a combined overall wave range of from 1,200 25,000 metres, and one short-wave non-radiating receiv with a wave range of from 15 to 100 metres, are to be su plied, and one complete set of apparatus for the Central Te graph Office control of the transmitters and receivers whi will be operated by the Postal and Telegraph Administratio

India.—RADIO-TELEGRAPHY.—India has kept well ahead development, says the annual report of the Indian Posts a Telegraphs Department for 1925-26. She has now an efficie system of stations to meet immediate requirements and organisation which will enable full advantage to be tak of future developments. The wireless stations in Burma a the Andaman Islands, which were erected in 1905, we among the earliest in the world for maintaining communic tion between fixed points on land. Coast stations for comm nicating with ships were erected a few years later at t principal ports and were followed by a chain of inla stations linking up the most important towns. Progress h called for a complete revision of regulations since the wa during the last five years a series of licences to suit vario purposes has been brought into existence, and arrangemen have been made for the issue of broadcast receiver licenc on an extensive scale, broadcasting on a temporary ba being carried out by several radio clubs, which are allotted share of the fees derived from licences. As regards n construction, only one large modern high-speed duplex wi less service between Madras and Rangoon has been inaug rated. A temporary direction-finding station was a erected at Karachi, and the results were of great value shipping. Schemes have been approved for completely modelling the coast stations at Karachi and Bombay a constructing permanent direction-finding stations to ass ships and aircraft, which work was in progress at the e of 1925-26, and arrangements have also been made for a te porary direction-finding station at the mouth of the Hoogh River to assist ships bound for the port of Calcutta.—*Reute Trade Service* (Bombay).

Radio Notes.

India.—STATION INAUGURATION.—The Viceroy will vi Bombay on July 23rd and will open the Indian Broadcasti Company's station, which is now practically complete. I will also open on that day the "beam" wireless-telegra service to England.

Regional Broadcasting.—REDUCTION OF STATIONS.—Lo Gainford, vice-chairman of the British Broadcasting Corpor tion, speaking at Truro recently, is reported to have sa that it was impossible to increase the size of the broadca wave-band in view of the just requirements of the Arm War Office, Air, and commercial and marine services. T only alternative was to reduce the number of stations Europe from 170 to 100. He hoped such a change would adopted in the near future. There were 19 stations Britain working on the broadcast wave-band, excludi Daventry. Their proposals were to decrease the number British transmitters using the broadcast wave-band, f which exclusive wave-lengths would be granted to Britai in an equitable international agreement. The objective w to bring to every listener the choice of a minimum of tv contrasted programmes capable of reception on the cheape and simplest apparatus. In addition, there would be t long-wave station at Daventry, giving a total of ten trar mitters altogether. Lord Gainford was referring to t regional scheme under which the whole country will ul mately be served by five, six, or seven high-power statio using ten or more wave-lengths, so that it will be possib for each to send out two programmes on different wav lengths.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Aberdeen.—June 13th. Ellon Castle Estates, Ltd. Electrical work at four blocks of houses. Messrs. Tawse and Allan, architects, 10, Bon Accord Square, Aberdeen.

Adwick-le-Street.—June 21st. Urban District Council. Cables, boxes, pillars, &c. (See this issue.)

Australia.—Melbourne.—August 15th. Postmaster-General's Department. One 55-ton 3-motor-type electrically-operated overhead travelling crane. (A.X. 4727.)*

Sydney.—July 18th. Municipal Council. Boiler-house equipment for the Bunnerong power station. (B.X. 3531.)* August 15th. Generator neutral earthing resistance. (B.X. 3550.)*

Cheadle and Gatley.—June 28th. Electricity Department. Static transformer, e.h.p. switch cubicle, and transformer switch and distributor kiosk. (See this issue.)

Dundee.—June 24th. Electricity Department. Three 500-kVA outdoor-type transformers and two sets of 750-kW rotary convertors. (See this issue.)

Egypt.—Egyptian State Railways, Telegraphs and Telephones. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, S.W.1. Telegraph and telephone materials: wire, porcelain insulators, enamelled cable, copper binders and pipes, £E4,000 to £E4,300.—*Reuter's Trade Service* (Cairo).

Glasgow.—June 16th. Corporation. Electric lighting installations for 510 houses at Knightswood. Specifications from Town Clerk.

Greenock.—June 17th. Corporation. Supply and erection of 11,000-V overhead transmission line and transformers. (June 3rd.)

Hull.—June 16th. Electricity Department. Steel coal hunker and conveyor housing. (May 20th.)
Switchgear extensions. (May 27th.)
The Corporation Health Committee is to obtain tenders for the installation of electric stoves and wiring at the Sanarium.

Kirkcaldy.—July 2nd. Electricity Department. L.p. c. distribution, l.p. and e.h.p. cables, boxes, and roadwork. (See this issue.)

Lanark.—June 13th. County Council Housing Department. Electric lighting installations for 100 houses at Carlyle, for 172 at Uddingston. Mr. P. C. Smith, Housing Department, Hamilton.

London.—Stepney.—July 11th. Electricity Supply Department. Boilers and boiler-house accessories, turbo-alternator, condenser, accessories, and switchgear. (June 3rd.)
H.M. Office of Works. June 13th. Fuseboards and fuses. (June 3rd.)

Manchester.—June 13th. Electricity Department. Seven 500-kVA static transformers. Mr. H. C. Lamb, chief engineer and manager, Town Hall, Manchester.

Marlborough. — Electricity Department. Additional underground feeder and overhead feeder. (May 27th.)

New Zealand.—Wellington.—August 9th. Public Works Department. 1,500 suspension insulator strings and 470 strain insulator strings (B.X. 3533.)*

Nottingham. — June 21st. Electricity Department. General stores for 12 months. (June 3rd.)

Oldham.—June 11th. Electricity Department. Water-cooling towers, foundations, tanks, and circulating water pipes. (May 27th.)

Portsmouth. — Electricity Department. Transformers. (May 27th.)

Pudsey.—June 14th. Electric lighting installation at the School of Art. Specification from Education Department, County Hall, Wakefield.

Sheffield.—June 11th. Tramways and Motors Committee. Supply and erection of weighbridge. Mr. A. R. Burnley, general manager, Division Street, Sheffield.

South Africa.—Cape Town.—June 30th. South African Railways and Harbours Board. Gasfilled and vacuum lamps for 12 months. (B.X. 3518.)* Telegraph material. (B.X. 3519.)*

Elliott (C.P.).—June 15th. Municipal Council. Electric lighting plant, including engines and dynamos, steel poles, copper wire, insulators, switchboard meters, house-service fuses and street-lighting brackets and suspension fittings.

Edenburg (O.F.S.).—June 21st. Municipal Council. Electric lighting plant, including engines, dynamos, steel poles, &c.

Southend-on-Sea.—July 6th. Light Railways and Electricity Department. L.p. and e.h.p. cables for 12 months. (June 3rd.)

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*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Electricity Committee. Accepted:—
10,850 yd. cable (£2,365).—Macintosh Cable Co., Ltd.

Bolton.—Electricity Committee. Accepted:—
Alterations and repairs to two rotary convertors at Duncan Street sub-station.—Metropolitan-Vickers Electrical Co., Ltd.

Burton-on-Trent.—Electricity Committee. Accepted:—
High-tension feeders, transformers, switchgear and low-tension feeders for supply to Stretton, Rolleston and Tutbury (£16,177).—Johnson & Phillips, Ltd.

Doncaster.—Electricity Committee. Accepted:—
L.p. cables (£2,621).—Hogan & Wardrop. This matter is referred to in our "Business Notices."
E.h.p. cables (£364).—Callender's Cable & Construction Co., Ltd.
Circulating-water pipework (£657).—Johnson & Moore.
Water intake from canal, pipework and screen (£1,775). —J. Holmes.

Grimsby.—Electricity Committee. Recommended:—
E.h.p. feeder cable and pilot cable (£2,597).—Johnson and Phillips, Ltd.
L.p. feeder cable (£1,236).—Connolly's (Blackley), Ltd.

India.—Great Indian Peninsula Railway.
269 miles of overhead line on lattice steel towers, for the supply of current to the railway from Igatpuri to Poona (approximately £300,000).—W. T. Henley's Telegraph Works Co., Ltd. Reference is made to this contract in our "Business and Industrial Notes" pages.

Leeds.—Electricity Committee. Accepted:—
Cables (£2,138), Enfield Cable Works, Ltd.; (£2,738), W. T. Henley's Telegraph Works Co., Ltd.; (£1,840), Hackbridge Cable Co., Ltd.; and (£14,047), Macintosh Cable Co., Ltd.
Switchgear (£232).—Yorkshire Switchgear & Engineering Co., Ltd., and (£297), H. J. Fuller & Sons.
Tramways Committee. Accepted:—
Two reciprocating rail grinders (£1,063).—Equipment and Engineering Co., Ltd.
Repairs to economiser at generating station (£1,251)—E. Green & Son, Ltd.
Town Hall Committee. Accepted:—
Electric fan blower for town hall organ (£245).—Abbott and Smith.

Maidstone.—Town Council. Accepted:—
Overhead materials for the trolley vehicle service.—British Insulated Cables, Ltd. (£186), and Wiseman, Ltd. (£162).

Oldham.—Education Committee. Accepted:—
Electric lighting installations at Werneth and Clarksfield housewifery centres.—W. Caton & Sons.

Plymouth.—Electricity Committee. Accepted:—
Transformers.—British Electric Transformer Co., Ltd.
A.c. meters.—Metropolitan-Vickers Electrical Co., Ltd.
D.c. meters.—Ferranti, Ltd.
Cables.—British Insulated Cables, Ltd.

Selkirk.—Town Council. Accepted:—
Electric lighting installation for the Victoria Halls (£319).—Jas. Kilpatrick & Son, Ltd.

Sheffield.—Electricity Committee. Accepted:—
Materials and work for lining steel coal bunkers at Neepsend (£499).—George Longden & Son, Ltd.
Tramways Committee. Accepted:—
20 pairs twin movable connected points (£2,515); 3 standard crossings (£84).—Hadfields, Ltd.
12 leg type crossings (£539).—Titan Trackwork Co., Ltd.
Six leg type crossings (£332).—Edgar Allen & Co., Ltd.

Forthcoming Events.

Physical Society.—Friday, June 10th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Heat Engine Trials Committee.—Friday, June 10th. Institution of Civil Engineers. 6 p.m. Discussion on the Report on the Results of Heat Engine Trials.

Illuminating Engineering Society.—Tuesday, June 14th. Stationers' Hall, E.C.4. 6 p.m. Discussion on "The Relation between Illumination and Fine Work," to be opened by Mr. H. C. Weston.

Institution of Electrical Engineers.—Summer meeting. Newcastle-on-Tyne. June 14th to 17th.

Röntgen Society.—Tuesday, June 14th. 1, Wimpole Street, W. Silvanus Thompson Memorial lecture, "The Structure of the Atom and Radiation." Prof. Sir J. J. Thomson, F.R.S.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Micro tube heaters.
Daisy washing machines.
Anthony's patent boiler feed pumps as made by Messrs. Robert Warner.

Notes.

Electric Heating in an Operating Theatre.

A successful method of utilising electricity for a special heating purpose in exceptional circumstances has been applied to the operating theatre of the Harwich and District Cottage Hospital. The hospital is equipped with a central heating system and, in order that the operating theatre might be kept at a suitable temperature, it was found necessary to keep the main boiler going practically all the year round and at times when it was not required for the general heating of the hospital. The aim of the managerial staff was to raise the temperature of the operating theatre during periods when the main system was shut down and extra heat was necessary, the process to occupy about 30 minutes, but the problem was accentuated by the fact that whatever system was employed, owing to the lack of space, the apparatus had to be of a type that could be easily and quickly removable after performing its duty. The solution was the adoption of a portable electric radiator, the success of which in actual service has been of a pronounced character. The apparatus is of the "Magnet" type manufactured by the General Electric Co., Ltd., loaded to 12 kW, and the desired temperature is obtained well within the time required. A tray is provided for the flexibles, so that they may be quickly disposed of when the radiator is wheeled out of the theatre. This method of heating should commend itself to many other authorities where similar circumstances exist.

Non-Ferrous Metals Research Association.

The seventh annual report of the British Non-Ferrous Metals Research Association, for the year ended December 31st, 1926, shows that during the year the membership increased from 139 to 144. The income of the Association from its industrial members increased by £1,164 over that fo the previous year to £9,155, and the minimum income cond tion on which the Government grant depends has been fu filled. Over £25,000 was expended during the period unde review on various researches. Considerable efforts hav been made to improve the form of the Association's report and a special conference of the Association's investigato has recently been held to consider this question. During th year forty-two investigators were working on the researche and over fifty research reports have been placed at the di posal of members. The following have joined the Counc by co-option:—Prof. D. Hanson, D.Sc., Mr. J. Leechmar and Dr. C. R. Young. The Association is co-operating in scheme for linking the Government service interests i electro-deposition with industrial developments and applic tions. The arrangements made by the Department Scientific and Industrial Research have provided a sum £5,000 to be expended over three years for the investig tions. The Association is contributing a small fraction the cost and is participating in the results of all the wor

The Shannon Power Scheme.

In a paper on "The Shannon Power Development Scheme, by Prof. S. W. Perrott, M.Inst.C.E., read before the Liverpo Engineering Society, the author gives a *résumé* of the wor which is being done in connection with the Shanno hydro-electric development. It is estimated that the averag flow of the river is about 12,400 cu. ft. of water per second fo the whole year, the flow being very large in the winter an very small in the summer. In the total development, which to produce 180,000 h.p., it is intended to raise the levels Lough Allen, Lough Rea, and Lough Derg, so as to giv a gross storage of 29,800 million cu. ft. From the intake to th power house the head race runs a distance of 6.46 miles. It intended to keep the water level in the head race almost at th same level as in Lough Derg, so as to provide a head of fro 90 to 100 ft. near the power house. The construction of th head race will necessitate the excavation of some six to seve million cu. yd. of earth, and over one million cu. yd. of roc The tail race, which is over a mile long, will entail the re moval of over a million cu. yd. of earth, and the same amou of rock. To provide an even discharge of water from th tail race into the Shannon, the bed of the latter will nee deepening at several points below the mouth of the race, tota ling about 1.2 miles. It is intended to admit boats to the ta race, and beside the power house a ship lift is to be provide to enable the vessels to be raised to the level of the head rac For the full development the calculated water level in Loug Derg is taken as 117 ft. for the highest and 105 ft. for th lowest level. The concreting operations on the constructio of the weir sills, &c., are being carried out with the help of cable way having a 1,300-ft. span, with towers 130 ft. hig The excavation of the head race is being carried out by mean of electric dredgers which are supplied from a 300-metre lengt of loop line running loosely in guards. A portable transforme wagon running on a 3-ft. gauge track is stationed at the en of the line, which it feeds at 3,000 V, transforming from 17,0 V. The main motor of the dredger is fed at the high pressur while a second transformer feeds the compressor and winc motors at 380 V. When a 300-metre section is completed th loop-line wires are pulled through another 300 metres withou causing much delay to the excavating. In this way 600 metre of the canal may be dealt with without changing the positio of the transformer wagon. The bucket excavators consum from 0.5 to 0.9 kWh per cu. m. The temporary power statio at Ardnacrusha, which has been erected to supply electricit to the works, is equipped with seven 560-kVA and two 300-kV. Diesel-driven generators. The paper was illustrated by mean of lantern slides.

Power Transmission by Radio.

"Beams of radio power, criss-crossing a city like searchligh rays and carrying light and power as wires do now," wer discussed as future scientific possibilities, following spectacula demonstrations by two Westinghouse engineers, Dr. Harve C. Rentschler and Dr. Phillips Thomas, to the New Yor Electrical Society recently. Electric lamps held by Dr. Thoma glowed brightly, although not connected to power wires in a novel furnace displayed by Dr. Rentschler chemical r actions possible only in a vacuum were initiated by radi waves; and a disk of metallic tungsten was heated whit hot "in an instant" by the rays. Dr. Thomas, who research engineer of the Westinghouse Electric and Manu facturing Company, U.S.A., generated before the Societ waves as short as 240 centimetres (8 feet) and predicted tha still shorter waves will be produced, capable of being cor centrated into narrow and powerful beams. "We ma visualise," he said, "a parallel beam of radiation 10 cent metres (4 inches across) along which is being sent 10 kV of energy; imagine each house furnished with a half-wav oscillator in line with a parallel beam from a sending statio so that heat and light may be obtained very much as a present, by simply turning a switch, but without the costl transmission wire equipment now required. Again, suppos the beam of highly-concentrated energy should render cor ducting the air through which it passes; then ordinary electri power could be sent along the beam as though the bear were a transmission line and the beam could be directed t any desired spot, with dire results to the target."

The furnace demonstrated to the Society by Dr. Rentschle who is director of research of the Westinghouse Lamp Com

pany, is designed to concentrate large amounts of radio power within a small space; certain metals, although long known to chemists, cannot be prepared usefully in metallic form by ordinary methods because they are combustible when in fine powder form, taking fire in air whenever they are heated. By conducting the heating of these inflammable metals with radio power and in a vacuum, Dr. Rentschler has made them in metallic form and in some quantity. Two of these metals, thorium and uranium, belong to the group of radio-active metals including radium. Now that the use of the vacuum radio furnace has made these peculiar metals available, it is expected to find uses for them, Dr. Rentschler said, in industry. Another use of the radio furnace is to turn metals like gold and silver into gases, so that their individual atoms can be studied and weighed, with results of important value to atomic science.

Rural Development in Warwickshire.

Speaking at the recent opening of the new electricity showroom at Solihull, to meet the convenience and rapidly-growing requirements of consumers in the area of the rural district of Solihull, in which the Birmingham City Electricity Department is now furnishing electricity, Councillor Beale, chairman of the Electricity Committee, stated that 38 miles of mains had been laid in Olton, Shirley and Solihull, and £53,000 spent in the district. 570 consumers were already connected, a good record, seeing that they were not able to commence work until the Order from the Electricity Commissioners was obtained in March, 1926. They hoped to spread out towards Knowle and Dorridge in the autumn, and proposed to construct a ring main so that supplies could be afforded to villages in the neighbourhood if justified by the demand. The agricultural use of electricity was one means by which the demand might be extended.

The Association of Consulting Engineers.

The proceedings at the annual meeting on May 27th and the Committee's report for the year ended April 30th, 1927, indicate the total membership to be 112, new members elected during the year numbering 5. Objection having been raised to the system of classification adopted in order to assist those requiring the services of engineers practising in any particular branches to know which members devote themselves to these special branches, the Committee ascertained the opinion of the whole body of members, with the result that an overwhelming proportion desired no change. The Department of Overseas Trade suggests that when the Association is informed that engineering schemes are under consideration in different places abroad, English consulting engineers should offer their services. Under the rules of the Association and of the Institutions of Civil, Electrical and Mechanical Engineers such a practice is not allowed, but the Department is of the opinion that such a rule, "while doubtless of great use in the United Kingdom, must inevitably lead to loss of opportunities for practice in countries where such a rule does not operate, and where engineers of the same type are normally free to use any legitimate means to influence public authorities to employ them." It is hoped to report more fully to members the result of joint deliberations. Amongst other matters on which the advice of the Committee was sought during the year was as to the proper fees to be charged in certain cases. The Committee has considered the Bill now before Parliament for the registration of architects, which is being opposed by the Institution of Civil Engineers, and has associated itself with the opposition.

Mr. J. W. E. Binnie, chairman, pointed out that the Association would shortly be celebrating its coming-of-age, and he would like to see Mr. A. H. Dykes (hon. secretary) occupying the chair that year. Some discussion took place with regard to the opposition to the Architects' Bill, after which the report was adopted. Mr. S. C. Lewis, hon. treasurer, reported that the financial position of the Association was sound: the income and expenditure account showed a substantial saving in the year; there was a balance in hand last year of £50 on deposit and a cash balance of £154. The income was £475 and the expenditure £403. The accounts were adopted, and the chairman announced that the new members elected to the Committee were:—London members: Mr. H. J. Dean, Mr. S. B. Donkin, Mr. W. Vaux Graham, and Mr. Walter Mansergh; country members: Mr. David Balfour and Mr. Ravenshaw.

Transformer Ratio and Phase Displacement.

In a paper published in the April issue of the I.E.E. *Journal*, Mr. B. G. Churcher, A.M.I.E.E., describes null methods of measuring the ratio and phase displacement of two alternating voltages which are particularly applicable to high voltages and are discussed in connection with the testing of power and potential transformers. An important feature is the use of a capacitance potential divider in place of the resistance type hitherto used; it possesses considerable advantages from the point of view of simplicity and low cost of equipment and ease of operation, while accuracy can be made as high as is desired, and there is practically no limit to the voltage at which capacitance dividers can be used. The theory of a method of measuring the ratio and phase displacement of transformers is outlined and its operation is illustrated by a test on a 66,000-volt potential transformer. Suggestions are made for developing apparatus for routine industrial testing, and it is pointed out that robust construction and adequate safety to the operator could be secured while retaining ample accuracy for commercial purposes. Tapping the secondary winding of a high-voltage testing transformer for the purpose of operating a wattmeter or voltmeter is considered, and a method of determining the ratio and phase displacement of the full and fractional voltages is explained. The testing of high-voltage potential dividers is also briefly considered.

A Low-Fall Hydro-Electric Installation.

Some interesting particulars are given in the *Implement and Machinery Review* of a small hydro-electric installation which has been put down on the site of an old water wheel on the farm of General Hildebrand at Higham, near Colchester, where, at low-water times, a fall as low as 18 in. is utilised. A "Pitman" Francis vertical-shaft turbine of about 12 b.h.p. drives a compound-wound electric generator through bevel gearing. A raw-hide pinion wheel on the lay shaft renders the plant silent in operation. A balanced flywheel and a flexible insulated coupling are used to assist the governing. The turbine has movable guide vanes operated by a "Pitman" oil-pressure governor. The plant runs in conjunction with a battery which supplies electricity for lighting the farm at 50 V. Power for various machines on the farm is supplied from the generator direct at 100 V. The installation was put in by Mr. Percy Pitman, M.I.Mech.E.

Voltage Standardisation in the Dutch East Indies.

The need of some degree of standardisation of voltage has been for some time under consideration, and it has recently been decided that, in the case of direct current, 110, 220, and 600 V are to be the standards with 440 V as a recognised "outsider"; the 110 voltage is intended for small individual installations, 220 V for general use for lighting and power purposes, and 600 V for power distribution, including street-railway supply. In the case of alternating current, 50 periods is to be the standard frequency and 220 V for power, 127 V for lighting, and 380 V for large power installations, with expert supervision; existing a.c. installations at 110, 190, and 500 V are still to be recognised and provided for. As regards h.p. installations, 6,000 V is to be regarded as the limit for large generators and distributing systems, 10,000 V having been found too high, owing to the climatic conditions. For h.p. overhead transmission purposes 30,000 V is to be the standard with recognised "outsiders" of 3,000, 15,000, and 25,000 V.

Fatality.

Whilst watching the boats on the Thames from the riverside gardens of the Sun Hotel, Richmond-on-Thames, on June 7th, Paul Barrett, of Chiswick, grasped a wire which ran from a flagstaff connecting it with electric wires used in the illumination of the gardens, and received a fatal electric shock.

Broadcast Radio Coverage of City Areas.

Mr. Lloyd Espenschied, of the American Telephone and Telegraph Co., recently published in the A.I.E.E. *Journal* some of the results of a systematic study which was made of the "coverage" of the New York metropolitan area, which portray some of the general requirements of a broadcasting system. Two types of transmission wave component are involved: one delivers directly to the receiving area immediately surrounding a broadcasting station a field capable of reliable high-grade reception; and another, transmitted through the higher altitudes, permits distant reception, but not with the reliability and freedom from interference required of high-grade reproduction. The day and night fields are roughly the same: fading commences between 50 and 100 miles from the stations and the range of the fluctuations increases to the maximum distance observed. A fact of importance is that "fading," which ordinarily is noticed at distances of the order of 100 miles, may under some conditions become prominent at distances as short as 20 miles from the transmitting station. Such short-distance fading appears to be a case of unusually high attenuation, caused by a tall building area greatly weakening the directly transmitted wave so as to enable the effect of the indirect wave component to become pronounced at night.

1. Field strengths of the order of 50,000 or 100,000 μ V per m appear to be about as strong as one should ordinarily desire; fields much stronger than this impose a handicap upon those wishing to receive some other station.

2. Fields between 50,000 and 10,000 μ V per m represent a very desirable operating level, which is ordinarily free from interference and may be expected to give reliable year-round reception, except for occasional interference from nearby thunderstorms.

3. Below 1,000 μ V per m reception becomes distinctly unreliable, and is generally poor in summer.

A 5-kW station may be expected to deliver a field of 10,000 microvolts some 10 to 20 miles away, and a 1,000-microvolt field not more than 50 miles, which fact indicates clearly the need for the employment of higher transmitting powers. The range goes up with the increase of power disappointingly slowly; even were no absorption present in the transmitting medium, the range in respect of overcoming interference would increase only as the square root of the increase in power. To extend the 10,000-microvolt field from 15 to 30

miles would necessitate an increase in the radiated power from about 5 to 100 kW. The "shadows" cast by the areas of high buildings are prominent; distribution effected from a location well outside of the suburbs is an attempt to encompass within the range of the station a widespread area and so to include the city within that area as to effect a more uniform distribution over it than is possible when transmitting from a location within the city.

Regarding the important factor of frequency selectivity for multi-station operation, receiving circuits group themselves into three classes in the order of their selectivity merit as follows:—

1. The single-tuned circuit (non-regenerative and regenerative), and the combination of two tuned circuits coupled together.
2. Circuits employing radio-frequency amplification with tuned circuits between stages.
3. The double-detection or superheterodyne type of circuit.

Attention is called to the fact that the various circuits attenuate *within* the desired transmission band of 5 or 10 kilocycles, which means that the higher-frequency components of the side band will be reduced (after detection) with corresponding distortion of the reproduction; the distortion is greater for the more highly selective sets, following from the nature of sharply-tuned circuits. Selective circuits, capable of approximating the filter type of characteristic, are to be desired.

Loud-speaker reproduction indicates that ordinarily a level of the average of the undesired signal 40 TU (power ratio) lower than that of the desired signal, while not introducing noticeable interference at times when the desired signal is strong, does permit the undesired signal to "show through" when the programme rendition is weak; reducing the undesired signal to 60 TU below the desired signal prevents this interference for the volume ranges which are now commonly transmitted.

When locating a new transmitting station it should be possible from a knowledge of the relative field strengths of other stations in the vicinity to predict approximately what the interference area will be for different types of receiving sets. In this connection there should be recognised the advantage from the interference standpoint which exists in grouping together the broadcast transmitting stations in one location, and in equalising their powers, to enable receivers to obtain substantially equal fields from all of the stations and minimise the selectivity which they are required to possess. While it is impracticable to accomplish this result completely, it is hoped that a better understanding of the mutual advantage to be gained from reducing interference will lead naturally to better co-ordination.

Flies and Dust.

In a letter to the *Daily Telegraph*, Mr. A. Moore Hogarth, chairman of the College of Pestology, says: It is gratifying to remark that the Prime Minister in his reference to electricity emphasised the note of cleanness. There is something within us all which responds to things clean; we may not be conscious of it, but a clean shop, a clean factory, a clean man, a clean house, gives us a feeling of wholesomeness and evokes an immediate response. I doubt if there is a more clean place in the world than our London electric railways; flies are practically an unknown quantity there, and it would seem that the ozone generated by the electric current is inimical to pests, but whether this be true or not it is certainly true that before flies and other living minute evils reach maturity they are capable of being completely annihilated by electricity harnessed into various forms, by which these particles of living dirt can be sucked out of their nurseries. Just recently I incubated one dram weight of dust from a suction sweeper, and I got as a result two flies and one flea. There is nothing to stir the imagination in such a small result, but there it is as an evidence of possibilities.

The Manufacture of Aluminium in Canada.

A large plant for the manufacture of aluminium has been established at the new township of Arvida in Quebec, by the Aluminium Company of Canada, in which a part of the enormous power of the River Saguenay will be utilised. The raw material will be cryolite from Greenland and bauxite from South America, and both of these materials will be previously refined and ground before being sent to Arvida, the bauxite being received in the form of pure alumina. The process is electrolytic, and consists briefly in passing a direct current through a molten bath of cryolite in which alumina to the extent of about 15 per cent. is dissolved, thus forming the electrolyte, to which fluorspar or other fluorides may be added in order to reduce the melting point of the mixture below the temperature desired for furnace operation. The current passes from carbon anodes through the electrolyte to the baked carbon lining of the furnace, which serves as the cathode. The metallic aluminium accumulates in a molten condition at the bottom of the furnace, where it is protected from oxidation by the bath of cryolite above it.

Provision is made for recovering the carbon of the used electrodes, for separating the iron therefrom by magnetic separators, and also for utilising other material, such as the green scrap from the hydraulic presses used in electrode manufacture. This used and waste material is conveyed to the mixing room, together with fresh supplies of ground coke and pitch, to be blended, pressed, and baked. The production of new electrodes is an essential part of the operations, and occupies a considerable proportion of the plant layout.

At Arvida there will be ultimately 40 furnace rooms, each containing 100 furnaces all running electrically in series; the voltage drop through any one pot is about 6 volts. Considerable skill is required in properly starting up a furnace room, and the electrolytic process must be very carefully controlled, especially in noting what is called the "anode effect." As electrolysis proceeds the concentration of alumina dissolved in the cryolite necessarily decreases, and ultimately reaches a point at which the anode effect occurs. The resistance of the furnace then rises sharply, the voltage jumps to several times its normal value, the electrolyte no longer "wets" the anodes, and the latter appear to be surrounded by a gaseous film through which a kind of glow discharge takes place. The duration of this anode effect must be reduced to a minimum, and is achieved by means of a system of lamp signals which indicate at once when the "effect" begins. The crust of "frozen" electrolyte on the surface of the bath is then broken with a crow-bar and stirred into the electrolyte beneath, thereby increasing the strength of the solution. Necessary anode adjustments are also made, and a small quantity of powdered aluminium is sprinkled on the surface of the newly-formed crust and stirred in at the next working. Theoretically it is possible to dissolve nearly 20 per cent. of alumina in molten cryolite, but this is not possible in practice, as the rate of solution is slow, and there is a risk that undissolved alumina may settle through the electrolyte to the bottom of the furnace. The maximum concentration of the solution must therefore be kept low, and the anode effect consequently occurs at frequent and regular intervals if the furnace is properly worked.

In the manufacture of one pound of aluminium about ¾ to 1 pound of carbon is used, and the energy consumption is probably in the neighbourhood of 12.5 kWh, but this has not yet been definitely determined at Arvida. A group bonus scheme has been introduced to speed-up output. The tapping of the furnaces and the collection of the molten aluminium are comparatively simple operations, but require great care and also strict analytical control of the resulting product to ensure that it is up to quality and free from iron and other impurities. The ultimate capacity of the Arvida plant is estimated at 300,000 tons of metallic aluminium per annum, or about twice the present world output. Numerous new uses and a great expansion of present uses will have to be found to absorb such an output.

Electric Steel Works in India.

In an instructive paper recently read before the Royal Society of Arts, on "The Iron and Steel Industry of India," Mr. R. Mather, B.Met., late metallurgical inspector, Government of India, points out that the industry is based entirely on indigenous materials with sufficient reserves to provide all the steel required by the country for at least one hundred years. The erection of electric steel works (of which the proprietors are Sir Sarupchand Hukumchand & Co.) was commenced in 1920 and the manufacture of steel began in 1922; the plant is situated at Ballygunge, a suburb of Calcutta, and consists of two 2-ton electric furnaces and a foundry for the production of steel castings. Electric power is obtained from the Calcutta Electric Power Corporation at rates which would not exceed ½ anna per kWh if the works were in full and continuous operation; the output of steel has never been more than a small proportion of the capacity, the production of castings having been about 510 tons in 1924, 760 tons in 1925, and 390 tons in 1926. During the last year, however, the works produced also about 150 tons of steel for springs, as it has acquired small rolling mills (20, 16 and 10-in., respectively), part of which it proposes to erect for the purpose of producing spring bar and other kinds of high-carbon bar.

The development of the steel-making plant and rolling mills at Jamshedpur, 157 miles west of Calcutta, of the Tata Iron and Steel Co., which produces two-thirds of the pig iron and almost all the steel made in India, has been important; the original open-hearth plant has been enlarged. The rolling mills originally erected by the Company were all steam-driven and of relatively small capacity; they have now been supplemented and almost superseded by the large equipment of new mills, all electrically driven, which came into operation in 1923 and 1924. Of nearly 35,000 tons of rolled steel produced in a recent month less than 5,000 tons were rolled on the old mills.

Standardisation in France.

A lecture by M. Tribot-Laspière, general secretary of the Union des Syndicats de l'Electricité, reported in *Génie Civil*, deals with the Association Française de Normalisation, which was formed last year, and corresponds with the B.E.S.A. in this country. It is pointed out that standardisation has been carried out in Germany for several years, with the help of the Government, which recently allotted a sum of 2½ million marks to the purpose, and that there is a risk that foreign buyers will adopt German standards and purchase German goods. Many standards have been promulgated in France by various bodies, including 41 set up by the Union des Syndicats de l'Electricité, but there was no central organisation for the purpose until the Association was formed ("A.F. Nor"). It will furnish information regarding French stand-

ards to foreigners, and regarding foreign industries to French manufacturers, and will be able to take part in the International Standardisation Association which is likely to be established in September next.

Appointments Vacant.

Engineer for the electrical department of the Government of the Punjab. Showroom sales and publicity superintendent (£300) and lady showroom demonstrator (£220), for the Leyton Corporation Electricity Department. Temporary shift engineer for the Eccles Corporation electricity works. Borough electrical engineer and manager (£1,250), for the Bolton Corporation electricity undertaking. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.

North-Western Centre.—The report of the Committee for the 1926-27 session shows that 10 meetings were held during the session, with an average attendance of 112, in addition to the Faraday Lecture and the annual dinner. At the annual general meeting the following officials and new committee men were elected for the 1927-28 session:—*Chairman*, Mr. A. B. Mallinson; *vice-chairmen*, Messrs. W. J. H. Wood and T. E. Herbert; *hon. secretary*, Mr. J. D. Peattie; *committee*, Messrs. H. Hawkins, A. L. Lunn, O. Howarth, H. Cobden Turner, and G. A. Juhlin; *hon. treasurer of benevolent fund*, Mr. A. S. Barnard. The officials for the Students' Section for the new session include: *Chairman*, Mr. G. R. Millward; *vice-chairman*, Mr. W. L. England; *hon. secretary*, Mr. H. W. Hardern.

Council's Nominations.—The Council's nominations for election to the Council to fill the vacancies which will occur on September 30th, 1927, are as follows:—*President*: Mr. A. Page; *vice-president*: Capt. J. M. Donaldson; *hon. treasurer*: Lieut.-Col. F. A. Cortez Leigh; *members of Council*: Major B. Binyon, Messrs. J. R. Beard, P. V. Hunter, H. Marryat, H. T. Young, and D. N. Dunlop.

Institution of Heating and Ventilating Engineers.

The Institution is holding its Summer Meetings on June 20th, 21st, and 22nd at Bournemouth.

Association of Mining Electrical Engineers.

The annual meeting was held held last week at Harrogate, Mr. D. Martin (Glasgow) presiding. The membership was reported to be 2,023. In his presidential address, Mr. G. M. Harvey (Birmingham) said that it was now universally acknowledged in the mining world that the increased application of electricity was the key by which they could attain greater production, thus enabling them to meet foreign competition without reducing wages. He suggested for consideration the possibility of adapting American methods, where practicable, in order to increase output. The Association's gold medal was awarded to Major E. I. David for a paper on "Protection of a.c. Systems Against Short Circuits." Messrs. F. Anslow (Glasgow) and J. C. Crawshaw (Dewsbury) were elected vice-presidents.

North-East Coast Institution of Engineers and Shipbuilders.

Summer Meeting.—The Institution will hold a summer meeting in Glasgow jointly with the Institution of Engineers and Shipbuilders in Scotland from June 20th to 23rd inclusive. The programme includes the reading and discussion of papers, visits to electrical and other works, and excursions specially arranged for ladies.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Birthday Honours.

In this year's list of Birthday Honours, which was published on Friday last, the great distinction of Order of Merit was conferred upon Sir Chas. Parsons, F.R.S., and Sir Harry Renwick received the honour of a Baronetcy. To these we refer in our leaderettes to-day. Other honours in the list are as follows:—Sir H. F. Heath, K.C.B., late Secretary to the Department of Scientific and Industrial Research, and Sir Richard Threlfall, K.B.E., F.R.S., receive the distinction of G.B.E.; Lt.-Col. G. W. Humphreys, C.B.E., Chief Engineer to the London County Council, is made a K.B.E.; Mr. H. Sparkes, O.B.E., Controller of Stores, G.P.O., receives the C.B.E.; Lt.-Col. A. G. Lee, M.C., M.I.E.E., Staff Engineer, G.P.O., Mr. V. E. Pullin, Director of Radiological Research, War Office, and Major J. J. Munro, Deputy Inspector-General of Telegraphs, Egyptian Government, receive the O.B.E.; and Mr. C. H. Klyne, Assistant Electrical Engineer, Admiralty, Mr. H. M. Johnson, Assistant Telegraph Engineer, Sudan Telegraphs, and Mr. R. Moffatt, Assistant Engineer, Posts and Telegraphs Department, Palestine, become M.B.E.

We reproduce herewith a portrait of Mr. W. J. H. Wood, who, as reported in our last issue, has been appointed engineer-in-chief to the County of London Electric Supply Co., Ltd. Mr. Wood received his early training at the Crystal Palace School of Practical Engineering, at the Phœnix Works, Antwerp, and with the Cie. Hydro-Electrique, Antwerp. He entered municipal electrical service as a junior engineer with the Edinburgh Corporation, and two years later went to Bolton as assistant engineer, being appointed engineer and manager in 1913. Mr. Wood was appointed chairman of the Engineering Committee of the South-East Lancs. Electricity Advisory Board in 1925, when Dr. S. L. Pearce resigned the position upon becoming an Electricity Commissioner. Since the formation of the North-Western Area District Industrial Council and the District Joint Board for the electricity supply industry, in 1919, Mr. Wood has represented a group of the largest undertakers. He is a member of the Institutions of Electrical and Mechanical Engineers, and of the Textile Institute. He



Mr. W. J. H. Wood,
Engineer-in-Chief to the County of London Electric Supply Co.

is senior vice-chairman of the North-Western Centre of the I.E.E., and a member of the Council of the Incorporated Municipal Electrical Association. As electrical engineer of Bolton he was directly and solely responsible for the design and construction of the Back-o'-th'-Bank generating station, and since his appointment the annual output of the undertaking has increased by about 46 million kWh.

The *Manchester Guardian* states that Mr. John Lee will retire from the controllership of the Central Telegraph Office this month. He was attached to the Secretary's office, London; in 1917 became Postmaster of Belfast, and in due course controller of the C.T.O., London. "Mr. Lee has done much to develop Whitleyism in the Civil Service."

The second Mascart medal has been awarded to Prof. Sir J. J. Thomson, F.R.S., by the Société Française des Electriciens, and was presented at the Sorbonne on Friday last. The medal, which commemorates the famous French physicist, is awarded once in three years; the previous award was to M. André Blondel.

Sir Donald MacAlister, Bt., and Sir Otto Beit, K.C.M.G., have been reappointed as members of the Governing Body of the Imperial College of Science and Technology for a further term of four years, and Lord Rayleigh, F.R.S., is appointed to be a member for a similar period.

Sir R. T. Glazebrook, F.R.S., has been appointed a member of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

Mr. W. Tyson, who has been a member of the research staff of the Standard Telephones and Cables, Ltd., of Woolwich, has been appointed agent and consultant for Great Britain for the Société Industriale de Téléphones, of Paris.

The Bromley (Kent) Town Council has decided to appoint Mr. W. G. Trend as borough electrical engineer for one year as from April 1st last, at an inclusive salary of £750 a year.

Mr. J. J. O'Horan, one of the mains engineers of the Calcutta Electric Supply Corporation, Ltd., has resigned his post after seven years' service with the company to take up an appointment on the engineering staff of a large motor-cycle manufacturing concern in this country.

Mr. Henry Reginald Williams, managing director of Messrs. Lindsay & Williams, Ltd., Manchester, was married at Chapel Allerton, Leeds, on June 1st to Miss Mary Ellen Coggan, of Sheffield.

Mr. C. W. Eve, sales promotion manager, Standard Telephones and Cables, Ltd., has been elected chairman of the Incorporated Society of British Advertisers.

At the annual meeting of the Ayrshire Electricity Board, ex-Provost Matthew Smith was unanimously reappointed chairman and Sir Alexander Walker vice-chairman. Police Judge Andrew Hunter and ex-Bailie David Jones were re-elected as conveners of the Finance and Engineering Committees respectively.

County Alderman T. E. Higham, of Accrington, chairman of the Mid-Lancashire Electricity Board, and chairman of Accrington Electricity Committee, has been selected as the jubilee Mayor of Accrington.

Will.—The late Mr. Albert Gay left £1,599 net and £2,184 gross personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Irish Radio Stockists, Ltd.—Private company. Registered in Dublin, May 26th. Capital, £1,000 in £1 shares. Objects: To acquire the business now carried on by the Irish Radio Stockists, and to carry on the business of dealers in wireless apparatus, &c. The subscribers (each with one share) are:—H. J. Farrell, 131, Emmet Road, Inchicore, Dublin, manufacturer's agent; J. Matthew, 99, Botanic Road, Dublin, clerk; H. J. Shirley, 55, Rose Mount Terrace, Kilmainham, Dublin, shop assistant; W. J. Byrne, 5, Lower Buckingham Street, Dublin, radio engineer. The first directors are not named.

British Curtis Radio, Ltd.—Private company. Registered May 28th. Capital, £2,500 in £1 shares. Objects: To acquire the business of manufacturers and merchants of wireless and telephonic apparatus now carried on by Peter Curtis, Ltd., at 11, Red Lion Square, W.C., and elsewhere. The first directors are:—A. E. Blackwell, "Dunromin," Dalmeny Lane, Carshalton, Surrey (director of the Vulcan Chemical Co., Ltd.); G. W. Croot, "Balmoral," Ashton Gardens, Chadwell Heath, Essex. Qualification, £1.

Artandia, Ltd.—Private company. Registered May 28th. Capital, £26,250 in 25,000 ordinary shares of £1 each and 25,000 "B" shares of 1s. each. Objects: To adopt an agreement with Don Gabriel Gonzalez de Andia-Yrarrazaval, of 24, Park Lane, Mayfair, W., providing for the purchase of certain inventions, patent rights, and registered designs in relation to sound reproducing and amplifying apparatus, and provision of certain services, and to carry on the business of manufacturers of and dealers in apparatus, instruments, &c. The first directors are:—Marquis Gabriel Gonzalez de Andia-Yrarrazaval, 24, Park Lane, W.1 (permanent); Rt. Hon. Baron Ridesdale, 26, Rutland Gate, S.W.7; Col. J. C. Brinton, C.V.O., D.S.O., Badminton, Glos. (nominee of Marquis Andia-Yrarrazaval); G. T. Bowles, 2, Ryder Street, St. James, S.W.1. Remuneration: 10 per cent. of the net profits divided between them. Solicitors: Hasties, 65, Lincoln's Inn Fields, W.C.2. Registered office: 38, Bedford Street, Strand, W.C.2.

Sifam Electrical Instrument Co., Ltd.—Private company. Registered June 1st. Capital, £1,000 in £1 shares. Objects: To acquire and carry on in the U.K., the Irish Free State, and British Colonies and Dependencies, the business hitherto carried on by La Société Industrielle pour la Fabrication d'Appareils de Mesure (a company incorporated in France), and to carry on the business of manufacturers, importers and exporters of and dealers in all kinds of electrical measuring apparatus, switchboard control instruments, &c. The subscribers (each with 2 shares) are:—J. P. McKenzie, 21, Leyland Road, Lee, S.E.12, engineer; A. J. Wheatland, 110, Dalzell Road, Brixton, S.W.9, solicitor's clerk. The subscribers are to appoint the first directors. So long as La Société Industrielle pour la Fabrication d'Appareils de Mesure holds £500 shares, it may have two representatives on the directorate. No share qualification required. Solicitors: Bulcraig & Davis, Amberley House, Norfolk Street, W.C.

Herne Bay and District Electricity Supply Co., Ltd.—Public company. Registered May 31st. Capital, £70,000 in £1 shares (50,000 ordinary and 20,000 deferred). The objects are to acquire a transfer from A. J. Hunt, A. W. Hunt, A. G. Hunt, Daisy E. Hunt, and Emmie Hunt, or other parties entitled thereto, of the Herne Bay and District Electricity Special Order, 1926, and the undertaking authorised by such Order, for £315 cash, to develop and turn to account the undertaking, and to carry on the business of electricians, mechanical engineers, manufacturers and workers of and dealers in electricity, motive power and light, &c. The minimum cash subscription is 7 shares. The first directors (to number not less than 4 nor more than 9) are:—Sir Thomas O. Callender, J.P., Bidborough Court, near Tunbridge Wells (managing director of Callender's Cable & Construction Co., Ltd.); P. V. Hunter, C.B.E., Springhurst, Addington (assistant manager of Callender's Cable & Construction Co., Ltd.); A. J. Hunt, 65, Mortimer Street, Herne Bay, engineer; Daisy E. Hunt, 65, Mortimer Street, Herne Bay, engineer (secretary of Hunt and Sons). Qualification: £500 shares or stock. Remuneration (except managing director) £100 each per annum (chairman £150), and a sum equal to 5 per cent. of the net profits in each year when a dividend of not less than 6 per cent. is paid on the ordinary and deferred shares, divided between them. Secretary: H. Foulds. Solicitors: Drake, Son & Parton, 24, Rood Lane, E.C.3. The registered office is at Hamilton House, Victoria Embankment, E.C.4.

Radio Electric Co. (Bournemouth), Ltd.—Private company. Registered June 2nd. Capital, £1,000 in £1 shares (250 7½ per cent. cumulative preference and 750 ordinary). Objects: To carry on the business of radio engineers (wireless), including television, and any other invention in connection with radiology. The first directors are:—Major A. G. Smith, 10, Rushton Crescent, Bournemouth; M. C. Barber, "Burwood," New Milton, gentleman; Miss Marion R. Smith, 10, Rushton Crescent, Bournemouth; S. H. Pearce, 24, Derby Road, Bournemouth, commercial tutor (all permanent). Qualification: £100. Secretary: M. R. Smith. Solicitors: J. and W. H. Devitt, Bournemouth.

R. J. Sinclair & Co. (Glasgow), Ltd.—Private company. Registered in Edinburgh, May 27th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, &c. The directors are:—J. Sinclair, 96, Camphill Avenue, Langside, Glasgow, accountant; G. Dalrymple, 80, Bellgrove Street, Dennistoun, Glasgow, cabinet maker. Qualification: £10 shares. Secretary: J. Sinclair. Registered office: 178a, Bath Street, Glasgow.

Electric Repairs (Glasgow), Ltd.—Private company. Registered in Edinburgh, June 2nd. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, &c. The first directors are:—A. M. Maclachlan, 1, Woodburn Place, Glasgow, electrical engineer; Kate Maclachlan, 1, Woodburn Place, Glasgow; H. G. Allday, 15a, Edenhurst Road, Mile End, Stockport, mantle merchant. Registered office: 105, Bothwell Street, Glasgow.

Official Returns of Electrical Companies.

County of London Electric Supply Co., Ltd.—A trust deed has been registered, dated May 19th, 1927, to secure £4,250,000 5 per cent. debenture stock (with power to issue further debenture stock from time to time, by supplemental trust deeds, but the aggregate amount of stock secured is not at any time to exceed the total amount paid up in cash in respect of the company's share capital, plus any amounts standing to the credit of the company's reserves and of sinking funds provided under the London Electricity (No. 1) Act, 1925). Property charged: The company's undertaking and property, present and future, including uncalled capital, coupled with a covenant by the company that it will not, without the previous sanction of an extraordinary resolution of the stock-

holders, create any mortgage or charge on any of its assets ranking in priority to or *pari passu* with the charge created by the above deed, except only charges (whether specific or floating) for securing temporary loans raised by the company in the ordinary course of business up to a total not at any time exceeding 10 per cent. of the nominal amount of the aggregate stock and of any additional stock ranking *pari passu* therewith in point of charge from time to time outstanding. The trustees are: The Electric and General Investment Co., Ltd., of Falcon House, Aldersgate Street, E.C.1; and the Law Debenture Corporation, Ltd., of 24, Old Broad Street, E.C.2. The stock was issued at 96 per cent., and the company paid to Messrs. W. Greenwell & Co. and Messrs. Foster and Braithwaite an underwriting commission of 1¼ per cent., and an overriding commission of ¼ per cent. on the nominal value of the stock.

Siderman Electrical Supplies, Ltd.—Debenture dated May 9th, 1927, to secure £500, charged on the company's property, present and future, including uncalled capital. Holder: A. Siderman, 51, Cleveland Street, Fitzroy Square, W.1.

British Resistor Co., Ltd.—Capital, £1,000 in £1 shares. Return dated January 28th, 1926 (filed April 13th, 1927). All shares taken up. £1,000 paid. Mortgages and charges, nil.

Valco, Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1926 (filed April 1st, 1927) Two shares taken up. £2 paid. Mortgages and charges, nil.

Darimont Electric Batteries, Ltd.—Capital, £18,000 in 62,000 ordinary shares of 5s. each, and 50,000 deferred shares of 1s. each. Return dated December 28th, 1926. All shares taken up. £8,999 16s. paid on 34,666 ordinary and 6,666 deferred shares. £9,000 4s. considered as paid on 27,334 ordinary and 43,334 deferred shares. Mortgages and charges, nil.

Gas and Electricity Development Co., Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1926 (filed March 22nd, 1927). All shares taken up. £2.000 paid. Mortgages and charges, nil.

Adelaide Electric Supply Co., Ltd.—Capital, £2,250,000 in 500,000 ordinary, 1,250,000 preference and 500,000 preferred ordinary shares of £1 each. Return dated November 24th, 1926 (filed February 9th, 1927). All shares taken up. £2,120,000 paid on 370,000 ordinary, 1,250,000 preference, and 500,000 preferred ordinary shares. £130,000 considered as paid on 130,000 ordinary shares. Mortgages and charges: £1,073,217.

Vee Cee Dry Cell Co., Ltd.—Capital, £5,000 in £1 shares. Return dated October 17th, 1926 (filed May 2nd, 1927). 1,450 shares taken up. £1,200 paid, £250 considered as paid. Mortgages and charges, £1,000.

Electric Cables, Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1926 (filed March 22nd, 1927). £1,000 shares taken up. £1,000 paid. Mortgages and charges, nil.

Johnson, Ross & Co., Ltd.—Particulars filed of £1,000 debentures dated May 9th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £500.

James Keith & Blackman Co., Ltd.—Satisfaction in full on May 14th, 1927, of debentures dated June 12th, 1914, and May 9th, 1922, securing £775.

J. Brent & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated November 30th (filed December 14th), 1926. 776 shares taken up. £576 paid. £200 considered as paid. Mortgages and charges, nil.

Turner, Atherton & Co., Ltd.—Capital, £140,116 in 62,861 preference and 77,255 ordinary shares of £1 each. Return dated August 17th, 1926 (filed January 21st, 1927). 49,172 preference and 51,597 ordinary shares taken up. £26,487 paid on 7,259 ordinary and 19,228 preference shares. £74,282 considered as paid on the remainder. Mortgages and charges, nil.

Milldale, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926 (filed April 6th, 1927). 740 shares taken up. £740 paid. Mortgages and charges, nil.

Forest City Electric Co., Ltd.—Capital, £5,000 in £1 shares. Return dated February 25th, 1927. 2,642 shares taken up. £2,202 paid. £440 considered as paid. Mortgages and charges, nil.

Mexican Hydro-Electric Development Syndicate, Ltd.—Capital, £26,000 in £1 shares. Return dated October 14th (filed December 28th), 1926. 25,350 shares taken up. £7,450 paid. £17,900 considered as paid. Mortgages and charges, nil.

Sydney W. Bussell, Ltd.—Mortgage or charge on the company's undertaking and property, present and future, including uncalled capital, dated May 24th, 1927, to secure £850. Holders: Pedestros, Ltd., 26, Langham Street, W.

I. D. Morison, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926 (filed January 21st, 1927). 500 shares taken up and fully paid. Mortgages and charges, nil.

Bestolamps, Ltd.—Capital, £3,000 in 2,500 preference shares of £1 each and 10,000 ordinary shares of 1s. each. Return dated December 31st, 1926 (filed April 2nd, 1927). 1,300 preference and 10,000 ordinary shares taken up. £500 paid on 500 preference shares. £1,300 considered as paid on 800 preference and 10,000 ordinary shares. Mortgages and charges, nil.

Wheatley, Smith & Co., Ltd.—Debenture dated May 18th, 1927, to secure £300, charged on the company's undertaking or property, present and future, including uncalled share capital. Holders: J. J. Eastick & Sons, Eelex House, Bunhill Row, E.C.

Jersey Electric Lighting and Power Co., Ltd.—Particulars filed of £15,000 debentures authorised May 5th, 1927, charged on the company's undertaking and property, including uncalled capital, the amount of the present issue being £12,000.

Abies Battery Co., Ltd.—Capital, £2,000 in £1 shares. Return dated August 14th, 1926 (filed April 21st, 1927). 878 shares taken up. £378 paid. £500 considered as paid. Mortgages and charges, nil.

Electrical Contracts and Maintenance Co. (1925), Ltd.—Capital, £3,000 in £1 shares. Return dated March 23rd, 1927. 2,075 shares taken up. £2,075 paid. Mortgages and charges, £250.

Quality Radio, Ltd.—Capital £100 in £1 shares. Return dated December 31st, 1926 (filed March 24th, 1927). 76 shares taken up. £76 paid. Mortgages and charges, nil.

W. Skewes & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated March 23rd, 1927. All shares taken up. £650 paid. £350 considered as paid. Mortgages and charges, nil.

Artic Fuse and Electrical Manufacturing Co., Ltd.—Capital, £5,000 in 4,700 ordinary and 100 deferred ordinary shares of £1 each and 4,000 founders' shares of 1s. each. Return dated December 31st, 1926 (filled March 1st, 1927). 2,433 ordinary, 100 deferred ordinary, and 1,933 founders' shares taken up. £2,079 13s. paid on 1,983 ordinary and 1,933 founders' shares. £550 considered as paid on 450 ordinary and 100 deferred ordinary shares. Mortgages and charges, nil.

Wickford and District Electricity Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1926 (filed February 4th, 1927). 2,206 shares taken up. £2,206 paid. Mortgages and charges, nil.

Kinetic Elutriators, Ltd.—Capital, £500 in 1s. shares. Return dated December 31st, 1926 (filed March 29th, 1927). All shares taken up. £100 paid. £400 considered as paid. Mortgages and charges, nil.

H. W. Dutton & Co., Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1926 (filed April 9th, 1927). All shares taken up. £1,415 paid, being £1 per share on 50 shares and 14s. per share on 1,950 shares. Mortgages and charges, nil.

Harrison Brothers (Electrical Engineers), Ltd.—J. H. Anderson, C.A., of Zetland Road, Middlesbrough, was appointed receiver on May 20th, 1927, under powers contained in debenture dated June 22nd, 1926.

C. J. Thursfield & Co., Ltd.—Second charge on the company's undertaking and property, present and future, including uncalled capital, book debts, and unpaid calls, dated May 13th, 1927, to secure all moneys for which the mortgagees (R. C. S. Jansie, 106, Trafalgar Road, Moseley, and two others) may become liable under a guarantee to company's bankers.

Airedale Electrical and Manufacturing Co., Ltd.—Equitable mortgage on freehold property No. 392, Bowling Old Lane, Bradford, dated May 11th, 1927, to secure all moneys due or to become due from the company to Bank of Liverpool and Martins, Ltd., not exceeding £700. This security is in addition to debentures granted to the above bank on November 28th, 1923.

Yarmouth (I.W.) Electricity Supply Co., Ltd.—Capital, £5,000 in £5 shares. Return dated March 21st, 1927. 361 shares taken up. £1,805 paid. Mortgages and charges, nil.

Gent & Co., Ltd.—Capital, £50,000 in 20,000 preference and 30,000 ordinary shares of £1 each. Return dated March 15th, 1927. 4,427 preference and 20,876 ordinary shares taken up. £6,887 paid on 957 preference and 5,930 ordinary shares. £18,416 considered as paid on 3,470 preference and 14,946 ordinary shares. Mortgages and charges, £16,500.

Wellingborough Electric Supply Co., Ltd.—Capital, £50,000 in £10 shares. Return dated March 9th, 1927. 4,500 shares taken up. £45,000 paid. Mortgages and charges, £17,500.

Smithfield Markets Electric Supply Co., Ltd.—Capital, £100,000 in 60,000 ordinary shares of £1 each and 8,000 ordinary shares of £5 each. Return dated March 9th, 1927. 60,000 £1 ordinary shares taken up. £60,000 paid. Mortgages and charges, £13,040.

City Notes.

Shanghai Electric Construction Co., Ltd.

The annual meeting of this company, whose report was dealt with in our issue of May 27th, p. 852, was held on June 1st. Mr. J. S. Haskell, the chairman, in the course of his speech, said that comparison of the past year's results with those of 1925 were of no value owing to the abnormal conditions prevailing in the latter year. Against 1924, however, there was a net improvement of £11,024 in the operating profit. The increase in the operating expenses was out of proportion to the growth of traffic, because there had been a general tendency towards higher wages and prices of supplies. The participation in the Singapore Traction Co., Ltd., made the substantial addition of £10,000 to their earnings. Although the profits would have justified a higher dividend, it was thought prudent to restrict it to 10 per cent. on account of the unprecedented conditions in Shanghai, coupled with a bank overdraft of £82,000. The time was not appropriate for a new issue to repay the bank, but the necessity for it, at the proper time, was realised. The company's business had been gravely handicapped by recent events in Shanghai, but he (the chairman) was glad to say that there had been an improvement lately, and with the advent of more settled conditions the company had been able to augment its services to bring them nearer the normal level. In view of the conditions, an application was made to the Municipal Council for a revision of tariffs. That was granted, and the new fares were put into force on May 1st and were understood to be satisfactory. Referring to the Singapore Traction Co., Ltd., Mr. Maskell said that the first year's results were good. The replacement of the trams by trolley 'buses was expected to be completed in the spring of next year. Since the end of March there had been a falling-off in receipts owing to a boycott by the Chinese. Upon the whole, conditions were not so unfavourable as they might have been, and although they were by no means free from anxiety, there were indications of a general improvement.

Madras Electric Supply Corporation, Ltd.

This company's report was reviewed in our issue of May 27th (p. 852). The annual meeting was held on May 30th, when the chairman (Mr. James Gray), in the course of his speech, said that the improvement in the sales of energy (7 per cent.) was considered satisfactory. The necessary equipment for the supply of energy to the workshops of the Madras and Southern Mahratta Railway had arrived, and the supply should be available during the latter half of the year. Negotiations were being conducted with another railway company for the supply of power in connection with the proposed electrification of the system. The first of the new 6,000-kW sets was put into commission in January, and the erection of the second was proceeding. The first 40,000-lb. boiler was put into operation in July last; a second was approaching completion and two others were to follow. During the year the capital was increased to £800,000 by the issue to shareholders of 110,000 ordinary £1 shares at 25s. 6d. each.

Dealing with the Madras Electric Tramways, the chairman said that only the preference dividend was paid for 1926. There had been no material change in the position, although there were indications that the opposition was relaxing. The management had granted various privileges to passengers to attract traffic back to the tramways; they were confident that in the end the tramways would come into their own again. The report and accounts were adopted.

Oriental Telephone and Electric Co., Ltd.

The annual meeting was held on June 3rd, Sir A. H. McMahon, G.C.M.G. (chairman) presiding. In moving the adoption of the report and accounts (which were dealt with in our last issue, p. 896), the chairman said that in view of the conditions the results of the past year's working were satisfactory. There was good reason for anticipating steadily-improving results as normal trade conditions returned. The available balance showed an increase. Of the two branches directly worked by the company that at Singapore had done very well, the gross revenue increasing by over £11,000; it had become necessary to consider the provision of additional equipment to meet the anticipated growth. The Mauritius branch unfortunately showed no signs of returning animation. The company was handicapped by its obligation to provide communication between the central exchange at Port Louis and exchanges in other parts of the island which had developed beyond expectation. Repeated application had been made to the Government for sanction to increase the rates, but this had not so far been granted. In addition, Mauritius had been passing through a period of depression. There were, however, some indications of improvement. After dealing with the operations of the subsidiary companies, the chairman mentioned the institution of a staff provident fund and the appointment to the board of Sir Thomas Catto in succession to Mr. G. Parker Ness, who had resigned.

Rangoon Electric Tramway and Supply Co., Ltd.

The annual meeting of this company was held on May 30th. Mr. P. Henstock (chairman), who presided, referred to the deaths of Mr. F. Tobin and Sir J. Harmood-Banner, who had been connected with the company. Turning to the report (*vide* ELEC. REV., April 29th, p. 691), Mr. Henstock said that the shareholders fully subscribed an issue of 100,000 ordinary shares, at Rs. 16 per share, which was made during the year. The year's capital expenditure amounted to £105,003, of which over £85,500 was incurred in the power-house plant and the cable system, including sub-stations. With the estimated expenditure of 15 lakhs during the current year, the total capital expenditure would reach £746,666. The scheme for modernising the Ahlone power house was nearly finished. The last set put in, which would shortly be ready for trials, brought the capacity of the station up to 16,500 kW. As a result of modernisation, in spite of higher fuel costs, the cost per kWh had been lowered. The economies effected had enabled them to make a reduction of about 9 per cent. in the charges. The same policy of modernisation was being extended to the boiler plant. They had had to spend Rs. 11 lakhs in connection with the supply of condensing water, which had made an appreciable addition to the production costs. The main tramway depôt was being constructed and brought up to date. The rate of increase in traffic had not been maintained, owing mainly to the exceptional floods which kept visitors away, and to motor-'bus competition. The company was running 'buses experimentally, and the services would be extended when the vehicles were received. To counteract the overloading of the mains, the pressure of supply was to be raised. In conclusion, the chairman said that the company proposed to contribute Rs. 15,000 towards the Rangoon University Endowment Fund.

Cawnpore Electric Supply Corporation, Ltd.

Mr. J. G. B. Stone (chairman) presided at the annual meeting on May 30th, and in moving the adoption of the report (ELEC. REV., May 27th, p. 852), said that there was a growing demand for industrial supply, and the sales of energy had risen by 18 per cent. Bulk supply consumers had benefited from a considerable reduction in the price of coal. The experimental 'bus services had proved unremunerative and were being discontinued; it was found that their object—to act as feeders to the trams—was not being fulfilled. The sales department, which made a profit of £865 in 1925, incurred a loss of £70 during last year. That department, in addition to carrying out installation contracts, was employed generally in the work of assisting and advising existing consumers, and in obtaining new ones. Owing to industrial depression, a large proportion of the plant lay idle for some time, but towards the end of the year there was an increased demand. The maximum demand had reached 6,708 kW, which was about half of the capacity of the Riverside Station, allowing for spare plant. At the end of April the demand was 33 per cent. more than at the corresponding date of last year, and further improvement was anticipated.

British Electric Traction Co., Ltd.

The gross profit for the year ended March 31st last amounted to £301,044, as against £300,544 in 1925-26, and after deducting general expenses, loan, interest, &c., there is a balance of £173,008. A dividend of 8 per cent. is declared on the ordinary stock, as for last year, leaving a surplus of £24,143. The directors recommend that a further non-cumulative dividend of 2 per cent. be paid on the preference stock (making 8 per cent. for the year), which will require £14,255, leaving a balance of £9,888 to be added to undivided profits account, making that account £304,378. The directors further recommend that £132,626, equal to 10 per cent. on the ordinary stock, be distributed out of undivided profits account to the ordinary stockholders in fully-paid deferred ordinary stock. It is also proposed to convert the ordinary stock into an equal amount of 8 per cent. non-cumulative preferred ordinary stock, ranking for dividend as from April 1st, 1927, and having priority both as to capital and dividend over the deferred ordinary stock. The amount standing to the credit of reserve account is £520,000. Meeting: June 21st.

North of Scotland Electric Light and Power Co., Ltd.

The report for 1926 states that during the year the Inverness Town Council completed the purchase of the local undertaking. The balance of general reserve account brought forward, together with the sums available for application to the Inverness undertaking, enabled the company to distribute a bonus of £71,250 to the shareholders. After providing for interest, preference dividend, &c., there remained a balance of £6,845. The total ordinary dividend is 7 per cent., free of tax; £3,000 has been transferred to renewal reserve account; and £345 is carried forward. Mr. F. E. Gripper has resigned from the board owing to ill-health; his place has been taken by Mr. C. H. Jones.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

The profit for the year ended December 31st last was £25,899, as compared with £22,138 for 1925. After providing for interest and depreciation and placing £3,000 to reserve and adding the balance brought forward, there remains £3,978. It is proposed to pay a dividend of 6 per cent. on the ordinary shares, leaving £978 to be carried forward. The meeting was to be held yesterday (Thursday).

Ever-Ready Co. (Great Britain), Ltd.

The annual meeting was held on May 31st, Mr. C. H. C. Moller (chairman) presiding. In presenting the report (ELEC. REV., May 13th, p. 770), the chairman said that, in spite of the adverse conditions, they had had a successful year. They were able to market their goods at prices with which small manufacturers were unable to compete. Every step was taken to improve production methods and reduce costs while maintaining quality. The properties, plant, machinery, &c., appeared in the accounts at a low figure, this being based upon pre-war values. The reserve now stood at £170,000, and the reserve for contingencies at £15,000. The contribution of £5,000 to a staff benevolent fund was a new item; the fund would enable the pensioning of employés to be dealt with in a systematic manner. Their Government securities now totalled £245,000; it might be necessary to realise some of these during the year to provide for expansion of the business.

Stock Exchange Notices.

The Committee has ordered the following to be officially quoted:—

Calcutta Electric Supply Corporation, Ltd.—136,671 ordinary shares of £1 each, fully paid, Nos. 1,366,711 to 1,503,381.

Shropshire, Worcestershire and Staffordshire Electric Power Co.—250,000 "A" ordinary shares of £1 each, fully paid, Nos. 860,001 to 1,110,000, and 150,000 "B" ordinary shares of £1 each, fully paid, Nos. 650,001 to 800,000.

Llanelly and District Electric Supply.—£279,581 5 per cent. first mortgage debenture stock.

North Metropolitan Electric Power Supply.—850,000 ordinary shares of £1 each, fully paid, Nos. 1 to 850,000.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

International Telephone and Telegraph Corporation.—$36,040,700 capital stock in shares of $100 each.

Metropolitan District Railway.—£250,000 new five per cent. redeemable debenture stock, 1933-43.

Electric Construction Co., Ltd.

The report for the year ended March 31st last records a net profit of £19,703, after providing for debenture interest and depreciation. To this is added £21,537 brought forward, making £41,240. It is proposed to pay a final ordinary dividend at the rate of 9 per cent. per annum, making 7½ per cent. for the year, as against 10 per cent. for 1925-26, when the net profit was £37,520. A balance of £14,345 is carried forward. Severe competition both in home and overseas markets was experienced during the year. This was intensified by the prolonged coal dispute, which was also responsible for an increase in production costs. The meeting was to be held yesterday (Thursday).

Bromley (Kent) Electric Light and Power Co., Ltd.

The report for the year ended December 31st last states that the outstanding debentures have now been redeemed. During the latter part of last year negotiations were entered into with the Bromley Town Council for a settlement of the purchase price for the undertaking and since the end of the year an agreement has been reached. After the payment of debenture interest, &c., the profit for the year was £27,491. To this is added £11,108 brought forward, making £38,599. It is proposed to pay a dividend of 10 per cent., free of tax, and to carry forward a balance of £29,599. Meeting: June 13th.

Ruston & Hornsby, Ltd.

The profit for the year ended March 31st last was £89,196, and after providing for debenture interest and depreciation and adding £28,307 brought forward, there remains £49,310. A year's dividend is to be paid on the 5 and 6 per cent. preference shares, and a balance of £25,810 is carried forward. The directors state that the improvement of the previous year was not maintained, and they are therefore unable to recommend a dividend on the ordinary shares. For 1925-26 a dividend of 2½ per cent. was paid.

Callender's Cable and Construction Co., Ltd.

The accounts for 1926, subject to final audit, show a profit of £356,590 against £368,643 in 1925. From this it is proposed to pay a total dividend for the year of 15 per cent. (3s. per share) on the old and new ordinary shares, of which 1s. per share has already been paid. The previous year's dividend on the old ordinary shares was 15 per cent.

Lima Light, Power and Tramways Co.

The report for 1926 shows a net profit of £P.114,477, and the addition of £P.12,912 brought forward, makes available £P.127,389. After providing for bond amortisation and preference share dividends, a balance of £P.11,158 is carried forward.

Stanton Ironworks Co., Ltd.

The final dividend on the ordinary shares is 6 per cent., free of tax, making 10 per cent., free of tax, for the year, as for 1925.

Anderston Foundry Co., Ltd.

A dividend of 6¼ per cent. has been declared out of a net profit of £7,894 for 1926-27.

Fellows Magneto Co., Ltd.

There was a net profit of £10,827 for 1926, but the aggregate debit balance at the end of the year was £253,000. In view of this and the necessity for working capital it has been decided to form a new company with the title "Fellows Manufacturing Co., Ltd." This company will have a capital of £175,000, and shareholders of the existing company will receive, if they elect to do so, a 10s. preferred ordinary share with 7s. credited paid for every preference share and one deferred 2s. 6d. ordinary share with 6d. credited paid for every ordinary share. The calls for the further amounts will be spread over four months. Meeting: June 15th.

Telephone Manufacturing Co., Ltd.

The accounts for 1926 show a net profit of £5,426, as compared with a loss of £21,212 for 1925. It is proposed to devote £4,094 of the profit and £23,275 from a special reserve to writing down the expenses of the new issue, the balance of profit being carried forward. The benefit of contracts delayed by the general strike will be felt during the current year. It is stated that the capital now consists entirely of ordinary shares and the whole of the assets are free from all charges.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

It was reported on the Stock Exchange last week (says the *Financial Times*) that the International Paper Company (a New York concern) had made an offer for the Newfoundland interests of the company.

Reduction of Capital.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., AND REDUCED.—A petition has been presented to the High Court for the confirmation of the reduction of the capital of the company from £4,000,000 to £2,374,954, and will be heard in London on June 14th.

Mirrlees, Bickerton & Day, Ltd.

A dividend of 6 per cent. has been declared on the ordinary shares. Last year the shareholders received 12½ per cent. under the amalgamation agreement with the Mirrlees-Watson Co.

Quebec Power Co.

A dividend of $1¾ per share has been declared on the common shares for the quarter ending June 30th. It is proposed to convert each $100 common share into four shares of no par value.

Guest, Keen & Nettlefolds, Ltd.

A final dividend of 1s. per share is recommended on the ordinary shares, making 10 per cent., free of tax, for the year, as for a number of years past.

Aron Electricity Meter, Ltd.

The directors recommend a dividend of 6 per cent. upon the ordinary shares in respect of the year ended March 31st last. The 1925-26 dividend was the same.

Northern Mexico Power and Development Co.

Dividends of 1¾ per cent. and 1 per cent. respectively have been declared on the preference and common stocks in respect of the current quarter.

Shawinigan Water and Power Co.

A dividend of $0.5 per common share has been declared in respect of the quarter ending June 30th.

O. C. Hawkes, Ltd.

An interim dividend of 6 per cent. per annum, free of tax, has been declared on the ordinary shares.

Stocks and Shares.

TUESDAY EVENING.

STOCK Exchange business suffered interference through the Whitsun holidays occurring in the long "account" that tempts men to remain away from town when the circumstances permit. There is not a great deal to engage business energy in Stock Exchange markets, although some few markets are very busy. Marconis have attracted a noticeable degree of interest. Brazilian Tractions continue active and strong. New issues are not able to count now, as they were a month or two ago, upon certainty of success. In a couple of cases within the past fortnight, underwriters were left with 94 per cent. of their obligations: in two others, the public took 50 per cent. of the one and 15 per cent. of the other. This had a sobering effect upon promotions, and a lull in the rush of new-comers is welcomed by people who want to dispose of previously-subscribed scrip which they had stagged.

The rise in Marconi shares follows the argument of three weeks ago that, at anything under 20s., the price showed reasonable chance of responding to the quiet accumulation of shares that was then noticeable. The effect of this earlier buying made itself felt as the public began to come into the market, and the shares rose sharply to 22s. 6d. Concurrently, Canadian Marconis jumped nearly 1s. to 5s. 3d. The reason

for this mild enthusiasm is that already mentioned here, *viz.*, the hope of an early dividend declaration, and the confidence that, with personal differences no longer disturbing the internal policy of the company, the Marconi undertaking can develop the advantages that it unquestionably possesses. Marconi's, too, have obtained an important contract in competition with French and German firms, for wireless communication with Bulgaria.

Brazilian Tractions are up 6, at 160, a price which is about 60 points higher than that of a year ago. Sir Alexander Mackenzie, president of the company, stated in a newspaper interview that the board had not considered the question of capital reorganisation. He spoke very favourably of the position, financial and physical, of Brazil. The Stock Exchanges of London and Toronto continue to assume that a bonus of some kind will be forthcoming, either in the shape of a scheme for splitting the shares, or a "melon-cut" of assets. The market for this group is buoyant and excited, Brussels speculation supplementing the bullishness of other quarters. Brazilian Traction preferred are up to 135. Barcelona Tractions improved to 51.

Henleys gained half-a-crown on the news that the company had obtained a contract worth £300,000 from the Great Indian Peninsula Railway in connection with electrification of the main line. The announcement came the more pleasantly by reason of the disappointment recently caused by the Southern Railway's acceptance of a foreign firm's tender for machinery required on its system. Henley's now stand at 91s. 3d., at which the yield on the money is about 4⅜ per cent. This is the same as Callenders afford at 68s. 9d. The Callender's Cable and Construction Company has declared 15 per cent. for the year, the same as before, and the profits of £356,000 are £13,000 less than those of the previous year that ended with December, 1925. In view of the coal strike and general upheaval, Callender's can be congratulated upon having come out of 1926 so well. The coal strike and severe competition are set down as the explanation of the Electric Construction Company's diminished profits shown in the report published the other day. For the year ended last March, the net profit came to £19,700, against £37,600 and £43,000 in the two preceding years, 1925 and 1924 respectively. The dividend, as recorded here last week, is 7½ per cent. against 10 per cent., and the price of the shares has eased off to 27s. 6d., at which the return on the money is 5⅓ per cent. General Electric 6½ per cent. preference strengthened to 24s. in the movement, now general, that is lifting all good preference shares on to a higher plane.

Yorkshire Electrics are better at 30s. The list of prices in the London group shows no change. Urban 4½ per cent. debenture is 6 points up at 92½. County of London Electric new debenture stands at 1¼ premium. The company's chairman and managing director, Sir Harry Renwick, K.B.E., received a baronetcy in last week's birthday honours, and, as recognition of a man who has done so much for the development of the electrical industry, the distinction will be deemed peculiarly fitting.

Resumption of vigorous buying of United River Plate Telephones resulted in a fresh gain of 7s. 6d., which took the price to 9¾. Orientals have rested after their jump last week.

Automatic Telephones are better at 47s. 6d., and Internationals at 40s. Telephone Manufacturing at 6s. 9d. are unchanged.

Cable stocks keep very firm. Anglo-American deferred is ½ higher. Eastern Telegraph ordinary is up a point. Globe preference gained ⅛, but, on the other hand, Great Northern Telegraphs at 28½ are 15s. lower. International Telephone and Telegraph shares just gained ground at 146¼.

British Electric Traction ordinary is 1 up at 149. Underground Electric Railways £1 shares have risen to within a shilling of their par value. The support for these shares serves to keep alive the expectation of early retirement of the company's 6 per cent. income bonds which, when carried out, should make a marked difference to the dividend prospects of the £1 shares. Other Home Railway stocks are still leaning to the lower side, and the rumbles of possible trouble amongst the miners is the latest addition to the market's handicaps. Metropolitan Consolidated has dipped to 60½, being now a point lower than Districts. That same apprehension of labour trouble has caused a slight decline to 52s. 6d. in Babcock and Wilcox, other shares in this division being similarly dull. Armstrongs remain at 3s. 6d.: there is talk of the likelihood that an American company may acquire the Newfoundland Power and Paper Company interests at present owned by Armstrongs, and which have hitherto proved more of a hindrance than a help to the company, whose annual meeting will be held on Thursday in this week.

Mexican Utilities have hardly varied, and the only movement in Argentines is a small advance in Anglo-Argentine Tramways 5 per cent. debenture stock. British Columbia issues are holding their ground, and the preferred retains its last week's gain of 2½ points. Amongst the lower-priced tramway descriptions, London & Suburban Traction ordinary nearly doubled in price, with a rise from ninepence to the present one-and-six. La Plata Trams keep at 4s. 9d. The rubber share market is dull and heavy; a decline in the price of the raw material caused surprise and mystification. Amongst new issues, Electric Finance preference rose from 3d. premium to 10½d. premium, and the debenture strengthened to 2 premium. Buenos Aires Lacroze debenture changes hands fairly frequently around 10s. premium.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price June 7 1927.	Rise or fall.	Yield. p.c.
	£					
Bournemouth and Poole	1	14	14	56/9	—	4 18
Brompton Ordinary	1	10	8⅜	25/-	—	5 12 0
Charing Cross Ordinary	1	15	8½	25/-	—	5 12 0
do. do. 4½ Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	8⅝	25/-	—	5 12 0
City of London	1	15	10	1⅜	—	5 1 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	30/6	—	5 5 0
County of London	1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/6	—	5 19 2
Elec. Supply Corporation	1	10	10	32/-	—	6 5 0
Kensington Ordinary	1	15	8	25/-	—	5 12 0
Lancs. Light and Power	1	7½	7½	26/-	—	5 15 5
London Electric	1	19	8½	24/-	—	5 16 8
do. do. 6% Pref.	5	6	6	5⅝	—	5 6 8
Metropolitan	1	11	8	29/-	—	4 16 7
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary ...	1	7	5	23/-	—	4 6 11
do. 5% Pref. ...	1	5	5	17/6	—	5 14 3
do. 7% Pref. ...	1	7	7	24/6	+ 6d.	5 14 3
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	25/6	—	5 9 10
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1½	—	6 3 0
Urban Ordinary	1	7	7	25/-	—	5 12 0
do. 6% Pref.	1	6	6	1⅛	—	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	30/-	+6d.	5 6 8

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	71	—	5 12
Metropolitan	,,	5	3	60½	—½	4 19 4
do. District	,,	3½	3½	61½	—	5 13 10
Underground Electric	£1	Nil	1½	19/-	+6d.	1 11 5
do. do. Income ...	Bonds	6	6	102	—	* 17 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 19 0
do. Def.	,,	1½	1½	24½	+¼	6 2 5
Automatic Telephone	1	3	10	47/6	+1/8	4 3 6
Chili Telephone	5	5	6	7⅛	—	3 17 5
Eastern Extension	10	10	10	18¾	—	*5 6 8
Eastern Tel. Ord.	Stock	10	10	182½	+1	*5 9 7
Globe Tel. and T. Ord. ...	10	10	10	18⅞	—	*5 6 0
do. do. Pref.	10	6	6	11⅛	+⅛	5 8 1
Great Northern Tel.	10	20	20	28½	—¾	7 0 4
Indo-European	25	8½	10	46½	—	*5 7 6
Marconi	1	Nil	Nil	1⅛	+3/16	... ...
Marconi-Marine	1	7½	8½	27/-	—	6 9 8
Oriental Telephone Ord.	1	12	12	56/3	—	*4 5 8
United R. Plate Tel.	5	8	8	9¾	+⅜	*4 2 1
Western Telegraph	10	10	10	17¾	—	*5 12 8

HOME AND FOREIGN TRAMS, &C.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3½	—	7 17 2
do. do. 2nd Pref. ...	5	6	6	3 1/16	—	8 2 8
do. do. 5% Deb. ...	Stock	5	5	71½xd	+1	7 0 0
British Electric Traction Ord. ...	,,	8	—	149	+1	5 7 5
do. do. 6% Pref. ...	,,	6	8	120½	—	6 12 10
Brazil Traction	100	5	6	160	+6	3 15 0
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	89½	—	5 11 9
do. do. Preferred ...		6¼	6¼	121	—	5 3 4
do. do. Deferred ...	,,	8	—	158	—	*5 1 3
do. do. Deb. ...	,,	4½	4½	80½	—	5 5 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	7/9	—	Nil
London United Tram. Deb. ...	Stock	4	4	52½	—	7 12 5
Mexico Trams, 5% Bonds	—	5	5	81½	—	6 2 8
Mexican Light Common	100	Nil	Nil	44	—	Nil
do. Pref.	100	Nil	Nil	110½	—	Nil
do. 1st Bonds	—	5	5	74½	—	6 14 3
Yorkshire (West Riding)	1	5	—	8/9	—	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	13	13	52/6	—1/16	4 19 1
British Aluminium Ord.	1	12½	10	43/-	—	4 13 0
British Elec. Transformer Pref. ...	1	Nil	7	18/3	—	7 13 6
British Insulated Ord.	1	15	15	67/6	—	4 8 11
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3 7/8	—	4 7 3
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	12/6	—	... ...
Edison-Swan	4/-	10	10	10/	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	7½	27/6	—1/16	5 9 1
Enfield Cable Pref.	1	7½	7½	25/6	—	5 17 8
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	3	—	12/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	+6d.	5 8 4
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	1	20	—	91/3	+⅜	4 7 9
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1⅜	—	*4 9 0
Johnson & Phillips	1	17½	12½	2½	—	5 0 0
Met.-Vickers Ord.	1	8	8	27/6	—	5 11 4
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	7½	7½	27/6	—	5 9 1
Telegraph Construction	12	10	10	28½	—	*4 4 2

* Dividends paid free of Income Tax.

The Incorporated Municipal Electrical Association.—III.

Annual Convention at Buxton.

ON Wednesday, June 1st, Mr. T. Roles read extracts from his long paper on "Recent Developments in Power Plant Design," of which an abstract llows, and an excellent discussion took place. The ıthor passed in review the chief developments of recent ars in every stage from the coal pile to the condenser, ving special attention to the economies that may be ob-



Members of the I.M.E.A. assembling at the Opera House, Buxton.

ined from the use of higher steam pressures and temratures, together with the difficulties met with in their option and the methods of coping with them. He owed that a net increase of efficiency of 13.8 per cent. ght be expected as the result of raising the steam essure from 200 to 1,500 lb. per sq. in., corresponding



Mobilising for a visit to the Waterworks.

saving of 0.17 lb. of coal (11,000 B.th.u. per lb.) kilowatt-hour generated. He pointed out, however, t the additional cost of the high-pressure plant could be stated in general terms, as such plant was not available in the market; the better the load factor, higher the steam pressure that could be economically loyed. Particulars were given of the plant designed work at 1,100 lb. per sq. in. which Mr. Roles is inling at Bradford, and many details in connection with feed-heating by partially expanded steam, reheated steam, boiler furnaces, air pre-heaters, pulverised fuel, and automatic boiler control were dealt with in the paper.

In the afternoon most of the members drove to the Derwent Valley waterworks, in charabancs and in their own cars, by routes through picturesque and interest-



Posing for the official photograph in the Pavilion Gardens.

ing scenery; the weather left something to be desired, the sky being overcast and the air misty, but the trip was very enjoyable. For the evening there was no special programme, the time being spent very happily in dancing and conversation; the organising ability of



The I.M.E.A. at the Derwent Valley Waterworks.

Mr. Hewlett, the manager of the Palace Hotel, in this connection was very much appreciated.

At the annual business meeting, which was held in private, Mr. Frederick W. Purse, M.I.E.E., chief engineer and manager of the electricity department of the County Borough of West Ham, was elected president for the ensuing year; and Mr. A. Nichols Moore, borough electrical and tramways manager, Newport, Mon., was elected vice-president.

Distribution over an Extensive Area.

Discussion on Mr. Wm. C. Bexon's Paper.

Mr. J. W. BURR, M.I.E.E., Swansea, in opening the discussion, said that economy in all transmission lines was dependent upon the voltage adopted, the object being to erect a line at the least possible capital cost, and with the lowest annual loss of energy. He did not think that for very long transmission lines the 1,000-V per mile rule would apply. Unfortunately, in transmitting energy over large areas it was almost impossible to have overhead construction throughout the whole distance, and hence underground cables often had to be used. Troubles were undoubtedly being experienced in the use of cables working at 33,000 volts and above. The frequent and sometimes lengthy interruptions which took place in the supply, due to cable failures, not only involved the users and manufacturers in financial loss, but had also delayed the electrical development of certain areas for years. The faults might be due to the method of construction, or they might be due to resonance in the line, or to a combination of the two. It must be borne in mind that on all large transmission systems both induction and synchronous machines were running in parallel and the conditions might at times be favourable to resonance, which need not be produced with the fundamental, but with higher harmonics with which the fundamental waves were frequently accompanied. It might, of course, be that the supply authorities were asking for trouble by offering a reduction in the price of electricity supplied at a high power factor, particularly if a bonus were allowed for leading wattless components. In voicing his preference for the star connection for transformers, Mr. Burr said that should a fault occur to earth on a star-connected line it was possible, as with a delta-connected system, to give a supply in the case of emergency by disconnecting the earth connection and running with the faulty phase earthed. He thought the phase on which the fault occurred should be permanently earthed until the fault was removed. He agreed with the author that the continuity of supply was an all-important factor, but how was this to be obtained? With regard to the suggestion that in a transmission system a duplicate feeder on the same transmission poles was the most economical proposition, he asked whether the author took the six lines into each consumer's premises, what arrangements he had for isolating a faulty line, and how he repaired a fault without shutting down the line. Mr. Burr said his own view was that whenever possible a ring main with directional relay protection was the best proposition. While the ring main with the protective apparatus would cost more than a single six-wire line, it would serve a much larger area and would certainly give greater security from interruption due to the necessity for overhaul. Unless collieries and large works generally were assured that continuity of supply could be reasonably relied upon no large electrical developments would take place in the future, however low the cost of the energy might be. The electrical development of many areas had been set back for years through the repeated interruptions in the supply. In giving small supplies to farmers near a transmission line, he suggested that the most economical proposition was to give the supply to a small company consisting of farmers and others interested, and let them distribute it themselves. A single supply to a farm from a 33,000-V line was not likely to be a paying proposition. He held the view that, generally speaking, a feeder pressure of 6,600 volts was better than 3,300 V, or it might be that 11,000 volts would even be more economical. Regarding the construction and costs of overhead l.p. distribution, he suggested that by developing the domestic load it might be possible to lay underground mains in preference to the overhead, which had its limitations. In his district they found that it paid to run underground mains and not extend the overhead system. He thought that the many regulations with which the electricity authorities had to comply might be modified considerably in connection with overhead lines without interfering to any extent with the safety of the public. The time had arrived when a bold policy should be adopted by all undertakings in regard to the liberal spending of money on distribution and transmission systems, both with a view to assuring continuity of supply and allowing for all reasonable development in both the industrial and domestic loads likely to take place in the near future.

Mr. W. A. TURNBULL, M.I.E.E., Aylesbury, said he had adopted 11,000 V in his undertaking for overhead transmission. He was experimenting with a new kind of pole at Wendover, and so far with success.

Captain J. M. DONALDSON, M.C., M.I.E.E, chief engineer of the North Metropolitan Electric Power Supply Co., said he was particularly interested in overhead lines because he had just put up 100 miles of them. He suggested that the Ministry of Transport should issue a small document explaining various points with regard to overhead lines; also that a form of consent should be prepared by the Ministry which would free supply undertakings from heavy legal charges.

Mr. T. HALL, Burton-on-Trent, said he had had a tremendous number of insulators broken. In one meadow there were over 27 of them smashed by colliery boys in one day. He had changed the colour from white to brown, but still the nuisance went on.

Mr. R. BORLASE MATTHEWS, M.I.E.E., East Grinstead, congratulated Mr. Bexon upon the initiative and enterprise he had shown in his undertaking. Mr. Bexon had over 73 farm consumers, the largest number in any one area. Tw years ago there were only 200 farmers using electricity this country, but to-day there were 700, and the number wa rapidly increasing. In the rest of the world there were abou a million farmers using electricity to-day. He had had th advantage of talking to farmers as a farmer, and every one h had spoken to was satisfied that electricity was far cheape than other forms of power. Mr. Matthews suggested that i all the rural distribution areas they should have power demon strations of all the appliances that could be reasonably use by farmers. He considered that there was a tendency to sup ply farmers with electricity too cheaply.

Mr. BEXON, in reply, said he had tried white, brown, green and glass insulators and an unbreakable insulator, but th last named would not stand up to the high pressure and h had to substitute porcelain. One week-end he had over insulators broken. The Scotch farmer was beginning to tak electricity for power and lighting. One paid him over £ for power last year and another for lighting paid him ove £44. The farmer had not realised that electricity would enab him to do work in one day that it would take three month to do under the old conditions.

Mr. R. B. MITCHELL, M.I.E.E., Glasgow, proposed a vote o thanks to Mr. Bexon, and said he admired his courage an enterprise in developing his areas. He had no overhead tran mission lines in his own area, but the paper came at a ver opportune time, when so much attention was being paid to th question of supplying areas that were not purely industrial.

Mr. BEXON briefly replied.

Recent Developments in Power Plant Design.

Their Effects on the Economy of Generation.

By THOMAS ROLES,
City Electrical Engineer, Bradford. (*Abstract.*)

HAVING been invited to prepare a paper on the abov subject, the author assumes that the reason underlyin his selection for the task is that certain extension which are now being made to the plant in the Bradford Co poration's Valley Road power station have aroused interes as it has been decided to install plant designed to work at higher steam pressure and temperature than any other plan previously put down in this country. Also last year th author had the opportunity of visiting a number of the larges and most efficient steam-operated generating stations in th United States, but he has had little or no actual workin experience with much of the power-station equipment whic will be commented upon.

The Valley Road power station as at present equipped operating under steam conditions of 200 lb. pressure pe sq. in., with a total steam temperature averaging abou 630 deg. F. It is also working under what is generall regarded as a disadvantage, in that the circulating water fo the condensers is cooled by means of towers. Under thes conditions the thermal efficiency of the station for the yea ended March 31st, 1927, based on units generated, was 16.6 per cent., the British thermal units per unit generated bein 20,450, and the station load factor 29.5 per cent.

In connection with modern generating stations, the chie developments during recent years have been as follows:—

In the turbine room: Higher steam pressures and temper tures; higher rotational speeds for large turbines; steam extraction from turbines for feed-heating purposes; re-heate steam; and improvements in the design of condensers.

In the boiler house: Higher steam pressures and temper tures; increased capacity of boiler units; re-heater boiler water-cooled furnace walls; air pre-heaters; regenerative fee heating; pulverised fuel firing; improved types of stoker and automatic combustion control.

The Newcastle-upon-Tyne Electric Supply Co., Ltd., on th advice of Messrs. Merz & McLellan, some ten years ag decided to adopt a working pressure of 475 lb. per sq. in in connection with a station to be erected by them at Nort Tees, near Middlesbrough, which was put into service in 192 In the United States of America and on the Continent, how ever, stations are being operated at higher pressures. I 1925 the Edison Electric Illuminating Company, of Bosto U.S.A., started up their new Edgar station at Weymouth containing a plant designed to operate at a gauge pressur of 1,200 lb. per sq. in., and a few months ago, at the Lak side station of the Milwaukee Electric Railway and Ligh Company, a plant of more than double the capacity of th at Boston was put into operation at a working pressure o 1,400 lb. per sq. in. There are also in the United State several stations designed to operate at pressures of from 5 to 650 lb. per sq. in., the total plant capacity for workin at these pressures in that country, either running or pro jected, being close on one million kilowatts.

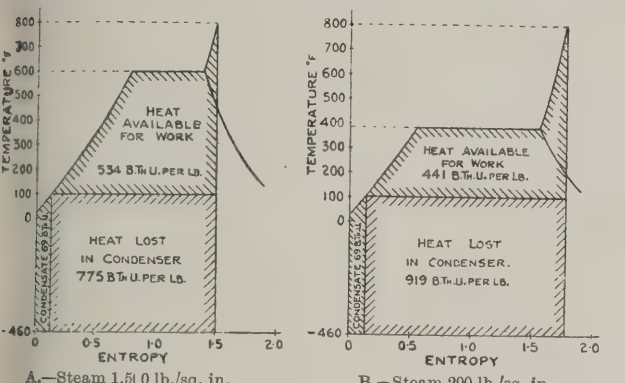
Although American engineers have gone well ahead i respect of the utilisation of higher steam pressures, they hav not for the most part adopted higher total steam temper tures than are employed in this country. Generally speakin the steam temperatures in use in their modern stations ar from 700 to 750 deg. F., and in very few instances has temperature as high as the latter figure been adopted.

With regard to Continental practice, the outstanding example of high steam pressure is the Langerbrugge station of the Centrales Electriques des Flandres, near Ghent, where since 1925 plant has been in operation at a working pressure of 800 lb. per sq. in. gauge and a total steam temperature of 840 deg. F., this being, so far as the author is aware, the highest steam temperature at which any power-station plant in the world is normally operated.

From what has been seen and learned in the course of his investigations, the author has come to the conclusion that the practical difficulties incidental to the working of extra-high-pressure steam plant are by no means insurmountable or likely to prevent the extended use of such pressures.

The English Electric Co., Ltd., in connection with the Benson plant at Rugby, made experiments with steam at a pressure of about 3,200 lb. per sq. in., which is known as the critical pressure, when the densities of water and steam are equal and the water passes into steam without ebullition. Very useful data have been obtained, but not published.

In considering the economy which theoretically may result from the use of higher steam pressures, a reference to the temperature entropy diagrams, fig. 1, will be useful. These



A.—Steam 1,500 lb./sq. in. Vac. 28 in. Hg.

B.—Steam 200 lb./sq. in. Vac. 28 in. Hg.

Fig. 1.—Heat Distribution per lb. of Steam.

diagrams have been prepared from figures obtained from "The Enlarged Callendar Steam Tables," and are based on steam at a temperature of 800 deg. F. and on a vacuum of 28 in. The hatched area in fig. 1A represents the total heat in one pound of steam at a pressure of 1,500 lb. per sq. in. absolute, *viz.*, 1,378 B.th.u. The area similarly treated in fig. 1B represents the total heat in one pound of steam at a pressure of 200 lb. abs., *viz.*, 1,429 B.th.u. The upper portions of the hatched areas in these diagrams represent the heat available for work, which at 1,500 lb. per sq. in. is 534 B.th.u., or 1.2 times the heat available at 200 lb. per sq. in., which is 441 B.th.u. The rectangular figures forming the lower portions of the hatched areas represent the heat rejected to the condenser, which is 775 B.th.u. at 1,500 lb. pressure and 919 B.th.u. at 200 lb. pressure, or 15.7 per cent. less in the case of the higher pressure. The diagrams therefore indicate that at the higher pressure the total heat in one pound of steam is 3.57 per cent. less than at the lower pressure, but, on the other hand, the heat available for work is 21 per cent.

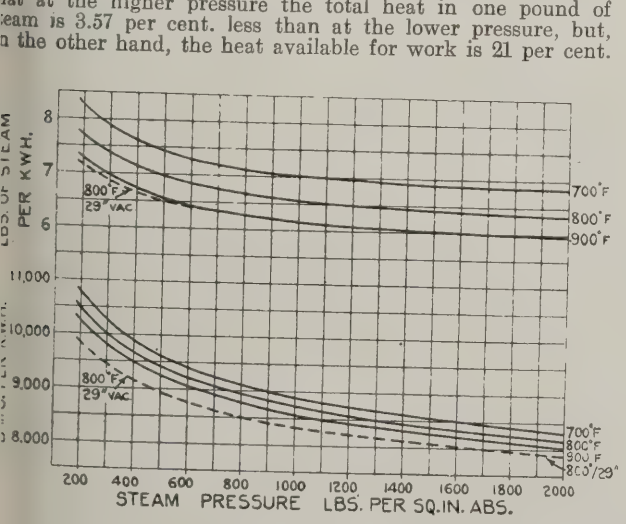


Fig. 2.—Consumption Variations with Steam Pressure.

greater, or, putting the matter in another way, it can be said that in the utilisation of a B.th.u. of heat in steam at a pressure of 1,500 lb. per sq. in., 26 per cent. more work is done than in the utilisation of a B.th.u. in steam at 200 lb.

The full-line curves in fig. 2 show the theoretical steam and heat consumption per kWh at various initial steam pressures between 200 and 2,000 lb. per sq. in. abs. when working with a vacuum of 28 in. and temperatures of 700, 800, and 900 deg. F. The curves given in dotted lines show such consumptions at the various pressures when the steam temperature is 800 deg. F. and the vacuum 29 in. The curves clearly indicate the increases in efficiency which may be obtained as the steam pressure and temperature are raised. From the curves in fig. 2 those in fig. 3 have been produced, illustrating the percentage rate of decrease in heat consumption with steam at various pressures of from 200 lb. to 1,600 lb. per sq. in. abs., superheated to a total temperature of 800 deg. F.

The operating efficiencies likely to be obtained in connection with various portions of extra-high-pressure steam plant may be compared with the efficiencies of lower-pressure plant.

Dealing first with prime movers, it is impossible to convert all the heat available in the steam into useful work at the turbine coupling, as losses take place in all turbines between the stop valves and exhaust branches, as well as in the bearings and by radiation. The best efficiency at the turbine coupling known to the author as having been actually obtained under such conditions is about 81 per cent.

It is not at present possible in a turbine built for a high pressure to abstract work from the expansion of the steam so efficiently as can be done in a turbine constructed for a lower initial steam pressure, and it is doubtful whether it ever will be possible to produce a high-pressure turbine as efficient as one built for pressures of, say, from 180 to 300 lb. per sq. in.

High-pressure turbines have to deal with steam of much greater density than normal-pressure machines, consequently the blade windage and disk friction must be greater. The steam guide passages and blade heights must be smaller and the clearance spaces of greater relative proportion, with consequent increased leakage loss. It would appear that in all probability high-pressure turbines will prove from 5 per cent. to 10 per cent. less efficient than normal-pressure turbines of the same capacity operating under other similar conditions.

With boilers working at high steam pressures the temperature of the flue gases leaving the steam-generating surfaces must of necessity be higher than with normal-pressure plant. This disadvantage, however, can be largely obviated by the use of larger economisers or air pre-heaters, or by a combination of both. Boiler-plant efficiencies under any conditions of pressure cannot be expected to exceed 90 per cent., as this figure closely approaches the physical limit. With high-steam-pressure plants the feed pumps require considerably greater power for their operation than pumps used for dealing with equal quantities of water in connection with normal-pressure boilers. It is not, however, possible at present to

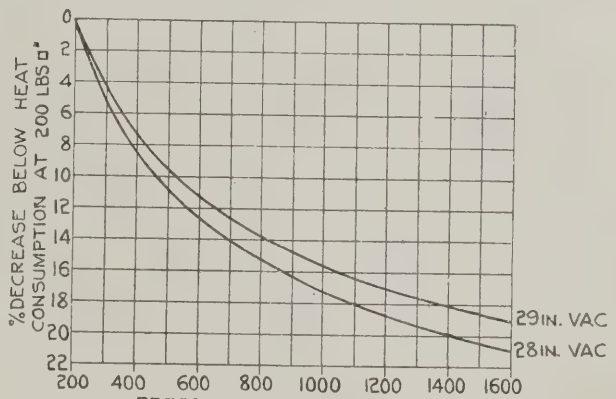


Fig. 3.—Relation between Heat Consumption and Steam Pressure.

obtain pumps for high-pressure working equal in efficiency to those suitable for operating at normal pressures. On the whole, it may be said that the efficiency of a high-pressure boiler should be little below that of a normal-pressure one.

After making the necessary allowance for the difference in efficiency between high- and normal-pressure turbo-generators, it may be taken that the original figure of 26 per cent. will be reduced to 16.41 per cent. if the following turbine and generator efficiencies are assumed:—Efficiency of high-pressure turbine, 74 per cent.; efficiency of normal-pressure turbine, 80 per cent.; and efficiency of electrical generator, in each case 95 per cent. The figure 16.41 per cent. is, however, only a measure of the increase in efficiency which may be realised by the utilisation of steam at higher pressure. The ultimate economy must be shown in terms of coal consumed.

If it be assumed that the efficiency of a boiler plant for normal pressure is 90 per cent., a figure of 88 per cent. may be taken as the efficiency of a high-pressure plant, both figures being based on the net calorific value of the fuel. On this assumption the figure of 16.41 per cent. is reduced to 13.8, and it may therefore be said that one may reasonably expect to obtain from the utilisation of a B.th.u. in a plant constructed to work at 1,500 lb. per sq. in. at least 13.8 per cent. more work than from the utilisation of a B.th.u. in a plant constructed for working at a pressure of 200 lb. This corresponds to a reduction in overall heat consumption of 1,870 B.th.u. per kWh, and assuming that the boiler is fired with coal having a calorific value of 11,000 B.th.u. per lb. net, the saving in coal per kWh generated would be 0.17 lb.

With regard to capital charges, the price paid for the plant determines the amount of the annual interest payments to be made on the capital expenditure, while the probable life of the plant fixes the sum to be set aside for depreciation.

The author considers that the additional cost per kW will increase in greater proportion the higher the pressure and the temperature adopted. From this it follows that in giving

consideration to the installation of high-pressure plant the question of the load factor at which the plant is to be run must receive careful thought. The load factor will determine the extent to which it is economical to adopt high-pressure plant in connection with any particular undertaking.

This fact has resulted in two different methods being adopted in which high-pressure steam is utilised in connection with large power plants. Under the first method the whole of the plant is laid out for high-pressure working, and under the second method high-pressure plant (used in connection with an appropriate proportion of normal-pressure plant) is installed of only sufficient capacity to deal with the base load of the station, the remaining load of poor load factor being dealt with by normal-pressure and, therefore, cheaper plant. In the first case each turbine—usually a multi-cylinder machine—receives steam direct from high-pressure boilers. In the second case only one or two turbines of comparatively small size are operated at high pressure, and the steam is exhausted from them into the normal-pressure steam range and utilised in any of the normal-pressure turbines coupled to that range.

Fig. 4 represents diagrammatically the second method, which the author has adopted in connection with extensions which are now taking place at the Valley Road station.

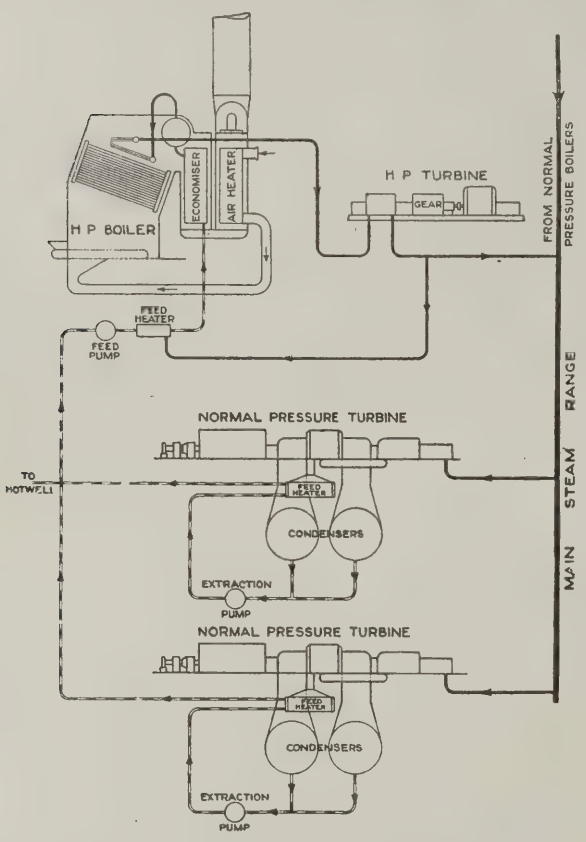


Fig. 4.—System for using both High- and Normal-pressure Steam.

It would appear that capital charges and the cost of repairs and maintenance will be somewhat higher in the case of h.p. plant than in that of normal-pressure equipment, and that the higher the price of fuel the greater are the monetary savings which can be effected. Assuming each type of plant to be run under equal conditions as regards vacuum, the lower the vacuum the greater is the saving attendant upon the use of h.p. plant.

Among the advantages gained by the use of machines having a speed of 3,000 r.p.m. over machines of similar capacities designed for lower rotational speeds are the following:—Lower initial cost; lower steam consumption; greater reliability; and greater ease of overhaul owing to weight of moving parts being less.

It is a fortunate fact that the tendency to increase the rotational speed of turbines harmonises with the movement in the direction of an increase in steam pressures, as in high-speed machines disks of smaller diameters can be employed and almost complete circumferential admission can be adopted, which, amongst other factors, and in view of the density of steam increasing with its pressure, make for greater efficiency in the utilisation of high-pressure steam.

The extent to which regenerative feed heating can be used depends, among other factors, upon the method adopted for firing the boilers. It is impossible to design a station to work at the highest efficiency unless the functions of the turbines and auxiliaries are properly correlated to those of the boilers and auxiliaries. With the introduction of regenerative feed heating the relationship between the turbine and boiler rooms becomes far more intimate and still closer if re-heating of the steam is carried out. This fact will in future cause responsible engineers considerable difficulty when dealing with contracts for the installation of new plant; in the event of failure to obtain a certain anticipated overall efficiency from the coal bunker to the switchboard it will be difficult to attach respon sibility to any particular contractor when different portions the plant have been installed under separate contracts.

It is now generally the practice in modern power statio to increase the temperature of the steam, at whatever pressu it is generated, from saturation temperature to from 550 t 700 deg. F. To attain the best results with regard to efficienc and to prolong the life of the blading, it is desirable that som degree of superheat should be retained in the steam up t the last expansion, and that the steam should enter the cor denser in a dry saturated condition. Unfortunately it i impossible to obtain this desideratum even when stear utilised at as low a pressure as 200 lb. per sq. in. is supe heated to a total temperature of 800 deg. F.

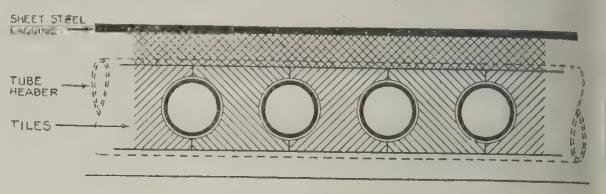


Fig. 5.—Water-cooled Furnace Wall (Bradford).

The question of re-heating or otherwise can only be settle after carefully considering whether the expenditure of th additional capital involved in the provision of such plant wil be justified, having regard to the saving in coal which ma be effected by increased thermo-dynamic efficiency and by reduction in the cost of turbine maintenance consequent upo the greater life of the blading in the low-pressure stages o the turbine. In the opinion of the author such justificatio will not be found except in the case of certain h.p. plants.

Generally speaking, it may be said that the justificatio for the use of boilers of large capacity is found in the reductio in capital expenditure for a given output, and in the greate ease of operation, rather than in any increase in therma efficiency. It is the author's opinion that with a boiler having an evaporative capacity of about 60,000 lb. per hour, one ca obtain a thermal efficiency as high as is practically an economically possible.

The introduction of pulverised-fuel firing has greatly assiste in the construction of boilers having large outputs, but com paratively small heating surfaces. It is doubtful whether i would have been possible to build boilers of such huge capacity as those which are in use in America and to operate them efficiently if any other method of coal firing had been adopted.

As a consequence of the greater efficiency attained in con nection with boiler plant and of higher rates of combustio in boiler furnaces, the cost of maintaining the brickwork used in combustion chambers designed on lines which proved fairly satisfactory for less efficient boilers and lower rates of com bustion has considerably increased. As the combustion chamber of a modern boiler is usually of far greater capacity in proportion to the heating surface than was the case some years ago, the amount of refractory material is necessarily also very much greater, and the cost of maintaining it is corre spondingly higher. In order to keep the cost of furnace repairs down to a reasonable figure and to enable boilers to be continuously operated over long periods without the neces sity of furnace repairs, furnaces have recently been designed to maintain the walls at a sufficiently low temperature to prevent rapid deterioration of such materials. The methods most usually adopted are:—the provision of ducts in the brick work of the walls, through which cold air is passed; walls constructed partly of refractory material and partly of steel tubes; and walls made up entirely of steel tubes of special design unprotected by refractory material.

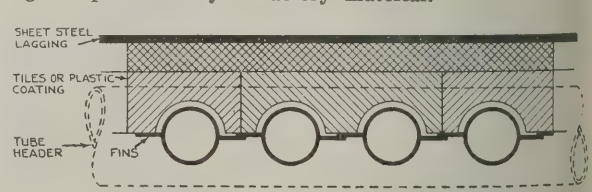


Fig. 6.—Murray Fin-tube Furnace Wall.

The h.p. boiler which is to be installed at Bradford is being fitted with water-cooled furnace walls of the refractory-material and steel-tube type, fig. 5. The desirability of utilising air pre-heaters has arisen largely as a result of the adoption of regenerative feed-water heating, and, as this method is being increasingly employed, air pre-heaters would appear likely to be much more commonly used in the future than they have been hitherto. Fig. 6 shows a section of a wall of a Murray Fin-tube furnace.

It would appear that where air pre-heaters are employed in connection with stoker-fired boilers, the grate area could be somewhat reduced, and in connection with pulverised-fuel-fired boilers the combustion chamber might be of somewhat smaller capacity, thus in each case reducing the capital cost.

It will probably be agreed that the greatest innovation in recent years in connection with boiler houses of power stations has been the introduction of pulverised-fuel firing. The following appear to be the principal claims made in favour of the use of pulverised-fuel plant:—Extreme cleanliness of

operation; ease of control; ability quickly to follow highly fluctuating loads; fuels of variable qualities mixed together in the same bunker can be better dealt with; low-grade fuels can be burned more satisfactorily and utilised more efficiently; a high sulphur content or a high ash content of the coal does not affect combustion to the extent it does with stoker firing; banking losses are considerably reduced; moving parts and mechanism are eliminated from the furnaces; furnace refractories last longer, owing to the fact that the highest temperature is in the centre of the furnace away from the walls; higher outputs per square foot of heating surface can be obtained from the boilers; and a higher average boiler efficiency can be maintained than that maintained by the use of stokers which under test conditions would give equally good results as regards efficiency.

In deciding whether or not to adopt pulverised-fuel firing the chief matters for consideration are the capital cost and the costs of operating and maintaining the plant, as compared with similar costs in respect of stoker plant.

The author reluctantly came to the conclusion that at Bradford the generation of electricity could be effected more cheaply in the immediate future by the adoption of stoker firing than by the installation of pulverised-fuel plant. He, however, realises that the present conditions may not be permanent, and, therefore, has arranged for the boiler furnace to be so constructed that pulverised-fuel firing can be adopted at a later date if then found desirable.

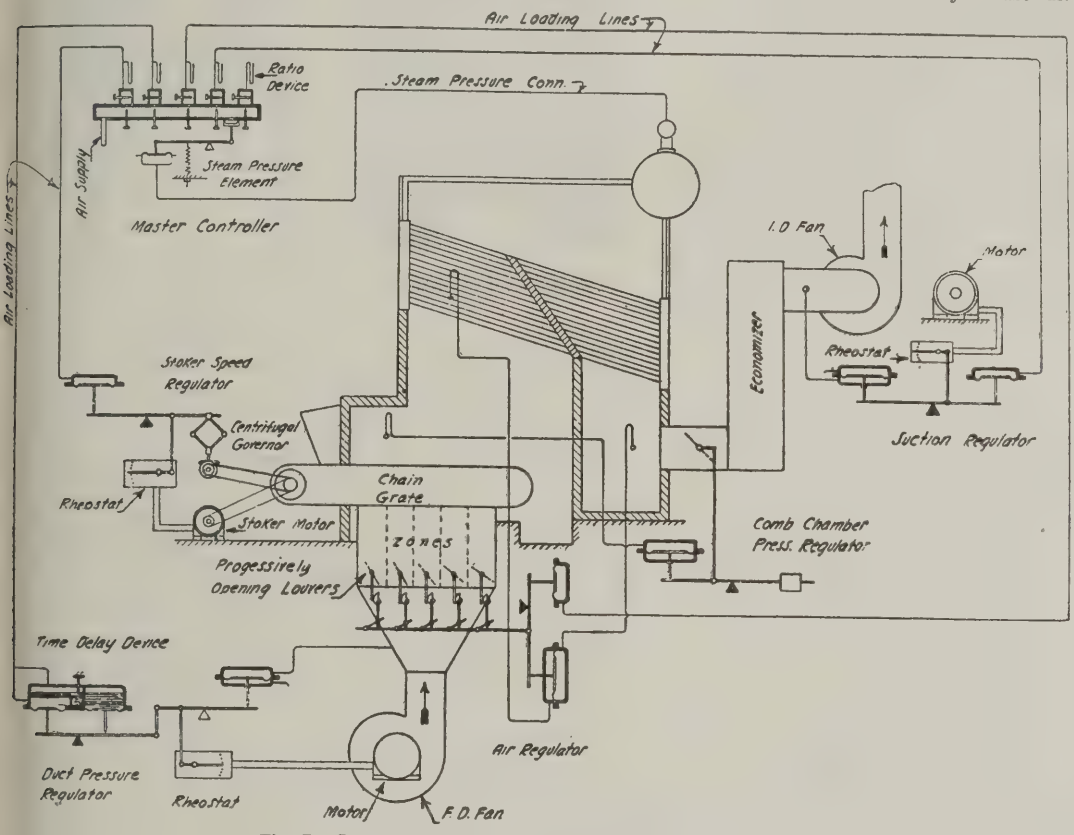


Fig. 7.—Lay-out for Smoot Automatic Combustion Control System.

The type of stoker which the general consensus of opinion in this country deems most suitable for the burning of British coals under water-tube boilers is that known as the chain or travelling grate. During recent years methods have been devised of enclosing the grates, which have also allowed of their use with air pre-heated to a temperature of about 250 deg. F.

So far as the author is aware, no system of automatic boiler control has yet been installed in Great Britain. Such installations to a large number, however, have been put into use in America, with, it is claimed, a marked gain in efficiency. The principle on which these automatic installations work is the maintenance of a constant steam pressure at all loads. Any variation in the steam pressure is transmitted to a number of regulators, whose combined function is to bring the pressure back to normal.

The two systems of automatic combustion control which appeared to the author to be most generally employed in the United States were those made by the Smoot Engineering Corporation, of New York, and the Bailey Meter Company, of Cleveland. In the Smoot system the variations in pressure are transmitted from the master controller to the regulators by air-pressure impulses. The regulators consist primarily of a diaphragm, one side of which is under air pressure transmitted from the master controller and is balanced by some force which bears a direct relation to the load on the boilers for the function which that individual regulator has to perform. The movement of the diaphragm is transmitted by levers actuated by an oil relay to the various rheostats, dampers, and other devices. Fig. 7 shows in diagrammatic form a lay-out of the Smoot automatic combustion control, as arranged for a stoker-fired boiler.

Discussion on Mr. Roles's Paper.

Mr. I. V. Robinson, of the B.E.A.M.A., said there was no doubt that high-pressure plant would cost more than plant of normal pressure. Both the Bradford Corporation and the manufacturers who were installing the h.p. equipment there were to be commended for their enterprise. Not until things had settled down should we be able to get with any degree of accuracy the difference in the costs of normal- and high-pressure plant. He suggested that it would be an advantage to the industry if a single-cylinder machine were used for outputs very much in excess of anything that had been attempted in this country, with an efficiency of 80 and not 83 per cent. A single-cylinder machine could be used for up to 50,000 kW with a normal-pressure plant. Undue emphasis was being put on thermal efficiency, which had been forced upon the engineers by the publication of tables by the Electricity Commissioners, and this, he thought, was not in the best interests of the industry. If thermal efficiency were the only thing we were working for, then there was no doubt which stations would win—those with internal-combustion engines. But thermal efficiency was not the goal we were striving for. He suggested that it might be possible to grade stations on the average price per unit, but it would be unfair to compare the average prices of purely residential districts with areas that were solely industrial. Would it not be possible to grade and classify the stations according to the percentage sold for lighting purposes? That would not only take into consideration thermal efficiency, but also initial costs. Referring to the re-heating of steam, he said there seemed much still to be done before re-heating was a success. The question of steam being re-heated by superheated steam was a matter that was worthy of consideration. He doubted the suggestion that the efficiency of the condenser had reached its maximum, in view of the improvements that were being made.

Mr. R. A. Chattock, M.I.E.E., said that for the past 18 months he had been engaged on the design of a new power station at Birmingham, and he found that he had been following to a very great extent along the lines given in the paper. When he was at the Valley Road station they had a thermal efficiency of 10 per cent.; now Mr. Roles had got it up to 16.68 per cent. The new Birmingham station was designed for a thermal efficiency of 23 per cent., which would be obtained quite easily, even with the use of cooling towers. The high efficiency would be obtained largely by the bleeding of the turbines and heating the feed water in that way. He did not think that the method of re-heating steam was likely to be generally adopted. The idea of placing the contracts for the whole of the plant with one main contractor had been adopted at Birmingham.

Mr. Chittenden, of the English Electric Co., pointed out that at Rugby they were generating steam at 3,200 lb. per sq. in. and using it at 1,500 lb., and they got an efficiency of over 80 per cent. without using a re-heater or other things. He had seen tests recently on a high-pressure boiler on which 88 per cent. efficiency was reached. There were a number of stations in this country which could not put on feed heating, because the turbines were not designed for it, nor could they alter the vacuum; but they could add a small percentage of high-pressure plant.

Mr. J. H. Bowden, M.I.E.E., Poplar, gave some details of a boiler he had seen in Berlin. It was designed to work at 3,250 lb. pressure and the firm expected to get an increase over and above the existing plant in thermal efficiency of 14 or 15 per cent. The quantity of water in the boiler was only 80 gallons, and it was fired by pulverised coal.

Mr. W. Bayliss, of Messrs. Babcock & Wilcox, Ltd., said the pressure that had been adopted at Bradford was not the highest that had been used commercially in connection with power generation. The contractors were out to help the electrical engineers of this country in any developments they desired to make. Probably at the present time there was a limited number of cases where conditions justified the disfavour which was accorded to h.p. delevelopment, and where

capital costs were a serious factor. Twenty-five years ago the maximum steam pressure was in the neighbourhood of 225 lb. per sq. in., but to-day plant was operating at 1,200 lb. He said we must go on in this country, we had to lead the world. There were engineers to-day willing to go beyond the pressures and temperatures mentioned in the paper. Mr. Bayliss asserted that although everyday improvements were being made in the detailed plants associated with pulverised fuel, it was a fact that at the present time there was no pulverised-fuel plant in this country that could show as high an efficiency as had been obtained from stoker-firing plant.

Mr. A. Q. CARNEGIE, of Messrs. C. A. Parsons & Co., said that re-heating had been tried in this country, but up to the present not wholeheartedly. A re-heating plant had been put up at North Tees, the steam temperature being raised 150 deg. F. The recently completed contract for Chicago aimed at 750 deg. F. for the re-heat. He could not see any advantage in re-heating by live steam. If it were possible to raise the temperature of the re-heated steam to 1,000 deg. F., it was also possible to take that steam into the turbine direct, which would have the same effect as taking the steam out of the turbine later and re-heating it. Most of the first-class engineering firms were always anxious with the pioneer in any new development to bear a fair share of the cost. He hoped that when Mr. Roles had got his h.p. system working he would give a paper on its results.

Mr. D. WILSON, of International Combustion, Ltd., said he was still prepared to defend the mechanical stoker in its useful sphere of influence, but he had no hesitation in following the predictions the author had given. The whole question was one of capital costs, which were rapidly tumbling down.

Dr. S. Z. DE FERRANTI reminded the members that an engineer named Perkins once ran a boiler and engine in this country on 1,000 lb. steam pressure a long time ago. He had devoted considerable time to the question of economy of generation. In the Deptford station they adopted 200 lb. pressure 38 years ago. There had been a large amount of money spent on electric supply, but he did not see any alternative to what was being done at present. In 1910 they put down at one of the Vickers works in Sheffield a 3,000-kW machine, 1,500 r.p.m. They only had a 200-lb. pressure, but they had one stage of re-superheating to 750 deg. F., the l.p. steam being at about atmospheric pressure. They then introduced a steam regenerator between the condenser and the turbine exhaust, and also went in for four stages of progressive feed heating, which obviously involved air heating. All these things were embodied in the 3,000-kW plant. They found afterwards that there was a serious steam leakage owing to the construction of the machine. He had found no solution for the problem of re-superheating, which he considered satisfactory. The New York Edison Co. in its latest station had not adopted re-superheating. It had adopted regenerative feed-water heating, but it had only gone in for 375 lb. boiler pressure. He was very much surprised at that.

Mr. HENMAN said the system of re-heating by the use of oil had great future possibilities, and one of its big advantages was that it required smaller pipes.

Mr. R. B. MITCHELL, Glasgow, felt that the day would come when base-load stations would have a working pressure all through of something like 1,000 lb. at least. He suggested that a case had been made out for a combined plant consisting of some stoker boilers and some pulverised-fuel boilers.

Mr. POTTER, of Messrs. Simon-Carves, Ltd., said it was generally admitted that the grit from the pulverised-fuel chimneys was much finer and there was no nuisance through the emission of the grit.

Mr. ROLES, replying, said that unless they were going to deal with basic loads it would not be economical to put in a very highly-efficient plant. The point was that the matter had been dealt with by the Coal Conservation Committee. There had been no Committee set up to consider the question of the conservation of capital. In America, probably due to the fact that the undertakings were in the hands of companies and not municipalities, they had developed rather faster than we had done. Municipal Committees should consider the question of development and pioneering.

Ald. J. A. G. BEAUMONT, St. Marylebone, in moving a vote of thanks to Mr. Roles, said he was hopeful that some day he might hear a paper read by someone who would be able to show that as new ideas increased capital costs decreased.

The I.M.E.A. Exhibition.

(*Continued from page* 905.)

The JACKSON ELECTRIC STOVE CO., LTD., exhibited a complete range of eleven domestic cookers for families of from two to fourteen persons. It is interesting to note that there are 20,000 Jackson cookers on simple hire in this country, and that this make is exclusively to be offered on simple hire by the Buxton Corporation. A breakfast cooker specially designed for hire purposes was shown, as were also immersion heaters designed for use in existing hot-water tanks and cylinders.

Wash boilers of various designs, including a new model which is specially designed to eliminate dirt traps, with a japanned steel outer case and a tinned copper interior, were included in the exhibit. A feature was the "Perco-Wash" device which is designed for use with wash boilers to clean clothes by percolating action. Other items on this stand included a new type of fire with plug-in elements, specially designed for hiring purposes, and a water heater with a low continuous loading controlled by a thermostat. This is heavily lagged and designed to meet the increasing demand for this class of apparatus.

On the stand of MESSRS. MOORWOODS, LTD., in addition to the "Moorwood" electric cooker, was a range of attractive

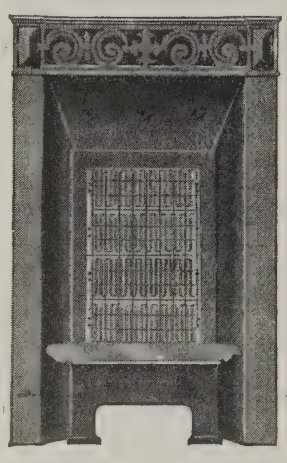


Fig. 6.—Moorwood Electric Fire.



Fig. 7.—New "Creda" Cooker.

electric fires. Fig. 6 shows one of the exhibits, which is specially designed for fitting in any room in place of the coal fire.

The principal features of interest on the stand of MESSRS. CREDENDA CONDUITS CO., LTD., were to be found in a range of "Creda" cookers. Included was a new model, C.43, fig. 7, which has an oven 12 in. by 9¾ in. by 9½ in., and a hob containing one of the new "Creda" patented enclosed boiling plates, 1,800 W, and a separate grill. The new "Creda" enclosed boiling plate embodies some special patented features making, it is claimed, for efficiency and long life. Nichrome spirals of unusual length and particularly low-current density are laid in china formers, and the whole are embedded in special non-hygroscopic and heat-conducting cement. The insulation is said to be particularly good, and all the plates are flashed at 2,000 V before dispatch. The plate is interchangeable with the "Creda" open-type appliance. The new model is made in sections, each approximately 8 in. by 4 in., two sections being employed to form the standard plate. One section only is on circuit for medium heat, thus enabling small cooking receptacles to be used economically. The shape of the plates permits two or more pots to be kept going in medium heat on the one section. The makers guarantee the plates for two years.

MESSRS. SANTON, LTD., exhibited a range of electric geysers in addition to a variety of connecting plugs and service boards and the "Santon" electric tank-belt. The last-mentioned device, fig. 8, is a simple apparatus for use in conjunction with an ordinary kitchen range hot-water system. It consists of a flexible metal belt with an asbestos-lined cover, which can be slipped over the tank and clamped in position

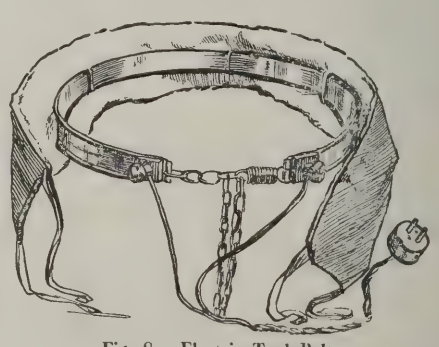


Fig. 8.—Electric Tank-Belt.

by means of a spring and chain attachment. It is supplied with 500-, 750- or 1,000 W loadings. It can easily be slipped up or down the tank as required, and two belts can be fitted and used together or separately. It is supplied complete with a length of flexible lead and a plug connection. The standard service board is fitted with two 30-A s.p. fuses and a rotary switch specially designed for heavy currents.

(*To be continued.*)

Reviews.

X-Rays, Past and Present. By V. E. PULLIN and W. J. WILTSHIRE, members of the Research Department, Woolwich. Pp. 229; figs. 43. London: Ernest Benn, Ltd. Price 12s. 6d. net.

The title indicates the wide and important field covered in the work by the authors, who are prominent members of the Radiological Research Department, Woolwich. The first four chapters are devoted to the early development and history of radiology; subsequent chapters deal with the application of X-ray methods to crystal lattice structure, spectroscopy and the practical applications of X-rays in surgery, medicine, and industry. The order of the subjects is well suited to the purpose of the book, and the authors write with evident experience of many of the difficulties of the subject.

When we consider that modern scientific resources enable us to enumerate with precision the constituent particles of an atom, and further to calculate the velocity of the particles and the ratio of their charge to their mass, we realise the romance of scientific investigation and the genius of the great investigators.

When a discovery of the first rank is made, the ultimate consequences always exceed anticipation. The X-ray was a discovery of this kind. At the time no one could have expected that these rays would provide us with a means of exploring the innermost secrets of atomic structure. Within a few years of their discovery, however, J. J. Thomson and Townsend had used the X-rays to convert air into an electrolyte, and had thus determined the value of the atomic charge, whilst later on Moseley and others, by the same means, had investigated the electrical constitution of matter with fertile observations and astonishing success.

The first aim of X-ray crystal analysis is to determine the classification of the atoms and molecules in the crystal unit, and to account for the properties of the crystal in terms of that classification. X-ray methods tell us directly the number of molecules in the crystal unit cell and the mode of their arrangement with such determination of length and angles as are required to define the structure completely. During the early history of the X-rays, the development of apparatus for their production was chiefly influenced by the requirements of medical radiologists; more recently the application of X-rays in physical research has become of outstanding importance. The analysis of a beam of X-rays into its constituent radiations by reflection at a crystal face provides a means of obtaining radiation of definite wavelength, and of such intensity as to enable its absorption coefficient in different materials to be measured with accuracy. Ingenious X-ray methods of qualitative analysis have been devised, exhibiting extraordinary delicacy and sensitiveness whilst dealing with infinitesimal quantities of matter. Industrially X-ray methods are finding increased application in metallurgy, consequent on the classical researches of Bragg, Ettisch, Polanyi, and others on the structure of metals, alloys, and steels. These methods are no longer of purely scientific interest; they are now utilised in several industries, including papermaking, explosives manufacture, and the leather, tanning, and textile industries.

The chapter dealing with the "Application of X-Ray Spectroscopy" is highly instructive. It contains an account of how Lane's inspiration and Professors Sir W. H. and W. L. Bragg's manifold applications of the method have already proved of the greatest practical value, not only in the advancement of scientific knowledge, but also in their application in several industrial and manufacturing operations.

As already pointed out, the book is intended for the layman, and is consequently not sufficiently detailed to be of special service to the expert. The volume is intentionally more or less elementary in design and is written to form an introduction to, rather than to supersede, standard works on the subject. It is, however, well suited for the purpose in view, and on the whole the book is probably the best available in its own particular line. The value of the descriptive matter is considerably enhanced by numerous illustrations, but the volume is practically devoid of references to the original work which has been consulted. The skill with which the authors have evaded mathematical difficulties and complexities allows one to recommend the volume as an interesting and generally accurate *aperçu* for the general reader.

History of Radio-Telegraphy and Telephony. Written and illustrated by G. G. BLAKE, M.I.E.E., A.Inst.P. Pp. xix+425. London: Radio Press, Ltd. Price 25s. net.

Nearly all books on radio communication contain a historical summary, but Mr. Blake has given us a really comprehensive historical treatise. The book is arranged essentially for reference as opposed to arm-chair study, but much of it is written so interestingly as to fit in with the latter form of reading as well.

There are 1,125 references to books, papers, patent specifications, &c. These references appear in the text as numerals which refer to a table of titles at the end of the book. There are also an excellent index and full chapter headings, and, in fact, for purposes of reference the book could not be better arranged. The general production, printing, and illustrations are first class.

This book is intended "to be a history of principles and invention rather than a record of commercial wireless," and the author's aim is "to bring into prominence almost forgotten schemes and devices in the hope that new ideas may spring therefrom."

The aim of the book may thus be taken as accounting for some apparent anomalies which would otherwise give grounds for criticism. For instance, we notice that the index contains more references to the author's own work than to that of Mr. Marconi, and again, far more space is given to inventions and suggestions which have proved of no commercial value than would have been the case in a strictly historical treatise. No outstanding practical work, however, has been omitted so far as this country is concerned, but it is impossible, as the author says, to make mention of all who have contributed to the development of radio communication. Developments in other countries are naturally dealt with less fully, but, remembering the author's aim, we consider that they are dealt with adequately, though, indeed, in describing theories of the upper atmosphere, Prof. Kennelly's name might well have been mentioned.

We are glad to see that the great pioneer work of Hughes receives full recognition, usually lacking in histories of radio, and in more recent times the work of Professor Eccles.

The book is full of interesting historical facts not realised by many recently recruited experimenters, such as Mr. Marconi's prediction in 1903 of radio communication with Australia, its realisation as long ago as 1918, a reference to piezo-electricity by Theophrastus in 300 B.C., the fact that the Eiffel Tower has been transmitting radio time signals for 17 years, and that telephotography over land lines has been in use for 23 years. These few extracts taken at random, in conjunction with the fact that there are 1,125 references, will help to give some idea of the thoroughness with which the author has dealt with his subject, and we have no hesitation in saying that his book will be found of great interest and value to every one who is engaged in the technical development of radio communication.

High-Frequency Electric Furnaces.

Prof. Ribaud's Experimental High-Temperature Equipment.

WITH the object of producing high-frequency electric furnaces capable of attaining a temperature of 3,000 deg. C., and permitting material under treatment to be easily removed or pyrometrical examinations to be conducted without being inconvenienced by smoke or fumes, Prof. G. Ribaud, of the Institut de Physique of Strasburg, has for some time past been conducting experiments with various forms of industrial

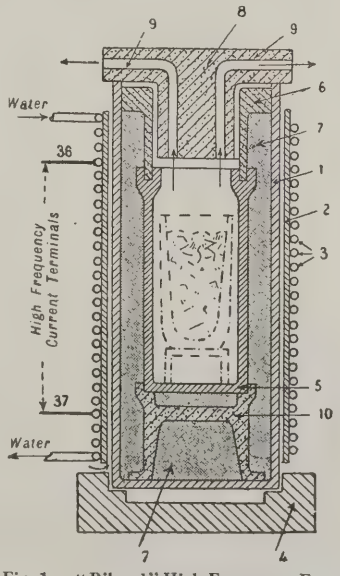


Fig. 1.—"Ribaud" High-Frequency Furnace.

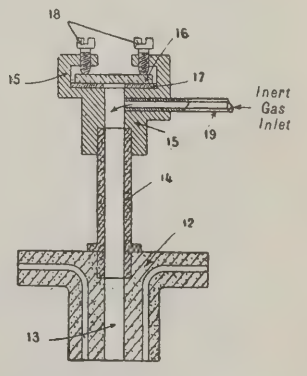


Fig. 2.—Special Testing Cover.

porous carbons. Such carbons, when composed of fairly large particles and also slightly agglomerated, are only slight conductors of heat and electricity, and are able to withstand temperatures exceeding 3,000 deg. C. On the other hand, by reason of their high porosity, they are combustible, and when red hot cannot be allowed to long remain in contact with air. At the same time their thermal conductivity is so low that the cover of the furnace, with the internal temperature referred to, which can be attained within three minutes, can be removed by hand. Fig. 1, reproduced from the *Journal de Physique et le Radium*, shows one of Prof. Ribaud's experimental furnaces. Its

essential components are an insulating cylinder made of melted quartz or other insulating substance capable of withstanding the high temperature, and a cylinder 2 on which is mounted the winding 3 for the high-frequency current, this winding taking the form of copper tubing. The two cylinders 1 and 2 are mounted on a base 4. The graphite crucible 5, heated by the induction, is prolonged at the upper end by a porous carbon cylinder 6, the outer surfaces of the crucible and the carbon being heated through the medium of the soot packing 7. The cover 8 is made of a piece of porous carbon, in which passages 9 are formed to act as outlets for the gases. The crucible rests on a piece of porous carbon 10, which is shaped so as to render it a poor conductor of heat.

The idea of making the external electrical winding of copper tubing was to enable water to be circulated through it, while in the course of experiment it was found necessary to extend the winding well above and below the crucible in order to keep the walls of the furnace as cool as possible, and so prevent burning. In order to reduce as far as possible any unnecessary increase in the self-induction, the source of high-frequency current was not connected to the extremities of the winding, but at the points marked 36 and 37. The outer cylinder is fixed at such a height above the base as to permit air to circulate between the two cylinders and so facilitate the cooling.

In furnaces in which it is desired to make pyrometrical tests the special cover shown in detail in fig. 2 is used in place of the cover 8 (fig. 1). In this case the cover 12 is provided with a central hole 13, in which is mounted a hollow extension piece 14 of porous carbon or other refractory material. This is surmounted by a special metal piece 15, in which is fitted a glass 16 supported on an elastic washer 17, and secured by two screws 18. A lateral tube 19 enables inert gas to be led into the inspection chamber and so drive from the latter any smoke that might detrimentally affect the inspection tests.

In furnaces of the Ribaud type the heating rapidity and the attainment of maximum temperature depend, of course, on the dimensions of the furnace and the available high-frequency power. For a furnace with a fixed interior capacity the heating-up speed is greater as the thickness is reduced. The maximum temperature attainable depends on the amount of available current, the consumption increasing at a greater ratio than the rise in temperature. Thus, in the case of a furnace with an interior volume of 100 cu. cm., while about 2 kW is necessary to give a temperature of 2,000 deg. C., approximately 7 kW is required to give 3,000 deg. C. With an available power of 10 kW the maximum temperature reached with graphite has been in excess of 3,000 deg. C. in the case of a furnace of a volume of 100 cu. cm., 2,500 deg. C. with one of 500 cu. cm., and 1,800 deg. C. with a 3,000-cu. cm. volume furnace. On a loading of 18 kW a temperature of 2,300 deg. C. has been reached in a 3-litre furnace, and 2,000 deg. C. in one of 5 litres capacity. As compared with a carbon-resistance furnace such as is used in the National Physical Laboratory in England, in which a temperature of 1,700 deg. C. can be attained in a 500-cu. m furnace on a consumption of 10 kW, Prof. Ribaud claims to be able to attain a temperature of 2,000 deg. C. in a furnace of similar size and with the same power.

Electrical Calculator Charts.

Two Charts devised by the electrical staff of Messrs. J. Lyons & Co., Ltd., for easily ascertaining motor loadings and cable volt-drop.

IT is often necessary to know the current taken by motors of varying h.p., and also to ascertain easily the voltage drop for a given length and size of cable, and in this connection the charts reproduced below, which have been prepared by Mr. Gordon Douglas, assistant electrical engineer, and Mr. A. B. Shirley, of the Electrical Department of Messrs. J. Lyons & Co., Ltd., for use in their own works, should prove interesting to many engineers.

By means of the chart, fig. 1, the current required by any motor of from 1 to 150 h.p., working at 90 per cent. 80 per cent., 72 per cent., and 64 per cent. efficiencies on either d.c., single-, two- or three-phase circuits can be directly read. The h.p. at the various efficiencies is found on the horizontal scale, the current in amperes on the vertical scale and the supply voltage and system on the curved scale. A transparent cursor (not shown), on which a central hair line is engraved, is pivoted at the point of origin. In order to find the current required by a certain motor, set the cursor with the line passing through the voltage of the supply system on which the machine is to operate, and find the h.p. at the desired efficiency on the horizontal scale. By looking down the chart to the cursor line and then along from this point to the current scale, the result in amperes is found. Similarly, if the h.p., current, and voltage of a motor are known, the efficiency of the machine can at once be obtained by

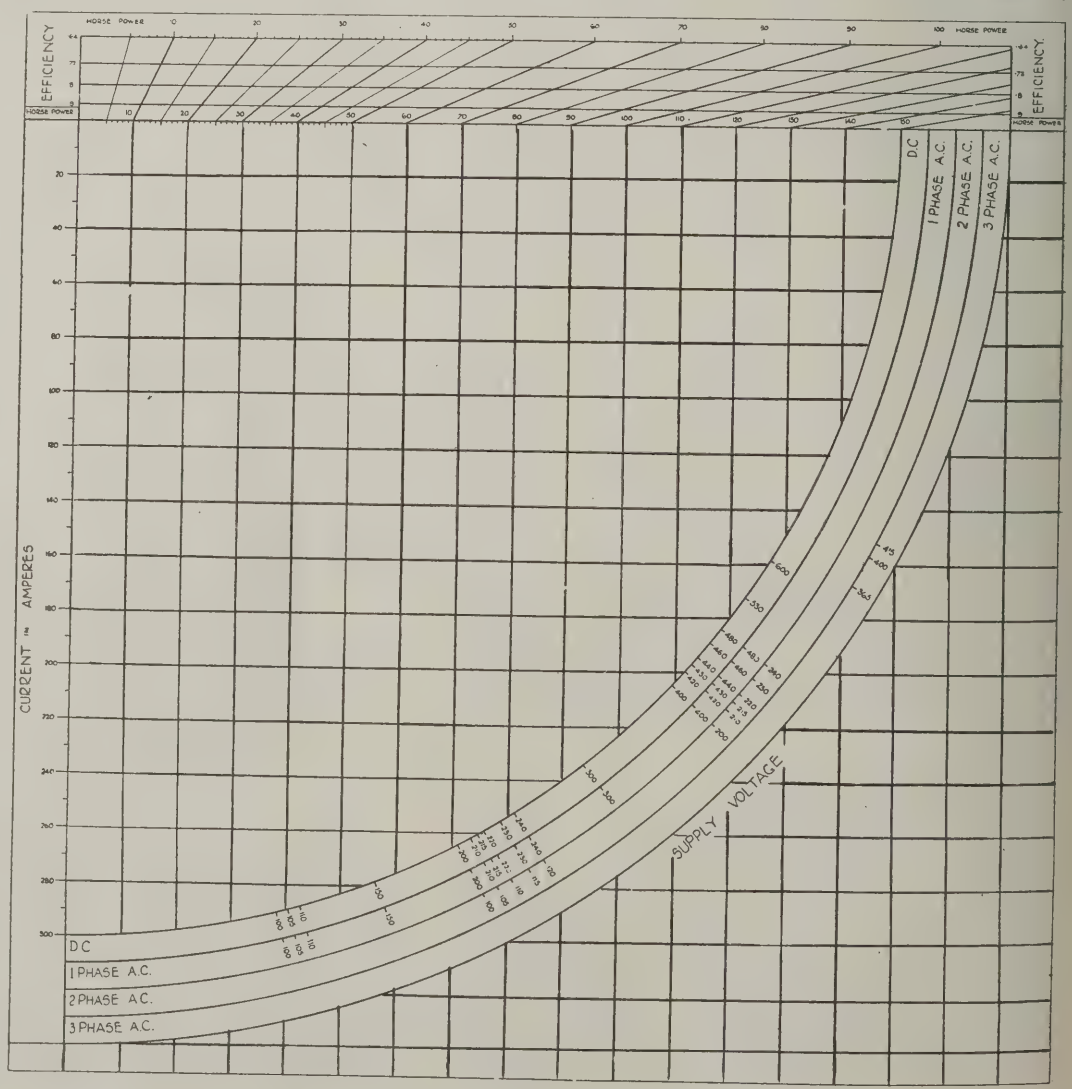


Fig. 1.—Motor Loading Chart.

reversing the method of reading.

With the volt-drop chart, fig. 2, it is easy to ascertain the drop per 100 yards run direct, not lead and return, for any size of cable from 1/.036 to 127/.103 carrying any current from 0 up to 150 amperes on d.c. single- or three-phase circuits. The size of cable is found on the horizontal scale, the current in amperes on the vertical scale, and the drop per 100 yards run of cable on the curved scale. A cursor similar to that used with the other chart is provided. To find the volt-drop the cursor is set so that the line passes through the point of intersection of the horizontal and vertical lines from the current and cable-size values, and the drop per 100 yards run is read off the curved scale. By reversing the method of working, the size of the most suitable conductor to carry a given current at a predetermined volt-drop may also be found.

For the sake of obtaining open scales in each case three columns are provided in colours, but to facilitate re-production these are shown blank.

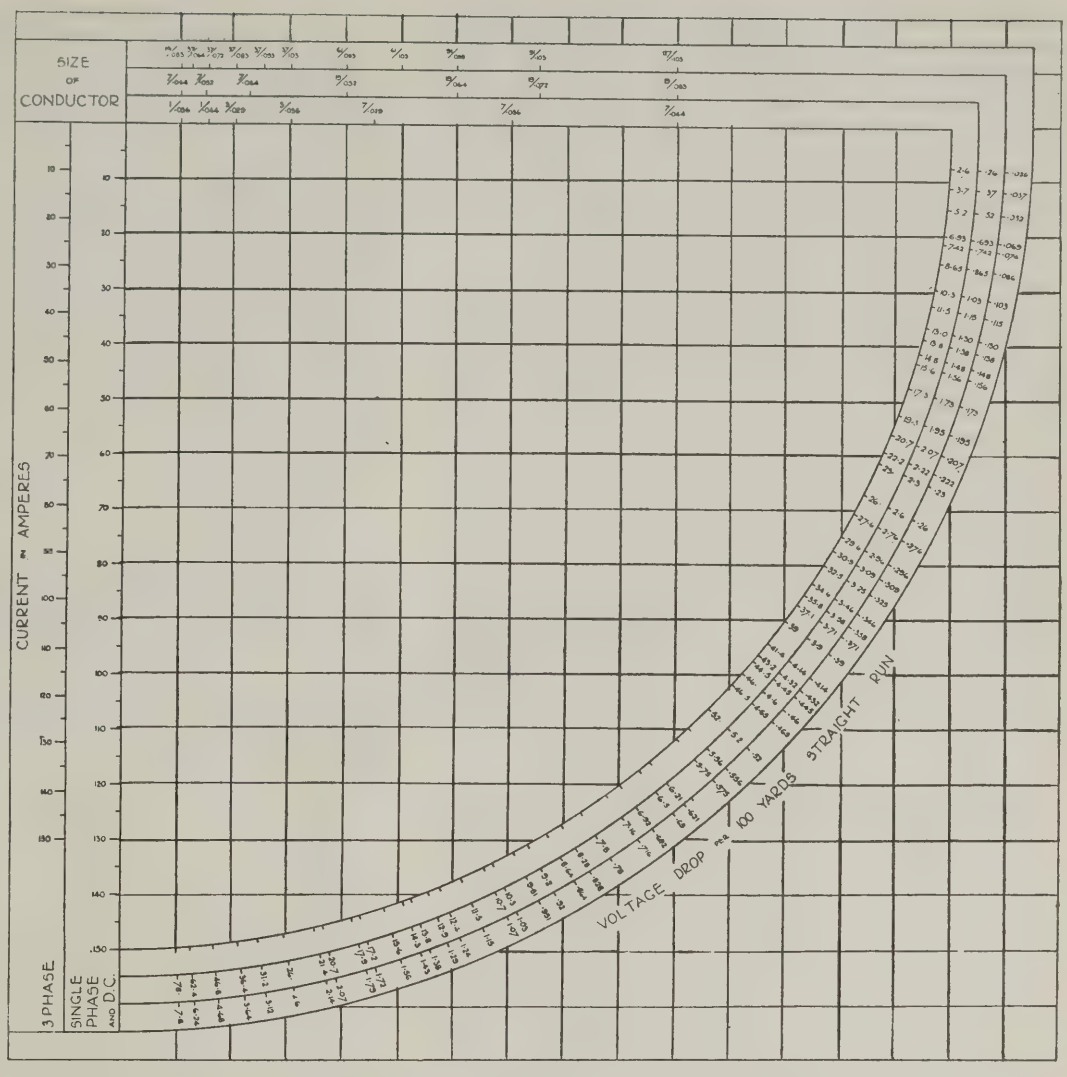


Fig. 2.—Cable Volt-drop Chart.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

A New Portable Receiver.

The reputation of their standard apparatus is sufficient recommendation for any new product of Messrs. Burndept Wireless, Ltd., who recently placed upon the market a new receiver that can not only be termed truly portable, but is also well suited for permanent home installation. The three batteries are totally enclosed in the polished oak cabinet, which is provided with a carrying strap, their weight being equally distributed in order to facilitate carriage; a 2-volt, 20-amp.-hour "Exide" S.P.7 unspillable accumulator is employed to heat the filaments, together with dry-cell grid-bias and 108-volt anode batteries. The five valves, two of which are h.f. and two l.f. amplifiers, are of the low-consumption class, and the speaker incorporated in the set is provided with a contorted horn no less than 3 ft. 2 in. in length, constructed on the exponential principle; it terminates behind a grill, as indicated in fig. 1, which also shows that the top front portion of the cabinet hinges upwards to give access to the three controls: a single geared tuning-condenser dial in the centre and a volume (reaction) knob on the left, the switch on the right having a threefold purpose: in the top position it allows of normal broadcast-wave reception, and in the bottom position it permits of the longer-wave stations being heard, while in the central position it disconnects all batteries. The pair of terminals on the extreme left is for the connection of an external loud-speaker, if desired, and the pair on the right for the use of an external aerial and earth connection, although the set normally operates with an enclosed frame aerial wound round the inside of the cabinet. The latter is 18 in. wide, 17 in. high, and 8 in. deep, its back being hinged to form a door to give access to the valves, &c. Fitted to one side of the cabinet are two sockets which are connected to the internal accumulator; should it be required to operate the instrument in one particular place for any lengthy period, a larger capacity external accumulator may be connected to these sockets without removing the internal accumulator, or the sockets may be used for re-charging the internal accumulator without the



Fig. 1.—The New Burndept Portable Receiver.

necessity of removing it from the instrument, and a row of terminals is provided internally, although easily accessible, to which larger capacity dry batteries or a mains unit may be

attached. This facility is particularly desirable when the instrument is permanently installed in the house throughout the winter months. The set is primarily intended for reception from Daventry within 200 miles of that station, but it should generally enable several Continental stations to be heard in Southern and Eastern England also, in addition to those operating on the lower broadcast wave band, so that there should be few places where the instrument will fail to make several alternative programmes available. A recent demonstration in a far from favourable location created an excellent impression of the capabilities of this new receiver.

An "Amplion" Cone Speaker.

Realising the fact that a considerable number of the receiving sets at present in use in this country are inherently incapable of operating certain types of cone loud-speaker, and that their owners are reluctant to purchase new receiving apparatus, MESSRS. GRAHAM AMPLION, LTD., have deliberately designed their latest models so as to give good results when used in conjunction with any good receiving set of normal construction. As an example their AC.5 type cone, which is visible through an open fretted grille, is "old gold" finished in contrast to the dark oak cabinet, the dimensions of which are only 15½ by 6½ in., whilst the overall height is 14 in. The electromagnetic unit is adjustable and the cone diaphragm is made of a strong seamless fabric, not paper, which is claimed to be impervious to climatic changes and temperature variations. The absence of the so-called "megaphone effect" is due to the elimination of the sound conduit, or horn, and one of the peculiar qualities of the cone speaker is its capability of reproducing the lower notes in the musical scale; manufactured in a variety of styles, this make of speaker obviates the necessity for a special or unusual design of circuit, and the sample lent us for trial functioned satisfactorily on a simple receiving set.

The "Gecophone" Battery Eliminator.

An anode-battery eliminator for operating off domestic a.c. electricity supply mains must, of course, incorporate a rectifier. A recently-evolved type employs a special valve containing a rarified gas in which rectification occurs by means of a species of glow discharge, such an arrangement representing a considerable saving of the energy required to operate the eliminator; indeed, the valve possesses no filament at all, and its life is therefore independent of the risk of filament fracture. An example of this system is marketed by the GENERAL ELECTRIC CO., LTD. After rectification, which is full-wave, the percentage ripple remaining superimposed depends on the efficiency of the smoothing, or filter, circuit, which consists of a large reservoir condenser and choke coils having a large inductance, the resistance of the choke being kept as small as is consistent with reasonable cost. An interesting feature is the means by which the output voltage of the eliminator (*i.e.*, voltage applied to the anodes of the valves in the receiver) is prevented from

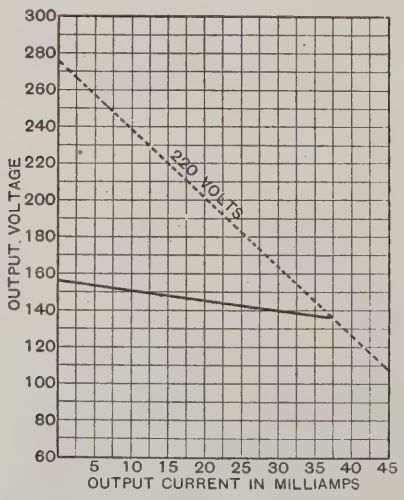


Fig. 2.—Battery Eliminator Characteristic "Curves."

falling very rapidly as the current taken from the eliminator increases; for example, if the anode current of any valve were changed, say, by altering the grid-bias voltage, the anode voltage would also change very appreciably. The accompanying characteristic "curves" were taken from a "Gecophone" eliminator attached to 220-volt a.c. mains; the dotted line shows the type of characteristic that would be obtained without the aid of the voltage regulator employed, from which it will be seen that as the output current increases from zero to 37 milliamps the voltage drops from approximately 280 to 150 volts, whereas with the voltage regulator in use the drop is comparatively small, being denoted by the slope of the thick black line. The regulator takes the form of a special "Osglim" neon lamp shunted across the output of the eliminator, and the important point is that on a multi-valve wireless receiver any grid-bias adjustments may be made, or valves substituted, with the knowledge that the anode voltage on each valve will remain constant.

Correspondence.

Correspondents should forward their communications as early as possible. *No letter can be published unless we have the writer's name and address in our possession.*

Energy Consumption in Small Houses.

Estimates of energy consumption, costs, &c., have been published from time to time in your pages, but so far as the writer recollects, there has been nothing which gives a fair indication of the consumption in a moderate-sized house which is not wholly "electric." The following average monthly consumption figures may be of use to contractors and others who are endeavouring to persuade possible customers to change over from gas to electricity for general purposes.

The house consists of two living rooms, three bedrooms, kitchen, and scullery. It is a modern semi-detached house costing £975.

The electrical equipment consists of:—

5.3-kW cooker.
2.0-kW portable fire.
.75-kW bowl fire.
Vacuum cleaner; iron.

The total wattage for lighting is 510. The 2-kW fire is used for occasional heating in the dining-room, such as breakfast time in the winter, and chilly evenings in spring or autumn. It is also used in the drawing-room in the winter, when the use of this room is required as well as of the dining-room.

The following average consumption is taken from daily meter readings, and is based upon the time the house is actually occupied, *i.e.*, allowance is made for holidays, week-ends, &c.:—

Date. 1926.	No. of days.	Units.	Average units per day.
March	31	168	5.42
April	27	134	4.96
May	31	138	4.45
June	28	138	4.92
July	29	102	3.52
August	27	104	3.85
November	30	169	5.63
December	31	191	6.16
1927.			
January	26	146	5.64
February	28	157	5.6
March	25	108	4.32
April	30	134	4.46
May	31	130	4.2

During the period under review, a total of 3 tons 12 cwt. of coal has been purchased. This is used only for the dining-room and kitchen. The number of residents in the house is two, but for about four months during this period an elderly relative has been living in the house also.

As only one meter is fitted, lighting consumption cannot be given separately, but this is estimated to be about 120 units. I trust these figures may be of use to readers of your paper.

A.M.I.E.E.

June 6th, 1927.

The Ideal Wiring System.

I have read with great interest the article and subsequent letters on the above subject. My reason for preferring steel conduit is because of the experience of a friend of mine, who had to re-wire a country house owing to rats having eaten away the lead sheathing and wiring too. Rats would have little difficulty in eating a way through rubber sheathing, but would find steel conduit a stiff proposition.

W. Garratt.

Bloxwich, *May 31st*, 1927.

Metal-clad Draw-out Switchgear.

I was very interested in the article on "Metal-clad Draw-out Switchgear" in your last issue.

Mr. T. Carter is evidently biased in favour of the horizontal type, which gives the impression that he, personally, is interested in its manufacture.

Might I point out that horizontal gear is no more British than the vertical type, although the author endeavoured to convey another impression? British ships of oak played an important part in our history, but our present-day Dreadnoughts are no less British, although the amount of oak used in their construction is a negligible quantity.

The author refers to metal-clad switchgear as "the ideal British standard and a pattern for the world to follow," but ideals and standards are apt to vary due to changing conditions, and I venture to prophesy that in a very short time the majority of the progressive firms will have decided in favour of the vertical type, however reluctant they may be at present to scrap existing designs and tools.

H. Whitehead.

Cardiff, *May 31st*, 1927.

Mr. Carter's article which appeared in a recent issue of the Review contained many convincing arguments in favour of the horizontal type of metal-clad gear, as against the vertical type, and any further points which I may attempt to advance in favour of the horizontal type may appear to be superfluous. I would, however, like to avail myself of the opportunity of relating a recent experience.

A few months ago, I had occasion to witness a series of short-circuit tests on various sizes of oil circuit breakers. These tests were carried out by throwing dead short circuits across a 45,000-kVA turbo-alternator. It was proposed to determine the limit at which some of the smaller breakers would fail to clear, and during one group of tests one of the breakers interrupted two consecutive "shorts" with a two-minute interval. When, however, the breaker was closed on the "short" for the third time, the effect was surprising. The complete breaker became enveloped in a cloud of flame approximately 10 to 12 feet in diameter and rising 30 to 40 feet high. The heat was so intense that those of us standing within 25 or 30 yards of the pit had to move further back. When the flames were extinguished, one naturally expected to find the breaker completely wrecked. This, however, was not the case; the tank was still in position, and the top cover and enclosure were found mechanically sound (in fact, these parts were used for subsequent tests).

The most remarkable revelation was the small quantity of oil lost, since, although such a large volume of flame followed the breaker's attempt to clear the short, only a few pints of oil were actually missing from the tank. It should be noted that the breakers tested were reasonably flame-proof; in fact it was difficult to account for the emission of such a large volume of flame in such a short interval of time.

If the advocates of vertical-type metal-clad gear, having busbars mounted directly above the oil circuit breaker, had an opportunity of witnessing such oil-circuit-breaker tests, they would undoubtedly insist on having gear in which the busbars are mounted as far as possible away from the top of the breaker, *i.e.*, as they are on the horizontal draw-out type. Moreover, they would hesitate before installing vertical-type gear, with oil-filled busbars, directly over the breaker.

Mr. Carter condemns a design in which connections from the main and auxiliary busbars are brought into a common circuit-breaking tank. Such an arrangement could be incorporated in the horizontal type of gear, just as easily as in the vertical type. It is doubtful, however, whether responsible engineers and manufacturers will be persuaded to jeopardise their designs by introducing a feature so contrary to established circuit-breaker practice. The effects produced by a breaker interrupting a large short-circuit current are now fairly well known, and one can only have very grave doubts regarding the efficiency and soundness of the second breaker after the first has operated under fault conditions. This, in effect, would be equivalent to the operation of one breaker on a fault putting two breakers out of commission.

Horizontal draw-out metal-clad gear (with compound-filled busbars) has stood the test of time, and it is significant that the supply undertakings which have had the most experience with metal-clad gear are refusing to change over to a new style. Novel ideas are always attractive, and may be sound, but their success requires a very keen imagination to predict all the conditions and combinations which are likely to be encountered in the future. The horizontal type of gear has long since passed through the experimental stage, and if, during the last 20 years, it had failed to meet all the conditions of service, it would not have reached its present unassailable position in the switchgear world.

D. R. Davies.

Manchester, *June 6th*, 1927.

A Mysterious Occurrence.

In answer to Mr. Hinsley, I do not think that his is the correct solution, as there was no sign of any creeping along the cables, at either the switch or transformer end of the cables. Further, each cable was covered with a film of white dry dust.

The h.p. cable is a 3-core armoured one, and is not old, having been installed new in 1923; the cores are separated before entering the transformer.

The l.p. cables are v.i.r. type, also new in 1923.

On leaving the transformer, all the cables rise upwards above the top of the transformer. The connections are made above the oil level; the ends of the cables are sweated into lugs and bolted to the lugs of the transformer coils.

June 4th, 1927. **W. H. M.**

Single-phase Induction-Motor Starting Devices.

Mr. G. Windred, by his article in your issue of June 3rd, would appear to be hopelessly out of date on this subject, as quoting from his article will show: "and to describe briefly a starting arrangement giving greatly superior characteristics to any of those at present in use" . . . "It is evident that the arrangement has not obtained the sphere of use in this country which its superior characteristics warrant, and it is with the object of bringing the arrangement to the notice of the engineers concerned that the present article has been written, giving, in the author's belief, a description of the method and its application hitherto unpublished in this country."

I have before me a copy of "Electric Motors" by H. M. Hobart, which I purchased 17 years ago, and which on page 614 describes, exactly, what your contributor calls the Ferraris-Arno method; it also states clearly that the author, H. M. Hobart, in co-operation with C. S. Bradley, carried out tests on this system in the year 1893. The book also quotes an article from the *Electrical Times* for December 13th, 1905, page 855, giving particulars of factories running two-phase motors from a single-phase supply and a pilot motor, by engineers of the West Ham electricity supply station, higher efficiencies and higher starting torque resulting from this. The article concludes as follows: "The idea is also described in Ferraris and Arno's B.P. 7504 of 1895," but, as already stated, the arrangement was proposed and tested at Lynn, U.S.A., by Bradley, in 1893.

W. S. Daniels.

Leeds, *June 4th*, 1927.

The Preservation of Historical Electrical Plant.

I believe I am correct in saying that many of the older locomotives which took part in the 1925 Railway Centenary celebrations owe their preservation to chance. They remained, in some cases, almost forgotten in sheds and sidings, until the flight of time gave them a value which was suddenly realised, and to-day they could not be bought for mere money.

There is not much hope of this kind of thing occurring in the electrical industry, however; sites are restricted and ground space is valuable, so that old plant is ruthlessly scrapped to make room for new.

These conditions render it impossible that a chief engineer of, say, the year 1950, will be able to make the discovery that the strange-looking machine, perhaps the pride of the station at the time of its building back in the 'nineties, but now dirty and neglected in a remote corner of the station, has a value which has passed from the local to the national.

One goes to the Science Museum at South Kensington and sees the history of electrical generating plant represented in very meagre fashion. Some of the early experimental apparatus is to be found, it is true, but of commercial types down to the present day, practically nothing.

Yet during the last few years many old generating sets have been advertised for sale in the Electrical Review, and these have doubtless all gone "under the ball." Siemens, Ferranti, Crompton, and Mordey alternators, types never to be seen again, but important in the history of electricity generating plant, have been going one by one, until now their numbers must be small in the land.

Similarly, too, many old switchboards, Manchester and Ferranti types for example, must have been broken up, and soon none will exist, if they have not all gone already.

In your current issue we read that at Deptford "the pioneer high-voltage plant of the world . . . the last two original Ferranti generating sets are now being dismantled, and the remaining historic Partridge switchgear will soon be displaced." The sending of these relics to the junk merchant will, in the writer's opinion, be an act of vandalism which later generators will find it difficult to excuse. Every effort should therefore be made, either by individual or joint action, to prevent this occurring, and to preserve these links with a past, which, although recent in number of years, yet is remote when measured by standards of progress.

In conclusion, your readers may have observed, during recent months, references in the newspapers to the passing of the old Brighton locomotive "Gladstone" to preservation in the Railway Museum.

Where is the electrical industry's museum, or has this industry less soul than the railways?

Ernest F. Smith.

Dunfermline, *June 4th*, 1927.

Cheap Electricity.

My letter on this subject, which appeared in your issue of April 29th last, has been a little misconstrued, as my object was not in any way to be personal or to attack anyone, but rather to draw attention to the great difficulty there is in refuting the arguments put forward in favour of the small independent plant. This trouble is largely due to the fact that it is not easy to include *all* the items of cost. Still I realise that in my hurry I did not express myself quite as I should, in reference to your correspondents; I must therefore apologise to them for my writings not having properly conveyed my intentions. I fully appreciated that Mr. Mountain's paper was written as a counterblast to the Electricity Bill. Mr. Mountain had told me that Messrs. Ruston and Hornsby had asked for a number of copies of his paper for distribution, and I understood that also a suggestion had been made to redraft and republish it. Hence I wrongly assumed that this new publication was the edited copy.

Shortly after writing my letter, I received closer information than that now given by Messrs. Ruston & Hornsby, Ltd., as to who had actually compiled the pamphlet. My opinion is, and was, that the data contained in both pamphlets are to be thoroughly relied upon as regards the accuracy of the figures quoted, for the authors are both authorities. The

point I wished to make was the great difficulty of including *every* cost, so that a figure might be arrived at, that would enable current to be supplied profitably to another independent party. I have been associated with the installation of a number of Diesel plants and consider that there is a very big field for them—but not in the area of a properly organised central station supply. I happened recently to be looking at a map which showed the electricity supply areas of this country, and in discussing one of them with a prominent engineer, he casually remarked, apropos of one public electricity supply station, "That works will of course have to be closed down, when the mains reach that town, as it is a Diesel station." Verb. sap.

R. Borlase Matthews,
Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.
East Grinstead,
May 30th, 1927.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Department of Overseas Trade.

Viscount ELIBANK has given notice that he intends, on June 16th, to call attention to the proposed termination of the separate existence of the Department of Overseas Trade and to move a resolution urging the Government to reconsider the proposal and retain the Department in its present form.

The Whitsun Recess.

The House of Commons rose for the Whitsuntide Recess on June 2nd, and will reassemble on Monday, June 13th. Mr. BALDWIN, the Prime Minister, announced on June 1st that it would be impossible to prorogue the Session in the summer, as had been hoped, and to start a new session in the autumn. He now hoped that it would be possible to adjourn at the end of July for the summer recess, and to continue the present session in the autumn.

Key Industry Duties.

On May 31st, Sir P. CUNLIFFE-LISTER, President of the Board of Trade, presented a statement showing the value of the goods upon which key industry duty was paid in the periods January-April, 1926, and January-April, 1927, respectively. This included scientific instruments, gauges and measuring instruments of precision, £34,620 and £48,326; wireless valves and similar rectifiers and vacuum tubes, £57,488 and £44,393; ignition magnetos and permanent magnets, £16,438 and £11,545; arc-lamp carbons, £9,343 and £6,973; and metallic tungsten, ferro-tungsten, manufactures of metallic and rare earth compounds, £5,760 and £13,636.

Breaking-up of Streets.

On June 1st, Sir R. THOMAS asked the Minister of Transport whether any steps were being taken towards unification of working among the various Metropolitan authorities controlling electricity, gas, water, and any other services which involved the laying of pipes and cables, with a view to reducing to a minimum the public inconvenience caused by the continual breaking-up of the streets.

Colonel ASHLEY said that his powers under Section 4 of the London Traffic Act, 1924, with regard to the control of the opening of streets in the London Traffic Area by public utility services were limited. Those undertakers, however, voluntarily supplied his Department with a considerable amount of information as to any street works of importance which they contemplated carrying out, and every effort was made to co-ordinate them with other street works as far as was reasonably practicable.

London and Home Counties Electricity (No. 2) Bill.

The Committee of the House of Commons which is considering this Bill, continued its proceedings on May 31st. During the day evidence was given by Sir John Snell (Chairman of the Electricity Commission) as to the attitude of the Commissioners towards the proposal to erect a station at Chiswick, in view of the London Power Co.'s proposal to erect another large station at Battersea (about five miles from Chiswick). The view of the Commissioners was said to be that both stations would be necessary if future demands were to be met.

Evidence was given on behalf of various rowing clubs which use the part of the river near the Duke's Meadows site, in opposition to the Bill, and the Committee adjourned until after Whitsuntide.

Yorkshire Electric Power Bill.

It is reported that this Bill, which has passed the House of Lords, is to proceed through the House of Commons as an unopposed measure. The Bill empowers the Yorkshire Electric Power Co. to raise a further £2,000,000 in share capital and £1,000,000 in loan capital. It also authorises the board to borrow to the extent of one-half instead of one-third of its existing authorised capital of £4,000,000.

Legal.

Hart Accumulator Co., Ltd., v. Berton & Onions.

IN the Bow County Court on May 30th, before Judge Snagge, the Hart Accumulator Co., Ltd., sued H. A. Berton and A. H. Onions, trading as the D.A.S.H. Wireless Service, Birmingham, for £10 5s. 3d. for goods supplied.

Mr. ATKINS, for the plaintiffs, said that the claim was for electrical and wireless goods supplied in November, 1926. Mr. Berton, one of the defendants, had made an affidavit stating that at the time the goods were ordered he was no longer a member of the D.A.S.H. Co., having dissolved partnership on June 10th. The dissolution was advertised in the *London Gazette*, which was sufficient to release him from any liability. Mr. Atkins submitted that a notice should have been sent to every firm with whom they had been trading. Mr. Onions had not appeared, and judgment would have to be entered against him, even if his Honour was against the plaintiffs as to the liability of Berton. His clients had received the order for the goods on D.A.S.H. Co. paper, with the names of the two alleged partners still on it, and no intimation had been received that Berton was no longer a partner.

Mr. GALLOP, for Mr. Berton, submitted that his client knew nothing whatever of the transaction, and said that the plaintiffs had no right to presume that Berton was a partner in November, and they therefore had failed to make out a *prima-facie* case.

Judge SNAGGE, in giving his decision, said it was an interesting point as to whether publication in the *London Gazette* was sufficient, but he was bound to come to the conclusion that the plaintiffs had not established a *prima-facie* case that Berton was a partner and liable, and therefore in his case there would have to be judgment for him with costs, but he would enter judgment for the plaintiffs for the full amount claimed against Onions, with costs.

Reid v. Dalrymple.

THE *Railway and Tramway Journal* reports that in the Court of Session recently, Lord Murray fixed the first week in July for the trial of the action by Councillor Reid, a member of the Glasgow Town Council, for slander, against Mr. James Dalrymple, the late general manager of the Glasgow Corporation tramways.

Aberdeen Suburban Tramways Co. v. Aberdeen Town Council.

THE First Division of the Court of Session has recalled the interlocutor of Lord Moncrieff in the action by the Aberdeen Suburban Tramways Company against the Aberdeen Town Council for payment of £26,800 for loss and damage to the pursuers' tramway track caused by the defenders' operations in connection with a new aqueduct, and assoilzied the defenders from the conclusions of the action with expenses. Their lordships took the view that the action was barred by Section 8 of the Aberdeen Suburban Tramways Confirmation Order Act, 1902, which provides that the Corporation (the defenders) shall not be liable for any damages the company may sustain through the acts of the Corporation—through the reasonable exercise of any rights, functions, powers, or privileges, vested in the Corporation, except in so far as such damage may be due to the fault or neglect of the Corporation.

The Danish Electrical Industry.

MR. H. KERSHAW, O.B.E., Commercial Secretary at Copenhagen, has submitted a report upon the economic situation of Denmark (dated February, 1927) to the Department of Overseas Trade (Stationery Office, 1s. 6d. net). In a general survey, Mr. Kershaw states that Denmark is slowly recovering from the effects of deflation, but is still confronted with serious social and industrial problems, one of the chief of these being the heavy burden of taxation. There is a widespread movement in favour of British goods, Denmark wishing to retain this country as her best customer; but British exporters must recognise the special conditions of the market. The national independence of thought necessitates intensive advertising, which means that higher commissions have to be paid to agents.

Electrical Production and Imports.

Denmark holds a strong position in the range and quality of her electrical products and, except in the case of heavy machinery for generating stations, would enjoy a larger measure of independence in the matter of imports if manufacturers could bring down their production costs. The constant overhauling of the numerous power stations and the construction of new ones provide good openings, but British prices, though more favourable now than for many years, were too high in the case of recent contracts. German, Swiss, and partly Swe-

lish machinery is still considerably cheaper. The Danish lectrical industry consists of about 55 factories, employing ,000 hands. During 1926 there were produced 278 dynamos, alued at kr. 1,374,000 (kr. 18.2 to the £); 455 transformers kr. 573,000); and 26,770 motors (kr. 9,700,000). The imports f electrical machinery in 1926 were 809 metric tons, valued at bout kr. 4,000,000. About a third of these consisted of acuum cleaners of German, Swedish, and Canadian origin. Germany and Holland dominate the lamp trade, notwithstanding the efforts made by the Danish manufacturers. In porcelain fittings German producers have again started to compete ery severely with Danish firms, and as regards insulating naterials, in addition to German and Italian firms, British nanufacturers have entered the market with excellent qualities t competitive prices. British firms have also improved their osition in the supply of switchboard material, pyrometers, nd certain other special instruments, but a few other foreign rms have been successful in countering the price-cutting by he Danish cable and wire works. There is an opening for ood-quality enamelled wire. Notwithstanding German competition, British accumulator makers have made a certain mount of progress. To avoid a higher rate of duty, German nakes are imported in parts for assembly. For large power tation batteries Germany still leads, but British portable types re gaining over the American and German makes. There s little to be done in primary batteries. In 1926 Denmark roduced (or assembled) 325 metric tons of portable accumuators, valued at kr. 684,000. The total production of primary ells amounted to 2,920 tons, valued at kr. 7,000,000, of which ome kr. 6,000,000 worth were exported.

There are about 150,000 registered radio-receiving sets in Denmark, but an impetus is expected to be given to broadasting when the new station at Kallundborg is completed. This station is being erected by a British firm. There are signs hat the market is leaning towards quality goods, which may avour British products at the expense of cheap German and Danish goods. American sets, while good, are handicapped by heir usual limitation to wave-lengths below 600 metres. Danish radio manufacturers are paying royalties up to 10 per ent. to American patent holders. The annual importation of adio apparatus, excluding batteries, is valued at about r. 3,000,000 and the home production at about kr. 1,750,000. he Danish output of batteries for radio purposes is valued at bout kr. 3,500,000 per annum.

Electrification.

The report states that most Danish agricultural undertakings ave been electrified in spite of the fact that the power proluction is mainly by means of imported fuel. This has been ccomplished by co-operation between the farmers themselves. Most of the electricity works are equipped with Diesel engine lant, and only the large factories and h.p. stations use steam urbines. A new 50,000-V cable, with a capacity of 17,000 kW, as been laid in the Oersund for the transmission of power etween Sweden and Denmark, a distance of 135 km. It is aid that this will result in the annual saving of about 25,000 ons of coal.

Published Specifications.

ompiled expressly for this journal by a firm of Chartered Patent Agents. he numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

28,064. "Prepayment electricity, gas, and other meters." Chamberlain nd Hookham, Ltd., and S. James. November 7th, 1925. (Cognate applicaon 30,904/25.) (270,467.)

28,495. "Electric fuses." B. Hesketh. November 12th, 1925. (270,969.)

1926.

1,271. "Electric tumbler switches." A. B. Reeves and F. E. Minton. nuary 16th, 1926. (Cognate application 25,915/26.) (270,781.)

1,315. "Telephone systems." Automatic Telephone Manufacturing Co., d., and J. E. Ostline. January 16th, 1926. (270,782.)

3,484. "Control of apparatus at an electric power sub-station from a ntral control office." Automatic Telephone Manufacturing Co., Ltd., and Remington. February 6th, 1926. (Addition to 252,231.) (270,788.)

3,653. "Adjustable grid conduit boxes for electric switches." J. P. nacker. February 9th, 1926. (270,792.)

3,842. "Telephone systems." Standard Telephones & Cables, Ltd. (G akin and L. Polinkowsky). February 10th, 1926. (270,794.)

3,951. "Apparatus for converting alternating current into unidirectional rrent." R. S. Atherstone. February 11th, 1926. (270,797.)

3,994. "Circuit arrangements for use with high-frequency currents." E. een. February 11th, 1926. (270,800.)

4,015. "Radio-transmitting apparatus." Standard Telephones & Cables, d. April 7th, 1925. (250,539.)

4,333. "Wave-distorting systems for electric signalling." Standard Teleones & Cables, Ltd. (Western Electric Co. Inc.). February 15th, 1926. 0,817.)

4,583. "Ringing arrangement for telephone systems." Standard Telephones d Cables, Ltd. (Western Electric Co. Inc..) February 17th, 1926. (270,825.)

4,835. "Steam-driven electric generating plant utilising exhaust steam for xiliary purposes." International General Electric Co. Inc. February 21st, 26. (247,984.)

5,042. "Container and handling means for storage batteries and the like." R. Palmer. February 22nd, 1926. (270,833.)

5,043. "Terminal assemblies for telephone exchanges." Siemens Bros. and ., Ltd., and C. Lambert. February 22nd, 1926. (270,834.)

5,108. "Electric pushes." J. Sax & Co., Ltd., and J. E. Abbott. February d, 1926. (270,836.)

5,388. "Induction regulators." English Electric Co., Ltd., and W. E. M. res. February 25th, 1926. (270,839.)

5,542. "Electromagnetic relays." Tyer & Co., Ltd., and J. W. Punter. ruary 26th, 1926. (270,843.)

6,298. "Electrically driven slicing machines." Berkel & Parnall's Slicing Machine Manufacturing Co., Ltd,, and H. Thomas. March 6th, 1926 (270,854.)

7,154. "Quick-action electric switches." A. J. Veall. March 17th, 1925. (249,517.)

7,447. "Wireless apparatus." W. C. Butler and R. W. Angel. March 17th, 1926. (270,864.)

8,898. "Wireless telegraphy and telephony." Bowden Wire, Ltd., and A. H. Nisbett. April 1st, 1926. (Cognate application 22,573/26.) (270,871.)

9,590. "Method of and means for interrupting electric circuits." G. S. Marston. April 12th, 1926. (270,879.)

10,378. "Dynamo-electric generators." F. Kesselring. April 18th, 1925. (250,972.)

10,277. "Electric dryers." Eastern Laboratories Inc. April 28th, 1925. (251,612.)

11,081. "Insulating material for electric condensers and the like." J. Lahousse. May 8th, 1925. (251,970.)

11,615. "Electrode for medical purposes, particularly for use in diathermic treatment and process for the production thereof." Dr. E. Last. November 14th, 1925. (261,335.)

11,832. "Variable static transformers provided with a variable magnetic circuit." G. Burnengo. May 5th, 1925. (251,998.)

12,063. "Plug and-socket connectors." C. L. Arnold and M.K. Electric, Ltd. May 10th, 1926. (270,899.)

12,093. "Connection systems for telephone plants with automatic counting of the calls." Automatische Fernsprechanlagen-Bau-Ges. February 15th, 1926. (265,912.)

12,101. "Gasfilled electric lamps." Siemens & English Electric Lamp Co., Ltd., and P. D. Oakley. May 10th, 1926. (270,900.)

12,192. "Armouring for single-core alternating-current cables." Felten and Guilleaume Carlswerk Akt. Ges. June 13th. 1925. (253,496.)

13,084. "Electric conductors for signalling purposes." Felten & Guilleaume Carlswerk Akt. Ges. July 9th, 1925. (255,025.)

13,900. "Electrical resistances or rheostats." Morgan Crucible Co., Ltd., and C. C. Gow. June 1st, 1926. (270,908.)

15,111. "Variable condensers and like instruments." W. Rogers and Wingrove & Rogers, Ltd. June 16th, 1926. (270,914.)

19,784. "Thermionic and like amplifiers." S. Y. White. August 11th, 1925. (256,967.)

23,808. "Exhausting apparatus for the production of a high vacuum." E. W. Moss (Akt. Ges. Brown, Boveri et Cie.). September 27th, 1926. (270,947.)

24,972. "Automatic thermal circuit-breaker for an electric circuit." G. Maire. October 7th, 1925. (259,593.)

25,421. "Diaphragm sound-reproducers for wireless apparatus, gramophones, and the like." Ritter & Uhlmann Akt. Ges. October 15th, 1925. 259,966.)

27,485. "Armouring for single-conductor alternating-current cables." Felten & Guilleaume Carlswerk Akt. Ges. April 21st, 1926. (Addition to 259,536.) (269,842.)

27,713. "Armouring of electric cables." Felten & Guilleaume Carlswerk Akt. Ges. April 21st, 1926. (Addition to 259,536.) (269,843.)

27,829. "Mounting for the electrodes of closed electric furnaces." I. G. Farbenindustrie Akt. Ges. December 28th, 1925. (263,756.)

27,844. "Modulation systems applicable for wireless signalling." Marconi's Wireless Telegraph Co., Ltd. November 28th, 1925. (262,076.)

28,660. Magnetic separators." F. Krupp Grusonwerk Akt. Ges. November 14th, 1925. (261,410.)

30,188. "Electric ignition systems for internal-combustion engines." J. De Coster. December 5th, 1925. (262,420.)

30,980. "Wired radio transmitting system." Wired Radio Inc. December 23rd, 1925. (263,777.)

30,802. "Fluid-tight electric switch." N. Munthesen. December 4th, 1926. (270,980.)

1927.

529. "Electric heating units." British Thomson-Houston Co., Ltd. January 7th, 1926. (264,172.)

1,046. "Electric resistance annealing furnaces." Akt. Ges. Brown, Boveri et Cie. May 19th, 1926. (271,003.)

1,078. "Scales for radio vernier-control apparatus." C. Nehrke. June 29th, 1926. (271,004.)

1,615. "Method of and apparatus for navigating aircraft by wireless." H. Junkers. February 12th, 1926. (265,940.)

1,628. "Arrangements for feeding the filaments or incandescent cathodes of discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabricken. January 29th, 1926. (265,183.)

6,978. "Containers for storage batteries and the like." T. R. Palmer. February 22nd, 1926. (Divided application on 270,833.) (271,019.)

7,946. "Electromagnetic acoustic apparatus." N. W. McLachlan. February 9th, 1926. (Divided application on 270,421.) (271,021.)

10,479. "Electric motors intended to work in an explosive medium." Ateliers de Constructions Electriques de Charleroi. April 19th, 1926. (269,592.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from June 1st. In the case of foreign applications, the names and addresses of the British representatives are also given :—

Duophragm. No. 477,742. Class 8. Telephone diaphragms.—Duophragm Syndicate, 92, Cannon Street, E.C.4.

Accuratune (lettering and design). No. 472,671.* Class 8. Radio apparatus and parts thereof, namely, condensers, transformers, rheostats, variometers, vario-couplers, coils, grid leaks, antenna equipment, graduated dials, potentiometers and battery chargers.—Mydor Radio Co., Newark, New Jersey, U.S.A. (Hans & Danielsson, 121, St. John Street, E.C.1.)

System Zeiler (lettering and design). No. 476,351. Class 8. Galvanic cells, dry cells, dry batteries, refill batteries, and electrical accessories and parts.—Die Batterien & Elemente Fabrik System Zeiler Gesellschaft, Berlin. (Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Spiovisor. No. 478,416. Class 8. Apparatus for use in transmitting views, scenes or images to a distance by telegraphy.—Television, Ltd., Motograph House, Upper St. Martin's Lane, W.C.2.

Zampa. No. 479,800. Class 8. Instruments and apparatus for use in connection with radio-telegraphy and telephony.—Mic Wireless Co., White Horse Place, Market Street, Wellingborough.

Domeno. No. 479,969. Class 8. Flash lamp batteries.—Runwell Cycle Co. (London), Ltd., 16, Great Eastern Street, E.C.2.

Viclaire. No. 479,727. Class 13. Ordinary electric lamps.—Michel Tchacon, Paris. (McKenna & Co., 31-34, Basinghall Street, E.C.)

Rheco. No. 476,148. Class 13. Electric lamps (ordinary), lamp fittings and shades, electric bells and fittings, electric switches and switch plates, wall and ceiling fittings, contacts and terminals, cut outs and similar electrical fittings and accessories, electric cooking and heating appliances.—Robinson & Hands Electrical Co., Ltd., 54, Barwick Street, Birmingham.

Insol. No. 478,945. Class 50. Radio-telegraphic fittings, and electrical fittings, all being goods made from condensation products of phenol and formaldehyde.—Die H. Römmler Gesellschaft, Berlin. (Wheatley & McKenzie, 40, Chancery Lane, W.C.2.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BEXLEY.—44 bungalows, Pickford Lane, for the U.D.C.; W. T. Howse, surveyor.

BILLINGHAM.—Additional 120 houses, for the U.D.C.; surveyor.

BIRKENHEAD.—Police station and 16 houses, for the T.C.; C. Brownridge, borough engineer.

BIRMINGHAM.—Welfare centre, Charlotte Road, Stirchley; R. Fenwick, Ltd. 86 houses, Spring Road, Tyseley; W. Edwards, Contractors (Birmingham), Ltd. Extensions, Salvage depôt, Lifford; Muirhead, MacDonald, Wilson and Co., Ltd. Church, Tyseley; Bishop's Commission. Extension, Central Technical Institute, Suffolk Street; Education Committee.

BEXHILL.—Houses, Cooden Drive, Magdalen Road, and De la Warr Roads; Harrison Smith Buildings, Ltd.

BOLTON.—Palais de Danse, Bridge Street, and St. George's Road; W. Worsley.

BOSTON.—Wesleyan church, Sutterton; W. E. Norman Webster, architect, Spalding; S. Favell, builder, Kirton End.

CHATHAM.—Sewage pumping station, &c., for the T.C.; W. H. Radford & Son, engineers, Albion Chambers, King Street, Nottingham.

CHESTERFIELD.—Houses (50), for the T.C.; James Leaver and Sons, Ltd., builders, Sheffield.

COULSDON.—50 houses, Westleigh Avenue; U.D.C. surveyor.

COVENTRY.—Additional 98 houses, for the T.C.; E. H. Ford, city engineer. School hall, Radford (£3,198), for the Congregational trustees; Jervis Bros., builders. Extensions, Stoke schools (£15,000), for the City E.C.; the clerk.

DERBY.—Extension of boiler house at the Institution; H. Lea & Son, consulting engineers, 151-153, Edmund Street, Birmingham.

DEWSBURY.—Extensions, Mitchell Laithes Hospital, for the Joint Hospital Board; H. Dearden, borough surveyor.

DUMBARTON.—Clinic at Duntocher (£1,400), for County Council; the county clerk.

EASTBOURNE.—Development of Redoubt as music garden with shelters and bathing pool; borough engineer. Alterations, Cavendish Hotel, Grand Parade; Pimm Hotels, Ltd. 96 houses, Victoria Drive Estate; borough engineer.

EDINBURGH.—Conversion of building at 60, Princes Street into furniture warehouse for J. Woodhouse & Son; the manager. Aerated water factory at Hutchison Road; Mr. Alexander Robb.

FALKIRK.—Infirmary (£100,000); W. J. Gibson, O.B.E., architect.

GLASGOW.—Two schools, Knightswood; Education Committee. 96 tenements, Parkhead; housing director. Academy of music; Sir D. M. Stevenson, Bt.

GRAVESEND.—Alterations, Wellington Brewery, Wellington Street; Charrington & Co., Ltd.

HANLEY.—Extensions, Foundry Street; Sentinel Newspaper Co.

HEDNESFORD.—Catholic church (£30,000); Harrison and Cox, architects, Birmingham.

HEMSWORTH (YORKS.).—Laundry, for the Joint Hospital Committee; W. T. Lynam, architect.

HILL & CAKEMORE.—School (£16,935), for Worcestershire E.C.; W. Jackson, builder, Langley Green, Oldbury.

HULL.—Heating at Mental Hospital; Rosser & Russell, consulting engineers for Corporation. 120 houses, New George Street clearance scheme; city architect.

HUTHWAITE.—Housing scheme (44), for the U.D.C.; G. Bostock, surveyor.

ILKESTON.—80 houses, Rutland Estate, and 76 on Southern Estate; borough engineer.

IRISH FREE STATE (CORK). Carnegie library; P. Monahan, city commissioner.

IRLAM (LANCS.).—Housing scheme (40), for the U.D.C.; surveyor.

KIDDERMINSTER.—Model dairy (£5,000) for Co-operative Society; secretary.

LANARKSHIRE.—Extensions to County Hospital, including two pavilions (104 beds), operating theatre, and nurses' home extensions, for the C.C.; the clerk, Glasgow.

LEEDS.—Dance hall showrooms, &c. Sheepscar Street; Vernon Gash, Ltd. Weights and Measures offices, George Street; C. F. Bowman & Son, architects. Electric hare course, Elland Road; Leeds Greyhound Racing Association, Ltd. Billiard hall and dance hall, Kirkstall Road; W. Ogden. Palais de Danse, Roundhay Road; William Hill & Sons (Carriers), Ltd. Cinema, music hall, shops and ballroom, Harehills Lane and York Road; Shaftesbury Cinema (Leeds), Ltd.

LONDON (BARKING TOWN, E.).—70 houses, Shirley Road; J. R. Leftley.

(W.C.).—Theatre, Leicester Square. (£300,000). H. Ds M.P.

(ILFORD, E.).—Extensions, dust destructor works; borou engineer. Motor body works, Eastern Avenue; W. Oram. Research laboratories, Britannia Works, Rod Street; Ilford, Ltd. 30 houses, Clifton Road; Triplete.

(LEYTONSTONE, E.).—Dining hall, bakery and workshops, f West Ham B.G.; G. A. Allan, architect, 1, Staple In Holborn.

(WEST HAM, E.).—268 flats, Memorial Estate, for the T.C borough engineer.

(E.C.).—Improved accommodation, police reserve office Bunhill Row; city engineer.

(FINCHLEY, N.).—110 houses, estate near Summers Lan Harper & Smith.

(ST. JOHN'S WOOD, N.W.).—Block of flats, Park Roa H. W. Wills & W. Kaula. 22, Southampton Street, W.

(ST. MARYLEBONE, N.W.).—Extensions, Queen Charlotte Hospital, Marylebone Road; governors. Extension Regent Street Polytechnic in Titchfield Place (£170,000 trustees.

(WOOLWICH, S.E.).—53 houses, Eltham Estate; borou engineer.

(FULHAM, S.W.).—Garages site of 923-931, Fulham Roa G. R. Farrow, Amberley House, Norfolk Street, W.C.

(WIMBLEDON, S.W.).—Extensions, King's College Scho (£26,000), for the governors; the clerk.

MAIDSTONE (LEEDS).—Servants' hostel, &c., with electric work, for the Hon. Mrs. Wilson-Filmer, Leeds Castl

MALVERN.—Extensions, Assembly Rooms (£16,000), for th U.D.C.; surveyor.

MANCHESTER.—48 houses, Kingsway Estate, for Corpor tion; F. W. Woolfenden, Didsbury. Tramway office Failsworth; Corporation tramway manager. Dinin hall, &c., Oxford Road Hospital; governors. Centr heating at 32 school departments; Education Com mittee.

MAXWELLTOWN.—Extensions, High School, for Kirkcu bright E.C.; education architect, Castle-Douglas.

MORECAMBE.—Refuse salvage scheme; borough engineer.

MOTHERWELL.—Secondary school, Jerviston, for Lanark shire E.C.; John Stewart, master of works, 20, Alber Street.

OLDHAM.—30 houses, Merton Avenue; W. Makin. Conver sion Greenacres Lodge into maternity home; Willian Lees (Oldham), Ltd.

PRESTON.—Central schools, Deepdale, for the borough E.C. B. Widdows, architect, Derby; George Hill & Sons Ltd., builders.

QUEENZIEBURN (KILSYTH).—Housing scheme (40), fo Stirlingshire C.C.; D. W. Glass, architect, 76½ Por Street, Stirling.

RICHMOND (YORKS.).—Bakery, garage and staff hostel, Cat terick Camp; Navy, Army and Air Force Institute.

RIPON.—Proposed swimming baths, shelters, café, and thea trical stage for Spa; Corporation Special Committee.

ROTHERHAM.—Shops and offices, Corporation Street, fo the T.C.; Vincent Turner, borough engineer.

ROTHWELL.—Secondary school, for West Riding E.C. director of education, County Hall, Wakefield.

SHEFFIELD.—Housing scheme, fifth section, Longley estate city architect. 36 houses, Dykes Hall Estate; city architect. New central library; city architect. Abattoir and wholesale meat market (£179,000); G. Longden and Son, Ltd.

SWINDON (WILTS.).—Hospital extensions (£25,000), for the governors of Victoria Hospital; secretary.

TANDRIDGE (SURREY).—Club house (£7,000), for the Golf Club; secretary.

TRUSTHORPE (LINCS.).—Hotel (£7,000); Messrs. Bush builders, Nottingham.

WHALLEY.—Nurses' hostel and extensions, Calderstones institution, for Lancashire Asylums Board (£31,000); the clerk, Preston.

WEST BROMWICH.—Drill hall and staff quarters, for Staffs Territorial Army Association; the secretary, Stafford.

YSTRAD MYNACH.—Central offices and 30 official residences, for the Powell Duffryn Co., Ltd.

The

Electrical Review

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Contents:

	PAGE
The Electrified Home	957
The Patent Office Report	958
The Necessity for Adequate Wiring	958
Frederick Walter Purse (*illus.*)	959
Stourport Electric Power Station (*illus.*) (*concluded*)	960
Portable Radio Receivers, by Paul D. Tyers	963
Recent Lighting Installations (*illus.*)	964
Ideal Electricity Supply, by Geo. Wilkinson	966
The Foreign Agency, by A. J. Smith	967
The Lay-out of the Contractor's Shop, by Eric N. Simons	968
The Institution of Electrical Engineers (*illus.*)	969
Metal-Clad Draw-out Switchgear, by J. R. Wilkinson	970
Business and Industrial Notes	972
Lighting and Power Notes	975
Tramway and Railway Notes	977
Telegraph and Telephone Notes	978
Radio Notes	978
Contract Information	979
Forthcoming Events	980
Notes	980
Institution Notes	982
Our Personal Column	983
Financial Section—	
New Companies Registered	983
Financial Section—*continued.*	
Official Returns of Electrical Companies	983
City Notes	984
Stocks and Shares	985
The Incorporated Municipal Electrical Association.—IV (*illus.*)	987
The Electrical Equipment of Baslow Hall (*illus.*)	988
Electrified Homes, by Herbert H. Berry	989
The Annual Dinner	990
The I.M.E.A. Exhibition (*illus.*)	991
A Large Electric Clock (*illus.*)	993
Indian Electrical Imports	994
New Electrical Devices, Fittings and Plant (*illus.*)	995
Short-Wave Wireless Telegraphy, by T. L. Eckersley	996
Correspondence—	
A Radio-Telephone Loud-Speaker	997
Single-phase Induction Motor Starting Devices	997
A Commutation Problem	997
The Ideal Wiring System	997
Power Supply for Wireless Sets	998
Metal-clad Draw-out Switchgear	998
Reviews	998
Published Specifications	999
New Work for Contractors	1000

The Electrified Home.

THE paper read by Mr. H. H. Berry at the I.M.E.A. Convention and the discussion that followed, which are reported elsewhere in this issue, fully maintained the interest that had been manifest at the two previous meetings. The author advocated what one speaker described as "a sort of half-way house," but three parties were represented in the discussion—those who agreed with him, those who, with Dr. Ferranti, favoured the (literally) "all-electric" house, and those who realised the difficulties that stood in the way of attaining that ideal, principally in point of cost.

It must be recognised, as the women especially urged, that the vast majority of actual consumers and the far greater number of potential consumers live in houses that are already built, most of which are rented, and that the cost of installing, extending, or modernising a hot-water system is beyond their means. Undoubtedly the ideal system is such a one as hundreds of the visitors were privileged to inspect at Baslow Hall, thanks to the courtesy of Dr. and Mrs. Ferranti, to whom both the E.A.W. and the I.M.E.A. are greatly indebted. But that unique installation was carried out at a heavy capital outlay and under expert supervision. What is to be done in the normal case?

Frankly—and as we have said on previous occasions—we feel bound to vote for the "half-way house." Where a supply of electricity can be obtained, as at Glasgow, during restricted hours for little more than $\frac{3}{8}$d. per kWh, electricity may be used for general heating; and where one owns the house and can afford the outlay, or where the house is as yet unbuilt, it may be equipped for that purpose to great advantage—but those are exceptional conditions, and in the ordinary case, numbered by the million, the all-electric ideal must be forgone in favour of a compromise. Mr. Berry, with inimitable eloquence, argues in favour of a central-heating and convector system, admirable in its way, but as the lady speakers remarked, of no use to the masses who live in existing houses. Leaving apart, however, the question of distributing hot water about

the house, there appears to be little room for doubt that, given a supply of electricity for heating at a reasonable price (certainly not more than 1d. per kWh), the most economical course to follow, as regards both initial outlay and running cost, is that which was recommended by the Advisory Committee on Domestic Supplies of Electricity, in the report which was quoted in Mr. Berry's paper—namely, to use coal or coke "in well-designed grates or furnaces for heating and mass production of hot water at one or two points in the house, the cooking being carried out on the electric range, occasional room warming with electric fires, and much of the housework by means of electrically driven appliances."

"Houses equipped in this manner," says the Committee, "give the occupants great satisfaction, and generally consume about ten times as much electricity in the year as they would for lighting alone." Be it noted that this system does not include the use of water for heating the house. It has been very widely adopted, and it has been shown by the Electrical Development Association that the saving in chimneys, &c., to which Mr. Berry also refers, pays for the cost of the complete electrical installation in a new house. Moreover, the system is suitable for even the smallest houses, and has indeed been employed in thousands of dwellings built under housing schemes. It is the nearest feasible approach to the ideal all-electric house for those of small and moderate means, and—a matter of the greatest importance—it can be applied to existing houses.

Although Mr. Berry appears to identify the Advisory Committee's system with his own proposition, the "Colectric system," it appears to us that the latter essentially employs central heating with convectors, which do not necessarily form part of the former. We accept his system as an admirable one for those who can afford it, a particular case of the problem; but in general that condition is not fulfilled, and the practicable must take precedence of the preferable.

In dealing with this question we think attention should be drawn to two points made by a woman Councillor—Mrs. Gregory, of West Ham—in the discussion—namely, that more women should be appointed on municipal electricity committees, to give the woman's point of view; and that domestic electrical appliances should be cheaper. Women can be co-opted, if they are not available as Councillors, and we think the inclusion of one or more women on a Committee would undoubtedly prove beneficial to domestic consumers. With regard to the latter suggestion, whilst the extending use of electrical apparatus certainly tends to lower the cost of production, the process is slow; there is no question but that the high prices of many electrical appliances present an insurmountable obstacle to their introduction into small houses, and manufacturers would serve the public interests if, without reducing the safety factor, they placed on the market in addition to the devices with which we are familiar, simple appliances constructed on the most economical lines.

The Patent Office Report.

THE forty-fourth annual report of the Comptroller-General of Patents, Designs and Trade Marks, issued under date May 9th, 1927, contains the usual full information about the activities of that department of Government, and sets it forth in a clear and concise manner which might well be an example to less useful branches of the Civil Service.

The number of patent specifications applied for constantly rises, having increased from 21,839 applications in 1918 to 33,080 in 1926. Of these applications about half were eventually sealed. On page 16 a table of mortality is given which probably corresponds fairly closely with the mortality statistics amongst the actual inventors. From this interesting table it appears that half the patents applied for up to 1922 reached the age of 5 years, 17 per cent. lived to be 10 years of age, and only 4.8 per cent. reached maturity in their sixteenth year. This table conjures up a painful vision of inventors expiring in garrets and cellars at a comparatively early age from failure, disappointment, and inability to pay the sums demanded for renewal fees. The report shows that from this notoriously struggling and impecunious fraternity the Treasury managed to extort no less a sum than £98,813, being the balance of receipts over expenditure which passes as in former years into its hands. We have referred before to this large surplus handed over year by year by the Patent Office as a "brain tax," and we are still of the opinion that the description is justified. Probably every pound so obtained by the Treasury represents a loss of hundreds in ordinary income tax which would have been secured had the patents and the patentees not been taxed out of existence at an early stage in their development.

As we have many times pointed out, the Americans know better; their fee of £7 down secures for the inventor a patent, carefully edited, after a most elaborate and complete search, which is then his undisputed property for a period of 17 years without any other fees or taxes whatever. Eventually, if he succeeds, he becomes an important taxpayer, but if he fails his "intellectual property" is not taken away from him because he is unable to find large and increasing contributions year by year from the start.

We turn with relief to a pleasanter side of this report. While the total cost of the staff is £254,000, it will be observed from the complete list which is furnished that nobody is overpaid. An immense amount of work is carried through at the Patent Office, and on the whole with wonderful efficiency. The publications issued by the Office, of which this report is a fair sample, are exceedingly useful and well arranged, and every facility is given to the poor inventor to make searches on his own account if he cannot afford to take the safer course of employing a patent agent.

Time after time we have called the attention of the Government of the day to the opportunities of development of business and consequent large revenue which they are missing by their short-sighted policy of the brain tax, and we venture once again to urge upon the present Government that it would be a business move to pass a short Act establishing the patent fees on a similar basis to that prevailing in America, when we venture to predict that similar results in the matter of revenue and valuable inventions would follow.

The Necessity for Adequate Wiring.

THE supplier of electrical goods has a very direct interest in the number of outlets that are installed in the house that is wired for electricity. To be possessed of a number of outlets means for the user the ability to apply electricity in all the rooms for many purposes, and paves the way for the sale by the dealer of a host of domestic electrical appliances. There are thousands of houses using electricity to-day that are inadequately wired, simply because they were wired years ago, when the use of electricity was practically restricted to lighting. The majority of these homes would make a far greater use of electricity for heat and power if only they had the necessary extra outlets. House agents will glibly advertise houses as "wired for electricity," when every electrical man knows that these houses generally contain about a quarter of the wiring equipment which is necessary if the occupants are to obtain the fullest advantage from the use of electrical labour-saving devices. The housing demand is by no means satisfied yet; in the course of the next few years thousands of new residences will be going up, and the adequate wiring of these means thousands of potential electrical sales. In this connection the builder assumes importance. He should be asked to appreciate the fact that where, for example, the title of the property remains in his own hands, it is made more valuable in the event of sale by the provision of a complete electrical service. Much could be done in this way that at present is left undone.

Frederick Walter Purse,

President of the Incorporated Municipal Electrical Association, 1927-28.

At the annual convention of the Incorporated Municipal Electrical Association at Buxton, Mr. F. W. Purse was elected president for the year 1927-28, and we have pleasure in reproducing his portrait herewith.

Like his immediate predecessor in the presidential chair—Mr. R. W. L. Phillips—Mr. Purse is a native of Bristol; he was educated at the Merchant Venturers' Technical College (which has since become the University of Bristol), where he won both junior and senior scholarships, and whilst at College he obtained many certificates in various engineering subjects, including the Honours Diploma of the City and Guilds of London Institute for electric light and power distribution. He entered the service of the Bristol Corporation Electricity Department in 1897, and was there associated with Mr. Phillips; two years later he became assistant engineer at Bath, and subsequently held the post of deputy-chief at Warrington for seven years. In 1908 he was appointed chief electrical engineer at Watford, and in 1913 he accepted a similar position at Carlisle; after spending six years in that position he returned to the south as chief engineer and manager of the Electricity Department of the County Borough of West Ham—the largest municipal electrical undertaking within 100 miles of London—and still occupies that post, having now spent 30 years continuously in municipal service, during 19 of which he has been in the seat of authority.



Photo by] *[Russell.*

Mr. F. W. Purse, M.I.E.E., M.I.Mech.E., President, I.M.E.A.

In addition to his normal duties Mr. Purse has for many years shouldered a heavy burden of public service, serving on various committees in connection with the British Engineering Standards Association and the Institution of Electrical Engineers; as vice-chairman of the I.E.E. Wiring Rules Committee he has played a prominent part in the formulation and revision of the rules, which, in his opinion, ought to be made compulsory and binding upon electrical contractors and supply authorities in general. He is also a member of the National Registration Board of Electrical Installation Contractors, hon. treasurer of the Associated Municipal Electrical Engineers, and past-president of the Greater London Centre of the A.M.E.E. He is a member of the Institutions of Electrical and Mechanical Engineers, and President of the Rotary Club of West Ham.

During the war Mr. Purse served as Captain with the 4th Vol. Battalion, Border Regiment, and chairman of the Carlisle Area Road Transport Committee; he was also a member of the East Cumberland Munitions Committee, and of the Management Committee of Carlisle National Shell Factory, and was a district engineer under the Coal Department of the Board of Trade. His literary activities have taken the shape of numerous papers and articles on problems connected with public electricity supply, his latest essay in that direction having been the article on "The Ascertainment of Kilowatt Maximum Demand" which was published in our issue for May 13th—a question of great importance to supply authorities which under the terms of the Act of 1926 will be called upon to give or take a bulk supply of electricity.

Under a somewhat blunt and uncompromising manner Mr. Purse conceals a warm heart and a sincere desire to serve his fellow-men, taking keen interest in the welfare of his subordinates and fighting the battles of the "under-dog"; in past years he has strenuously contended for the interests of the younger members of the Institution of Electrical Engineers, and has resisted the increase of their burdens at the annual meetings, which he never fails to attend—though latterly he has not had occasion to offer adverse criticism. At an earlier stage in his career, in collaboration with Mr. A. Nichols Moore (now vice-president of the I.M.E.A.), Mr. Purse championed the cause of the smaller municipal undertakings and ultimately secured for them direct representation on the Council of the Association. Since his promotion from the small to the large class of station, Mr. Purse has carried on at West Ham a progressive and energetic policy, directed towards the increase in efficiency of his undertaking and the reduction of cost to the consumer; he now controls generating plant aggregating 43,500 kW, with a maximum load of 24,500 kW, and an annual output of over 77 million kWh, serving a population of 318,000, with a large industrial load (the load factor is 35.8 per cent.). The prices charged for lighting, power and domestic purposes in West Ham are just about half those demanded over a large proportion of the Metropolitan area, and it will not be the fault of Mr. Purse if electricity is not universally adopted in the County Borough. Plain-spoken and business-like, he will conduct the affairs of the Association with efficiency and dispatch, and his period of office will be one of prosperity and achievement for the Association.

During the past year the President, Mr. Phillips, was kept so busy with the Electricity (Supply) Bill that he finally came to loathe it, and at the annual dinner of the Association he referred to the difficulties that would be experienced in the working of the Act; it falls to the lot of Mr. Purse to be in office while the Act is being brought into operation, and it is safe to say that he will have plenty of work to handle. With the support of a public-spirited and hard-working Council, he may be relied upon to do his utmost to ensure the success of the national scheme.

Stourport Electric Power Station.

A new 25-cycle capital generating station capable of extension to an ultimate capacity of 250,000 kW, designed to serve, in conjunction with other plant, the Central England district, a scheme for which is being prepared by the Electricity Commission.

(*Concluded from page* 917.)

THE circulating water for the condensing plant is conveyed to the pumps by twin ferro-concrete culverts, each measuring 62 sq. ft. in area, having a connection from the river at the one end, through fish screens and penstocks, to screen chambers, in which are two Waller 27-ft. diameter rotary screens. The discharged water is carried by a single ferro-concrete culvert, 59½ sq. ft. in area, to the river at the down-stream end of the site.

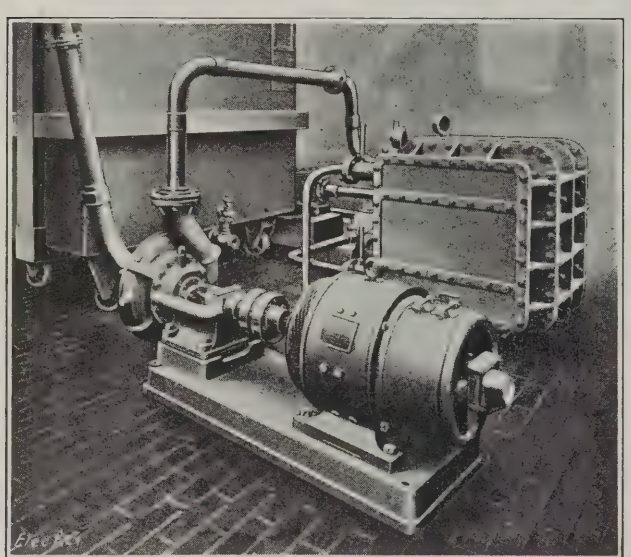


Fig. 8.—Main Transformer Oil Cooler.

designed for a steam pressure of 325 lb. per sq. in with 246 deg. F. superheat, capable of carrying 25 p



Fig. 9.—Main 5/33-kV Metrovick Transformers on Test.



Fig. 10.—Halesowen Sub-station, 33,000 Volts, B.T.-H. Switchgear.

The 6,000-r.p.m. house turbo-generator drives through gears a multi-pole d.c. generator normally rated at 750 kW, 600 r.p.m., 1,630 amperes, 460 volts,

cent. overload fo two hours. Its con denser was supplie by Cole, Marchent Morley, Ltd., t maintain a 28-in vacuum when dealin with 9,800 lb. o steam per hour, wit circulating wate supply at the rate o 58,700 gallons pe hour at 70 deg. F. it has a cooling sur face of 1,300 sq. ft. and in order to b able to raise th vacuum quickly th plant is fitted wit Edwards 3-throw ai pumps having cylin ders of 12 in. di ameter by 12-in stroke, running a 120 r.p.m., being driven by a B.T.-H motor rated at 8 h.p., 600 r.p.m., 46 volts d.c. The circu lating pump is driven direct by a B.T.-H. 15-h.p. motor running at 1,000-1,100 r.p.m., on a 460-volt circuit. A 750-kW rotary converter has also been installed.

For stepping up the output of the generating sets from 5,550 V to the distribution pressure of 33,000 volts, two 3-phase banks of transformers have been supplied by the Metropolitan-Vickers Electrical Co., Ltd.,



Fig. 11.—Coal Elevator, with Ash and Soot Bunkers Below.

each of a capacity of 22,500 kVA, consisting of three single-phase shell-type units of unusually large size on account of the low-frequency; each unit, with its tank and oil, weighs 33 tons. The tanks are of boiler iron with cast-iron covers and sealing bells for the entry of lead-covered cables on both the h.p. and l.p. sides: each has its own oil conservator and a calcium-chloride breather, and two sets of oil-cooling equipment accompany each bank, figs. 8 and 9, one cooler of each pair being normally in operation at a time, the other acting as a stand-by for use during overhauling and cleaning. The temperature of the oil is shown on dial-type indicating thermometers.

Apart from the metering instrument transformers and neutral earthing gear, no control switchgear is provided between the generators and main transformers, which are protected on the circulating-current system in addition to time-limit overload devices. Part of the station's output is reduced



Fig. 13.—A Typical Section of Overhead Power Transmission Line.

from 33 kV to 11,000 V, two transformers supplying the neighbourhood of the station and a third the station auxiliary plant; this local supply is further reduced by two 500-kVA transformers to 400 volts. The 25-cycle transformers supplied by the Brush Electrical Engineering Co., Ltd., include one of 2,500-kVA, 3-phase, and six single-phase forming two 4,500-kVA 3-phase banks, ratio 33,000/11,000 volts; also two of 1,500 kVA 3-phase ratio 33,000/11,000 V; one of 825 kVA 3/6-phase for use with the B.T.-H. rotary convertor, ratio 11,000/343 V with 20 per cent. internal reactance; and two of 500 kVA 3-phase, ratio 11,000/400 V for station service. All of them are of the oil immersed self-cooled core type, the boiler plate tanks being of the outdoor pattern with domed lids, expansion chambers, and calcium chloride breathers, and on the 33,000-volt cable boxes an expansion chamber and calcium chloride breather are fitted. All the transformers are of the outdoor type with distant thermometers in the control room; each stands in a brick cubicle without roof to localize trouble



Fig. 12.—Halesowen Sub-station, 33,000/5,500-volt Brush Transformers.

in the event of a tank bursting, with a pit below to trap the oil. The transformers stand on rails and a special truck facilitates removal (see fig. 6, last week).

All the switchgear in the station has been supplied by the British Thomson-Houston Co., Ltd. Single-core 33,000-volt cables are brought into the basement, through current transformers, and up to the main busbar floor; the gear is of the cellular type with duplicate busbars and, in the case of the generator and feeder circuits, with duplicate circuit breakers, one being alloted to each busbar. The remaining circuits which are at present only equipped with one breaker each are arranged so that the second breaker can be added at a future date without necessitating any considerable alteration. On the upper floor of the building the oil circuit breakers are erected in two rows, each corresponding to one of the two sets of busbars, which run along both outside walls on the floor below in cubicles. Above the busbars are their isolating switches and on this floor the centre bank comprises the incoming cubicles and the potential transformer cubicles which also house the mechanically-

operated circuit breaker selector switches. So far as has been practicable each separate piece of apparatus forming a hazard has been mounted in a separate compartment fitted with sheet steel doors and lined with "Uacolite" slabs. The isolating switches are all mechanically operated with mechanism arranged to operate the switches in groups of three by convenient levers attached to the fronts of the cubicles on the bus-bar floor; they are furnished with interlocking gear and auxiliary switches for the purpose of indicating their positions by means of automatic electrically-operated relays on the indicating panels of the control board.

The potential transformers are mounted complete with their fuses and current-limiting resistances on draw-out trucks, obviating the necessity for potential-transformer isolating switches. Current transformers on the 33,000-volt gear are of the single-turn primary type mounted in earthed metal cases and threaded over the single-core lead-covered cables, being located with the neutral earthing equipment in the basement. All current transformers on both 33,000- and 11,000-volt equipments are fitted with a special testing winding to enable load conditions to be reproduced when they are out of commission. In the control room overlooking the turbo-generator room the panels are wired with asbestos-braided wire coloured in accordance with the I.E.E. standards.

type, and the oil circuit breakers for the earthing equipment are solenoid operated from the main control boards.

The switchgear in section A comprises the 33,000-volt side of the step-down 33- to 11-kilovolt transformers (fig. 6, last week). Sections B and C of the gear are operated at 11,000 volts, section B being provided for the control of outgoing cables for local distribution while section C controls the alternating-current auxiliaries and workshop plant in the power station in addition to obtaining its supply through a step-down transformer from section A it can also be interconnected with section B, and l.p. distribution in the station is controlled by special switchboards; one portion is fed from two 500-kVA 3-phase transformers controlled on their 11,000-volt side by switches in section C, delivering energy at 400 volts. A d.c. board is also provided receiving its supply from the 750-kW turbo-generator the 750-kW rotary convertor, and from the 250-kW d.c. auxiliary generator directly coupled to each main turbine. From this 460-volt 3-wire system the lighting supply is normally taken, but in times of emergency by means of throw-over switches the principal lighting circuits can be supplied from the battery. Both in the case of a.c. and d.c. low-voltage boards the control is divided into two, the first switchboard controlling

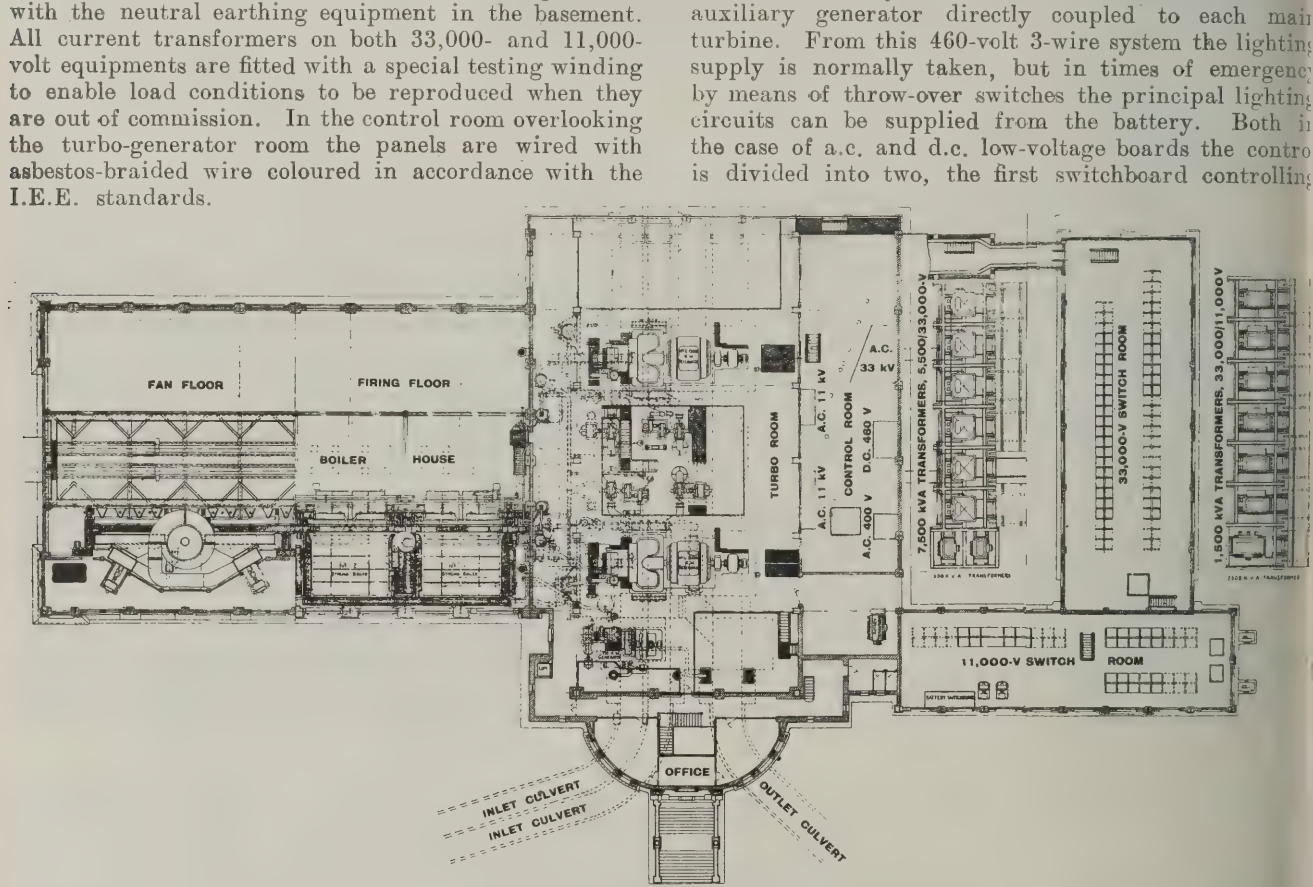


Fig. 14.—Plan of Stourport Generating Station.

The 11,000-volt switchgear on the secondary side of the 33-kV transformers controls the outgoing cables for local distribution and for auxiliary plant in the power station. It is also cellular with busbars in duplicate at the top of the structures, one set on each side of the dividing wall; below are the mechanically-operated selectors and below these are mounted the oil circuit breakers and the instrument transformers and line side isolating switches on the other side of the dividing wall. The breakers consist of three single-pole units coupled together and operated by solenoid mechanism outside the cell. Switchgear has been provided for earthing the neutral of the 5,500-volt generators and the 11,000- and 33,000-volt systems, including banks of resistances of such a capacity as to permit of the dead earthing of any phase of the system for thirty seconds without a dangerous rise in temperature while passing sufficient current to operate the protective devices of the faulty circuit. As the main transformers are star connected on the 33,000-volt side, the neutrals are employed for the purpose of earthing the system, but in the case of the 11,000-volt system the corresponding windings are delta connected and it has been necessary to provide earthing reactances for the purpose of obtaining a neutral point, of the oil-cooled outdoor

the input and transmitting it by bus cables to the second board from which all circuits around the power station are controlled.

For operating the h.p. switches duplicate Exide batteries are situated in the basement of the switch house, each of 350 ampere-hours capacity at the five-hour rate of discharge, for which the milking motor-generator sets were supplied by Mawdsleys, Ltd.

Besides those mentioned, other contractors included British Insulated Cables, Ltd. (interconnecting cable), R. A. Evans, Ltd. (electric passenger lift), Gent & Co., Ltd. (electric clocks), Messrs. B. French (lighting and power wiring), Laurence, Scott & Co., Ltd. (motors), Brookhirst Switchgear, Ltd. (control pillars), Allen, West & Co., Ltd. (controllers), and cranes were supplied by Stothert & Pitt, Ltd., Vaughan Crane Co., Ltd., and J. M. Henderson & Co., Ltd.

For the sub-station at Halesowen, which is equipped with B.T.-H. switchgear and as fig. 10 shows is of the outdoor pattern, and that at Oldbury, which are connected to the Stourport generating station by 33-kV underground cables, the Brush Co., has supplied two banks of single-phase 25-cycle, 33,000/5,500-volt transformers, each of 7,500 kVA capacity, and fig. 12 shows one of them assembled in their outdoor cubicles.

In addition to supplies furnished by underground cable to the industrial portion of its area, represented by the southern part of the Black Country, the company has constructed many miles of 11,000-volt 3-phase power lines carried overhead on wood poles, and similar low-voltage distributors in the more rural districts. There are over 100 miles of such standard lines in south Worcestershire and Shropshire, of which fig. 13 is a typical representation; some of them have been built to operate at 66,000 volts.

Villages on either side of the line routes are supplied through step-down transformers. For the 3-phase, 25-cycle, 11-kV lines stranded bare copper 0.1-sq. in. conductors are used spaced 3 ft. apart in the case of single-circuit lines and 2 ft. 6 in. in that of double-circuit lines, the maximum spans being 240 ft. and 300 ft. respectively. Single "A," and "H" type creosoted red-fir poles are employed with Buller pin type and double-link strain insulators. As a safety precaution galvanised steel wire is erected underneath the line wires and connected to four earthing bars per mile throughout.

The expenditure in respect of land, buildings, machinery, mains, and other equipment, including interest during construction and the cost of special Acts and Orders, amounted to approximately £2,500,000. In addition to the new plant, the company has a large station at Smethwick and another at Redditch; it operates the supply section of the Kidderminster and District Electric Lighting and Traction Co., Ltd., and the power stations of the Halesowen Lighting and Traction Co., Ltd., the Tewkesbury Electric Light Co., Ltd., and the Ludlow Electric Light Co., Ltd., besides being associated with the B. & M. Joint Committee of Electricity, Tramways and Motor-Omnibus Undertakings, its system being interlinked with them and also with that of the Birmingham Corporation. The company has undertaken the standardisation of frequency in the western portion of its area, but it is interesting to note that both its new station and that of the Birmingham Corporation at Hams Hall, which will no doubt be "selected" by the Central Electricity Board for its national scheme, are equipped with 25-cycle a.c. generating plant.

Portable Radio Receivers.

Some Features of Modern Instruments to which the Trader's Attention is Directed.

By PAUL D. TYERS.

DURING the past year very considerable progress has been made in the design of portable broadcast radio-telephone receivers. Until recently only a small proportion of sets of this pattern were really efficient, but this season there is a surprising number of new and really good instruments. The trade as a whole is making a considerable feature of a summer sales campaign, and, accordingly, retailers would be well advised to consider the sale of portable receivers really seriously.

The capabilities of portable receivers are somewhat limited, which is a point the trader would do well to impress upon his clients. The "pick-up" of a small frame, or indoor, aerial, compared with that of even a moderately efficient outdoor aerial, is exceedingly small, and the public, being accustomed to the normal type of aerial, is rather apt to overlook this fact. Of course, it is possible to obtain excellent results with a small aerial, provided that considerable amplification is employed, which must necessarily increase the complication and cost of the apparatus.

Portable receivers can broadly be divided into three classes: (1) really lightweight portable sets, (2) sets intended for reception from the London and Daventry stations only, and (3) comparatively complicated and heavy multi-valve sets, usually working on the super-heterodyne principle, which are capable of receiving from great distances. The very small portable sets, which are frequently enclosed with all batteries and even the loud-speaker in a leather attaché case, may be said to be truly portable; the other sets are also certainly portable, but to a more limited degree. When considering the purchase of a portable set, the probable use to which the client will put it should be borne in mind: a man who owns a motor-car is not likely to trouble very much about the size or weight of the set, but it is no good suggesting a set of this description for the man whose means of conveyance is the train, motor-'bus, or bicycle. One very good attaché-case portable receiver is provided with headphones only, although it will work a small loud-speaker satisfactorily at short range; others incorporate a loud-speaker in the lid, and give satisfactory loud-speaker results when reproducing the London and Daventry transmissions, whilst still others are built into a wooden case and provided with a leather carrying strap. Several of the larger firms are marketing portable sets also, some of which are made in two portions: the set itself is in one carrying case, and the amplifier and loud-speaker in another, which, perhaps, rather limits the portability of the apparatus.

The greatest obstacle encountered when attempting the production of a portable set designed to be as efficient musically as the ordinary type is the provision of the necessary power. Most portable sets utilise fairly small valves, and the size and weight factor necessarily limits the size of the high-voltage battery which can be used. If the loud-speaker type of portable set is to be worked so that it will give reasonably distortionless reproduction, it means that a heavy demand will be made upon the anode battery, which will constantly need replacing owing to its small size.

Since portable receivers are fitted with frame aerials, the high-frequency side of the receiving circuit is less highly damped than in the case of a set used with an outside aerial. This usually means that the set is slightly more difficult to stabilise, particularly in the case of a multi-valve receiver. For this reason it is advisable that only the valves recommended by the makers should be used; some valves, of course, have larger inter-electrode capacities than others, or amplify to a greater degree, and makers usually recommend the valves which particularly suit their circuits. Any attempt to substitute other valves, or, perhaps, cheap ones, may make a vital difference to the functioning of the apparatus, and it is quite conceivable that the performance of a really good set might be very materially limited by so doing; accordingly purchasers should be reminded that it is advisable to examine and probably replace the battery at more frequent intervals than might possibly be imagined to be necessary. The same might be said of large-sized dry cells if they are fitted for supplying the filament current instead of an unspillable type of accumulator; in the writer's opinion, the unspillable type of accumulator gives greater satisfaction than a large-capacity dry cell. The difference in weight is not likely to be very considerable.

Recent Lighting Installations.

Electric lighting schemes for the new Indian Legislative Assembly, Delhi, and the Church of St. Mary the Virgin, Ashford, embodying cornice and flood-lighting respectively.

THE interior illumination of churches and public buildings, where beautiful architecture is a predominating feature of the structural design, usually presents problems which are somewhat outside the province of ordinary installation work, each case bringing its own peculiar difficulties. That such problems can best be dealt with by electric lighting is nowadays evident, and in this connection the following particulars concerning two electric lighting schemes recently carried out are of interest.

One is that at the new Indian Legislative Assembly (Indian House of Commons) at Delhi, where the first essential was to provide good general lighting without shadows. This has been done very effectively by means of cornice lighting, which also gives a very impressive tone to the surroundings, as indicated in figs. 1-3.



Fig. 1.—Indian Legislative Assembly, Council Chamber.



Fig. 2.—Council Chamber Walls and Ceiling.

The illustrations are reproductions from untouched photographs which were taken after dark by the light from the cornice system only.

Fig. 1 shows the interior of the council chamber. The beautiful stone fretwork ceiling of this room is brought into prominence at night time by the artificial lighting, as indicated by fig. 2. The interior of one of the Committee rooms is shown in fig. 3. It will be seen that the illumination of the ceiling is absolutely uniform. In addition to the foregoing, the Chamber of Princes, the Council of State, and the library, which has a dome of 90 ft. diameter, are all illuminated on the same system. "Emvee" cornice reflectors, supplied by Messrs. Metro-Vick Supplies, Ltd., are installed throughout. They are specially designed to overcome the streaky effect which is sometimes produced by cornice lighting.

The average service illumination on the tables and desks is 4 ft.-candles, the installed wattage being 45 per foot run of cornice. Each reflector is 13 in. long, and is fitted with two 30-W vacuum lamps in a twin holder served by one pair of terminals, thus reducing the wiring to a minimum. The wire is brought out at the back of the reflector, a convenient wiring channel bein cut in the concrete. A strip of corrugated mirro runs the whole length of the front of the reflecto and serves a double purpose. It spreads the ligh laterally so that patchiness from the individual lamp is obviated, and it reflects the light in the correc direction to give a uniform illumination on the ceilin above. The mirror is coated with pure silver an heavily backed with electrolytically deposited copper It is claimed that the surface remains permanentl bright and is unaffected by climatic conditions. Eac section of the troughing can be removed independently Clear cover glasses are provided to prevent dust accumu lating in the interior of the reflector, and to facilitat cleaning. The reflector is designed to be suitable fo a small cornice.

The installation was carried out by the Public Works Department under the direction of Sir Herbert Baker, A.R.A., the responsible architect for the premises.

The second installation is that at the church of St. Mary the Virgin, Ashford, where the architecture is a combination of the decorated and plain perpendicular styles, with some traces of Norman or early English. It was decided that the system must serve the dual purpose of providing adequate light for the congregation and bringing out the structural details of the ancient pile. In this connection the vicar, the Rev. Hy. Blackburne, D.S.O., consulted Capt. A. Mayne, M.I.E.E., who, in collaboration with the Illuminating Engineering Department of the General Electric Co., Ltd., drew up a scheme for flood-lighting the chancel, nave, and transepts by means of "Gecoray" flood-light projectors equipped with 150- and 200-W white gas-filled lamps.

The lighting of the nave, fig. 4, is carried out by means of these units installed at the clerestory level, nearly 40 ft. from the floor, each being focused by means of adjustable brackets attached to the transverse beams at suitable angles to light the pews on opposite

sides of the nave. The effect is an absence of glare or dazzle in the eyes of the congregation, yet a beautifully soft illumination of even intensity renders, it is claimed,

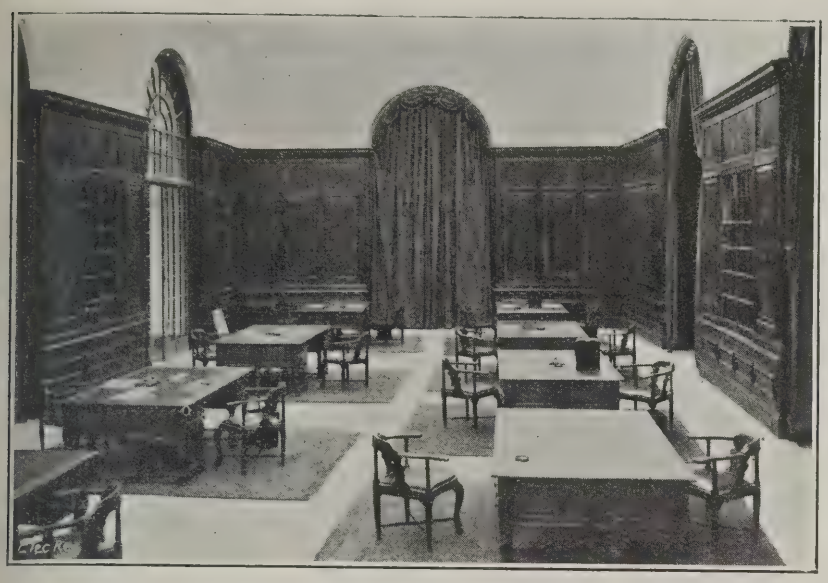


Fig. 3.—Committee Room at Indian Assembly.

the smallest print legible in the pews. The choir stalls are illuminated on the same lines as the nave, the richness of the architecture and carved woodwork being brought out to the fullest extent.

The lighting of the chancel and reredos, fig. 5, has been accomplished by installing flood-light projectors on the eastern side of the main chancel pillars. Three "Gecoray" projectors, equipped with 200-W white gasfilled lamps, are neatly fixed to each pillar, out of sight of the congregation, and focused at suitable angles; the result is a particularly uniform light on the altar and reredos. The north and south transepts are illuminated in a similar manner to the nave, the

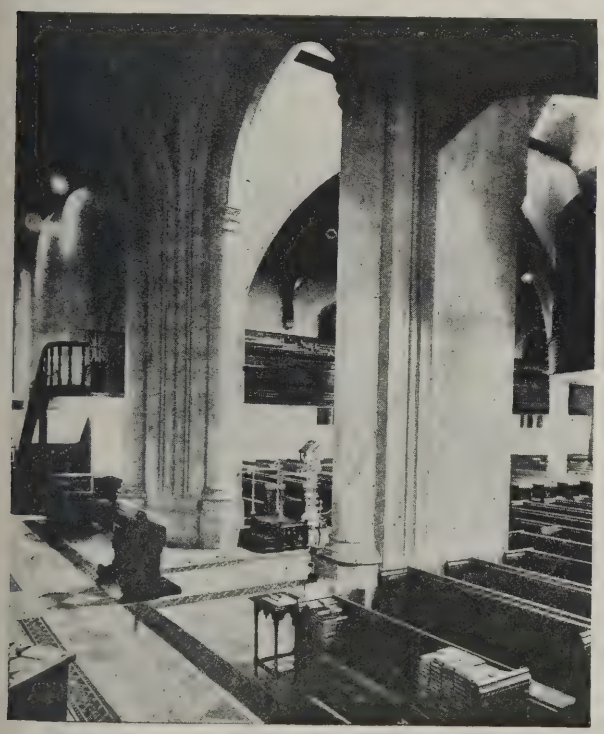


Fig. 4.—Church of St. Mary the Virgin, Nave Lighting.

flood-lighting of the "Smythe" monument in the south transept being pleasingly effective. Two flood-light projectors, equipped with 150-W lamps, are installed on the top of the rood to illuminate it and the richly-decorated roof.

The gallery illumination called for special consideration, as it was there necessary to provide a separate system; this was also the case for the seating accommodation underneath the gallery, running parallel with the nave. In the upper chamber are installed specially designed spun-aluminium "Gecoray" reflector units fitted with glazed "Morocco"-pattern diffusing glass doors, each equipped with 150-W lamps. Below, where the roof slopes inwards towards the nave, similar units of copper of octagonal design are installed. These are fitted with 150-W white sprayed lamps and provide particularly even and well-diffused illumination.

Messrs. Hayward & Co., local contractors, were responsible for the installation, which was carried out under the personal supervision of Mr. G. Dowling, and they are to be congratulated on the particularly praiseworthy manner in which the work was executed. Thanks are also due to the vicar for the facilities granted for securing the photographs which we reproduce.

A very interesting example of up-to-date electric lighting is the installation recently completed to provide efficient and uniform illumination for two hard tennis courts for the employés of Messrs. Cadbury Bros., Ltd., at Bourneville. Fifteen B.T.-H. "Dispersa" lanterns, each fitted with a 1,000-W Mazda gasfilled frosted lamp, have been installed. They are arranged in three lines of five lanterns each, one line on each of the outer sides of the courts, and one between the two courts, no units being suspended over the courts themselves or behind the service lines. The centre row of lighting units is mounted 30 ft. high, and the two side rows 24 ft. high. The side units are tilted at an angle of 10 deg. towards the centre of the courts. The installation work was



Fig. 5.—Illumination of the Chancel and Reredos.

carried out by the electrical staff of Cadbury Bros., to a specification prepared by the British Thomson-Houston Co., Ltd.

According to information obtained from the players, no glare is encountered during play, even when playing very high strokes, and the installation is in every way satisfactory.

Ideal Electricity Supply.

The importance of high Load Factor, and a method of attaining it by heat storage during light-load hours.

By GEO. WILKINSON, Harrogate.

THE forward movement for the development of national electricity supply has received official recognition and stimulus by the passing of the Electricity (Supply) Act, 1926, which is now part of the law of the land. The Act paves the way for shutting down uneconomical generating stations and the substitution of modern works equipped with the most economical generating plant obtainable. These new stations, wisely placed and provided with well-designed e.h.p. transmission lines and distribution networks, should give advantages in the shape of lower costs of production.

By far the more effective method of producing economy, however, lies in increasing the load factor of every generating station by eliminating the long periods of each twenty-four hours when, at present, they are—with few exceptions—working on extremely light loads at a dead loss to the undertaking. These daily losing periods have to be set against the remaining periods of heavier load, with the result that the average tariffs to-day are abnormally high.

Turn these periods of light load into periods of heavy load and the whole outlook of electricity supply will be radically improved.

Such a change, if it can be accomplished, will not impose any additional burden on the business in salaries, wages, or capital charges in the generating station. The only increased expense will be the extra amount of fuel consumed—plus a negligible item for slightly more oil and stores. Therefore these extra units can be sold at fuel cost plus a reasonable profit thereon, say of thirty three and one third per cent.

We can get a clue as to the method of achievement by considering the gas undertakings of the country. Where would their profits be, and what would the supply tariff be, if they worked on the same method as obtains to-day in the electrical world? They would at once have prohibitive outlay in the provision of additional retorts, to be put in and out of commission as the demand for gas rose or fell. Such a method at once provokes ridicule, and everybody recognises that the whole commercial success of the gas service lies in the making of gas at an average rate and storing the amount not required at any particular time in gas-holders until the time arrives when there is a heavier demand. Thus the rate of manufacture is an average one while the demand is a fluctuating one. Unlike electricity supply, the economy of production is maintained at a high value by average production in retorts working at high efficiency and the levelling-up between supply and demand by a reasonable amount of gas storage.

When electrical engineers are wise enough to imitate the gas engineers in this particular, the dawn of really cheap electricity will come. The object of the writer is to indicate some methods whereby this desirable end may be achieved, at least in a substantial degree.

It is true that there are no methods known to science to-day which enable large accumulations of electricity to be made and drawn upon excepting under prohibitive terms of capital outlay and storage loss. In the case of gas, a few holders furnish the means for effective and economical storage which is denied to electricity works.

It is, however, open to the electrical interests to secure a close parallel advantage by storing the electrical energy during periods of small demand in the shape of heat, the heat so stored being arranged so that it can be usefully employed the next day instead of taking the equivalent amount of energy from the generating station during the periods of heavy demand. Thus a double advantage is to be realised; first, the efficient employment of machinery during long periods, which are now hours of small and uneconomical demand, by converting them into periods of heavy and efficient demand by means of heat storage. Secondly, the reduction of the amount of generating plant required for the heavy-load period, due to the fact that the heat storage already effected serves during the heavy-load hours to reduce the amount of generating plant required to make up a given aggregate output.

No scheme for effecting this improved condition of working appears to have been entertained hitherto, and the economy realisable thereby has yet to be recognised. It is true that gas storage is easily effected within the gas works' domain, whereas heat storage in connection with electricity supply must necessarily be effected in smaller amounts on the premises of the consumers; nevertheless, the economies in each case are comparable, although the balance of advantage must remain with gas, because in the other case there is a change in the form of storage which in itself means loss.

Some attempts have been made to average up the electrical loads by offering current during the light-load hours at reduced cost, and allocating the proper times for the respective supplies by means of time switches. This method cannot, however, in any event meet the case. For a full realisation of the possible benefits, the supply taken during the, at present, periods of light load, must be conserved until the periods of heavy load and vended during these periods, thus reducing the maximum load imposed upon the generating station. In this way there will be two valuable gains, one, due to a good load factor at all hours and the other, due to the reduced top-load. The latter means less capital outlay for generating plant, both in the boiler house and the turbine room, together with a less costly building for its accommodation.

If trouble be taken to study the requirements of the all-electric house and, to a less extent, of the all-electric office, it will be found that from 70 to 75 per cent. or thereabouts of the electricity taken is required for the furnishing of low-grade heat, *i.e.*, for hot water and room heating. Such low-grade heat can be efficiently and cheaply stored during the hours of low loads and used next day during the hours of high demand upon the electricity works. As already shown, this out-of-hours supply can be given on perfectly sound commercial lines at coal cost plus a reasonable profit, and on these terms it is within the capacity of the householder to buy it for heat storage purposes.

The author suggests that the question of efficient super-stations should not be allowed to monopolise the attention of technical and commercial minds, but that consideration can with greater benefit be given to the aspect of the problem that he has ventured to set out.

It is essential, inasmuch as the sale of electricity at cheap rates is involved, that the cost of the extra equipment on consumers' premises and especially the extra outlay imposed on the generating authority should be kept low.

In a future article the author may have an opportunity of describing some details and equipment which have been designed to meet the new order of business herein outlined.

One factor in the proposition has already been described in the Press under the designation of the "dispensable circuit," but the eventual development will undoubtedly be the provision of what, for want of a better name, the author has designated a "change" circuit. This will be an alternative network of limited extent supplying a variable amount of electrical energy at a low rate per unit for heat storage purposes.

The amount of current supplied through this network will be the difference between the maximum load on the generating station and the demand for the time being on the ordinary supply network.

During the period of top load the supply to the "change" circuit would cease entirely. Moreover, the "change" circuit will suffer no disadvantages due to fluctuations in either pressure or current.

The more the possibilities of such a network are considered the better for both the industry and the community.

The Foreign Agency.

Some Points which are often Overlooked in Overseas Arrangements.

By A. J. SMITH.

THE perusal of any considerable number of foreign agency agreements of different engineering firms points very clearly to the advantages which would be derived from some method of pooling experience through the medium of a central organisation, as well as the need of a generally-accepted type of agency agreement capable of meeting the reasonable requirements both of a normal manufacturer and an average overseas agent. Although the greater portion of the overseas trade of this country in engineering material is probably transacted under some form of sole agency agreement or other, and there must be thousands of such agreements in existence, many of them show a distinct lack of provision for some of the most ordinary happenings which arise under such arrangements, and which could in most cases have been readily settled in the preliminary negotiations. Nothing is lost in facing the fact that the interests of the parties are in certain contingencies opposed, and when such cases are viewed in the initial stages as abstract propositions, it is far easier to agree upon the procedure than it is when an actual incident has occurred, and a decision results in one party being a loser.

The Description.

The first point which calls for consideration is the actual word employed to describe the second party to the agreement. Though the use of the word "agent" in this connection has attained the sanction of commercial usage, it is really a misnomer, as is readily apparent when the wide legal powers attributed to an agent are considered. The party of the second part, or selling agent, in the more restricted commercial acceptation of the term is either a distributor who possesses the sole buying or importing rights of a particular make of article for a defined territory, or alternatively he may be a sole representative in that territory for the purpose of introducing the goods to the notice of buyers. In the motor-car industry, such words as "distributor" and "sole concessionaire" are beginning to be used for designating the duties and powers of such an importer, although they are American terms which have not yet attained general acceptance in commercial phraseology. While in most agreements, and in these notes, the word "agent" is still used, it is becoming increasingly common for an extra clause to be inserted in the document which expressly disclaims the full legal meaning of the word, and defines the exact duties and powers which attach to the term.

Exclusive Arrangements.

Another question which frequently arises relates to the exclusive nature of the arrangement on both sides. The agent undertakes to deal only in goods of a particular class made by one manufacturer, and the latter transacts all business for a certain territory through the agent there. In the complete observance of this reasonable stipulation, however, the manufacturer works under certain difficulties which are not always apparent to the agent who may not be fully acquainted with the ramifications of export trade apart from that concerning his own territory, and these difficulties render certain exceptions necessary.

It is not a difficult matter to refer to the agent all inquiries and orders received *direct* from an agency territory for attention, but a very large volume of export business comes to the average British manufacturer through merchant-buying houses in England, the makers often being to a great extent unaware of the exact destination for which the goods are required. The policy of first inquiring the destination in all such cases, and refusing to quote if the goods are intended for an allotted market, which is the plan often seriously advocated by agents when the position is explained to them, is open to certain objections. In the first place, the merchant house may already be a regular buyer, fully conversant with current prices, and therefore not needing to put through the usual inquiry before ordering. In the next place, a merchant house does not always care to name the destination in the inquiry stage, and further the manufacturer who seeks to take up the attitude of picking and choosing which inquiries he will quote for and which he will refuse, is not likely to have such opportunities presented to him more than once or twice. As a consequence of refusing to quote a merchant house for comparatively unimportant markets such, for instance, as Turkey and Bolivia, the maker may, as a consequence, miss altogether the much more important business which the same merchant may have to place for other destinations. The agency agreement should therefore always contain a provision that the manufacturer may continue to do business through the merchant houses of this country, even if it is necessary to pay a small commission upon such trade.

Names of Users.

It is not an unreasonable request that the manufacturer should be kept informed of the names of the ultimate customers to whom his goods are sold through an agency, in such trades where the procedure is possible, though, generally speaking, there is a disposition on the part of many agents to keep the manufacturer in the dark as much as possible. As a consequence, there are instances of makers, after doing a regular trade for a number of years with a certain territory, who, following a rupture with the agent, are left entirely ignorant of who their customers have been or the terms upon which the business has been done. It is therefore advisable for the agreement to provide for the name of the ultimate purchaser to be disclosed, and for regular efforts to be made to ensure the arrangement being adhered to.

Government Orders.

Another frequent point of difference between the principal and the agent arises in connection with certain business of the class similar to that regularly placed in London by overseas railway companies, by

the Crown Agents, by large foreign shipyards financed by British capital, and occasionally by large armament firms abroad. Much of this class of business originates, and is settled entirely in this country, without any special reference to the territory to which it is to be sent. If there is any definite work done by the agent in originating such business, there are not many manufacturers who would object to including it in the ambit of the agreement, but where it originates and is settled entirely between the maker and the buyer in this country, there is a not unnatural disposition in manufacturing quarters to regard it as being outside the scope of the arrangement. It is a point in any case which should be discussed and settled when the terms of the arrangement are being negotiated, and, in addition, the agent would be acting in his own interests to keep the makers advised upon the details of any propaganda work he may undertake with establishments of the type described, and where the business may ultimately have to be referred to authorities in London for settlement, rather than waiting for the *fait accompli* of an order before making a claim.

In connection with agency agreements generally, it is an unfortunate fact that there is not enough co-operation between manufacturers in a particular trade, either in regard to standardising conditions or pooling the results of experience. In a somewhat similar field, the electrical industry has led the way by providing an agreed set of conditions of sale for various classes of export business, and what has been done in the electrical industry in this respect could be paralleled in other exporting trades by the provision of a standard form of agency agreement which, if it could also be passed by an organised body of importers in some overseas market, would be the means of striking a happy medium between conflicting interests.

The Lay-out of the Contractor's Shop.

By ERIC N. SIMONS.

THE interior of the shop is one of the most important factors in electrical retailing. The deep gloom common to many electrical dealers' shops must be avoided. Sometimes it is caused by the heavy character of the stock, but as a general rule it can safely be ascribed to inefficient window-dressing, poor lighting, and faulty arrangement of fixtures. Inefficient window-dressing means that the articles in the window are so tightly packed, and the window itself so crowded with opaque objects, that very little light gets into the shop from outside, even on the sunniest day.

Bright and cheerful shop interiors put people into a more generous frame of mind. They feel more disposed to buy optimistically. Artificial light employed in day-time is not only expensive but also depressing. It makes the assistants look pallid and the shop less attractive.

Bad lighting increases the gloom. In one electrical shop known to the writer, all the upper windows, which were put in originally to throw light towards the back of the shop, were covered with black paper, so that something could be done to them outside. Naturally, the gloom was fierce. It is often the case that slight structural alterations would vastly improve the lighting of a shop. For example, an extra skylight or window, costing comparatively little, would soon repay its cost in increased sales. Some retailers imagine that because they deal in electrical appliances, they ought to have electrically lighted shops both day and night. No fallacy could be greater. Electric light is for night, not for the day, and the wan appearance it has in the latter instance tends to damage rather than help its appeal.

Bad stock arrangement can easily be altered. Piles of bulky objects or stacks of big boxes and cases, placed too near the source of light, cast deep shadows, exclu sunlight, and make gloomy corners where none necessary.

Overcrowded floor space is another great fault many electrical retail shops. Sometimes one ha literally to tiptoe one's way to the counter, steppin over this and that and the other package, evading pack ing cases that ought not to be there at all, and ofte going in fear of catching a big pile of boxes with one elbow and bringing it down with a crash. Again, man retailers leave only a few inches of clear space on thei counters, so that the customer burdened with glove stick, handbag, other parcels, or whatever it may be, i unable to rest them anywhere while negotiating o examining goods. These things make shopping uncom fortable, and the electrical retailer's business is to mak shopping easy. Generally, this condition is due t under-staffing by the retailer, so that his goods are no stocked, unpacked, distributed, and so forth, as quickl as they ought to be, with the result that they are lef encumbering the selling spaces.

The retailer should have some regard for the comfor of his customers. It is astonishing how few electrica retailers have chairs on which their customers may sit if they have to wait any time. Again, many fail t afford proper facilities to their customers for the in spection of the appliances they wish to buy. Ofte owing to the crowded counter already mentioned ther is no room to demonstrate an appliance.

Shelving by its design and arrangement affords great deal of attraction to the shop. If oak shelving stained dark, is too costly, stained deal may be used t advantage.

The shop floor is very important. The ordinar wooden planking covered with linoleum is not ver satisfactory. It wears quickly, looks unsightly after little wear, takes a great deal of keeping clean, and i fairly costly. Many electrical retailers are beginnin to favour a polished hardwood floor, sometimes covere by rugs here and there. This wears well. Best of all perhaps, is the rubber carpeting now being used i many shops. This quietens the shop, and so enables th words of salesmen to be better heard, and the remark of the customer to be less costly in effort.

Efficient Drawing-Office Lighting.

The correct illumination of a drawing office presents a number of special problems which necessitate careful scientific treatment. An installation recently designed by the General Electric Co., Ltd., and carried out by Messrs. Tyler & Freeman, exemplifies the application of such treatment. The approximate ceiling height of the offices in question from floor level is 9 ft., and on account of this the working plane is situate only about 5 ft. below the lamp filament with the fittings mounted direct on to the ceiling. The spacing was so arranged as to provide each drawing bench with right-hand, left-hand, and frontal lighting. The fittings are of the "Unalux" enclosed pendant type, made by the G.E.C., in which the 16-in. diameter glass bowl is supported by bronzed metal work, each fitting containing a single "Osram" 200-W gasfilled lamp. The fittings are equipped with standard ventilating galleries. The average intensity approximates to 46 ft.-candles; the scheme was designed to provide an ultimate average of 30 ft.-candles on the working plane. Tests carried out on a number of the drawing boards resulted in its being impossible to detect, or even to create, anything in the nature of objectionable shadows. It was proved that the finest lines could be drawn with perfect ease and precision from either the right- or the left-hand side of a set square. Altogether there are 191 lighting points, each of 200 W. 38,000 watts in a drawing office is in itself something new in office illumination. There are over 100 draughtsmen employed in these offices, which are situated on two floors.

The Institution of Electrical Engineers.

Summer Meeting at the North-Eastern Centre.

THE early contingents of the 290 members and their ladies from the various I.E.E. Centres who are participating in the summer meeting of the Institution, under the presidency of Dr. W. H. Eccles, F.R.S., forgathered on Monday evening last in the banqueting hall of the Central Station Hotel at Newcastle-upon-Tyne, to initiate the week's proceedings by meeting the Committees of the North-Eastern Centre and Tees-side Sub-Centre, whose chairmen are, respectively, Mr. J. Rosen and Mr. W. R. Cooper. The establishment of the Centre dates from 1899, and in 1912 its activities were enlarged by the inauguration of a Students' Section; the present membership is 510. The Tees-side Sub-Centre was formed in 1912, and its membership is 96.

Standing on the line of the Roman wall which was built across country from coast to coast as a defensive obstacle to the northerners, ending at Wallsend-upon-Tyne, Newcastle's distinctive name originated from the "new" castle of Norman times, as distinguished from the old castellum of Pons Aelii, the family name of the Emperor Hadrian, who visited Britain in A.D. 120, which was shared by the Roman bridge that crossed the river at that spot and the camp on the hill above. The district is to-day renowned chiefly for the winning and export of coal, naval and mercantile shipbuilding, the production of iron and steel, and ordnance, while the coast line can boast of some of the finest harbours and docks in this country. The locality was early associated with the introduction of steam traction and the development of the steam locomotive by William Hedley, Timothy Hackworth and George Stephenson, and with the invention of the Parsons steam turbine, and Sir Joseph Swan publicly exhibited electric lighting on a large scale by means of incandescent lamps for the first time in Newcastle. Although the manufacture of electrical products cannot be described as a staple industry, the production of electrical machinery and appliances nevertheless occupies a prominent position in local industry. Apart from its industrial aspect and the historical remains extant, the Centre is within easy reach of some of the most picturesque parts of the kingdom; the Northumberland coast and moors have a charm of their own, and the Durham and Yorkshire dales are perhaps too little known.

On the Tuesday morning alternative visits were paid to the Heaton works of Messrs. C. A. Parsons & Co., Ltd., and to those of Messrs. A. Reyrolle & Co., Ltd. Although the late Alphonse Reyrolle established a small workshop in London in 1886, it was not till 1901 that the first works were built on the present site at Hebburn-on-Tyne. Beginning with two or three small single-storey buildings, they grew apace until in 1922 they occupied 150,000 sq. ft. of floor space on a site of 5½ acres which was nearing its economic limit. Accordingly, it was not only decided to equip a fresh factory, but to take the opportunity thus afforded of thoroughly modernising the existing one. An already acquired site of 4½ acres not far from the Hebburn works, which had been used as a recreation ground for the workpeople and staff, was laid out to accommodate all the machine tools, except the minor services incidental to the assembly of the apparatus, and this site now forms part of the ground of the New Town works; when it was built upon, a new and larger recreation ground was laid out to take its place. Fig. 1 is an aerial view of both factories.*



Fig. 1.—Aerial View of Messrs. Reyrolle's Old Town and New Town Works and Sports Ground.

The new buildings are light and airy, with provision for the safety and welfare of the workmen; they comprise nine bays, each from 200 to 250 ft. long and from 30 to 40 ft. wide, the total area being 72,000 sq. ft., with ample space available for extension to 200,000 sq. ft. when required. The machine tools installed are of modern type, and the arrangement of the bays and equipment is designed to reduce handling to a minimum, cranes having been provided for the transport of material and finished parts; a battery locomotive with a haulage capacity of 75 tons deals with inter-works traffic, both the old and the new works being alongside the London and North-Eastern Railway. An aggregate of 100 tons of metal (steel, cast-iron, copper, brass, &c.) is every week wrought into switchgear, the combined factories being capable of an output of 210,000 kW of gear per annum. At present the works provide employment for some 2,000 workpeople, engaged upon the production of metal-clad switchgear for pressures ranging up to 132,000 volts and breaking capacities up to 2,000,000 kVA. Fig. 2 shows the general arrangement of the bus-bars and sectionalising switch of the 12,000-V, 1,500-A, 3-phase, solenoid-operated, draw-out, twpe A.2 gear supplied for the South African railways.

The Company has applied strong principles to one branch of the engineering industry: the basis of its switchgear design simply consists of the complete enclosure of all fittings and conductors which would be dangerous to handle, in such a way that they are rendered inaccessible when "alive," the enclosure being of earthed metal: but merely working to a general principle would avail but little if it were not backed by thoroughness in all detail of both design and workmanship. Its work having at first been regarded as eccentric, the position to-day is that not only are metal-clad principles being extensively adopted for the largest power- and sub-station equipments in this country and

* See also Elec. Rev., January 12th, 1923, p. 59.

the British Dominions, but also that some very large American manufacturers have taken up the production of corresponding apparatus, amongst whom the Allis-Chalmers Company manufactures under licence to Reyrolle designs.

The Heaton works of Messrs. C. A. Parsons & Co., Ltd., were founded in 1889 for developing the steam turbine for land use; the first ship's turbines were constructed in those works also, but in 1898 an additional site was chosen for marine work, which was taken over by the Parsons Marine Steam Turbine Co., Ltd. In 1889 the Heaton works occupied an area of 2 acres, the original shop being no more than 170 ft. long by 50 ft. wide, and the entire staff numbered 48 all told; to-day the acreage is 18 and over 1,200 men are employed. The record of the Company is indeed one of continuous pioneering work*; the output of turbines for use on land alone (manufactured at Newcastle and throughout the world under licence) cannot aggregate less than 50,000,000 h.p., noteworthy sets being those of 20,000 h.p. at Treforest, of 55,000 h.p. at Barking, and of 70,000 h.p. at Chicago.

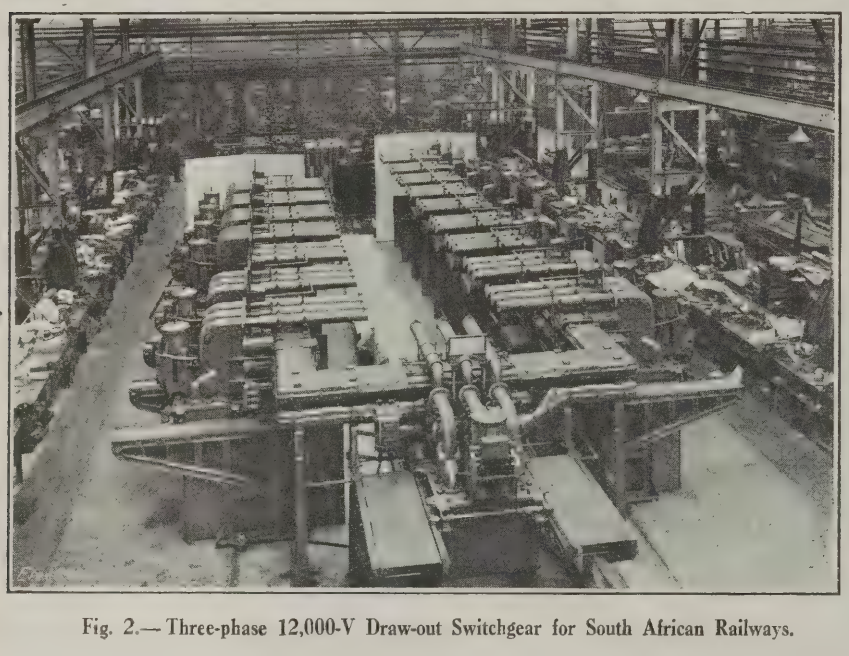


Fig. 2.—Three-phase 12,000-V Draw-out Switchgear for South African Railways.

Other products include surface condensing plant, high-speed centrifugal fans, compressors, blowers, exhausters, &c.; d.c. dynamos, low- and high-speed a.c. generators, and air coolers for the last named: the fact that 3,000-r.p.m. machines of over 28,000 e.h.p. are being constructed at present is indicative of recent development. The insulating materials are prepared from the raw materials entirely in a department specially ventilated and maintained free from dust, the stranded stator conductors being encased in insulating troughs by special machines evolved in the Heaton works. Besides the principal shops, which consist of three 385-ft. and one 416-ft. bays, two new shops were built in 1924 for the erection of electrical transformers which the Company has recommenced to manufacture. Searchlight reflectors have been one of the Company's standard products since its foundation, and in order to meet the British and Allied Government's requirements during the late war the shops devoted to their manufacture were enlarged to three times their previous capacity, which enabled the output to be increased tenfold, up to 100 mirrors per week, ranging from 10 in. to 5 ft. in diameter.

Two balancing houses enable alternator rotors to be run at 33 per cent. over-speed and turbine shafts and disks 50 per cent. above normal. The various shops are interconnected by full-gauge railways, electrified on the overhead d.c. trolley-wire system, power being mainly purchased and delivered to two works sub-stations which transform the 5,750-V a.c. supply to 440 volts for shop services: d.c. is also available for driving motors and lighting from motor-generator sets, whilst a reserve d.c. supply is obtainable from three condensing turbo-generators in the test house, which can also be run as back-pressure machines to feed steam to the works for heating purposes. Automatic telephones are employed throughout the establishment, and a works school was commenced in 1919 as a development of the apprentice scheme, the custom of the Welfare Department being to pass every "trade" apprentice through the school and to encourage further study at evening classes and at college by financial aid.

At mid-day the whole party assembled outside the Armstrong College, where an official photograph was taken, and after luncheon at the Grand Assembly Rooms, Barras Bridge, those who had visited Messrs. Parsons's works during the morning toured Messrs. Reyrolle's, and *vice versa*, tea being served at both works by the respective Companies. In the evening there was a civic reception by the Lord Mayor (Councillor A. W. Lambert, M.C.) and the Lady Mayoress, dancing being indulged in to a late hour.

(To be continued.)

* ELEC. REV., January 26th, 1923, p. 130.

Metal-Clad Draw-out Switchgear.

Another Point of View, with Reasons.

By J. R. WILKINSON, B.Sc.Tech., A.M.I.E.E., A.M.C.T.

IN his interesting, though perhaps somewhat biased, article appearing in the May 27th issue of the ELECTRICAL REVIEW, Mr. Thomas Carter comes to a number of conclusions which to my mind do not by any means represent the full facts of the situation. From his opening paragraph it would appear that he has only recently come into close touch with the various types of metal-clad switchgear. He states himself that this is a question where experience counts enormously, and I venture to suggest that the experience of a large number of operating engineers does not bear out his contentions. As personal opinions are of very little weight without a backing of solid reason, I propose to deal with the points raised in Mr. Carter's article, in the order in which they occur.

Horizontal-type gear is dependent on its rails for guidance and alignment, and it is more difficult to obtain perfect contact where the whole weight of the moving part is on the guide than where it is allowed to centre itself freely about a vertical axis. The lifting gear on the vertical type is extremely simple, is an integral part of each unit, and serves the dual purpose of isolating the breaker and lowering the oil tank. With horizontal gear recourse has still to be

had to the despised vertical principle for removing the tank or the complete breaker, but in this case it takes the form of a cumbersome separate lift. Surely it is preferable to have one mechanism rather than two, especially when the latter only permits one switch to be inspected at once. With regard to the point that two motions are required with vertical gear, this is only the case when the oil tank or switch is completely withdrawn. It is not necessary for routine inspection.

I agree that, so far as practicable, switchgear should be made for man and not *vice versa*. Its primary function is, however, the control of electrical energy, and I imagine that most engineers will agree that the vertical type best combines these functions. The point about orifice inspection is immaterial, as with properly constructed gear there is hardly ever any necessity to do this. When necessary, it is almost as easy with one type as the other, and it is far easier to leave stray nuts, &c., in the horizontal spouts.

Strong exception must be taken to Mr. Carter's statement that plug changing is the simplest and most rapid method of busbar selection. On the contrary, it is one of the crudest, and is quickly becoming obsolete. Change-over cannot be made without shutting down the circuit and isolating the breaker, and it is difficult, complicated, and expensive to provide an interlock to prevent two plugs only being changed over. Oil-immersed selector switches interlocked with the circuit breaker are a distinct advance, but do not allow change-over under load without the use of a separate bus-coupler switch. With double circuit breakers change-over is effected with the utmost ease and rapidity, and complete control is centralised in the control room. A whole station can be changed-over from one set of bars to the other in far less time than is taken by transferring a single unit using the plug method. Moreover, a separate coupler is not essential, and the second breaker acts as a spare should the contacts of the first be damaged by a "short." More than one important operating engineer was initially prejudiced against metal-clad gear, due chiefly to the lack of facilities for busbar selection, but has been converted by the double-breaker principle. On the rare occasions when it is necessary to change the complete circuit breaker the advantage again lies with vertical gear, as the breaker has to be lowered only and not racked out and then lowered.

The lifting mechanism on the vertical type is sufficiently robust to support the circuit breaker in the operating position. The additional catches or brackets are merely additional safeguards and for supporting the breaker top plate in the "isolated" position when it is desired to lower the tank only. With both types the operating gear is equally accessible, but the arrangement of the vertical type is such that this can be mounted on the fixed portion of the unit, thus eliminating auxiliary plugs and sockets and giving complete interchangeability of the fully-protected breakers.

Mr. Carter complains of the height of the cable box on vertical gear, and almost in the same breath refers to the use of basements for switchgear. I would remind him that such basements seldom have a cable floor beneath them, and all supply engineers now realise the risk of bending cable at too small a radius. This height, whilst not detracting from the accessibility of the box, enables a bend of large radius to be used.

Dealing with the question of floor space occupied, I agree that with both types it is essential to have a passage way in front of the units. On the horizontal gear, however, the brackets which support the breaker in the isolated position project permanently into the passage, which has to be widened accordingly. On the vertical gear the circuit breaker is merely drawn out temporarily and then removed. Moreover, for contact inspection on vertical gear the breaker is not withdrawn, but only lowered. This will probably occur a hundred times for one removal of the complete breaker.

One of the great advantages of vertical-type gear is the shortness of the conductors and the minimising of the "loop" formation, thus giving great robustness under short-circuit conditions. The circuit breaker is firmly clamped between the lifting mechanism and stops on the fixed portion to prevent movement under shorts. All forces on the fixed portion are direct as against the cantilever action on the spouts and bushings of the horizontal gear. In this connection I cannot do better than refer to a paper read by Messrs. Sporn and St. Clair before the American Institute of Electrical Engineers early this year. Fig. 17 of this paper shows the destructive effect of these forces on the busbars, rather contradicting Mr. Carter's conclusions.

The question of the methods of bus selection on duplicate busbar systems has already been dealt with. It should, however, be pointed out that with double breakers the interlocks are far simpler and more robust than with a separate oil-immersed isolator. I am afraid Mr. Carter's remarks about two breakers in a common tank indicate lack of experience on this gear. It has been conclusively proved by short-circuit tests of high capacity that if the two busbars of such a unit are connected to two unsynchronised supplies, heavy shorts may be broken on one without in any way tending to spread to the other. These tests were carried out at 33 kV, under the worst possible conditions. It is also interesting to note that many systems have been operating successfully for a considerable time, in which a separate source of supply is maintained in each set of busbars, and the double breaker selects the supply to which the circuit shall be connected.

Coming to the question of the comparative weather-proofness of the two types of gear, I agree that the problem is not so much the danger from dripping water as the humidity of the atmosphere and sweating. It appears to me that it is equally difficult to solve this with either of the types in question, and that only a hermetically sealed chamber will absolutely prevent the ingress of moisture.

The experiences of operating engineers carry great weight in matters of this kind, and accordingly it is interesting to note the following comments of an operating engineer of a large station where vertical type gear has been installed for some years. In his view the weight to be handled and supported has not presented any difficulty in operation, and it is simply a question of suitable mechanical design. Isolation and removal of the oil tank is rapid and convenient in operation, and there is a saving in time due to special tank-lowering tackle being dispensed with. The interchanging of the oil circuit breaker is readily carried out. The space required is a minimum, and far fewer horizontal units could be accommodated. The question of being able to change-over from one set of busbars without interrupting the supply is of the utmost importance to the operating engineer. Although the switch house in question is not a particularly dry place, no trouble has been experienced due to moisture; the insulators have been in continual service for two years without cleaning, and were remarkably clean at the end of that period.

In conclusion, I cannot agree that the fact that the pioneers of metal-clad switchgear still hold to the horizontal principle indicates any superiority of principle. It is well-known that the manufacture of a range of metal-clad switchgear entails an enormous outlay on jigs and tools, and there is a natural reluctance to make so drastic a change even where a better principle is involved. One large manufacturer of metal-clad gear actually commenced with the horizontal type and then abandoned it for the vertical gear.

Metal-clad gear is now being developed on the Continent and in the United States of America, and it is significant to note that in these places the tendency is towards the vertical principle.

I trust that I have made it clear from the above that the argument is by no means as one-sided as Mr. Carter would have us believe, and that taking all things into consideration the balance undoubtedly lies with the gear designed on the vertical principle. It is extremely probable that the future will see the wholesale development of the vertical type of switchgear.

D

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Contractors' Convention.

The second annual convention of the E.C.A. Allied Associations is to be held at Scarborough from Wednesday next until the following Friday. A very successful gathering is anticipated; the registrations up to the end of last week were in excess of those for last year's conference at Brighton.

Demand for Higher Australian Tariffs.

A Sydney correspondent of *The Times Trade and Engineering Supplement* states that at a recent meeting of the Chamber of Manufactures, a resolution in the following terms was adopted:—"The Electrical Manufacturers' Section views with alarm the protracted delay in dealing with requests for effective tariff protection, and respectfully urges the Council of the Chamber to use every effort in its power to expedite the tabling in Parliament of the Tariff Board's reports already submitted to the Minister, and the early reference to the Tariff Board of all outstanding applications." The Chamber reports that only nine matters which it has asked to be referred to the Tariff Board have not yet been so referred; these include air-break ironclad switches, switch-fuses, and circuit breakers.

Engineering Wages in Australia.

The Australian engineering trade unions recently made an application to the Commonwealth Arbitration Court for the application of the 48-hour week wages to the present 44-hour week. The employers made a counter-application for an entirely new award which would recognise a bonus or payment-by-results system. Mr. G. B. Clerk, managing director of the English Electric Co. of Australia, Ltd., in his evidence, said that Australian electrical manufacturers could not compete with overseas manufacturers who had lower wage rates and a wider market. His company had made over 200 traction motors and had lost at least £47 on each of them. They had, therefore, abandoned the manufacture of the machines until conditions altered. He held that the most satisfactory method of payment in the engineering industry was to guarantee a regular hourly wage and pay a bonus depending upon output.

The Importance of Argentina.

To illustrate the predominant position which Argentina holds in South America, the *Journal* of the British Chamber of Commerce in the Argentine Republic quotes a number of notable facts. It is shown, for instance, that in 1924 over half of the foreign trade of the Continent was attributed to Argentina, and in 1923 the amount of foreign trade per head of population amounted to $159 gold in the case of Argentina and only $33 in respect of the whole of the remainder of South America. The Republic had 60 per cent. of the railway merchandise traffic; 42.7 per cent. of the railways—37.7 km. per inhabitant against 29.3 km for the remainder; 45 per cent. of the telephones; and 58 per cent. of the motor cars.

The Anglo-German Industrial Conference.

Last week-end representatives of British and German industries met at Leverkusen, near Cologne, to continue the discussions opened in this country in October last. Dr. Duisberg was the host, and the British steel and engineering industries were represented by Sir William Larke and Sir Archibald Ross. Among the matters dealt with were the European steel cartel, the eight-hour day, and the re-establishment of European industry.

Chinese Notes.

The net profit for 1926 of the Pootung Electric Supply Co., Ltd., was $41,047. A total dividend of 11 per cent. has been paid. The company has a subscribed capital of $300,000.

It is proposed to broadcast music, news, &c., in Peking and Tientsin, and offices have been established to take charge of the system. Any person who desires to install a receiving set must register at one of these offices, and pay an annual fee of from $6 to $12. Importers and sellers of radio equipment also have to be registered.

The Chapei Electricity and Waterworks Co., Ltd., Shanghai, earned a net profit (including $52 brought forward) of $249,115 for 1926. A dividend of 6 per cent. was declared on the deferred and founders' shares. The capital is to be increased from $2,000,000 to $4,000,000.

British Engineers' Association.

A luncheon organised by this Association took place at the Hotel Cecil on Thursday (yesterday), 16th inst. Guests were invited to meet Sir Arthur Balfour, K.B.E., and the Rt. Hon. R. McKenna, P.C.

Unemployment.

There was a small increase (7,320) in the number of unemployed during the week ended May 30th. The total at that date was 985,500, as compared with 978,180 on May 23rd and with 1,614,210 on May 31st, 1926. The last figure was abnormal on account of the coal stoppage. The latest total includes 208,900 women and girls.

Electric Power in Industry.

Railways are the principal subject of Preliminary Report No. 14 upon the 1924 Census of Production, issued as a supplement to the *Board of Trade Journal* dated June 9th. The total value of goods made and work done during 1924 was £70,727,000. This total included:—Telegraphic and telephonic lines, works and apparatus, £1,023,000; electric lines and works, £589,000; and electricity generated for other than railway companies' manufacturing purposes, £1,046,000. The equivalent of the last figure in 1912 was only £371,000. The total capacity of electric generators at railway companies' works was 164,712 kW, as against 83,260 kW in 1907. The aggregate power of electric motors in use was 137,837 h.p., and power was purchased for 52,209 h.p. of these.

The same report also deals with other trades. It is shown that in the blacksmithing trade in 1924 there was only 13 kW of generating plant (against 60 kW in 1907). The motors in use aggregated 4,379 h.p., and power was purchased for 4,370 h.p. of these. The small arms trade did not report any generating plant (there was 981 kW in 1907), but it had in use 2,856 h.p. of electric motors. Electric generating plant rated at 1,917 kW (against 716 kW in 1907) was returned by the bacon-curing and sausage trades. There were also motors with a total capacity of 9,778 h.p. installed, and power for 7,983 h.p. was purchased.

Great Britain's Radio Exports.

Details of the exports of radio apparatus from this country during April are given in the *Wireless Trader* for June 11th. The total value (excluding re-exports) is given as £109,092, which includes valves valued at £21,746. Our principal customer was Australia, whose share is given as £27,230 (valves £8,397); this figure represents a substantial increase. The share of New Zealand—£12,444 (valves £2,087)—was more than double that of the preceding month. The chief foreign customer was Holland, which took goods to the value of £6,503 (valves £89). Although Japan remained in the second place with a total of £4,452 (valves £105) its share again diminished considerably.

The World Economic Conference.

The recently-published final report of this Conference (under the ægis of the League of Nations) surveys the whole field of finance, industry and trade and makes many recommendations. Perhaps the most important section is that relating to Customs tariffs and kindred matters. The reasons for high tariffs are examined and shown to be economically unsound; internal taxes upon imported goods are condemned; and export taxes upon raw materials are also viewed with disfavour by the Conference. Matters of more immediate practicability which are dealt with are the interchange of commercial information and statistics between countries, and "rationalisation" (standardisation and organisation).

Works Visit.

On the occasion of the summer meeting of the Institution of Mechanical Engineers at Birmingham a visit will be paid to the works of the B.T.-H. Co. at Rugby on Friday, July 1st.

Wages in the Engineering Industry.

A further conference between employers and trade union representatives of the engineering industry was held on Tuesday last. The employers expressed their inability to offer more than 2s. a week increase for plain time workers, and the employés' representatives thereupon intimated that the offer would be submitted to a ballot of the unions' members.

New Australian Company.

A company with the title Scott & Co. (Australasia) Pty., Ltd., has recently been registered in Melbourne, with a capital of £25,000, to carry on the business of ironfounders, mechanical, electrical and tramway engineers, &c.

For Sale.

Bath Corporation Electricity Department invites offers for two Babcock & Wilcox (12,000 lb.) marine-type boilers, with underfeed stokers, forced-draught fan, steel chimneys and dust catchers, and 10,000 110-V lamps of various makes and candle power. Messrs. W. Beardmore & Co., Ltd., invite offers for one marine-type cylindrical boiler, two 625-kW Brush-Ljungström turbo-alternators, two 650-V induction motors, and one helical reduction gear. West Central Merchandise Mart will sell by auction on June 23rd, at 10, Red Lion Passage, Holborn, W.C., a quantity of coils of new and perfect cables and 2,000 coils of twin and workshop flex. Preston Corporation Electricity Department has for disposal one 500-kW rotary-convertor, with booster, exciter, and starting motor, &c., and one 1,250-kVA, 3-phase delta star transformer group. Ilford Corporation Electricity Department invite offers for dismantling and removal of battery and booster plant at the Goodmayes sub-station. (See our advertisement pages to-day.)

Local Exhibition.

Morecambe.—A demonstration of electric cooking, organised by the Electricity Department, was given recently. It was stated that during the last twelve months the department had supplied 140 cookers, 20 washing machines, 50 washing boilers, 15 geysers, nine water heaters, and 400 vacuum cleaners, in addition to other miscellaneous electrical appliances.

Russia and British Orders.

It is announced from Baku that Mr. Barinoff, one of the directors of the Azneft (Baku Oil Trust), is reported to have stated that the Trust this year proposed to place with English firms orders of the value of 10,500,000 roubles for electric pumps, compressors, turbo-generators, &c. Now the Trust was only leaving in England orders, the withdrawal of which was undesirable, and which had almost been completed. All the remaining orders would be distributed among other countries. Orders for 2,500,000 roubles which had been destined for England had already been withdrawn and had for the most part been allocated to firms in Germany, America, and Czecho-Slovakia. A further message from Leningrad states that the Electric Current Undertaking (Elektrotok) of that city has discontinued the giving of orders to England, where the Elektrotok has on order two turbo-generators, with accessory mechanical equipment of the value of 2,000,000 roubles. The first set is to be delivered in May, 1928, and the second in July of that year, for installation at the Krasny Oktyaber station now under construction. At the end of May the undertaking is stated to have received confirmation from the Vickers Company that all its obligations would be fulfilled. It is added that the final solution of this question has been handed over for the consideration of the National Committee of Trade, and that further orders required by the undertaking will be placed in Germany and America.

Trade Announcements.

Darimont Electric Batteries, Ltd., has granted the sole manufacturing and selling rights relating to "Darimont" appliances and accessories to the General Radio Co., Ltd.

Automatic & Electric Furnaces, Ltd., has entered into an arrangement with Messrs. G. Blundell & Co., Ltd., of Yokohama, for the sale of the Wild-Barfield electric furnaces in Japan.

Messrs. Lindsay & Co. have removed to 9, Cheapside, Liverpool. Telephone: Bank 52.

The Trelleborg Ebonite Works, Ltd., has removed to Union Place, Wells Street, W.1.

The head offices of the County of London Electric Supply Co., Ltd., and its associated companies, are now at County House, 46-47, New Broad Street, E.C.2.

Catalogues and Lists.

The Piggott Electrical Co., Ltd., 24, New Bridge Street, E.C.4.—A series of illustrated and priced pamphlets dealing with "Imperial" domestic appliances.

The Shipton Automatic Telephone System, Ltd., 37, Totthill Street, S.W.1.—A pamphlet advertising the company's automatic telephone service.

Messrs. Downes & Davies, 1 & 3, Stanley Street, Liverpool.—Folder giving illustrated and priced particulars of the "Palatine Luxray" lighting fittings.

Messrs. E. P. Allam & Co., Ltd., 107-109, Gray's Inn Road, W.C.2.—Monthly stock list of motors for sale and hire.

The Tungsram Electric Lamp Works (Great Britain), Ltd., 72, Oxford Street, W.1.—An illustrated price list of gas-filled and vacuum lamps of various types.

The Walters Manufacturing Co., Ltd., Kensal Road, W.10.—List No. 125, containing full details and prices of "Koda" active and inert batteries.

Messrs. Hopkinsons, Ltd., Britannia Works, Huddersfield. List No. 1870, describing the company's patent "Stamstel" steam valves. Illustrated.

Siemens & English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, E.C.4.—June price sheet of electrical materials, accessories, and appliances.

Messrs. Edward Holme & Co., Ltd., Moss Lane, Altrincham.—A well-illustrated catalogue of electrical control gear and contactor equipment for many purposes.

The Burovox Co., 48, Rupert Street, W.1.—Two illustrated pamphlets describing "Burovox" telephones for intercommunication purposes and for installation in automobiles.

Messrs. H. E. Ashdown (Birmingham), Ltd., Perry Barr, Birmingham.—A pamphlet (arranged for overprinting) illustrating and describing the company's shock-proof lampholders.

Messrs. Belbin & Bowden, Ltd., 3, Finsbury Square, E.C.2.—A price list of electrical accessories and appliances of all kinds.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—June stock list of motors and dynamos.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Pamphlet No. 667, containing illustrated descriptions of examples of the company's large metal-clad draw-out switchgear.

The Cook Electric Co., 2,700, Southport Avenue, Chicago.—An illustrated catalogue of telephone protectors, terminals and supplies.

British Insulated Cables, Ltd., Prescot, Lancs.—Lists Nos. P.213 and 215, illustrating and describing the "Prescot" and "Junior Prescot" ceiling fans respectively.

Mr. F. Tuckett, 87, The Grove, Broadway, Hammersmith, W.6.—A priced leaflet (No. 62) depicting examples of shades, standards, and other lighting fittings.

The Mullard Wireless Service Co., Ltd., Mullard House, Denmark Street, W.C.2.—Two illustrated and priced leaflets advertising examples of the company's valves and one dealing with fixed condensers and resistances.

The London Electrical Co., 1, Sherborne Lane, King William Street, E.C.4.—A net trade price list of electrical supplies; a price list of conduits and fittings; and a leaflet advertising fans, also priced.

The Universal Manufacturing Co., 7, St. George's Circus, S.E.1.—A price list of vacuum and gasfilled lamps and a card bearing examples of colours of the firm's opaque enamels.

Bankruptcy Proceedings.

S. B. Marshall (trading as the Pytram Manufacturing Co.), Dunbar Road, New Malden, Surrey, designer, manufacturer, &c.—Last day for receiving proofs for dividend, June 25th. Trustee, Mr. F. W. Davis, 28, Theobald's Road, W.C.1.

C. J. Nichols (trading as C. J. Nichols & Co.), 7, Park Street, Bridgend, Glam., electrical engineer.—First and final dividend of 2s. 9d. in the £, payable June 20th, at 26, Corporation Street, Birmingham.

Company Liquidation.

Holbrook's Electric Service Co., Ltd., electrical and wireless dealers, 1, Foster Lane, Cheapside, E.C.—A meeting of creditors was held on June 8th, at the offices of Messrs. Chantrey, Button & Co., 61-62, Lincoln's Inn Fields, W.C. Mr. J. Hamp reported that on May 18th last a resolution for voluntary liquidation was passed, and he was appointed liquidator. The statement of affairs which had been prepared showed ranking liabilities of £799, and net assets of £344, or a deficiency so far as the creditors were concerned of £455. The company was registered in 1924 with a nominal capital of £1,000; it was formed for the purpose of taking over a business which had previously been carried on by Messrs. A. E. Snelling and E. Morris for the sale of wireless and electrical fittings. The assets were paid for by a sum of £650 being handed to the vendors, who also subscribed £350 in cash for shares. Mr. J. R. Holbrook became managing director in May, 1924, but he resigned in April, 1926. During the year to April 30th, 1925, the sales were £3,498, and in the following year they fell to £2,628, and in the last twelve months to £2,244. The present position was probably due to the fact that the turnover had been insufficient to meet the expenses. Messrs. Snelling and Morris had advanced to the company sums totalling £264, in respect of which no interest had been paid. There were some inquiries for the business, and if it could be sold as a going concern, a good price might be obtained. If the business could not be sold as a going concern, Mr. Hamp hoped to be able to realise the assets and complete the winding up at an early date. A resolution was passed confirming the voluntary liquidation of the company, with Mr. Hamp as liquidator.

Private Arrangements.

A. H. Dickinson, trading as A. H. Dickinson & Sons, electrical and wireless dealers, &c., Tidworth, Salisbury, and Bulford Camp.—A meeting of creditors was held on June 9th, when the chair was occupied by Mr. W. H. Cork, 19, Eastcheap, E.C., who presented a statement of affairs which disclosed liabilities of £9,850, of which £4,600 was due to trade creditors; there were partly secured creditors for £6,500, who held security valued at £1,250, leaving £5,250 to rank as unsecured. There was also a fully-secured creditor for £2,050, who held security valued at £3,000, showing a surplus of £950. The assets were valued at £7,160, leaving a deficiency of £2,690. Mr. Cork stated that a conference of the principal creditors was held recently, when a resolution was passed to the effect that a deed of inspectorship and assignment should be executed to

him as trustee, with a committee of five of the principal creditors. The debtor started business about 26 years ago. He was successful until 1919, when the trade was adversely affected. A resolution was passed agreeing that a deed of inspectorship and assignment should be executed to Mr. Cork as trustee with a view to the payment of the liabilities in full. A committee of inspection was also appointed consisting of the representatives of Messrs. Brown Bros., Ltd., Colthurst & Harding, Ltd., Falk, Stadelmann & Co., Ltd., Osmond & Matthews, Ltd., and Mr. Hawkins, representing creditors. It was also decided that the business should be carried on for a period of six months on condition that Mrs. Dickinson gave an undertaking that any loss would be discharged by her. The following are creditors :—

	£		£
Barnes & Mullins ...	61	Fox & Co., Ltd., F. F....	26
Brown Brothers, Ltd. ...	336	Mullard Wireless Service Co., Ltd.	28
Brock, C. T., & Co. ...	103	Osmond & Matthews, Ltd.	261
Colthurst & Harding ...	262	Walter & Sons, J. ...	214
Dunn & Co., R.	74	Wholesale Fittings Co., Ltd.	90
Electric Heating Co. ...	28		
Eckart, Ltd., W. & R....	34		
Falk, Stadelmann & Co., Ltd.	230		

Dissolution of Partnership.

John Lightfoot, 94, Oxford Road, Manchester, electrical engineers.—Messrs. J. & R. G. Lightfoot have dissolved partnership. Mr. J. Lightfoot will attend to debts and continue the business.

Recent Contracts.

Following on the recent contracts placed by the Liverpool Corporation with the Metropolitan-Vickers Electrical Co., Ltd., for a second 25,000-kW turbo-alternator set for the Lister Drive No. 3 power station, two further important contracts, covering the transformers and switchgear for the extensions in Lister Drive power station and for the reconstruction of three sub-stations, have now been placed with the company. The transformer contract covers the supply of eight 10,000-kVA, 3-phase core-type units for new feeders from Lister Drive. Two of the units are designed for 6,300/33,000-V operation, and are duplicates of the six main transformers already installed. The other six units are for 6,300/22,000 V. The necessary extensions to the existing forced cooling and oil filtering equipments are included in the contract. Each phase of the transformer windings is enclosed within a supporting cage in which it can be removed from the core as a unit. The switchgear contract provides for a 19-cubicle extension to the 6,300-V switchboard in the Lister Drive power station, 49 6,300-V circuit-breakers for Lark Lane, Beaumaris Street, and Garston sub-stations, together with auxiliary switchgear and spares. The main power station switchgear is a two-floor masonry cubicle arrangement embodying metal-clad circuit-breakers of the fixed type, and the extension will be similar to the 36 cubicles already installed. The circuit-breakers each have a rupturing capacity of 750,000 kVA. The sub-station circuit-breakers are to be metal-clad draw-out units, with duplicate bus-bars, each unit having a breaking capacity of 250,000 kVA.

Among the orders recently given to Messrs. Bolckow, Vaughan & Co., Ltd., are two for tramway materials. The Manchester Corporation has ordered 1,000 tons of rails, and the Brisbane Tramways require 1,525 tons of rails and 90 tons of fishplates. In addition, an order for 10,000 tons of rails and 650 tons of fishplates has been received from the Buenos Aires Great Southern Railway.

W. T. Henley's Telegraph Works Co., Ltd., has received from the Eastern Telegraph Co., Ltd., an order which is said to be one of the most important of its kind placed in recent years. It is connected with the Eastern Co.'s institution of the regenerator system of working for long-distance traffic, and comprises the supply and laying of over 200 miles of armoured cable between Port Said and Suez. The work is expected to be completed within six months.

Food and Cookery Exhibition.

The 30th annual Food and Cookery Exhibition is to be held at the Holland Park Hall from November 15th to 24th next. Particulars can be obtained from the Westminster Advertising Service, Ltd., 26, Bedford Street, Strand, W.C.2.

Electrical Goods for India.

The *British Export Gazette* reports that while the business passing in India in textile machinery and industrial plant has been rather less active than usual during the past few months, electrical machinery of all kinds continues in demand. Among lines customarily handled by the mercantile community, sales of lighting accessories and fittings are on the up grade, and British goods are more than holding their own against German and American competition. Electro-medical apparatus, electric fans, and electric bells are other lines in which business is being done, and the electrical goods trade as a whole is more promising than ever before. Especially significant is the fact that many new power stations are being established throughout the country, and it will probably be some time before the requirements of the new consumers of light and power are satisfied with regard to fittings, &c.

Australia and German Contracts.

The Sydney *Sun* reports that Mr. Hume Cook, secretary of the Australian Industries Protection League, commenting upon the award of contracts to German firms for a dredger and locomotive for the Yallourn electricity works, by the Victorian Electricity Commission, said :—"These orders contribute still another shock to Australian sentiment. As far as I am aware, no inquiries were made in Australia as to whether the dredger or locomotive could be made in Australia. It is also probably correct to say that no inquiry was made in Britain. At the very moment when the people of Australia are filled with enthusiasm for the Empire, by reason of the Duke of York's visit, responsible State Ministers, without a single word of explanation, calmly approve of proposals which make public patriotism look as shoddy as their own."

In a statement issued by the Electricity Commission, as quoted by the Melbourne *Age*, it is said that three tenders were received for the supply of three electric locomotives, one British and two German. "The British tender was found to be 85 per cent. above the more acceptable of the other two, that of Messrs. Gollin & Co., agents for Messrs. Siemens-Schuckertwerke, at £11,793 c.i.f. and including spare parts."

Correction.

In the fan advertisement of the Edison Swan Electric Co., Ltd., which appeared in our issues of May 21st and June 4th, owing to a dropped figure in the advertisers' electro the wattage of fan No. H367 was shown as 5 watts instead of 45 watts.

The Norwegian Cable Industry.

The Norwegian Storting has decided to deprive the home cable manufacturing industry of the protection which it has enjoyed for two years past in the form of an import duty of 10 öre per kilogramme (100 kr. per ton) on lead-covered cables. The Skandinavisk Kabel Og Gummivare Fabrik, which appears to be the chief company concerned, has informed the Storting that as a consequence of the abandonment of the duties the company has been compelled to discontinue activity as the possibility of remunerative working no longer exists. The company further states that foreign dumping in the past few years has assumed such dimensions that even if the workmen and staff were to give their services free of charge, it could not exist without the duties. A total of 8,000,000 kr. has been invested in the undertaking, and one half is stated to have been lost, and it was intended to re-finance it on the basis of 4,000,000 kr.; the factory is a modern one and the production costs are now only slightly different from those of foreign works. During the years 1921-1926 the imports of lead-covered cables into Norway amounted to 36,000,000 kr., of which about 30,000,000 kr. applied to the years 1921-1924, before the Norwegian company had commenced working on any scale. It is further stated that the Association of Electricity Works is not opposed to a duty of 5 öre per kg., and that the imposition of the duty has not had the effect of increasing the prices of Norwegian cables.

Registered Electrical Contractors.

On June 10th the Executive Committee of the National Register of Electrical Installation Contractors accepted the following applications for registration :—

Higginbotham, A., & Sons, Idle, Bradford.
England, Robinson & Co., Ltd., Harrogate.
Binks, T., & Son, Washington Station, Co. Durham.
Pearce, T., Aylesbury.
Cantwell & Hedger, Broadstairs.
Fawcitt, J., & Co., Sunderland.
Myles & McCaffery, Blackpool.
Seddon, H., Blackpool.
Walker, E., Manchester.
Ollier, G., Blackpool.
Rose, E., Miles Platting, Manchester.
Hutchison, W. E., Cardiff.
Lewis & Hall, King's Heath, Birmingham.
Parker, C., Handsworth, Birmingham.
King, W. E., Rathmines, Dublin.
Keatinge & Gaule, Waterford.
Allen & Welsby, Walkden, nr. Manchester.
Robinson, W. G. M., Leicester.
Ward, G. L., & Co., Cardiff.
Kendal, J., Lomax & Co., Ltd., Manchester.

At the same meeting 10 applications were declined.

A German Amalgamation.

It is proposed to amalgamate the Continental Company for Electrical Undertakings and the Electricity Company (late Schuckert), both of Nuremberg. The former was originally formed by the latter as a financing company for its electrical undertakings to be established, at the time when the Schuckert Company was a manufacturing concern, that is to say, before its Nuremberg works were transferred to the Siemens-Schuckertwerke in 1903. As the losses caused by the war have greatly diminished the development possibilities of the Continental company, and its objects are now identical with those of its founder company, it is considered desirable for the latter to absorb the former.

Book Notices.

Tait's "Electrical Directory of Australia and New Zealand." Price 7s. 6d. Melbourne: Tait Publishing Co. Pty., Ltd.—The 1927 edition of this directory is the seventh issue, and is considerably larger than its predecessors. The particulars regarding all existing undertakings have been completely revised, and it is believed that every Government undertaking, municipal council, company or private concern distributing electricity or operating electric traction systems has been included. Certain new features have been added, including maps of the supply areas in the cities of Adelaide, Melbourne, and Sydney, and maps of the various Australian States and of the north and south islands of New Zealand, showing the principal electrically-supplied cities and towns and main transmission systems. There is also a complete schedule of the retail electricity supply tariffs of the State Electricity Commission of Victoria.

"Advertising, Printing and Art in Commerce," by J. F. Preston and E. Arch. Pp. xvi+301; figs. 196. London: Chapman & Hall, Ltd. Price 16s. net.

"Modern Steelwork, 1927: A Review of Current Practice in the Application of Structural Steelwork to Buildings and Bridges." Pp. 275, illustrated. London: Nash & Alexander, Ltd. Price 5s.

The McGraw-Hill Publishing Co., Ltd., has issued a revised edition of its list of books on metallurgy.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.	Price June 14th.	Fortnight's inc. or dec.
a Acid, Oxalic ... ... per lb.	5¾d.	...
a Ammoniac, Sal ... ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£13 10s.	...
a Sulphur, Commercial ... ... ,,	£9 10s.	...
a ,, Roll ... ... ,,	£9 10s.	...
a Soda, Chlorate ... ... per lb.	8½d to 8¾d.	...
a ,, Crystals ... ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots... ... ... per ton.	£107 to £112	...
b ,, Wire ... ... per lb.	1/6 to 2/-	...
b ,, Sheet ... ... ,,	1/8 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net.	£259	£3 inc.
Grade II ... ... ,, ,,	£180	£2 inc.
Grade III... ... ... ,, ,,	£93	...
Brass (rolled metal 2" to 12" basis) per lb.	9⅜d.	...
,, Tubes (solid drawn) ... ,,	11¼d. to 11⅝d.	...
,, Wire, basis ... ... ,,	9⅜d.	...
Copper Tubes (solid drawn) ... ,,	1/0½	...
,, Bars (best selected) ... per ton.	£86	...
,, Sheet ... ... ,,	£86	...
,, Rod ... ... ,,	£86	...
,, (Electrolytic) Bars ... ,,	£60 5s.	...
,, ,, Sheets ... ,,	£143 10s.	...
,, ,, Wire Rods ,,	£70 5s.	...
,, ,, H.C. Wire per lb.	8⅝d.	...
Ebonite Rod ... ... ,,	2/3 to 2/6	...
,, Sheet ... ... ,,	2/3 to 2/6	...
German Silver Wire ... ... ,,	2/2	...
Gutta-percha, fine ... ... ,,	8/-	...
India-rubber, Para fine ... ... ,,	1/5½	¾d. dec.
Iron Pig (Cleveland No. 3.) ... per ton.	75/-	...
,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
Lead, English pig ... ... ,,	£26	5/- inc.
Mercury ... ... per bot.	£20 15s. to £21 10s.	25/- to 35/- dec.
Mica (in original cases) small ... per lb.	3d. to 3/-	...
,, ,, medium ,,	4/- to 8/-	...
,, ,, large ... ,,	10/ to 20/- & up.	...
Phosphor Bronze, plain castings ,,	1/3½	...
,, ,, drawn bars & rods ,,	1/3	...
,, ,, rolled strip & sheet ,,	1/2½	...
,, ,, wire... ... ... ,,	1/3½	...
Platinum ... ... per oz.	£28	...
Silicium Bronze Wire ... ... per lb.	10½d.	...
Steel, Magnet, in bars ... ... ,,	7½d.	...
Tin, Block (English) ... ... per ton.	£292 to £292 10s.	£3 10s. inc.
,, Wire, Nos. 1 to 16 ... ... per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

G. Boor & Co.	g James & Shakespeare.
The British Aluminium Co., Ltd.	h Edward Till & Co.
Thos. Bolton & Sons, Ltd.	i Bolling & Lowe.
Frederick Smith & Co.	l Richard Johnson & Nephew, Ltd.
F. Wiggins & Sons.	n P. Ormiston & Sons.
India-Rubber, Gutta-Percha and Telegraph Works Co,. Ltd	o Johnson, Matthey & Co., Ltd.
W. F. Dennis & Co.	p C. Clifford & Son, Ltd.

Reporting on the lead market, under date June 11th, Messrs. ames Forster & Co. stated:—"The position on the whole oes not seem too adverse. The American market wears a etter tone, and had last week's improvement here been naintained, the price would undoubtedly have been advanced. ermany is consuming about 75 per cent. more lead than a ear ago, and consumption in France is improving. In this ountry demand is still only moderate, but, on the other hand, rrivals during the last six weeks have not been unduly heavy. he position is such that a moderate amount of extra buying y cable-makers would quickly put a different complexion on he market, particularly if, at the same time, there were igns (of which there are none at present) of any curtailent of production."

Social Event.

The eighth annual athletic sports meeting of the London establishments of the General Electric Co., Ltd., was held on June 11th at the company's sports ground at Wembley. The occasion was favoured by excellent weather, and there was a large attendance of friends to witness the keenly-contested events. The programme was a heavy one, including 38 events, and the number of entries was exceptionally large. The various events were run well to time, however, and the programme was carried through without a hitch. It is not possible to give all the events in detail, but the tug-of-war teams (ladies and gentlemen) deservedly attracted general attention, and the ultimate winners were enthusiastically cheered. The prizes were numerous and valuable, and included six handsome challenge cups. Mr. and Mrs. M. J. Railing were among the distinguished visitors, and Mrs. Railing kindly presented the prizes. There was a number of side-shows, and these were surrounded throughout the afternoon by the visitors. The weather, which threatened during the prize distribution to summarily end the proceedings, fortunately held up, and the day was concluded with dancing on the excellent turf. The music during the afternoon and for the dancing was rendered by the band of the 23rd London Regiment, under the direction of Mr. F. E. Poole. The sports officials are to be congratulated on the arrangements made.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during April last amounted to a value of £23,481, as compared with £30,312 in the April, 1926. The aggregate imports during the first four months of the current year are returned at £131,803, as compared with £159,499 in the corresponding period of last year.

Lighting and Power Notes.

Aldershot.—LOAN.—The Town Council has applied for sanction to a loan of £19,800 for mains, services, meters, and a new feeder.

Barnstaple.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £1,800 for providing and laying a feeder cable in High Street.

Burton-on-Trent.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to loans of £25,500 for mains and services, and £6,500 for plant.

Buxton.—HIRE-PURCHASE SCHEME.—The electrical engineer (Mr. A. Bishop) has submitted a scheme to the Borough Council for the hire and hire-purchase of domestic appliances, which has been approved, and the chairman and engineer have been authorised to expend up to £250 in the purchase of apparatus.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—In view of the increased demand for power at Port Arthur and Fort William, Ont., the Ontario Hydro-Electric Power Commission is planning to increase the generating capacity of its Nipigon system from 75,000 h.p. to 230,000 h.p. Work is now in progress for increasing the capacity of the development at Alexandra Landing by 55,000 h.p., and an additional 100,000 h.p. will be generated at Virgin Falls and Portage Island.

Tenders have been invited for building the highest-voltage power transmission line yet to be constructed in Canada. The tenders are for the construction of 200 miles of line from the Ontario side of the Ottawa River at Fitzroy Harbour to Toronto. This transmission line will carry power developed on the Gatineau River in Quebec to Toronto at a pressure of 220,000 V.

It is expected that shortly the Duke-Price Power Company will install the last two generators at its hydro-electric plant on the Saguenay River. The plant, which commenced to deliver power in 1925, now has ten generator units in operation with a capacity of 400,000 h.p. Already these units are fairly well loaded and they will be fully loaded when the Shawinigan Water and Power Company takes the 100,000 h.p. which it has contracted for. The Shawinigan Company is building a h.p. transmission line to Quebec, and it is expected that it will be completed by August. The load being carried by the Duke-Price plant has been steadily increasing during the past year due to industrial activity in the Saguenay district, particularly the operations of Price Brothers' pulp and paper mills, the Aluminium Corporation of Canada, and the Port Alfred Pulp and Paper Mills.

Chesterfield.—LOANS.—The Corporation Electricity Committee is applying for sanction to the borrowing of £1,360 for overhead cables to afford an electricity supply to the area of the Brampton and Walton Urban District Council.

Sanction has been obtained to a loan of £1,777 for a sub-station, transformer kiosks and equipment.

Continental.—Latvia.—A recently-issued report of the Department of Overseas Trade on the economic and industrial conditions in Latvia (H.M. Stationery Office, 9d. net) states that the electrification schemes which were the subject of so much discussion a few years ago have made no progress, and although they have not been finally abandoned, they will have to remain in abeyance until general conditions become more satisfactory.

Italy.—The Crown Prince Umberto on June 9th inaugurated the large hydro-electric power station at Mese, which, it is estimated, will have an output of 700,000,000 kWh per annum.—*Reuter* (Sondrio).

Dartford.—Electricity in Bulk.—Recently the Urban District Council approved a recommendation of the Electricity Committee for carrying out proposed plant extensions in order to meet the increased demand on the undertaking, and authorised application for sanction to a loan of £33,480. The Electricity Commissioners have intimated that any loan granted for plant extensions would have to be paid within a period of 10 years. The Committee has considered the comparative annual costs of local generation and obtaining a bulk supply on terms quoted by the West Kent Electric Co., Ltd., and finds that it would be more economical to purchase electricity in bulk than lay out capital expenditure repayable within such a short period, and has therefore recommended that a bulk supply be obtained from the company.

New Plant.—The Committee has also recommended extensions of the converting plant at an estimated cost of £3,750.

Dover.—Supply to Corporation Engineers.—The Electricity Committee has recommended that the borough electrical engineer be required in future to pay for all electricity consumed by him for cooking and heating purposes, and that a previous resolution sanctioning a supply to the power station superintendent and the mains superintendent at 2½d. per kWh be rescinded.

Gravesend.—Change-over.—At a recent meeting of the Corporation Electricity Committee, the town clerk reported that the consent of the Electricity Commissioners had been received to the alteration in the system of supply from 3-wire, d.c., at 460 V and 230 V, to 3-phase, 4-wire, a.c. at a frequency of 50 cycles, and pressures of 400 V and 230 V.

Loan Sanctioned.—Sanction has been received to a loan of £12,647 for boiler plant extensions, &c.

Harrogate.—Inquiry.—An inquiry was held by Col. T. C. Ekin, on behalf of the Electricity Commissioners, at the Royal Spa Rooms on June 8th and 9th, into conflicting applications for Special Orders. The applicants were Mr. R. F. Winder, in respect of an area of a mile and a half from St. James's Church to Boroughbridge; the Electrical Distribution of Yorkshire, Ltd., in respect of Ripon, the rural districts of Ripon, Knaresborough, Great Ouseburn, and part of the rural district of Thirsk; the Harrogate Corporation, in respect of parts of the rural district of Knaresborough; and the Ripon Corporation, in respect of the city of Ripon and the rural district of Ripon less the parish of Sawley. For the company it was stated that it obtained its supply from the Yorkshire Electric Power Co., at a very low rate, and that so far as Ripon was concerned it would be a costly operation to start an organisation, while the Harrogate proposal was unsatisfactory. In support of the Harrogate Corporation's application it was contended that it could supply electricity at as low a rate as any town in England. The Corporation was prepared to change over the system of supply from single- to three-phase a.c., the cost being estimated at £12,000. The Ripon City Council stated that it had provisionally agreed to take a bulk supply from Harrogate. The maximum price scheduled in the Ripon Order was 8d. per kWh, as compared with 10d. in the company's Order. The estimated cost of laying a cable from the northernmost point of the company's system was £18,000. For Mr. Winder, it was stated that plant was already installed at his mill at Boroughbridge, and he was supplying to people in the town. The Commissioners will give their decision in due course.

Hove.—Electricity Extensions.—The borough electrical engineer has submitted a report to the Electricity Committee on extensions to meet the increased demand for electricity in the Aldrington area. He recommends the laying of four feeder cables at a total estimated cost, including additional switchboard panels in the sub-station, of £3,830. The Committee has recommended to the Town Council that application be made for sanction to the borrowing of this sum for the purposes stated.

Irish Free State.—Dublin.—The City Commissioners have issued a report on recent developments of the electricity undertaking. The report states that during the six years from April 1st, 1920, to March 31st, 1926, a sum of approximately £300,000, which resulted from the working of the electricity department, was re-invested in electricity development work. In addition to this, the gross indebtedness of the undertaking was written down from £559,706 to £429,945. During this period the business done was more than doubled, and the energy sold increased from 10,527,000 to 22,000,000 kWh. The G.N.R. and the Dublin Port and Docks Board closed down their generating stations, and contracted with the Corporation for their full supply of electricity. All the new factories and works which started in Dublin also took their power from the city works. Supplemental supplies were also given to Rathmines and Pembroke electricity works, and a larger turn-over from private power plants to the city supply was secured. The revenue of the Department for the year ended March 31st, 1927, was approximately £320,000, exclusive of meter rents, and the surplus is estimated at £55,000, before making provision for reserve, renewals, or contributions to rates. There were no very abnormal items, with the exception of the large excess expenditure on coal due to the coal dispute, amounting to over £50,000. Some £100,000 has been expended since April 1st, 1926, and it is estimated that a further £200,000 may be expended by the end of the current year. Reductions in the charges for electricity are proposed, amounting in the aggregate to, approximately, 25 per cent.

The Free State Ministry of Industry and Commerce has sanctioned the extension of the Pigeon House power station by the addition of another turbine at a cost of £41,000.

Limerick.—The draft agreement in connection with the supplemental supply of electricity by Siemens Bau Union to the Corporation, has now been submitted for consideration. The terms of the draft agreement will come before the Electric Lighting Committee without delay. The cost for making provision for the additional supply is estimated at £25,000, for which a loan will be obtained.

Keighley.—Loan.—The Corporation Electricity Committee recommends the Council to make application for sanction to borrow £90,000 to cover expenditure during the next two years in connection with the electricity undertaking. The items include mains and services, £50,000; main transmission lines, £7,000; transformers and motor, £6,000; sub-stations and equipment, £12,000; erection and furnishing of new showrooms, £5,000; cookers, radiators, &c., for hire, £6,000; and street lighting, £4,000.

Kendal.—Electricity Supply.—The Town Council has decided to make its own arrangements for the supply of electricity for the next few years until a national supply becomes available. This decision has been arrived at after consultation with the Electricity Commissioners, and after consideration of the possibility of obtaining a supply of electricity in bulk.

Leyton.—Loan Sanctioned.—The Town Council has received sanction to a loan of £9,000 for mains and services.

London.—Woolwich.—The Town Council has accepted the estimate of the Electricity Committee for the electrical equipment of 360 new houses which are to be "all-electric," the necessary fittings to be installed at a cost of £7,826.

Southwark.—The *Financial News* reports that the Electricity Commissioners have refused the Borough Council permission to incur an expenditure of £37,500 in developing its electricity undertaking. At the recent inquiry it was contended by the County of London Electricity Supply Co., as ratepayers, and the London Power Co. that a bulk supply would be more economical and a substantial saving to the ratepayers. It was pointed out that the Council's electricity undertaking was a paying concern, but there was a heavy loan, which would be paid off by 1942. The power station was originally built by the Newington Vestry, and supplies power and electricity to only a portion of the borough. Before the formation of the Borough Council, authority was obtained by four companies to supply electricity, and at the inquiry it was contended by them that they were able to meet the increasing needs of the district. The Electricity Committee has decided to ask the Council to consider the position.

Bermondsey.—The borough electrical engineer, reporting on the development of the electricity undertaking since its inception 25 years ago, states that the station was opened in January, 1902, the generating plant consisting of three steam-driven dynamos with a total capacity of 375 kW. The generating and converting plant now amounts to 8,500 kW. The feeders have a total length of 14¼ miles, and the length of distribution cables is now 87 miles. There are also five miles of e.h.p. cables. There is a steady demand for electrical energy for industrial purposes, and at present, 60 per cent. of the energy sold is consumed in factories, &c. The Council some few years ago instituted a free wiring scheme, and 3,500 houses have been connected to the mains under this scheme. The capital expenditure on the electricity undertaking now approaches £500,000. Owing to the limitations of space and unsuitability of the site of the electricity works, the later extensions to the plant have been machinery at the sub-stations at Bermondsey and Rotherhithe for transforming and converting electricity purchased in bulk. The Council will shortly have to make provision for further extensions of plant, which will be machinery of this nature.

Northern Ireland.—Ballycastle (Co. Antrim).—The Urban District Council has referred to the Electricity Commissioners for Northern Ireland the question of the proposed purchase of the electricity works, the local company having refused an offer of £4,024.

Lurgan (Co. Armagh).—The new municipal electricity scheme is nearing completion, and it is expected that an electricity supply will be available before the end of this month. Over 100 consumers have already registered.

Belfast.—We have received from Mr. Johnstone Wright, city electrical engineer and general manager, a copy of his last report on the working of the Corporation electricity undertaking covering the year ended March 31st last. The total revenue amounted to £379,683, as compared with £355,753 in the preceding year. The cost of production was £183,079, as against £144,467. This increase was wholly accounted for by the

abnormal conditions prevailing, the extra cost arising from the coal dispute being £41,794. The gross profit was therefore £196,604 (£211,256), and after meeting capital charges and sundry items, there was a net surplus of £46,422, as compared with £62,402 in 1925-26. The supply to the shipyards fell considerably, owing to bad trade aggravated by the coal dispute, but this was largely counterbalanced by a record increase in the general lighting and power supply, and the sales of electricity therefore only showed a slight decrease, from 45,086,797 to 44,755,828 kWh. In connection with the extension of the Harbour power station, considerable progress has been made, and the piling and foundation contract will be completed shortly. An 18,750-kW turbo-alternator, complete with condenser and auxiliaries, has been placed on order. This extension is timed to be ready for service during the winter of 1928-29.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

BATLEY.—The increase of 5 per cent., imposed owing to the coal dispute, has been removed.

DEWSBURY.—The increases of 5 per cent. in the charges for lighting and 15 per cent. for power and heating, made owing to the coal strike, have been removed.

EGHAM AND STAINES.—*The Egham and Staines Electricity Co., Ltd.*—Lighting: From 9d. to 7½d. per kWh.

SWANSEA.—The Corporation Electricity Committee has decided to revert to the charges in operation prior to the coal dispute.

Spalding.—ELECTRICITY CHARGES.—The Urban District Council, which will commence a supply of electricity on September 1st next, has decided to reduce the provisional charges from 9d. to 8d. per kWh for lighting, and from 4d. to 3d. per kWh for power, subject to the following discounts:—100 kWh, ½ per cent.; 200 kWh, 5 per cent.; 300 kWh, 7½ per cent.; 400 kWh, 10 per cent.; 500 kWh, 12½ per cent.; 600 kWh, 15 per cent.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them granted to the Urban District Council of Criccieth for the supply of electricity by the Electricity Distribution of North Wales and District, Ltd., in the urban district, and the Urban District Council of Bridgend to supply in the rural district of Penybont.

Stoke-on-Trent. — LOAN SANCTIONED. — The Corporation Electricity Committee has received sanction to the borrowing of £25,700 for mains and sub-station equipment.

Sunderland.—NEW SUB-STATIONS.—The Corporation has decided to erect two new sub-stations, with mains, one in Adelaide Place at a total estimated cost of £3,615, and the other in Newcastle Road, on a new housing estate, at a total estimated cost of £7,430. A site for another sub-station near the Empire Theatre has been purchased for £450.

INAUGURATION OF NEW PLANT.—In connection with the new plant recently installed by the Corporation electricity works in Hylton Road, it is proposed to invite Sir John Snell to perform the opening ceremony.

Tilbury.—LOANS SANCTIONED.—The Urban District Council has received sanction to a loan of £32,000 for mains and services and £1,960 for plant in connection with the electricity scheme.

Torquay.—LOAN.—The Town Council has applied for sanction to a loan of £20,860 for extensions to the power station at Newton Abbot.

West Penwith.—ELECTRICITY SUPPLY.—The general manager of the West Cornwall Electricity Supply Co., Ltd., Mr. L. A. Hards, appeared before the Rural District Council at Penzance on June 2nd, to obtain the Council's support to the Special Order for which his company has made application. The clerk mentioned that the Council had entered a protest against the use of overhead lines, and against the proposed charge of 1s. per kWh. Mr. Hards said the company was extending its system in a number of directions, and intended to lay approximately 28 miles of h.p. mains this summer, and was practically doubling its station plant at Hayle. With regard to the rate of 1s. per kWh, it was impossible in such scattered rural areas as West Penwith to supply electricity at a lower rate at present. Before the company could erect overhead lines it had to obtain the consent of owners and local authorities and the approval of the Electricity Commissioners. It preferred to lay mains underground, but it was a question of the cost of distribution. The clerk stated that the Special Order was in respect of Sancreed, Sennen, St. Buryan, Gulval, St. Hilary, Marazion, Lelant, Morvah, Towednack, Zennor, &c. The Council gave its consent to the whole of the company's requests.

Wigan.—ELECTRICITY SUPPLY.—The Corporation has approved electricity mains extension to Gidlow, involving the following expenditure:—Sub-station building, £250; e.h.p. mains, £1,027; l.p. main link, £434; l.p. mains on housing estate, £1,024; transformer, £375; switchgear, £550; transformer kiosk, £250; total, £3,910. The whole of the western district is to be changed over to a.c.

The Electricity Department is negotiating with the Orrell and Billinge Councils with a view to giving a supply of electricity in these districts.

Wimbledon.—LOANS.—The Town Council is applying for sanction to the borrowing of £28,000 for new transformer stations and extensions to existing sub-stations as required, £10,000 for the purchase of domestic appliances, and £2,568 to cover expenditure already incurred in the purchase of appliances.

Tramway and Railway Notes.

Continental.—SWITZERLAND.—The first of a new type of electric locomotive for the Swiss Federal Railways has recently been completed at the works of the Brown-Boveri Co., at Munchenstein. It is one of sixteen which are being built by the firm in conjunction with the Winterthur Locomotive and Engineering Works. The engine, which is known as the 2-D-1 type, comprises a four-wheel bogie at the front, eight centrally-located wheels, each pair being independently driven by electric motors of a total capacity of 3,100 h.p., and a single pair of wheels at the rear. On its trials on the line between Berne and Munsingen a maximum speed of over 73 m.p.h. is stated to have been attained.

Some interesting figures have been issued by the directors of the Rathischen railway, whose system is about 173 miles in length, and which has been electrified since 1922. It is stated that the adoption of electric traction has enabled a reduction of 52 per cent. to be made in the engineering staff at the workshops for the maintenance of the electric locomotives, while there has been a reduction of 48 per cent. in the track maintenance department and of 43.5 per cent. in the service personnel. As compared with steam traction it is estimated that 20,000 tons of coal are being saved each year, and that despite a considerable increase in the price of coal, electric traction is still proving more economical than steam.

The recently-completed electrified section of the Swiss Federal railways between Winterthur and Rorshach, a distance of about 44½ miles, is being supplied with electricity from the power station at Amsteg by means of open air transformer stations at Steinen and Gossau, each of which is equipped with three 3,000-kVA, 66,000-15,000-V transformers. For the supply of power to the 32-mile section between Romont, Freiburg and Berne, the power will be supplied from an outdoor transformer station near the railway station at Freiburg, this being also equipped with three 3,000-kVA transformers.

Glasgow.—INCREASED REVENUE.—The revenue of the Corporation tramway undertaking during the past year amounted to £2,340,836, an increase of approximately £82,000. The number of passengers carried decreased by 5,500,000, but since the introduction of a maximum fare of 2d. the revenue has steadily improved.

FARES.—At a recent meeting of the Corporation it was decided to reintroduce the halfpenny fare, which will be brought into operation almost immediately.

Japan.—OSAKA.—The Government has authorised the Municipality of Osaka to construct 35½ miles of underground railway, at a cost of 162,000,000 yen.—*Reuter* (Tokio).

Lincoln.—YEAR'S WORKING.—The loss on the Corporation tramway last year was £1,642, and the Corporation will shortly be called upon to decide whether the system shall be abandoned in favour of omnibuses, which made a net profit of £1.766 during the last 12 months.

Walsall.—PROPOSED TRAMWAY PURCHASE.—The *Electric Railway and Tramway Journal* states that it is understood that the Corporation is negotiating for the acquisition from the South Staffordshire Electric Tramways Co. of the tramways outside the borough connecting Walsall with Wednesbury and Darlaston, and also the tramway between Wednesbury and Darlaston. At present the Corporation has a joint service over the company's lines to and from Wednesbury and Darlaston, but the route between these two towns in operated solely by the company. Some time ago Walsall took over from the company the tramway between Willenhall and Darlaston, and recently Wolverhampton came to terms for the purchase from the same company of the tramway lines between Wolverhampton, Bilston, and Darlaston, Bilston and Willenhall, Bilston and Sedgeley, and Bilston and Bradley, a total length of 12 miles. Further progress with the Wolverhampton scheme is being held up by the failure of the Corporation to secure the necessary consent from the Bilston Council. It is stated, however, that the intention of Wolverhampton is to run railless cars on all these routes when the present deadlock is removed. Should Bilston maintain its present attitude the Wolverhampton Corporation would have no option but to seek Parliamentary powers. It is hoped that as a result of the gradual municipalisation of road transport services of the Black Country it will be possible eventually to arrange for through running between all the important towns.

Telegraph and Telephone Notes.

Australia.—TELEPHONE SERVICE.—There are now 436,000 telephone subscribers in Australia, according to figures made available recently by the Director of Postal Services (Mr. H. P. Brown). According to the *Sydney Morning Herald*, in March, 1927, 5,719 new subscribers were supplied with telephones, a record for any one month in the history of the Commonwealth. The number of persons who applied for telephones but had not yet been connected was 6,310.

Cable Communication between Canada and Australia.—A *Reuter* message from Victoria, B.C., states that the cable ship *Restorer* sailed on June 10th with 70 miles of cable to complete the link of the second Allied cable connecting Canada with the Antipodes. The Canadian Pacific telegraphs will link up the cable with the newly-completed copper line between Vancouver and Halifax, Nova Scotia, approximately 3,400 miles in length, thus completing duplicate cable communication between Australia and England.

Glasgow.—WIRELESS IN LIGHTHOUSES.—It was reported at a meeting of the Clyde Lighthouses Trust that wireless telephonic communication between Cumbrae and Toward was now in working order. The licence of the Postmaster-General was limited to sending and receiving messages on the private business of the Lighthouses Trust, but the clerk was instructed to communicate with the Postmaster-General with a view to having the licence extended to include helping both shipowners and mariners in reporting the arrival of vessels, and also in communicating with steamers during fog, and giving them directions. It was stated that, owing to an invention by Mr. D. Alan Stevenson with synchronised clocks, the installation would be under the estimated cost of £700.

United States.—NEW RADIOGRAM RELAY STATION.—That history repeats itself is once again emphasised by the fact that two decades ago Marconi chose the Newfoundland coast as the best site for the reception of signals originating in England; more recently, transoceanic traffic has been handled from the north shore of Long Island, far to the south. Hence the Belfast, Maine, receiving station of the Radio Corporation of America marks the return of transoceanic radio reception to the north-eastern coast of America. It appears that extensive tests proved that the reception of European signals was much better at Belfast than at Riverhead, on Long Island, where the main receiving station is located. A survey of thunderstorms during the past decade by the United States Weather Bureau indicates that there are twice as many thunderstorms at Riverhead as at Belfast, and so the reception at the former point is more affected; also, while Belfast is nearly north of Riverhead, it lies almost directly on the great circle route from Riverhead to Europe, and is 300 miles nearer the distant transmitters than is Riverhead; for this reason the European radio signals are at least 30 per cent. stronger at Belfast. The new station at present houses 12 complete long-wave receiving sets, operating on wave-lengths from 8,000 to 23,000 metres, in addition to battery and motor-generator equipment, oil heating and steam plant, and has its own water supply. The function of the new station is to pick up radio-telegraph signals from European stations on a uni-directional triple antenna, consisting of three antennas, each nine miles long and spaced six miles apart throughout their parallel spans. It is highly directional, covering only a small angle and capable of receiving signals from Norway to the north and sweeping down to Italy on the south. It is the invention of Mr. H. H. Beverage, and is only 20 feet high itself, strung along on poles very much after the fashion of a rural telephone line. A multiplicity of receiving sets are worked on one Beverage wave antenna, each set being provided with a wave trap and filters so that signals from the desired transmitter are taken off the antenna and then built up by radio-frequency amplification for subsequent detection and audio amplification, and are automatically relayed over leased telegraph lines to the central office in New York City, where they are automatically recorded on high-speed recorders, while the inked paper tape with its wave-line passes by the operator seated before a typewriter on which the dots and dashes are transcribed into complete radiograms.

Radio Notes.

Belgium.—NEW BROADCASTING COMPANY.—The *Financial News* reports that there is a proposal to form a national broadcasting company in Belgium, with a capital of three million francs, to continue for ten years, with the right to extension for a further five years. The present company's equipment and clientele would be taken over, and the State would be interested to the extent of 60 per cent. of the receipts. The board of directors is to consist of 11 members, of whom the Minister of Posts and Telegraphs will appoint the chairman and five other members, and the rest will be appointed by the general meeting. The State will reserve the right to use all the company's equipment for communications of public interest.

Canada.—LICENCES.—Wireless receiving licence revenue in Canada during the 11 months ended February last totalled 207,328 dollars at one dollar each, an increase of 77,462 dollars over the revenue during the corresponding 11 months of the previous fiscal year. Ontario led the provinces in the number of licences issued with 97,851.—*Reuter* (Ottawa).

NEW STATION.—The Winnipeg Grain Exchange will this summer operate a 500-watt broadcasting station, to be erected at a cost of 25,000 dollars; its call letters will be "CJCW."—*Reuter* (Winnipeg).

Colombia.—NEW BROADCASTING STATION.—The Government has concluded a contract with a foreign corporation for the installation of a complete broadcasting station, with a range of 300 km., at Bogotà. The international call letters assigned are HJH-HKZ. The recently completed stations at Caracas (Venezuela) and Balbóa (Panamá) are expected to make the development of radio easier for Colombia. A wireless telegraphic station will also be installed, establishing communication with the remotest provinces.—*Reuter's Trade Service* (Bogotá).

Short-wave Experiments.—RECEPTION TESTS.—During two recent week-ends 24-hour broadcasting tests were carried out by the two short-wave "annexes" to the American station at Schenectady (WGY) uninterruptedly: 2XAF used 32.77 metres and 2XAD 26.8 metres in order to enable distant reception effects to be observed. According to the wireless correspondent of the London *Evening News*, the charts drawn by B.B.C. engineers to illustrate the reception in England of those test transmissions are not encouraging to those who believe in the immediate establishment of world-wide relaying of programmes. Throughout the whole 48 hours of the tests engineers were listening at the B.B.C.'s listening-post at Keston, using special short-wave super-heterodyne sets, and from about 10 p.m. till 4 a.m. the signals were at their best, strong and clear enough to be successfully relayed, there being during this period practically no difference between the 32-metre, 26-metre, and 22-metre wave-lengths. At other times, except for short "freak patches," signals were weak, badly distorted and subject to violent fading.

Teaching by Wireless.—That 372 new schools had come on the B.B.C. register this term, and that there were 3,000 schools now in wireless communication with London and Daventry, was the statement made by Mr. J. C. Stobart (B.B.C. Director of Education) on Saturday at a distribution of prizes at the B.B.C. Studio, Savoy Hill, to 19 children successful in examinations dictated by wireless. Captain Ian Fraser, M.P., made the distribution, and said that though, perhaps, the schools would not be superseded in the future, there could be no doubt that teaching by wireless would be of great value to education. The service had gone beyond the experimental stage. Captain Revel, the headmaster of an elementary school, said Captain Fraser had been instrumental in providing more than 3,000 free licences for blind hearers.—*Daily Telegraph.*

The Eclipse of the Sun.—RADIO TESTS.—The British Broadcasting Corporation's stations at London, Daventry, Manchester, Birmingham, and Newcastle-upon-Tyne are to assist observers of the sun during its eclipse on the morning of June 29th. They will transmit a programme of time signals in accordance with the suggestions of the Astronomer-Royal; Mr. F. Hope-Jones is the B.B.C.'s time expert. They will also radiate for the benefit of observers who will attempt to ascertain the effect of the eclipse on radio transmission itself a continuous wave, unmodulated, but swinging continually over a wave-band 10 metres broad, 5 metres on each side of the station's normal wave-length, not merely on June 29th, but in the early mornings of June 27th, 28th, and 30th, and July 1st. This wave will only be interrupted by the time signals. As for short-wave tests during the eclipse, transmissions are being arranged by the Radio Research Board in conjunction with the Radio Society of Great Britain on 90 metres, 45 metres, and 22 metres.

Turkey.—NEW STATION.—At present there is only one station at Osmanié, 16 miles outside Constantinople, which has a wave-length of 1,200 metres; its call is "Radio Stamboul." On June 15th, however, a new station, which has cost over £100,000, was to be opened at Angora, and, says *The Times*, will be the most powerful in the Near East. The control of wireless telegraphy in Turkey is in the hands of a limited company in which the Post Office, the official Anatolian News Agency, and the Banque d'Affaires are interested. Any one can purchase a licence by paying £T14 (30s.), and a heavy fine is imposed on persons who listen without possessing a licence.

Wave-lengths Abandoned. — KILOCYCLE NOTATION. — The British Broadcasting Corporation proposes to adopt forthwith the principle of stating the kilocycle figure instead of the wave-length for all stations. This means that the measurements will be stated in terms of frequency. Support for this step is furnished by the fact by the Union Internationale de Radiophonie, Geneva, has throughout based its system of measurement on frequencies and not on wave-lengths.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Adwick-le-Street.—June 21st. Urban District Council. Cables, boxes, pillars, &c. (June 10th.)

Australia.—MELBOURNE.—August 15th. Postmaster-General's Department. One 55-ton 3-motor-type electrically operated overhead travelling crane. (A.X. 4727.)*

August 16th. Automatic telephone exchange equipment. (B.X. 3566.)

November 14th. State Electricity Commission of Victoria. Two 10,000-kW back-pressure turbo-generators and accessory plant.

SYDNEY.—July 18th. Municipal Council. Boiler-house equipment for the Bunnerong power station. (B.X. 3531.)*

August 15th. Generator neutral earthing resistance. (B.X. 3550.)*

Cheadle and Gatley.—June 28th. Electricity Department. Static transformer, e.h.p. switch cubicle, and transformer switch and distributor kiosk. (June 10th.)

Dundee.—June 24th. Electricity Department. Three 200-kVA outdoor-type transformers and two sets of 750-kW rotary convertors. (June 10th.)

Egypt.—Egyptian State Railways, Telegraphs and Telephones. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, S.W.1. Telegraph and telephone materials; wire, porcelain insulators, enamelled cable, copper binders and tapes, £E4,000 to £E4,300.

Halifax.—June 25th. T.C. Wiring 118 houses, Albert Road, for electric light; borough engineer. (Returnable deposit of £2 2s.)

Harrogate. — June 27th. Electricity Department. Transformers, meters, house-service fuse boxes. (See this issue.)

Hazel Grove and Bramhall.—June 28th. Urban District Council. 2,800 yd. .06 3-phase, 6,600-V cables, including laying and accessories. (See this issue.)

Inverness.—June 18th. Town Council. Electric lighting work at 30 blocks of houses. Schedules from Mr. J. Hinton Gall, Lombard Street, and Mr. John G. Chisholm, Union Street, Inverness.

Kirkcaldy.—July 2nd. Electricity Department. L.p. a.c. distribution, l.p. and e.h.p. cables, boxes, and roadwork. (June 10th.)

London.—STEPNEY.—July 11th. Electricity Supply Department. Boilers and boiler-house accessories, turbo-alternator, condenser, accessories, and switchgear. (June 3rd.)

METROPOLITAN WATER BOARD. June 23rd. Six and twelve months' supply of electric lamps. Chief Engineer, 173, Rosebery Avenue, E.C.1.

LEWISHAM.—July 4th. Board of Guardians. Steam and electric steriliser plant for the operating theatre. Mr. G. W. Martin, consulting engineer, 33, Arran Road, Catford, S.E.

Manchester.—June 21st. Electricity Committee. Twelve months' supply of time switches. Mr. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall.

New Zealand.—WELLINGTON.—August 9th. Public Works Department. 1,500 suspension insulator strings and 470 strain insulator strings. (B.X. 3533.)*

Nottingham. — June 21st. Electricity Department. General stores for 12 months. (June 3rd.)

Smethwick.—June 25th. Smethwick and Oldbury Joint Hospital Committee. Electric lighting installation at the Holly Lane Hospital. Mr. F. Chapman, clerk.

South Africa.—CAPE TOWN.—June 30th. South African Railways and Harbours Board. Gasfilled and vacuum lamps for 12 months. (B.X. 3518.)* Telegraph material. (B.X. 3519.)*

Southend-on-Sea.—July 6th. Light Railways and Electricity Department. L.p. and e.h.p. cables for 12 months. (June 3rd.)

July 5th. 3,000 meter boards. (See this issue.)

Whitehaven.—July 1st. Rural District Council. Laying two miles of overhead cable and erection of fittings, &c., in connection with the electric lighting of streets at Moresby Park Village. Mr. W. J. Goode, engineer and surveyor, Union Hall, Whitehaven.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bradford.—Electricity Committee. Accepted:—

Erection of steel chimney.—Newton Chambers & Co., Ltd.

Switchgear for Low Estate sub-station and Haworth Road, Toller Lane, Ormond Road, and Great Horton Road transformer chambers.—A. Reyrolle & Co., Ltd.

Buxton.—Borough Council. Accepted:—

Diesel engine and gas engine oil for the electricity works for the ensuing twelve months.—C. C. Wakefield, Ltd.

Chesterfield.—Electricity Committee. Accepted:—

100-kVA transformer (£127).—Hackbridge Electric Construction Co., Ltd.

Tramways Committee. Accepted:—

Two reduction gears, shafting, &c., for the Thronfield depôt (£134).—Crofts (Engineers), Ltd.

Dartford.—Electricity Committee. Recommended:—

Supplying and laying 1,062 yd. of cable from electricity works to West Hill (£1,092).—Johnson & Phillips, Ltd.

Dewsbury.—Town Council. Accepted:—

4,500 yd. cable (£1,207).—Deutsche Kabelwerke A.G.

Douglas (I.o.M.).—Electricity Committee. Accepted:—

One h.p. truck-type switchboard to control one 50-kW and one 500-kW motor-alternators and one h.p. feeder, as well as l.p. panels (£1,439).—Kartret Switchgear Co., Ltd.

Mercury rectifier and equipment for sub-station (£3,415).—Hewittic Electric Co., Ltd.

Motor alternators (£2,345).—Electric Construction Co., Ltd.

Dumfries.—Dumfries and Galloway Joint Sanatorium Board. Accepted:—

Extension and repair of the existing fire alarm and telephone installation at the Sanatorium and Lochmaben Combination Hospital (£295).—A. Baird & Sons.

Glasgow.—Electricity Committee. Recommended:—

Cables, &c., for 1927-28:—

Telephone cables.—Callender's Cable and Construction Co., Ltd.

L.p. cables.—Enfield Cable Works, Ltd.; W. T. Glover and Co., Ltd.; Callender's Cable and Construction Co., Ltd.

H.p. cables.—Callender's Cable and Construction Co., Ltd.; W. T. Glover & Co., Ltd.

Rubber-insulated cables.—Craigpark Cable Co., Ltd.

Flexibles.—Craigpark Cable Co., Ltd.

Meters.—Chamberlain & Hookham, Ltd.; Edison Swan Electric Co., Ltd.; Ferranti, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.

Arc lamp carbons.—General Electric Co., Ltd.

Cast-iron boxes, section pillars, &c.—Carron Company; Falkirk Iron Co., Ltd.; Lion Foundry Co.; McDowall, Steven & Co., Ltd.; Walter Macfarlane and Co., Ltd.; Sykes & Dyson, Ltd.; Robert Taylor and Co., Ltd.

Malleable iron tube and fittings.—Stewarts & Lloyds, Ltd.

Cleansing Committee. Recommended:—

Construction of the garage for electric vehicles at the new refuse destructor works, Govan (£12,627).—Melville, Dundas & Whitson.

Tramways Committee. Recommended:—

Lead-covered cable.—Standard Telephones and Cables, Ltd.

Welding plant.—British Brown, Boveri, Ltd.

India.—BOMBAY.—Corporation Standing Committee. Accepted:—

Electric lamps.—Allen Electric Co.; Spence & Co., Ltd.; Turner, Hoare & Co., Ltd.

Electric accessories.—Allen Electric Co.; Greaves, Cotton and Co., Ltd.

Liverpool.—Tramways and Electric Power and Lighting Committee. Recommended:—

Special steelwork for tramway junctions (£2,538).—Titan Trackwork Co., Ltd.

Repairs to four Worthington cooling towers at Lister Drive power station (£5,180).—W. Griffiths, Sons and Cromwell, Ltd.

London.—Admiralty. Accepted:—
Rotary switches.—Edison Swan Electric Co., Ltd.

Portrush.—Urban District Council.
Repair and extension of the battery of the electric supply works:—
Premier Accumulator Co. (1921), Ltd., less allowance for old material £505
Tudor Accumulator Co., Ltd., less allowance for old material £490
Forshaw & Bradshaw, less allowance for old material £470
T. May. (Accepted.) **£461**
—*Irish Builder and Engineer.*

Seaham.—Durham County Council. Accepted:—
Installation of electric light at Seaham Hall (£351).—Reid, Ferens & Co.

Southport.—Electricity Committee. Accepted:—
One 150,000-gallon-per-hour water-cooling tower (£2,465).—Peter Brotherhood, Ltd.
One 7,000-kW turbo-alternator and accessories (£22,700).—Brush Electrical Engineering Co., Ltd.

Stevenage.—Urban Council. Accepted:—
Supply of electrical plant and a motor for the sewage disposal works pumping plant (£127).—Electric Light and Power Co., Ltd.

Swansea.—Electricity Committee. Accepted:—
Six Bailey boiler meters, steam and air flow (£708).—Industrial Combustion Engineers, Ltd.
One steam flow meter recorder (£118).—Electroflo Meter Co., Ltd.

Education Committee. Accepted:—
Installation of electric lighting at schools.—R. G. Buckland (Glais School); D. O. Williams & Co. (Graig School); G. L. Ward & Co. (Morriston Boys'); G. L. Ward & Co. (Peniel Green Mixed); Cole & Day (Peniel Green Infants'); P. J. Davies (Pentrechwyth School).

Thanet.—Isle of Thanet Joint Hospital Board. Accepted:—
Maintenance, &c., of bells, telephones, &c., at the hospital for 12 months.—E. Coveney (Ramsgate).

Torquay.—Electricity Committee. Accepted:—
Two switchgear panels (£688).—Metropolitan-Vickers Electrical Co., Ltd.

Forthcoming Events.

Institution of Heating and Ventilating Engineers.—June 20th to 22nd. Bournemouth. Summer meeting.

Electrical Contractors' Association.—June 22nd to 25th. Scarborough. Annual conference.

Institution of Welding Engineers.—Wednesday, June 22nd. Engineers' Club, W. 8 p.m. "The Red-Shortness of Weld Metal," by Mr. A. H. Goodyear.

Physical Society.—Friday, June 24th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Water dimmers.
England-Richards fluid-free cell.

Notes.

Fatality.

Whilst removing a portable electric saw bench at Messrs. Reichwald's timber yard at South Harbour, Blyth, two employés and Benjamin Jennings, a hawker, of Bedlington Bank Top, received severe electric shocks. Artificial respiration was applied, and the two employés recovered, but in the case of Jennings, the shock proved fatal.

An inquest was held on Friday last, when William Wells, a sawyer, said that he and another were operating an electrically driven saw-bench in the timber yard; Jennings was present collecting sawdust. About five o'clock witness and his companion commenced to shift the saw-bench. Witness put his hand on to it to knock off some dust from the wheel, and received a shock. Victor Lillie, the yard foreman, said he noticed after the accident that the trailing cable, which was attached to the table by means of a plug, had become wrapped round the wheel of the bench. There was nothing to indicate how the deceased got a shock. Dr. W. I. Gordon gave the cause of Jennings's death as heart failure, the result of an electric shock. There were not, however, any burns on the body; Jennings might have died from heart failure on seeing what had occurred. The opinion expressed by Mr. A. J. McCoggan, from the Home Office, was that the fouling of the cable had subjected the connecting plug on the table to a great strain, which had drawn it from its normal position and brought a small portion of unprotected cable into contact with the ironwork, thereby electrifying the bench. The jury returned a verdict of "Death from heart failure consequent upon electric shock accidentally received."

Electrolytic Disinfecting Fluid.

The report for 1926 of the medical officer of health to the borough of Poplar (Dr. F. W. Alexander) states that 65,317 gallons of electrolytic disinfectant fluid were manufactured during 1926 and broken down to 130,635 gallons for distribution. The total cost for materials and electricity was £345, of which £168 was for electrical energy. Since the installation of the plant, a period of 21 years, 957,181 gallons of fluid have been manufactured at a cost of £1,585 for electricity and of £1,898 for materials.

B.E.S.A. Publications.

Recently-issued British Standard Specifications by the British Engineering Standards Association include Nos. 174 to 184 for overhead line materials for telegraph and telephone purposes. These are revisions of the 1923 editions and are issued in two volumes, the first volume comprising specifications Nos. 174-181, and dealing with non-ferrous materials, the second volume comprising Nos. 182-184, and dealing with galvanised iron and steel wire. The following are the chief features in which these specifications differ from the 1923 editions:—Specifications for cadmium-copper wire, tapes, binders and jointing sleeves have been included in specifications Nos. 175, 178, and 181, the only material recognised in the corresponding old specifications being bronze. A new class of material has been introduced into specifications 182-184, this being designated "high-purity iron." This is given as an alternative to the ordinary low-carbon steel, which, of course, is still retained. As the result of experience in working to the original specifications for galvanised line wire, it was found that the data given in the tables were in certain cases inconsistent as between the diameter and weight per mile of the wire. The tables have been fully revised, and are now perfectly consistent amongst themselves. Certain amendments which have been made to the galvanising tests are described in specifications 182-184. Copies of these specifications may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, S.W.1, price 2s. per volume, or 2s. 2d. post free.

Royal Air Force Display.

Air-Marshal Sir John Salmond, Air Officer Commanding-in-Chief, Air Defences of Great Britain, who is also chairman of the R.A.F. Display Committee, will deliver a broadcast address about the display from Savoy Hill to-morrow (Saturday) evening. Arrangements have also been made with the British Broadcasting Corporation for a broadcast of about an hour of three of the principal events. These are the destruction by aeroplanes of an observation kite balloon, the air battle for London in which 30 aircraft will take part, and the air rescue of the European population besieged in an Eastern town. It is specially urged that early booking should take place. Tickets are now obtainable at the usual agencies, and from the Secretary, R.A.F. Display, Uxbridge.

Legal.

Marconi's Wireless Telegraph Co., Ltd.—On Tuesday last Mr. W. Greene, K.C., applied to the Court for a fortnight's adjournment of the company's petition for the confirmation of its reduction of capital. He said that the petition was opposed by shareholders, and a long affidavit had to be answered. Notice had been given to cross-examine Senatore Marconi and Sir Gilbert Garnsey, who had made affidavits in support of the petition.

Mr. Justice Eve granted the adjournment required.

Appointments Vacant.

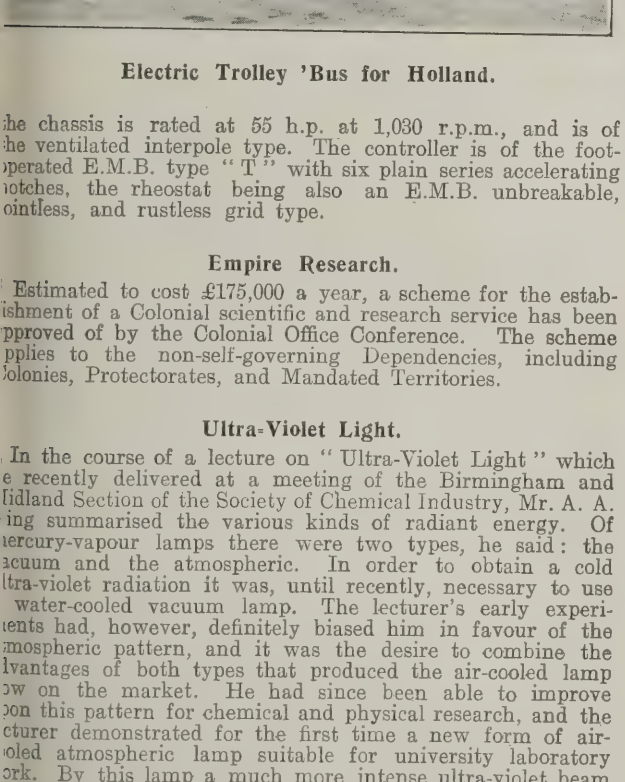
Showroom salesman (£4), stores clerk (£3), for the Radcliffe Urban District Council Electricity Department. Charge engineer for the Peterborough Corporation Electricity Department. Meter mechanic (68s.) for the Bexhill Corporation Electricity Works. Assistant engineer (temporary) and draughtsman (temporary) for the Dublin Corporation Electricity Department. Assistant engineer for the Inverness Corporation Electricity Department. Electrical engineer for the Public Works Department of the Government of Bihar and Orissa. Borough surveyor (£500) for the County Borough of Waterford. (See our advertisement pages to-day.)

Electrical Association for Women.

The Glasgow Branch of the Electrical Association for Women has arranged an outing to the Corporation waterworks at Loch Katrine, where electricity plays a prominent part, on June 20th next.

Holland Adopts Trolley 'Buses.

The first trolley 'bus system in Holland has just been inaugurated by the Municipality of Groningen, which has acquired two Associated Daimler vehicles, to be followed later by a further number if the venture proves satisfactory. The bodies, built by Vickers, Ltd., are of the one-man operated type and provide seating accommodation for 24 passengers; the small seating capacity is explained by the fact that ample room is available for standing. The lowness of the entrance step, which is a feature of these vehicles, has been rendered possible by the low loading height of the "Model 604" chassis frame. Pneumatic tires, size 34 in. by 7 in., are fitted, and a spare is carried underneath the frame behind the rear axle. The "Bull" motor carried in the centre of



Electric Trolley 'Bus for Holland.

he chassis is rated at 55 h.p. at 1,030 r.p.m., and is of he ventilated interpole type. The controller is of the foot-perated E.M.B. type "T" with six plain series accelerating notches, the rheostat being also an E.M.B. unbreakable, ointless, and rustless grid type.

Empire Research.

Estimated to cost £175,000 a year, a scheme for the establishment of a Colonial scientific and research service has been pproved of by the Colonial Office Conference. The scheme pplies to the non-self-governing Dependencies, including olonies, Protectorates, and Mandated Territories.

Ultra-Violet Light.

In the course of a lecture on "Ultra-Violet Light" which e recently delivered at a meeting of the Birmingham and lidland Section of the Society of Chemical Industry, Mr. A. A. ing summarised the various kinds of radiant energy. Of iercury-vapour lamps there were two types, he said: the acuum and the atmospheric. In order to obtain a cold ltra-violet radiation it was, until recently, necessary to use water-cooled vacuum lamp. The lecturer's early experi-ients had, however, definitely biased him in favour of the mospheric pattern, and it was the desire to combine the lvantages of both types that produced the air-cooled lamp ow on the market. He had since been able to improve on this pattern for chemical and physical research, and the cturer demonstrated for the first time a new form of air-oled atmospheric lamp suitable for university laboratory ork. By this lamp a much more intense ultra-violet beam uld be produced by means of a forced draught of air, the cessive heat being removed without the absorption effect tendant upon heat removal by water. The lamp also lent self to the application of a sterilised, ozone charged, air eam for therapeutic purposes, and was much more robust handle than any vacuum mercury-vapour lamp. The model own comprised the fluorescent cabinet, the open lamp for n baths, and the medical lamp adapted for applicator work. ntinuing, the lecturer said that an important new applica-on of ultra-violet rays lay in the distinction between the orescence of pure and impure substances, in which cate-ry might be included many true and imitation gems and cious stones. The presence of minute amounts of impurity uld be detected and identified by subsequent analysis. Some v months ago he had occasion to ascertain with the aid the utmost refinement of the then known methods the sence of minute quantities of arsenic in foodstuffs. The tzeit method of mercury-arsenic stain was selected for ther examination, and an attempt to intensify the stain th monochromatic light served a useful purpose, but when stains were examined in ultra-violet light the making of a new method was found for the detection and quantitative examination of minute quantities of arsenic quite impossible by previous methods. The absorption of ultra-violet rays by the mercury-arsenic stain gave it an intensely black appearance, and stains which were quite invisible to the naked eye in ordinary light flashed up black upon a phosphorescent background when placed in ultra-violet rays. He had been able to detect with certainty 0.00000005 gramme of arsenious oxide, which meant that this arsenic test was approximately 100 times more sensitive than any other method known. Of the commercial applications of ultra-violet rays there were many in the experimental stage, and a few seemed to have become permanent successes; among the latter were the various cabinets used for testing the fastness of colours, and detecting mildew in wool. The use of such rays for the sterilisation of liquids, particularly water, was a promising line of development.

Electricity in Swiss Industries.

A return lately issued by the Swiss Union of Electricity Consumers shows that the association now comprises 109 firms connected with the textile industry, 51 with the food supply trade, 25 with the chemical industry, 22 with the paper, leather, and timber trades, and 144 with the engineering and metallurgical industries. In addition, there are 120 other miscellaneous members, as well as eight electric railway undertakings. The whole of the members are responsible for an annual consumption of purchased electric power of 650 million kWh, in addition to a private output of 100 million kWh. It is estimated that the consumption of electricity in Switzerland now amounts to 980 kWh per year per head of the population.

The Heaviside Layer.

In a recent lecture before the Royal Institution on "Wireless Transmission and the Upper Atmosphere," Prof. E. V. Appleton is reported by *The Times* to have explained that recent intensive study of the shorter waves had shown that the effects of the Heaviside layer could be detected only a few miles away from the transmitter. As the effects increased with increased distance, they became of importance to broadcast listeners, whose receivers were 100 to 150 miles from the transmitting station. The signal fading they experienced was due to the arrival of two sets of waves at the receiver, one travelling along the ground and the other from the upper atmosphere after reflection at the Heaviside layer, the height of which was about 70 kilometres in the day-time, and after sunset gradually rose often to 120 kilometres, only to fall to its day-time value at sunrise. The layer was found to reflect broadcast waves copiously at night, but in the day-time there was practically no reflection, and only ground waves were received. Listeners situated a long way from the transmitting station who were only able to receive during the dark hours often complained of the uncertain intensity and bad quality of their signals, but they should remember that the day-time signal was the one to which they were really entitled. The night-time signal they received was merely a gift from the upper atmosphere, and they must not complain if the gift was a somewhat variable quantity. With decreasing wave-length the amount of bending the atmosphere would accomplish became less, so that with very short waves penetration of the Heaviside layer became feasible, especially at night, when the amount of electricity in the upper atmosphere was least. It had been said that communication with Mars was impossible because the Heaviside layer would present an impenetrable barrier to wireless waves, but from calculations it appeared as if waves of the order of one metre would penetrate it at night and thus be of no use for long-distance communication. A surprising result had recently been found in the effects of magnetic storms on wireless transmission. Such storms interfered very seriously with long-distance short-wave transmission, and yet with very long waves the signals were stronger than usual. If it was assumed that a magnetic storm increased the electricity in the layer, short waves, which had to penetrate the layer to be bent gradually back to the ground, were more strongly absorbed because they now returned at lower levels, where the friction experienced by the electricity was larger. On the other hand, long waves were truly reflected by the layer at its surface, and an increase in the amount of electricity in the layer increased the amount of this reflection.

Electrical Prospecting for Minerals.

We learn that the electrical process of prospecting for mineral deposits is to be thoroughly tested on a large scale in the Kamiscotia copper area of Northern Ontario. The Hollinger Consolidated holds a large area under option which is heavily overburdened with sand and muskegs, rock outcrops being few in number. Prospecting by the ordinary methods would entail much expense, and an arrangement has been entered into between the company and the Government under which the latter agrees to accept the electrical survey of the claims in lieu of the first year's assessment, on condition that the indications of the survey are to be followed up by diamond drilling. As the company undertakes to make a thorough electrical survey of the whole area covered by its claims this will be a more comprehensive and conclusive test of the value of the process than has hitherto been made in Ontario.

The Effect of High Voltages on Tantalum Anodes.

During some recent work with high voltages upon metal electrodes, Mr. E. N. Dunham has found that tantalum exhibits some very unusual phenomena when used as a positive electrode in certain electrolytes. Very brilliantly coloured films are formed on the metal in the following order: violet, reddish purple, indigo, light blue, green gold, light yellow and finally gray. The colours were produced in succession by increasing the voltage, so that any one of the above colours may be obtained by shutting off the current at the proper time. The films form just before the electrode begins to emit light, and the highly-coloured ones disappear when tiny scintillating sparks appear on the surface of the film. The gray film mentioned above is the final product after the breakdown voltage is exceeded. The films are apparently permanent, and the colours give no evidence of being formed by interference. Mr. Dunham has been unable to reproduce them by heating or other means, and is withholding any possible explanation of the phenomena until further data are available.—*Science.*

Chief Technical Assistants' Association.

On June 9th last the above Association entertained Mr. A. P. MacAlister to a complimentary dinner at the Holborn Restaurant, London, in honour of his being appointed borough electrical engineer of Islington. Mr. A. Murdoch, chairman of the Association, presided. After the loyal toast, the chairman proposed the toast of the guest of the evening, and mentioned that the Association was brought into being mainly by the efforts of Mr. MacAlister. He reviewed the events which led up to its formation in February, 1915, when certain Electricity Supply Bills were before Parliament. The chairman referred to the very high esteem in which the guest was held both in their Association and in the supply industry generally, and heartily congratulated him upon his well-deserved appointment. Other members spoke of their appreciation of Mr. MacAlister's many virtues, and the whole Association joined in wishing him a long, happy, and prosperous career in his new position. On behalf of the members, the chairman presented him with a pair of entrée dishes. Mr. MacAlister, in reply, referred to the various conferences held during the earlier days, and to the work of the late Mr. C. H. Wordingham in the cause of the staff engineer.

Electricity in Agriculture.

In a lecture delivered by Dr. E. A. White, Director of the Committee on Relation of Electricity to Agriculture, at a meeting of the National Electrical Manufacturers' Association at Hot Springs, Virginia, U.S.A., it is stated that the possibility of securing three million new customers—farm customers—is not out of range. According to statistics recently released by the Rural Electric Service Committee of the National Electric Light Association, California, with its great irrigation pumping load, heads the list with 62,000 farms connected, 45.4 per cent. of the total. Then follows New York with 35,600, 18.9 per cent., while Washington, with 20,000 and 27.4 per cent. is next. This report shows 227,422 farms served in 27 States, which would indicate a figure between 300,000 and 350,000 in the United States. According to statistics recently released by the Bureau of Agricultural Economics, U.S. Department of Agriculture, the farm population was 27,892,000 on January 1st, 1927, as compared with 28,541,000 on January 1st, 1926, a decrease of 699,000. Evidently there is something wrong with agriculture. As in other industries, the use of power brings with it at least two distinct possibilities; increased production per worker and improved living standards. Agriculture needs both of these. Agriculture is in a state of transition, with every promise of using more power in the future than it has done in the past.

There is a potential electrical load on the farm of sufficient size to ensure reasonable rates in the more important agricultural regions. The farm-house needs electricity for cooking, refrigeration, lights, water pumping, and numerous conveniences. Studies show a load ranging from 200 to 500 kWh per month per farm. With three farms per mile this would give 9,000 kWh per year per mile of line, solely for household uses. The load on the farm, outside of the household, will vary with the type of farming and future developments in the art of applying electricity to agricultural operations. On the dairy farm it will be large, ranging up to 500 kWh per cow per year. Poultry farming produces a good load. Vegetable gardening is most promising. The general live-stock farmer can use electricity to advantage. In fact, it is only on the grain or cotton farm that the use of electricity has to be confined to the household. Considering the territory most promising for the development of rural electric service during the next five years, it is conservative to say that there are possibilities for the use of up to 18,000 kWh of electricity per mile of line per year. Contrasted with this, 4,000 kWh per mile per year is considered good in non-irrigated regions.

To bring such a development about will require equipment. In New Hampshire the average cost of equipment and installations on seven farms above the average was $2,256.65. In 1926 these seven farms used an average of 4,253 kWh per farm. This was experimental, but it shows the possibilities. In 1926 100,000 rural customers were added to electric service lines. If it cost only an average of $200 to reach each customer and only $50 per home was spent for wiring this represents $25,000,000 for labour and materials. The present volume of business is bigger than most people realise, for these figures are certainly conservative. There is a market for electrical equipment in rural districts to-day and it will increase.

Although the progress of the past five years has been great only 5 per cent. of the farmers of the country are to-day reached by the copper wire. The use of electricity on the farms served, excluding irrigation pumping, is far below the possibilities. Generally speaking, these possibilities are as new to farmers as they are to engineers. The use of electricity on the farm will bring a big readjustment problem to agriculture. It is better that this readjustment should come gradually, with as few mistakes as possible. The farmer needs reliable information as to electrical uses on the farm; so do the manufacturers, and so do the electric light and power companies. The big problem is to take the equipment that we now have and that which will be developed and fit it into farm requirements, or fit farm requirements to it. Instead of educating the farmer, as is so often attempted, and so seldom realised, the farmer should be given a chance to educate himself. Speeches, articles, and pamphlets will have an important place, but the groundwork will be the demonstration.

E.L.M.A. at Teachers' Conference.

At the annual conference of the Association of Teachers in Technical Institutes, held recently at Plymouth, a scientific exhibition was organised and a series of lectures given for the benefit of the general public. Mr. H. Lingard, of the E.L.M.A. Lighting Service Bureau, London, gave a special lecture to the delegates and four lectures to the public on the subject of electric lighting, and displayed some demonstration cabinets. Three cabinets were employed, one of eight sections showing the history of artificial lighting, a four-section one illustrating the effect of the colour of different electric light sources on coloured ribbons, and a special "What-reflectors-will-do" cabinet depicting good and bad shop-window lighting. These cabinets were installed in a small darkened room for the period of the exhibition and created considerable public interest. The keen appreciation shown by the audiences at the lectures indicated the growing interest of the public in the "electric lighting art."

Institution Notes.

Institute of Wireless Technology.

The annual general meeting of the Institute took place on May 25th. The chairman announced the result of the election of officers for the ensuing year, and briefly reported on the progress of the Institute during the past year. This has been very satisfactory; ordinary meetings have been held monthly at the Engineers' Club, at which papers have been read and discussed. A first number of the *Journal* has been published, and an enlarged and improved number is now in the press. The Institute is receiving a good measure of support, and the membership is steadily increasing. The next session of ordinary meetings will open in October, and it is anticipated that sufficient support will be forthcoming to hold informal meetings monthly for discussions on problems of special interest. Those desiring further particulars of the activities of the Institute are invited to address themselves to the hon. secretary at 71, Kingsway, London W.C.2.

Diesel Engine Users' Association.

At the meeting held on June 10th a paper by Mr. Arthur F. Evans, M.I.A.E., M.I.Mar.E., entitled "Consumers' Oil Tests," was read and discussed. The author said that such tests as did exist and were generally recognised by the oil suppliers fell short of the actual requirements of oil users for the following reasons:—(*a*) They were not universally adopted by oil suppliers; (*b*) they did not give all the required particulars; (*c*) they were too difficult for the ordinary engineering firm to carry out. He recognised that it was almost impossible even in a laboratory to test all the properties of a lubricating oil. For instance, there did not yet exist an apparatus for accurately determining the actual lubricating values of oil under the varied circumstances and conditions of an engine. Neither was there a means of accurately ascertaining the comparative amount of carbon which the oil would deposit in the combustion chamber, the closest approach being the "bomb" test, which at its best was but an approximation. The greater part of the lubricating oil purchased was bought by name and reputation. Where the purchaser was in any case departing from some known brand the selection was made, apart from commercial considerations by colour and comparative viscosity at room temperature. After many years' experience in purchasing oils, he commenced testing samples of oil which had been submitted to him. He dealt in detail with the tests which he suggested should be carried out, and gave interesting information regarding the apparatus which was necessary and the method of using it. Copies of the paper, together with an account of the discussion thereon, can be obtained from Mr. Percy Still, joint honorary secretary of the Association.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Following upon the resignation, after nearly 30 years' service, of Mr. F. C. McQUOWN, joint manager and secretary of the County of London Electric Supply Co., Ltd., Mr. H. W. SPRUNT, M.I.E.E., M.I.Mech.E., has been appointed commercial manager, and Mr. JOHN C. DALTON has been appointed secretary of the company.

The *Western Mail* states that Mr. E. MILLWARD, A.M.I.E.E., aged 23, at present employed with Messrs. Bertram Thomas, of Manchester, has been appointed assistant engineer to the Sudan Railways and Steamers. The *Mail* adds that Mr. Millward leaves for the Sudan in a few weeks' time, and he will have sole control of "a new power station to be erected in the lower regions of Southern Egypt, where an electric railroad is being laid."

SENATORE MARCONI was married to the Countess Marie Bezzi-Scali at Rome on Sunday last.

Mr. HAROLD PEACE, of the Dewsbury Corporation electricity works staff, has been presented by his colleagues with an oak clock and a bedroom clock on the occasion of his marriage.

On June 7th, Mr. A. J. B. GOSLING was presented with a set of oxidised copper fire-irons by members of the Electrical Staff of the London, Midland, and Scottish Railway, upon the occasion of his marriage.

The marriage took place on June 6th of Mr. WILLIAM ALEXANDER BLACK, an electrical engineer, at the Tees Station at the Newcastle-upon-Tyne Electric Supply Co., Ltd., and Miss D. MORTON, of Whitby.

Mr. D. MAXWELL BUISH, personal assistant to the Hull Corporation electrical engineer, has been appointed chief electrical engineer to the Synthetic Ammonia and Nitrates, Ltd., of Billingham.

Mr. FRED. W. DAVIES has relinquished the position of manager to Messrs. T. W. Broadbent, Ltd., of Huddersfield, which he has held for more than 20 years, and has established a business under his own name at Electrical Maintenance Works, Colne Road, Huddersfield. He has no manufacturing interests and will carry on a general consulting practice and electrical maintenance and repair business. He has long specialised in the design of a.c. and d.c. generators and motors, and his workshop is equipped for the repair of such machinery.

Obituary.—MR. H. CHILDS.—The death took place on June 8th, at the age of 60 years, of Mr. Henry Childs, electrician at Whipp's Cross Hospital, Walthamstow.

MR. J. C. CRAWSHAW.—Mr. John Charlesworth Crawshaw, who after the war was associated with the English Electric Co., Ltd., at the Bradford works, and latterly was general manager of Crawshaw & Warburton, Ltd., colliery-owners, of Dewsbury, died suddenly while playing tennis on Saturday last. He was 42 years of age.

MR. W. J. NEWBIGIN.—Reports just to hand from Australia state that Mr. William Johnstone Newbigin passed away in April at Sydney, at the age of 53 years. He went to Australia on behalf of Messrs. C. A. Parsons & Co. about 30 years ago. Subsequently he joined the staff of William Adams & Co., Ltd., and during the past four years was managing director. He was a member of the Commonwealth Council for Scientific and Industrial Research, a past-president of the Institute of Engineers of Australia, and a member of the main committee of the Australian Engineering Standards Association.

MR. G. M. TAYLOR.—We regret to record the death, which occurred on June 11th at Kensington, of Mr. G. Midgley Taylor, M.Inst.C.E., at the age of 65 years.

Wills.—The late Sir JOHN TURNEY, of Nottingham, left £172,410 gross and £158,598 net personalty.

Mr. ARCHIBALD CAMPBELL, M.I.E.E., left £3,068 gross and £3,035 net personalty.

The late Captain REGINALD J. WALLIS-JONES left £2,160 gross personalty (net personalty nil).

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Reid Process, Ltd.—Private company. Registered June 'th. Capital, £100 in 1s. shares. Objects:—To carry on the usiness of a financial, commercial, electrical manufacturing, ontracting, promoting, mercantile, developing association, specially electrical matters; to seek for openings for the rofitable employment of capital, &c. The subscribers (each ith one share) are:—T. H. Higgins, 25, Duke's Avenue, Muswell Hill, printer; R. Elliott, 23, Cranley Gardens, N.10, ompany secretary. The first directors (to number not less han 2 nor more than 7) are:—Lt.-Col. the Hon. H. Scott Davey, C.M.G., and Major A. H. Woodhouse. Remunera- ion, £100 per annum (chairman £150). Secretary: R. Elliott. Registered office: 30, St. Swithin's Lane, E.C.4.

Miller's Radio Products, Ltd.—Private company. Regis- ered June 7th. Capital, £100 in 1s. shares. Objects:—To cquire the business formerly carried on by J. W. Miller s wireless components engineer and manufacturer, at 68, arringdon Street, E.C.4. The subscribers (each with one nare) are:—E. C. Goman, 44, Leghorn Road, Harlesden, lectrical engineer; A. Secretan, 44, Montgomery Road, hiswick, W.4, clerk. The first directors are not named. ecretary: F. B. Weller. Registered office: 64, Mill Hill oad, Acton, W.3.

Airships Electric Advertising Co., Ltd.—Private com- any. Registered June 9th. Capital, £350 in 340 preference nares of £1 each and 2,500 deferred shares of 1d. each. bjects:—To deal in airships, aircraft, balloons and captive rships, and electrical appliances; to act as advertising agents nd contractors, &c. The first directors are:—Capt. P. W. eigh-Pemberton, "Southmead," Newbury; Mrs. J. M. ord, 21, Collingham Gardens, South Kensington, S.W.5. ualification, 10 shares. Secretary: John Ford. Registered ffice: 24, Queen Victoria Street, E.C.4.

Frank Raworth, Ltd.—Private company. Registered me 8th. Capital, £3,000 in £1 shares. Objects:—To quire the business of electrical engineers and contractors rried on by the executors of Frank Raworth at 36, Spring rdens, Buxton. The first directors are:—H. Le Mare ckson, 51, King Street, Manchester, accountant; F. Thomp- n, 36, Spring Gardens, Buxton, electrical engineer.

Official Returns of Electrical Companies.

Neutron, Ltd.—R. S. Andrews, C.A., of 448, Strand, W.C.2, ceased to act as receiver on May 30th, 1927.

Dulverton Electric Lighting Co., Ltd.—Satisfaction to the extent of £950 on May 31st, 1927, of debentures dated March 12th, 1907, securing £2,000.

Norton Wireless Co., Ltd.—B. A. Nichols, of 54, St. John's Road, Hoxton, N.1, was appointed receiver on May 26th under powers contained in debenture dated March 14th, 1927.

Hazeltine Neutrodyne Radio Sets, Ltd.—Capital, £5,000 in £1 shares. Return dated December 23rd, 1926. 4,900 shares taken up. Nil called up. Mortgages and charges, nil.

Lacy Induction Coil Co., Ltd.—Capital, £26,725 in 25,500 ordinary shares of £1 each and 24,500 founders' shares of 1s. each. Return dated December 29th, 1926 (filed January 20th, 1927). 14,552 ordinary and 12,250 founders' shares taken up. £14,552 paid. £612 10s. considered as paid. Mortgages and charges, nil.

Townlea Electrical Co., Ltd.—Capital, £1,000 in 300 preference and 700 ordinary shares of £1 each. Return dated January 11th, 1927. All shares taken up. £500 considered as paid. Mortgages and charges, nil.

Nox Electric Lamp Co., Ltd.—Return dated January 21st, 1927. Capital at date of return, £2,000 in £1 shares (increased March 16th, 1927, to £15,000 in £1 shares). 502 shares taken up. £2 paid. £500 considered as paid. Mortgages and charges at date of return, £662 13s. 4d. (paid off March 1st, 1927). Since registered: £6,000 debentures (part of a series of £15,000 authorised February 24th, 1927).

Kent Bros. Electric Wire Co. & E. H. Phillips, Ltd.—Capital, £15,000 in £1 shares. Return dated December 31st, 1926. 11,500 shares taken up. £500 paid. £11,000 considered as paid. Mortgages and charges, £15,500.

John Armstrong & Co. (Manchester), Ltd.—Capital, £2,500 in £1 shares. Return dated March 18th, 1927. 1,493 shares taken up. £849 paid. £644 considered as paid. Mortgages and charges, nil.

City Notes.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

The annual meeting was held on June 9th. Lord Southborough, the chairman, was prevented by illness from presiding, and the vice-chairman (Mr. J. F. Taylor) took his place. Mr. Taylor first made reference to the arrangement made in December last for a five years' moratorium (*vide* ELEC. REV., December 17th, 1926, p. 1006), and referred to the losses occasioned by the coal strike. He had been advised that it was necessary to write down the value of the plant and properties by a substantial amount, and the same remarks applied generally to investments. He proceeded to deal with the more important of the last. Adverse circumstances had arisen in the case of the Newfoundland Power and Paper Co., Ltd., and in view of the outlook they had come to the conclusion that further commitments should not be entered into. They had therefore assented to the Newfoundland Company entering into negotiations with the International Paper Co., of New York, which provided for the latter's acquiring the undertaking and assuming responsibility for the further financing of the business. The company had nearly £1,400,000 invested in the Italian company, S. A. Armstrong di Pozzuoli, which had been put into voluntary liquidation. Their investment in the Pearson and Knowles group of companies was also causing them anxiety; to ease the situation a moratorium had been declared in respect of the payment of interest, &c. It was hoped that there would be a recovery in that group. Where other investments had proved a drag upon the company, they were being drastically dealt with, but with an eye all the time to the best possible outcome for the company. Against those adverse circumstances there were important offsets. They had disposed to very good advantage of their investments in the Armstrong Siddeley Companies and in Messrs. Walmsleys, of Bury. The armament business was wholly inadequate. All the civil engineering contracts had been finished, with the exception of those in New Zealand, which could not possibly be completed until 1928 at the earliest. They had claims in respect of several contracts. A small profit had been realised in the construction of the Hermitage Dam in Jamaica, and they had been commended for their work. New lines were not easy to find, and they were examining possibilities which were close to hand. Included in those were closer working arrangements with Vickers, Ltd.; conversations to that end were taking place. When the board was reconstructed a complete scheme of management would be put into operation. In conclusion, Mr. Taylor said that the time was approaching when a revaluation of assets and a considerable writing down of capital would have to be considered.

Electric Construction Co., Ltd.

The annual meeting was held on June 9th, Mr. P. E. Beachcroft (chairman) presiding. In presenting the report (*vide* our last issue, p. 941), the chairman said that the year under review opened with fairly favourable prospects, and their order book showed an improvement. Those prospects, however, were not fulfilled owing to the prolonged coal strike, which caused comparative stagnation in many industries. Such contracts and orders, therefore, as could be procured were subjected to increased costs and severe competition. So intense had competition become in overseas markets that selling prices showed a small surplus only over the cost of labour and materials. They refused to take any order which did not carry a fair share of establishment charges. Although that policy had resulted in a reduced turnover, their position would have been worse if they had not adopted that course. The company was in an exceptionally favourable position to take advantage of any general improvement in trade, of which there was some slight indication. Little or nothing had been done to relax the burden of taxation, which bore so heavily upon industry. On the contrary, they were threatened with more bureaucratic interference in the form of "safety supervisors," who were to undertake duties which were at present admirably discharged by factory inspectors. He hoped that the proposal would be more fully ventilated than it had been before the new officers were appointed. Reviewing the accounts, Mr. Beachcroft said that they felt that, during the present troublous times, at any rate, they could reduce the amount for depreciation. The directors were disappointed that for the first time in the past ten years they were unable to recommend payment of the bonus of 2½ per cent. on the ordinary shares. The present outlook was somewhat obscure, and the indications of a general improvement in trade were still unconvincing, but there was little doubt that when the new Electricity Act was in full operation there would be a greatly increased demand for electrical plant and apparatus.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

Speaking at the annual meeting on June 9th, the chairman (Mr. G. C. Howard) said that during the year the income debenture stock had been reduced by £10,100 and now stood at £102,800. Although the average receipts per kWh were lower and the expenses had increased, they were able to show better results on account of the fairly steady and full output. They hoped to be able to produce satisfactory figures at the end of the current year. The chairman then referred to the report of the Commission appointed by the Western Australian Government to make recommendations with a view to prolonging the life of the Kalgoorlie mining industry. He said that the Federal Government had since appointed a technical committee to examine the position. That committee recommended an amalgamation of mining interests, co-operation between the management and the workers, and the introduction of capital. They had now to wait to see what the mining companies would do and what measure of financial support would be afforded by the Federal Government. Any practical suggestions would have the full support of the company.

Lisbon Electric Tramways, Ltd.

The net profit for 1926 was £230,826, as compared with £166,624 for 1925. A balance of £9,122 brought forward was added, making £239,948. From this £100,000 is transferred to general reserve, £7,000 to the staff benefit fund, and £10,000 to exchange reserve. A final dividend of 3 per cent. is recommended, making 6 per cent. for the year, and £8,307 is carried forward. £155,756 standing at the credit of the depreciation account has been released and transferred to the general reserve, making £320,756. It is proposed to capitalise £317,013 of this and distribute it in the form of £1 ordinary shares to existing shareholders in the proportion of one new share for each two held. Proposals for giving this effect will be placed before an extraordinary meeting which is to be held after the annual meeting on June 22nd.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The company, under date June 13th, informed its shareholders, with much regret, that the improving conditions of a year ago, which were interrupted by the coal dispute and the general strike, had not, so far, been re-established. The reduction in the company's turnover during the half-year under review was serious in many directions, although, on the other hand, there were considerable increases in some sections. The announcement reads:—"It is hoped that the second half of the year may, in some measure, compensate for the loss of trade in the earlier months. Your directors fully recognise the imperative need for increased business and to this end all energies are being directed. In these circumstances they cannot recommend the payment of an interim dividend to the holders of ordinary shares, but the half-yearly dividend on the preference shares will be paid as usual on 1st proximo." The directors add that "there is no truth in the rumours recently circulated as to the possible disposal of this company's business or any portion of it."

Westinghouse Electric and Manufacturing Co.

The sales of this company during 1926 reached the record total of $185,500,000, exceeding those of the previous year by $20,000,000. The net income was $16,138,442, and both preferred and common stock received an 8 per cent. dividend. The current assets are put at $120,000,000, while the current liabilities are only $18,000,000. The value of uncompleted orders at the close of the year was $55,300,000. Mr. Guy E. Tripp (chairman), in his report, says:—"The sales billed for the year reflect the improvement in operations due to the more efficient use of the manufacturing facilities added during the past two years. The cost of sales reflects the keenness of competition and slightly lowered prices. The volume of sales for export increased over the previous year. Competition for export business continued to be keen, but certain affiliations in the foreign field effected during the year should assist in securing a substantial volume of new business."

Cuba Submarine Telegraph Co., Ltd.

The receipts for 1926 were £58,603, as compared with £63,400 in 1925, while the expenses increased from £25,970 to £31,250. After a smaller provision for cable repairs, the balance is £20,481, as against £25,350 (after allowing £3,903 for taxation) in the preceding year. The ordinary shares received an interim dividend of 2½ per cent., free of tax, but after providing for the dividend on the 10 per cent. preference shares, the balance of £18,372 (including £7,891 brought in) is carried forward. The ordinary dividend for the three preceding years was 5 per cent., tax free. The Direct West India Cable Co. Ltd., in March last, offered £10 each for the company's preference shares and £7 for the ordinary shares.

W. T. Henley's Telegraph Works Co., Ltd.

The directors recommend a final dividend on the ordinary shares of 2s. 6d. per share, making 4s. per share for the year. They also recommend a cash bonus of 1s. per share. After placing £50,000 to general reserve as last year, and paying the above dividend and bonus, the amount carried forward to next year will be £506,202, which is an increase of £2,423 on the amount carried forward last year. It is not considered necessary to further increase the carry forward, for which reason the directors are able to recommend the payment of the cash bonus.

Mexican Light and Power Co.

The Canadian Courts have approved the arrangement for dealing with the arrears of dividend on the 7 per cent. cumulative preference shares by the issue of fully-paid 4 per cent. cumulative redeemable second preference shares, and allotment is to be made after the end of this month.

United River Plate Telephone Co., Ltd.

The company reports a total revenue of £2,247,169 for 1926 and a balance on working of £454,955, from which is deducted £13,500, debenture interest, making £441,455. After meeting the preference dividend, it is proposed to pay a final dividend of 5 per cent. on the old ordinary shares, making 8 per cent., free of tax, for the year and a dividend of 5s. per share, free of tax, on the new ordinary shares. This leaves a balance of £28,655, which is added to the amount brought in, making a total of £136,586 to be carried forward. In order to cope with the demand heavy capital commitments have been and will be necessary. It is therefore proposed to increase the capital from £6,000,000 to £7,000,000 by the creation of 200,000 £5 shares; these will not be issued immediately. The report records the death of the deputy-chairman, Sir Frederick Green. His place has been taken by Major E. C. Quilter, and Mr. W. Howard Williams has been appointed to the board. Meeting: June 21st.

A Joint Authority Issue.

The list was to close on or before to-day (Friday) in an issue by the West Midlands Joint Electricity Authority of £2,000,000 5 per cent stock at the price of £98 per cent. The prospectus stated that £500,000 of the proceeds would be used in discharge of a portion of the purchase consideration for the generating stations and other property to be acquired. The plant referred to is at present the property of the Corporations of Shrewsbury, Wolverhampton, Walsall and West Bromwich and the Midland Electric Corporation for Power Distribution, Ltd. The total purchase price is put at £1,329,000.

Whitehall Electric Investments, Ltd.

The gross income for the year ended March 31st last was £712,482, as compared with £708,522 in 1925-26; the net income increased from £456,102 to £468,655. After deducting the preference dividend and one of 2½ per cent. on the ordinary shares, there remains £156,155, which is to be applied in reduction of discount on debenture stock. The meeting was to be held yesterday (Thursday).

Newcastle-upon-Tyne Electric Supply Co., Ltd.

This week the preference and ordinary shareholders were offered 770,000 ordinary shares of £1 each at par in the proportion of one to each five shares at present held. The new shares will participate *pari passu* with the existing shares as from the due dates of the instalments (July 1st and October 1st).

Altrincham Electric Supply, Ltd.

After meeting expenses, including debenture interest, the net profit for 1926 was £27,567 (against £29,181 in 1925). To this is added £927 brought forward, making £28,494. A dividend of 7½ per cent. is recommended on the ordinary shares and £3,500 is allocated to the deferred shares, leaving £1,758 to be carried forward, subject to directors' fees.

Barcelona Traction, Light and Power Co.

An interim dividend of 50 cents per share has been declared on the ordinary stock and one of 1¾ per cent. on the 7 per cent. non-cumulative participating preference stock. The latter stock also receives an additional dividend of 1 per cent., corresponding with that on the ordinary stock.

Richard Johnson, Clapham & Morris, Ltd.

The net profit for 1926-27 was £20,077, and the addition of the balance brought forward gives £28,276. The ordinary dividend is 3¾ per cent. (against *nil* for 1925-26), and a balance of £13,824 is carried forward.

Seaton (Devon) and District Electric Light Co., Ltd.

An increase in revenue of £836 was reported at the recent annual meeting. The balance carried to the net revenue account was £782, as compared with £43 in the previous year.

Globe Telegraph and Trust Co., Ltd.

A final dividend of 5s. per share net is recommended on the ordinary shares, making 10 per cent. net for the year as usual.

Cape Electric Tramways, Ltd.

The directors have declared an interim dividend of 3 per cent., free of tax, as last year.

Chiswick Electricity Supply Corporation, Ltd.

An interim dividend of 7½ per cent. (against 5 per cent.) has been declared.

Mackay Companies.

A quarterly dividend of 1¾ per cent. has been declared on the common stock.

Yorkshire (West Riding) Electric Tramways Co., Ltd.

An interim dividend of 3 per cent. has been declared on the 6 per cent. cumulative preference shares.

Canadian General Electric Co.

A dividend of 1¾ per cent. has been declared in respect of the current quarter.

German Company.

The *Land and Sea Cable Works Company*, Cologne-Nippes, reports that business improved in the second half of 1926 and a further revival has taken place in the current year. After providing for depreciation, the accounts show net profits of 327,000 marks for 1926, as compared with 337,000 marks, the dividend remaining at 10 per cent.

French Companies.

The *Société le Matériel Isolant* reports net profits of 245,000 fr. for 1926; the dividend is 55 fr. per share.

The *Société l'Appareillage Electro-Industriel* earned net profits of 770,000 fr. in 1926, and is paying a dividend of 20 fr. per share.

The *Société le Moteur Electrique* reports a net profit of 107,000 fr.; the dividend is 30 fr. per share.

The 1926 accounts of the *Société la Radiotechnique* show net profits of 1,000,000 fr., and a dividend of 75 fr. per share has been declared.

The *Compagnie Française de Radiophonie* states that its net profit for 1926 was 155,000 fr., which has been carried forward.

The *Société des Accumulateurs Fixés et de Traction* records profits and balance forward amounting to 2,401,000 fr. for 1926; the dividend is 15.625 fr. per share.

The *Compagnie Générale de Télégraphie Sans Fil* reports net profits of 8,507,000 fr. for 1926, as against 7,308,000 fr. in the previous year. It is proposed to increase the dividend from 45 in 1925 to 50 fr. per share.

Swedish Companies.

Aktiebolaget Elektrolux has decided to increase its share capital by a maximum of kr. 25,000,000 nominal, issuing shares giving the right of 1/1,000th part of a vote at meetings. The new capital will be used for the purchase of shares in Aktiebolaget Lux and other companies collaborating with Aktiebolaget Elektrolux.—*Reuter's Trade Service* (Stockholm).

L. M. Ericsson Co.—The net profit for 1926 was 4,410,000 kr., as compared with 4,150,000 kr. for 1925. A dividend of 3 per cent. has been declared.

Swiss Companies.

The report of *Gebruder Sulzer*, Winterthur, for last year shows a net profit of £57,600 as compared with £40,800 in 1925. A dividend of 6 per cent. is again being declared.

The *Alioth Elektrizitäts Gesellschaft*, Basle, reports a net profit of £14,010 for 1926, as against £13,880 in the preceding year, out of which a dividend of 5 per cent. is being paid.

Stocks and Shares.

MONDAY EVENING.

BRAZILIAN Tractions stand out with pre-eminent strength amongst the active securities of the Stock Exchange markets. The appetite of the buyers appears to be insatiable, and the price has gained a further 15 points at 175. The preferred advanced 12 to 146. Reference was made here last week to the favourable comment upon the position of Brazil as reported in an interview with the President of the Brazilian Traction Company, Sir Alexander MacKenzie. There seems to be some odd affinity between the market in these shares and that in American Celanese, the price of which has been rising in meteoric manner, though what connection there can be between Brazilian traction and American artificial silk it is indeed hard to see.

Henley's Telegraph shares are a good deal to the fore by reason of the directors' proposals to pay a 5 per cent. bonus on top of the 20 per cent. dividend. The company is doing very well. In addition to the £300,000 contract obtained from the G.I.P. Railway, Henley's have received a big order from the Eastern Telegraph Company. The price of the shares has risen 3/16ths to 95s., making 6s. 3d. in a fortnight. No other changes of consequence have occurred in this section. Telephone Manufacturing Company shares went back to nearly 5s. 9d. before the price recovered to 6s. 6d. The report is regarded as poor. In 1925 there was a loss of £21,200; for last year the company made a profit of £5,400. After setting aside various allocations, a balance of £1,332 remains, and this it is proposed to carry forward. The meeting is to be held on the Friday in this week. Siemens 4½ per cent. debenture is 2 higher at 91.

The Cuba Submarine Telegraph Company made £20,500 last year, showing a decline of nearly £5,000, as compared with the previous twelve months. No final dividend is to be declared; the company paid an interim of 2½ per cent., tax free, six months ago. It may be recalled that we took Cuba Submarines out of our price list some months ago because, the Direct West India Cable Company having made offers for the Cuba Submarine ordinary and preference (of £7 and £10, respectively), public interest in them became reduced to a minimum. The nominal price is £7, and the last-recorded bargain in the shares was at 6½, early in March. United River Plate Telephones maintain their gain at 9¾. In spite of the fact that nothing has yet transpired to account for the remarkable advance in the quotation, the character of the recent buying is considered sufficient justification for the advice that holders should not part with, at any rate, all their interest. A further advance may easily take place. Indo-European Telegraphs have shed £1. The Eastern quartette holds its previously-acquired strength.

Whitehall Electric Investments, a company interested mainly in Mexican and Chilean utility concerns, has done better, making an extra £11,000 profit, at £468,600. The 7½ per cent. preference shares stand at 20s. 6d., and are a reasonable speculative purchase at that price. It is pointed out in the report that the income received from companies operating in Mexico shows a small reduction, but that the progress in Chile has been well maintained. Unsettled conditions in the country are debited with the decline of the company's earnings in Mexico. The Canadian Courts, having approved the scheme of the Mexican Light and Power Company for satisfaction of the accumulated dividends on the 7 per cent. preference shares, letters of allotment are to be issued in respect of the new 4 per cent. "cumulative redeemable second preference shares." The allotment will be made to those who are registered in the company's books on the last day of this month. Mexican Utility descriptions remain almost unchanged, a fall of 1 in the Light and Power common shares being the only noticeable movement.

British Electric Traction ordinary is 2 higher at 151 in response to the publication of an excellent report for the year ended March 31st, 1927. As already announced, the company proposes to pay 8 per cent. on the preference and the ordinary, with the addition of a 10 per cent. bonus, in deferred stock, to holders of the ordinary. This new deferred stock is likely to become a popular investment, and the opening of a market in it will be awaited with no little interest.

Home Railway stocks have few friends, and investors refuse to put much money into an industry so menaced from without by motor competition and, from within, by never-ending talk of labour troubles. We have previously remarked that the underground systems stand in a class different from that of the steam railways, for the Tubes, to quote the description applied to them by a director, are glorified trams, carrying London to work and home again, goods traffic being of nearly negligible proportions. But the Underground group moves to some extent in sympathy with the others, and falls are marked this week in Metropolitans, Districts and Underground £1 shares.

Twenty-one months ago a director of one of these companies wagered a level £50 that Districts, then many points below Metropolitans, would stand higher than the latter in two years' time. The cheque changed hands last week, the winner laughingly observing that he had come home comfortably, with three months in hand.

Barcelona Tractions remain at 51½. The company is paying an interim dividend of 1 per cent. on the common shares, which gives the 7 per cent. preferred an extra 1 per cent. in their quarterly dividend, under the participating rights that the preferred enjoy. Shawinigan Water and Power is several dollars higher, at 93½. Sidros are 15½, and somewhat neglected. Anglo-Argentine Tramways first preference have hardened a trifle. Cape Electric Trams are unchanged at 23s. on declaration of the interim dividend of 3 per cent., tax free. Rangoon Electric 4½ per cent. debenture at 99½ is a couple of points higher. Revived talk of a bonus on Bournemouth and Poole Electricity shares served to raise the price 2s. 3d. to £3, a fair number of transactions taking place up to 61s. An official announcement is expected to be made immediately. Edmundsons are a strong market, with a rise to 28s. 3d. Charing Cross shares rose 6d. to 25s. 6d. County of London new debenture reacted to 1⅛ premium by reason of the duller tendency in gilt-edged stocks. London Power 5 per cent. debenture is 98 ex dividend, but the scrip, recently-issued, can be bought at 99¼, carrying a coupon of 25s. per cent., now payable. As there is no Government stamp on the scrip, the buyer will save money, of course, in taking this, rather than the old registered stock. The two classes are identical in point of security. Electrical Finance preference are again better at 1s. 3d. premium, and the debenture keeps hard at 2 premium. The new Buenos Aires Lacroze debenture at 5s. premium has gone back a few shillings.

Marconis continue to attract lively attention, though greater interest is, perhaps, being paid to Canadians, in which an active market prevails. The price is better on the week at 5s. 6d., and speculation prophesies a higher level than this. Some people hint that the Radio Corporation is accumulating the shares. Marconi 6½ per cent. debenture has risen to 102. In other wireless shares there is no particular animation. The engineering group is dull, but Armstrongs put on a few pence, to 4s., on the chairman's statement at last week's meeting, that "conversations" are proceeding between Armstrongs and Vickers. At 52s. 6d. Babcocks show no alteration.

Disappointment is felt at the India Rubber, Gutta Percha Company's announcement that no interim dividend will be paid on the ordinary shares, although the preference are to receive their half-yearly dividend on July 1st. No interim was paid a year ago on the ordinary, but shareholders had 5 per cent., tax free, last December. The directors contradict the rumour of a possible disposal of the company's business or any part of it. The price of the shares is 22s. 6d. International Telephones have lost a few pence at 39s. 6d. Newcastle Electric Supply at 22s. 6d. are ex the right to apply for the new issue, the offer of 770,000 ordinary shares at £1 each at par. The proportion is one new share for every complete multiple of 5 shares, ordinary and preference alike. This constitutes a useful little bonus. Rubber shares are weak in consequence of another fall in the price of the raw material.

Share List of Electrical Companies

	Nom.	Dividend. 1925.	Dividend. 1926.	Price June 13 1927.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	3	+2/3	4 18
Brompton Ordinary	1	10	8⅝	25/-	—	5 12
Charing Cross Ordinary	1	15	8½	25/6	+6d.	5 12
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2
Chelsea	1	12	8⅞	25/-	—	5 12
City of London	1	15	10	1⅜	—	5 1
do. do. 6% Pref.	1	6	6	22/6	—	5 6
Clyde Valley	1	8	8	30/6	—	5 5
County of London	1	15	7½	28/-	—	5 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6
Edmundson's Ordinary	1	7	8	28/3	+1/6	5 13
do. 7% Pref.	1	6	7	23/6	—	5 19
Elec. Supply Corporation	1	10	10	32/-	—	6 5
Kensington Ordinary	1	15	8	25/-	—	5 12
Lancs. Light and Power	1	7½	7½	26/-	—	5 15
London Electric	1	10	8½	24/-	—	5 16
do. do. 6% Pref.	5	6	6	5⅝	—	5 6
Metropolitan	1	11	8	29/-	—	4 16
do. 4½% Pref.	1	4½	4½	17/-	—	5 8
Midland Counties	1	5⅝	6	22/6	—	5 6
Newcastle-on-Tyne Ordinary	1	7	5	22/6 xd	—	4 8
do. 5% Pref.	1	5	5	17/6	—	5 14
do. 7% Pref.	1	7	7	24/6	—	5 14
Notting Hill 6% Pref.	10	6	6	10	—	6 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9
St. James' and Pall Mall	5	17½	8	25/6	—	5 9
South London	1	15	8½	25/-	—	5 12
South Metropolitan Pref.	1	7	7	1½	—	6 3
Urban Ordinary	1	7	7	25/-	—	5 12
do. 6% Pref.	1	6	6	1 1/16	—	5 13
Westminster Ordinary	1	15	8½	25/-	—	5 12
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	—	7 6
Yorkshire Elec.	1	8	8	30/-	—	5 6
Home Rails.						
Central London Ord. Assented	Stock	4	4	71	—	5 12
Metropolitan	,,	5	3	60	—½	5 0
do. District	,,	3½	3½	61	—½	5 14
Underground Electric	£1	Nil	1½	18/6	—6d.	1 11
do. do. Income	Bonds	6	6	102	—	*5 17
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 19
do. Def.	,,	1½	1½	24½	—	6 2
Automatic Telephone	1	8	10	47/6	—	4 8
Chili Telephone	5	5	6	7⅞	—	3 17
Eastern Extension	10	10	10	18⅝	—	*5 6
Eastern Tel. Ord.	Stock	10	10	182½	—	*5 9
Globe Tel. and T. Ord.	10	10	10	18⅝	—	*5 6
do. do. Pref.	10	6	6	11⅛	—	5 8
Great Northern Tel.	10	20	20	28½	—	7 0
Indo-European	25	8½	10	45½	—1	*5 7
Marconi	1	Nil	Nil	1⅜	—	...
Marconi-Marine	1	7½	8½	27/-	—	6 9
Oriental Telephone Ord.	1	12	12	56/3	—	*4 5
United R. Plate Tel.	5	8	8	9¾	—	*4 2
Western Telegraph	10	10	10	17½	—	*5 12
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3 9/16	+1/16	7 15
do. do. 2nd Pref.	5	6	6	8 11/16	—	8 2
do. do. 5% Deb.	Stock	5	5	71½	—	7 0
British Electric Traction Ord.	,,	8	8	151	+2	5 6
do. do. 6% Pref.	,,	6	8	120½	—	6 12
Brazil Traction	100	5	6	175	+15	3 9
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	90½	+1	5 11
do. do. Preferred		6¾	6¾	122	+1	5 7
do. do. Deferred	,,	8	—	158	—	*5 1
do. do. Deb.	,,	4½	4½	80½	—	5 5
London & Sub. Trac. 5% Pref.	1	Nil	Nil	7/9	—	Nil
London United Tram. Deb.	Stock	4	4	52½	—	7 12
Mexico Trams, 5% Bonds	—	5	5	81⅓	—	6 2
Mexican Light Common	100	Nil	Nil	43	—1	Nil
do. Pref.	100	Nil	Nil	110½	—	Nil
do. 1st Bonds	—	5	5	74⅓	—	6 14
Yorkshire (West Riding)	1	5	—	8/9	—	...
Manufacturing Companies.						
Babcock & Wilcox	1	13	13	52/6	—	4 19
British Aluminium Ord.	1	12½	10	43/-	—	4 13
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13
British Insulated Ord.	1	15	15	67/6	—	4 8
Brush Ord.	1	10	10	26/3	—	7 12
Callenders	1	15	15	3 7/16	—	4 7
do. 6½% Pref.	1	6½	6½	23/9	—	5 9
Crompton Ord.	1	Nil	Nil	12/6	—	...
Edison-Swan	4/-	10	10	10/	—	4 0
do. 5% Deb.	Stock	5	5	85	—	5 17
Electric Construction	1	10	7½	27/6	—	5 9
Enfield Cable Pref.	1	7½	7½	25/6	—	5 17
English Electric	1	Nil	Nil	10/-	—	...
do. do. Pref.	1	3	—	12/6	—	...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8
do. Ord.	1	7½	—	30/6	—	4 18
Henley	1	20	25	4¾	+1/16	5 5
do. 4½% Pref.	5	4½	4½	4¼	—	5 6
India-Rubber	1	5	5	1⅛	—	*4 9
Johnson & Phillips	1	17½	12½	2⅝	—	5 0
Met.-Vickers Ord.	1	8	8	27/6	—	5 11
do. Pref.	2	8	8	28	—	6 14
Siemens Ord.	1	7½	7½	27/6	—	5 9
Telegraph Construction	12	10	10	28½	—	*4 4

* Dividends paid free of Income Tax.

The Incorporated Municipal Electrical Association.—IV.

Annual Convention at Buxton.

On Thursday, June 2nd, Mr. H. H. Berry's paper on "Electrified Homes of Great Britain" gave rise to a lively discussion; members of the Electrical Association for Women were specially invited to be present, and acquitted themselves with distinction, the remarks of the women who spoke being highly practical and to the point. Afterwards the E.A.W. members and others interested in electrical development lunched together at Ashwood Park Hotel. The afternoon was



Assembling at the Opera House.

devoted to separate meetings of Committee representatives and engineer members; but members of the E.A.W. and other ladies attending the Convention were invited by Dr. and Mrs. Ferranti to visit Baslow Hall, at Baslow, Dr. Ferranti's all-electric house, of which particulars follow; a large party, numbering some 400,



The E.A.W. starting for BaslowH lla .

and including many men, took advantage of this unique privilege, and inspected the installation with keen interest and appreciation. The visitors were entertained to tea, and a hearty vote of thanks was moved by Lady Snell and seconded by Mrs. Ll. B. Atkinson, to which Dr. Ferranti briefly responded. The weather on this and the following day was delightful, fully compensating for the shortcomings of the earlier part of the week.

On Thursday evening the annual dinner of the Association was held in the Pavilion; the President occupied the chair, and there were present some 450 members and ladies.

Friday morning was devoted to the annual meeting. In the afternoon a motor tour to Matlock was thoroughly enjoyed by a large number of the visitors; this was the concluding item of the official programme, but those who stayed at Buxton for the week-end were invited to take part in visits to the electricity works of the Buxton, Macclesfield, and Manchester Corporations, the works



The "Electricar" under Inspection.

of the D.P. Battery Co., Messrs. Hopkinson, Ltd., Ley's Malleable Casting Co., and Mirrlees, Bickerton and Day, Ltd., and the experimental station of the Safety in Mines Research Board at Harpur Hill.

The arrangements for the Convention, which were in the hands of the Hon. Secretary, Mr. A. C. Cramb, the secretary, Miss B. J. Lanfear, and her staff, were carried out on the usual high level of efficiency which



Some well-known members.

has long characterised these meetings of the I.M.E.A., and which has called forth expressions of keen approval on the part of the members; the programme was conducted without a hitch, and the Convention, the largest recorded in the annals of the Association, was also one of the most successful.

The Electrical Equipment of Baslow Hall.

Electric light, electric cooking, and a few electric fires were installed at the Hall a number of years ago; it was only, however, two years ago that complete electrification was achieved. Since then every requirement of heat, light, and power has been filled electrically, the fundamental feature underlying the installation being the storage of heat in water.

In the discussion on Professor S. Parker Smith's I.E.E. paper on "An All-Electric House," Dr. S. Z. de Ferranti explained the system which he had adopted at the Hall. Remarking that our great handicap in



Baslow Hall.

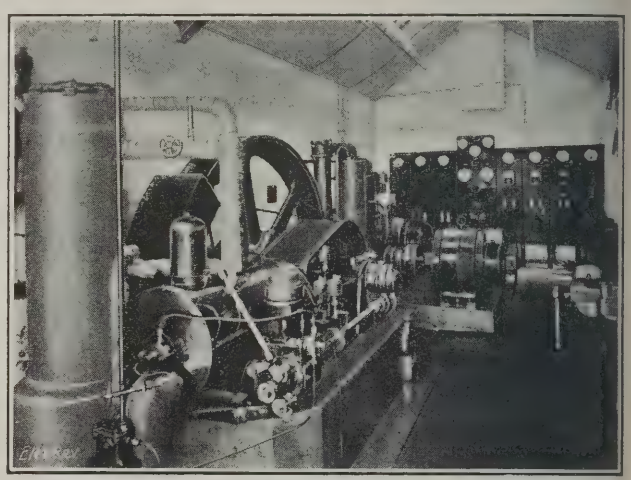
electrical work was that we had no efficient means of storing electricity, he pointed out that hot water was a very cheap form of energy storage, and the provision of a large water tank enabled electricity to be taken at a time when it had practically no value. In his own house he burnt no coal or coke, and used no gas; he burnt crude oil in a 25-h.p. engine, the maximum load being 18 kW (at a time when the battery was assisting the engine). A very large portion of the heat of the jacket water and of the exhaust was used to supply the hot-water storage in the house. He had a



Dining Room.

storage battery containing about 2 tons of lead, and a hot-water storage tank in the basement 6 ft. in diameter, 6½ ft. long, with about 6 in. of heat insulation, holding about 6 tons of hot water. All the principal rooms had invisible panels in the ceilings, consisting of pipes embedded in the plaster below the surface. The general heating was therefore taken care of by radiation at low temperature from the ceilings of all the principal rooms, and not by heating the air by convectors, which were wrongly called radiators. The reason for placing the panels in the ceiling was that they should not heat up the air; the idea was to have in the top of every room a layer of stagnant hot air which kept the surface of the ceiling reasonably warm. The heating was produced by radiation at low temperature from the warm surfaces. The temperature at the surface of the ceiling was 110-120 deg. F. The high-grade radiant heat was produced by electric radiators; every room had one or more of these. The heat efficiency of the whole installation was extremely high; something over 75 per cent. of the heat in the oil was usefully employed.

In the house there are four bathrooms, ten lavatory basins, and five sinks, so that the demand for hot water is considerable. This is obtained from a tank contained inside the large storage tank previously described. Electric lighting is amply provided for. In the cellar there is an electric washer, a motor-driven electric ironer, and a large drying and airing cupboard. There is also an electrically-driven cream

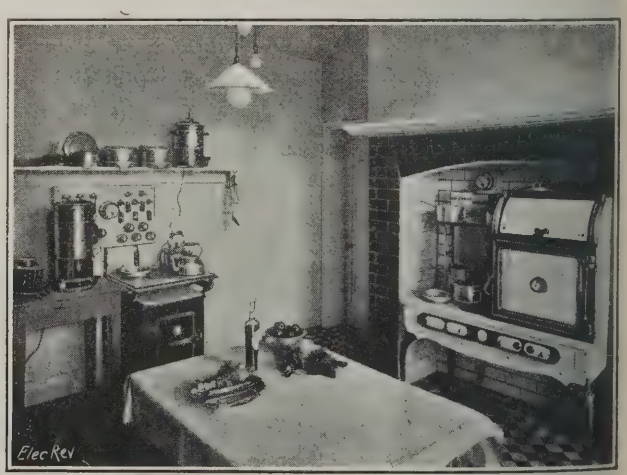


Oil-Engine Generating Plant

separator in the dairy, and an electric fan to keep the air moving in the cellar and the dairy.

The kitchen is provided with a complete cooking range, and an old electric oven made in the early days of electric cooking is still in use and perfectly effective. There are also a number of cooking appliances with self-contained heater elements for which a special table and switch and plug board is provided.

In the main bedrooms the fireplaces have been taken out, and wardrobes have been let into the spaces normally occupied by the grates and chimneys. An air inlet has been arranged which passes underneath the wardrobe to the back of the chimney, so preserving the ventilation obtained before. If the chimney requires cleaning, the wardrobe can be



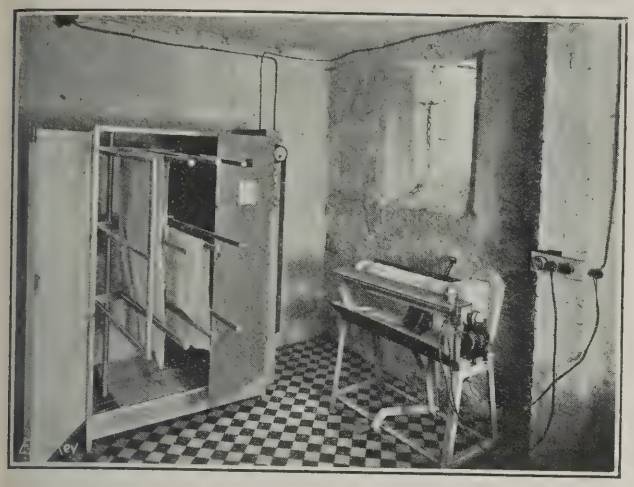
Kitchen.

removed by unscrewing two thumb screws, and lifting it out as a unit. All unnecessary furniture has been deleted, and as the bedrooms are abnormally large, coke-breeze partitions have been erected. By this means a large hanging closet and bathroom have been added to each of the main bedrooms. The closet has been arranged on the American system, in which a light is lit when the door is opened, and is fitted with boot racks, clothes hangers, &c. The bathrooms are fitted with sunk baths and appliances, adjustable mirrors, electric radiators, &c.

In the smaller bedrooms the fireplaces have been taken out and the recesses arranged for an adjustable looking-glass and washing basin. The air outlet is still preserved, but in this instance, as the basin is a fixture and cannot be removed, a special catch trap has been designed by Dr. Ferranti to fit

into a circular aperture above the basin. This traps dirt in the air and allows filtered air to pass into the room. This aperture is also used for cleaning the chimney.

The towel racks in the bathrooms are above the heating apparatus, thereby allowing hot air to circulate through the damp material instead of hanging the towels on hot pipes.



Ironer and Drying Cupboard.

The cow house is fitted with an electric chaff cutter, a food cutter, and other apparatus. The floor of the garage is heated by means of the exhaust gases taken in piping through the floor prior to their being discharged into the atmosphere.

A large electric lawn mower is used for mowing the lawn. Power plugs are connected at different points in the garden, for the electric lawn mower, and at the tennis courts, for teas.

All dirt has been eradicated by the installation of electricity, and the space that was once used for coal and coke and the heating boiler has now been adapted for electric washing.

It has been estimated that by introducing a complete electrical system nearly 50 per cent. has been added to the accommodation of the house, and it is significant to note that where it was necessary, before the installation was complete, to employ five maids to work and keep the house clean, the whole of the work is now being done by two helpers. It will be seen, therefore, that electrical equipment materially lightens the work, reduces the labour costs, and increases the floor space available for useful work.

Electrified Homes.

The Domestic Heating Problem.

By HERBERT H. BERRY. (*Abstract.*)

The author accepts the "All-Electric Home" as a high standard to be attained and achieved under certain circumstances, and at the same time desires to point out that those circumstances only arise in a percentage of the total number of cases which need diagnosis at the hands of the skilled adviser.

The ultimate solution of the domestic-heating problem lies, not in the adoption of any one particular system as at present, but in a scientific combination of two or even more selected systems which may vary with the local and other conditions. The author desires to draw special attention to a combined system for supplying heat energy for domestic purposes, about which, as far as he knows, little has been said, and no established data published. He will refer to it as the "Colectric System." It represents a combination in modified form of two well-known systems—heat energy generated in the immediate vicinity of the home direct from fuel, plus heat energy generated remotely and distributed in the home in the form of electricity. It is capable of very wide and diverse application, the field including almost every kind of building.

The application in the home is not always the same, but the facts underlying the several principles are more or less identical. In the majority of homes a constant supply of hot water is desirable throughout the day and year, and the principal living rooms, excluding bedrooms, need to be kept warm during the six winter months.

For the purpose of reference, the two systems of heat energy will be separately described as the "constant load" and the "intermittent load." The "constant load" is dealt with from the local furnace, and the "intermittent load" electrically. The "constant load" requires the provision for 52 weeks of constant hot water at 160 deg. F. for domestic purposes, and a means of interior air heating at 55 deg. F. during 26 weeks. The "intermittent load" requires provision for raising the temperature of "constant load" hot water as and when required for cooking and other purposes; the provision of radiant electric heat for topping up the "constant load" temperature in the principal living rooms to 65 deg. F., or for dealing with the spring and fall intermittent load when the "constant load" is shut down; the production of light combined with radiant heat energy, or a reproduction by electricity of the cheerful coal or log fire with radiant heat.

With the "colectric" system the disadvantages inherent in both systems automatically disappear, no artificial humidity is needed and ventilation is simplified. The necessary constant-load convectors are not of sufficient dimensions to make their existence known. The electric radiant glowing fire in a room, whether it is being used at the moment for "topping up" the temperature or not, gets all the credit. The possibility of instantaneously providing a glowing fire and "topping up" with radiant heat where the outside temperature is at or below freezing point and the inside temperature uniform at 55 deg. F. is a luxury so delightful that it is good to know it is within such easy reach. The benefit to health to be derived from sitting in direct radiant heat of short wave-lengths is undeniable. The blood circulation is improved, breathing is deeper and waste matter is expelled more actively by the lungs.

The "Colectric" home is provided with one chimney only. The saving on the simplified construction will completely pay for the installation of the central-heating plant and hot-water system. It is usual in such systems to include convectors in the bedrooms, but since we employ a secondary means of heating, the piping and accessories can be omitted in the upper rooms of the house. The saving thus effected is estimated to more than cover the cost of the electric wiring. The boiler should be of the high-efficiency type in which the central heating water only flows through it. Convectors should be run off from this supply to the living rooms, and hall, or passages, of sufficient heating surface to ensure that the temperature does not fall below 55 deg. F. on the coldest days. Unless required for drinking purposes, it will never be necessary to bring water to the boil from cold. For washing clothes, cooking, and so on, hot water should be used from the tap, and by means of electricity the necessary additional heat for boiling or simmering be applied.

The temperature of the already partly heated living room is "topped up" when required by electric radiation. Here the spectacular effect plays an important part, and it will be very often experienced that no electrical heat is required at all so long as the brilliance of a natural coal fire is maintained. It is this particular feature, controlled from the door, which is so attractive. A combination such as described provides a luxurious method of living under perfect temperature control, and within the means of the humblest purse. The "Colectric" system opens up an entirely new field for the larger class of private installation, as the power required for the intermittent or "topping-up" load can well be supplied by a plant of moderate size. The significance of this application is of vast importance. It means that an electrified home is the most practical proposition regardless of situation.

In certain places where a cheap price for energy is quoted, electrically heated water may be introduced with considerable success. Very great care is needed in the initial layout of any such scheme in order that it may function at the maximum efficiency for a given type of load. There can be much said in favour of the local storage tank. The chief defect from the consumer's point of view is the limited hot-water output and the time-lag in heating up afresh. To mitigate as far as possible this trouble, a tank of fairly large capacity must be installed to meet the maximum demands likely to occur during the day.

An alternative all-electric system is the central-storage or pressure-type calorifier thermostatically controlled. The tank in this case can be of a much greater capacity and should be placed as near as possible to the central position relative to the draw-off taps. All such tanks should be well lagged. It is interesting to recall that the radiation per square foot of surface of an unlagged tank working at 150 deg. F. represents an electric consumption of about 30 to 40 watts. In round figures this is equivalent in a 25-gal. tank to a loss of about a quarter of a unit per hour, or approximately 40 units per week. For a polished copper tank the loss is about half. The system has an obvious advantage over local storage, inasmuch as hot water is available to full capacity at any tap to which it may be connected. A dual purpose can be served if the tank is placed in a linen cupboard. It is important to keep the flow pipe runs as short as possible.

Discussion.

Mr. L. L. ROBINSON, Hackney, opening the discussion, said that for many years he lived in an all-electric flat, and during the past year he had been living in the country in a house which had been so designed that it might become all-electric as soon as the power was available. One thing he had learned was that the all-electric house was much cheaper, where the current was sold at a reasonable rate. He thought Mr. Berry would have to extend his investigations so that they could put the all-electric house within the reach of poor people. He was inclined to advocate a system which allowed the public to heat water and do their cooking by electricity in the summer, and which would enable them to get back to solid fuel in the winter.

Mr. G. WILKINSON, Harrogate, said he had had an all-electric house for 25 years, and had got precisely the system

advocated in the paper, but it could only be justified if one owned his house and not if it were rented. For lighting alone he used less than 3 per cent., for cooking just under 20 per cent., for hot water over 20 per cent., and for room heating 57 per cent.; out of the total of energy consumed no less than 77 per cent. was what he called low-grade heat—something less than boiling point—which could be stored. He suggested that they might introduce a "change circuit" system for getting cheaper electricity, a circuit which was laid out in a very circumscribed area, and took in a spasmodic way the amount of energy which could be supplied between the normal and the top load.

Lady Brooks, C.B.E., the President of the Birmingham and Midland Branch of the E.A.W., said Mr. Berry's paper was an extraordinarily practical one from the woman's point of view. In the future they were going to receive with open arms everything electrical, but for the moment that was impossible. They wanted closer co-operation with the architects and builders.

Dr. S. Z. de Ferranti recognised that it was a most contentious subject. Some people would not give up their open coal fire at any price, but they were out of date or shortly would be. He looked upon the system which Mr. Berry advocated as a makeshift; years ago he had the "Colectric" system, a central system of heating at a low temperature with a water radiator in every room and a furnace in the basement, and "to put it bluntly, we got fed up with it" owing to fumes from the coke furnace. If Mr. Berry said the all-electric house was the ultimate solution he would agree with him, but they must have storage capacity. The output of electricity undertakings would be increased not ten times, but a great deal more when all the requirements of the public were properly met.

Mr. T. Hall, Burton-on-Trent, said that for electricity for heating and cooking they had received £10,000 this year; they were educating people to use electricity for everything they possibly could. He urged the importance of introducing a satisfactory system of storage, and said he was trying out several experiments in the breweries with this object in view. The demands of the breweries for hot water were enormous; one brewery wanted 2,000 or 3,000 kW for this purpose.

Mrs. Gregory, of West Ham, stressed the point that the people into whose homes they wanted to get electricity were not those who could afford it, but the millions of homes of the workers who would enjoy and appreciate its advantages. They were educating the people of the country with regard to electricity, but she felt that a good many of the men on electricity committees also wanted educating, and it would be useful if more women were members of municipal electricity committees to give the woman's point of view. It was time the engineers found a way of getting the appliances cheaper.

Ald. H. G. Odell said from the discussion it seemed to him that they were going to throw over the slogan of the "all-electric house" and were going in for a sort of half-way house. But they must have no compromise, they must go for the all-electric house, which was practical, popular, and much appreciated. At Ilford they had received letters expressing satisfaction not only with the electrical service, but also with the cost of it. The main thing was to get the prices right and make the service attractive.

Mrs. A. L. Hayes said if they could get a cheaper supply of electricity and cheaper apparatus they would better help the masses. Mr. Berry's plan was not going to help the masses who were living in present-day houses.

Mr. W. A. Gillott said the system proposed by the author would not increase the output of electricity, and drew attention to the value of a coal fire for the destruction of household refuse.

Mrs. H. C. Lamb said they had adopted Mr. Berry's plan and had some of his "Magicoal" fires on approval. Many of their friends had come in and told them what a lot of heat there had been from these fires (when there had been no heat at all). They had been able to keep their friends warm for twenty hours at a cost of a penny. As soon as the women realised what a thick cloud they were putting between the sun and their own children, the domestic fire would disappear. It was the work of the E.A.W. to educate people in this direction. The problem of disposing of refuse must not be lost sight of.

Mr. D. M. Peattie, of Manchester, considered that the cost of supplying energy for radiators was too high.

Mrs. H. A. Howie, of Walsall, asked what was the use of going on building houses "in the same silly old way." They wanted more women on the Housing Committees, and in the E.A.W.

Mr. F. W. Purse supported the idea of making a compromise until they could reach a perfect system.

Councillor J. Thickett, of Walsall, said there was no doubt about the all-electric house being the ideal, but thousands in this country could not even afford gas. Why did they not bring the cost within the limits of the poor?

Mr. E. Kilburn Scott gave his experiences in Pittsburgh, where they had central heating by steam, and suggested that electrical undertakings should sell steam as well as electricity. A great many existing power stations were out of date, but the boilers could be used to supply steam.

Mr. Berry, in reply, said that the all-electric home was the high ideal.

Alderman Mrs. Hammer, of Hackney, in proposing a vote of thanks to Mr. Berry, said much had been done, and could be done, by wiring and hiring schemes.

The Annual Dinner.

The annual dinner was held at the Buxton Pavilion; Mr. R. W. L. Phillips (president) was in the chair, and there was a large attendance of members and ladies.

After the toast of "The King" had been honoured, Sir Harry Haward, proposing "the I.M.E.A.," congratulated the Association upon its successful work, and extended on behalf of the Electricity Commissioners their best wishes for the future. They recognised the value of such an Association as a means of focusing the ideas and opinions of the 350 local authorities which were operating electricity undertakings, pooling their experiences, providing opportunities for the collective expression of opinion and collective action where such was desirable, and above all things, conducing to a breadth of vision on the part of individual engineers and chairmen of committees which did not come from the mere study of the local undertakings. Such pleasant gatherings as that dinner formed a welcome contract to some of the thorny questions with which the Electricity Commissioners had to deal, and which demanded the wisdom of a Solomon, but unfortunately they were without his power of decision to cut the baby in half. It was impossible to please everybody, but they tried to base their decisions on engineering and technical considerations and not upon party politics or policy. He thought the public generally was not really aware of the extent to which the supply of electricity in this country was dependent upon the efforts of the local authorities. No less than £150,000,000 represented the capital expended by local authorities on their electricity undertakings. During the last year over which statistics were available, he found that only 17 undertakings made calls upon the local rates, totalling about £18,000, whereas 107 undertakings contributed to the rates a sum of £772,000. The Act of Parliament passed last session, like its predecessor the Act of 1919, was a great landmark in the history of the supply industry in Great Britain. He would not hazard a speculation as to what would have been the position in 1926 if the Electricity Commissioners had been able to carry out the intentions and hopes of the sponsors of the measure of 1919; they did their best with the limited powers that Parliament gave them, striking the keynote of co-operation between themselves and the local authorities, and between the local authorities and the companies, but they encountered difficulties and delays of no ordinary kind. By meetings of joint boards of electricity authorities they managed to get them together in some fashion, but there was only one case in which a real union between the parties was effected, and that was in the Midland district. Then came the Central Board, and every undertaking, large and small, would have to look to the Board for its supplies of electricity. With reference to the owners of the selected stations, who would be the pivot of the new system, they felt that all indications pointed to a spirit of co-operation on their part with the Commissioners and the Central Board in working a national scheme. He made an earnest appeal to the owners of the smaller undertakings, as to whose attitude to the new state of affairs he was not quite certain, that they should cordially co-operate with the Commissioners and the Central Board in making this great national effort a success. The sooner all came in the better it would be for them and for everybody else. The great problems that faced the electrical undertakings were those connected with distribution; and here surely there was enough work for the most energetic and enthusiastic engineer. The problem of the domestic load was a pretty tough one for the electrical undertakings; the Electricity Commissioners indulged in a vain hope that they might get advice from the Advisory Committee as to what was an ideal tariff, but unfortunately they drew a blank. Electrical undertakings should be in a position to supply the domestic load when they got it, and he had very grave doubts as to whether many undertakings were adequately equipped in that respect. Vision was needed in all branches of the industry.

Responding to the toast, the President said that King Solomon did not cut the baby in half, but he had heard that recently the Commissioners had cut something in half—that was the period for the repayment of loans. As to his plea that all undertakings should do their best to work under the Act, he could assure Sir Harry that they had been working under very awkward legislation for the last thirty or forty years and were used to it. However difficult this Act was to work, they would do their best with it. The Commissioners themselves would, he feared, experience a considerable amount of difficulty in working the Act and they could be assured of their deepest sympathy in their task. He was utterly sick of the 1926 Act, and had had quite enough of it; they hoped that they should soon see the end of the difficulties that now seemed to be looming ahead.

The Mayor of Bedford, Ald. G. H. Barford, J.P., gave "The Buxton Corporation," and thanked the Mayor and Corporation and all the people for what they had done to make the Conference one of the most successful they had ever had.

The Mayor of Buxton (Councillor W. Goodwin) responded.

Alderman W. Walker proposed the toast of the "Ladies and Guests" in felicitous terms, and suggested that the ladies might create for them a fashion in the use of electricity.

Lady Brooks, C.B.E., J.P., in responding, said that what they wanted in the electrical world was vision: electricity and intelligence could not be separated.

During the dinner the Gardens orchestra, under the direction of Mr. Sydney Freedman, rendered selections of music.

The I.M.E.A. Exhibition.

(*Concluded from page* 948.)

On the stand of the General Electric Co., Ltd., a full range of "Magnet" household appliances included the vacuum cleaner, washing machine, wash boiler, and the refrigerator. Special attention was given to the "Magnet" electric cooker, which showed the latest developments in the company's enclosed hotplates. We understand the G.E.C. has developed a hotplate which is claimed to be fool-proof, quick boiling, very robust, and at the same time has a high efficiency and high insulation resistance, both when hot and cold. Street lighting appliances were also shown, including the "Wembley" lantern in various designs. A special attraction was a large ornamental "Wembley" for promenade and main-street lighting.

Messrs. Kelvinator, Ltd., displayed three domestic models of the Kelvinator refrigerator, and also a Kelvinator Nizer compressor, which is designed particularly for use with large installations for butchers, hotels, and so on.

A comprehensive range of electrical cooking apparatus was shown on the stand of the Hotpoint Electric Appliance Co., Ltd. Of special interest was the new Hotpoint cooker, model 6281, fig. 9. It is fitted with a double-door oven, which can be sub-divided into two small ovens, and an efficient grill with a plate-warming chamber. A feature was an electrically heated frypan; it is constructed of cast-iron and fitted with side-handles for lifting. A heat-regulating switch is mounted underneath. The loading is 2,000 watts. An electric wash-boiler, 9-gal. capacity, was also included in this exhibit. The body is constructed of cast-iron, and black glass-enamelled inside. A standard 3-kW, 3-heat immersion heater is provided.

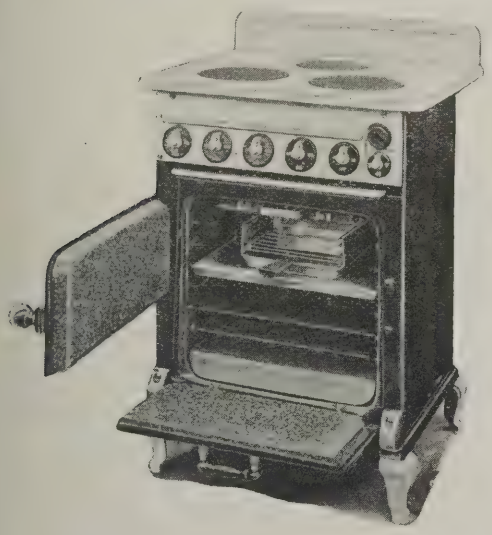


Fig. 9.—Hotpofnt Double-door Cooker.

A revised model of the No. 5280 Hotpoint-Falco standard electric cooker was also shown. It has a grey porcelain enamelled hob which carries two "Sadia" boiling plates, 1,800 W each, and a 3-heat grill, 1,500 W. The oven is loaded at 2,000 W. The chief innovation is the fall-down oven door, which is of the usual standard size. The oven lining is fitted with wire runners instead of the usual angle-iron or pressed metal, thus making for greater cleanliness. The grill chamber is fitted with a drop-down door.

The display by Messrs. Sadia, Ltd., included "Sadia" automatic thermo-storage water heaters with capacities of from 2 to 44 gal. A full range of fast boiling plates, including the new 4½-in. circular single-heat plate, was also shown. The latter was also seen mounted as a table stove. A new mercury-break thermostat for a very fine control of air and water temperature was demonstrated, and also automatic time and temperature control switches.

Some improvements to the Bastian storage geyser were seen on the stand of the makers, Messrs. Bastian Meter Co., Ltd. A new model has a white enamel finish, a new method of fitting the terminals, and a capacity of 15 gal. The exhibit also included electric fires embodying the Bastian Quartzalite heating element. The latest Bastian fires are the "Super Imp," 2 kW, the super "Imp de Luxe," 2 kW, the "Black Baby Imp," 1 kW, and the "Sunshine Baby Imp" in brass and copper, 1 kW. These are very attractive models, and so designed that the parts are easily accessible for cleaning.

In accordance with the wishes of the I.M.E.A. Council, Messrs. J. H. Tucker & Co., Ltd., kept their display as simple as possible and confined it to a demonstration of the load-breaking abilities of Tucker tumbler switches of the B.4,000 type. A s.p. 5-A switch that can deal with 33 A at 250 V, and 5 A (its normal rated current) at 525 V d.c., was shown breaking a load of 15 A at 250 V, while a s.p. 15-A switch carried 60 A at 250 V, and 15 A at 550 V d.c. Moulded switch-plates of a new design were shown, eliminating the loose ring, and providing improved insulation, and the "Kwik-wire" terminals, reducing erection costs, were demonstrated.

A variety of apparatus exhibited by Messrs. Archibald Low and Sons, Ltd., included a 75-gal. electric thermo-storage tank; this is of copper, white enamelled, and fitted with two 2-kW heaters controlled by the thermostat, and one 2-kW booster heater, fitted near top of tank, controlled by an ordinary switch. This tank is being fitted in an all-electric house in Edinburgh for heating during the off-peak load. A 10-gal. "Highlow" electric hot-water tank, No. 312, which was shown, has a loading of 750 W, and is designed for fitting over a bath. For use over a basin is a 2-gal. "Highlow" tank, No. 345. This was also exhibited; it has a loading of 500 W. The "Highlow" Parker-Smith cooker was also seen on this stand, as also were immersion heaters and electric oil heaters.

Among a variety of ingenious devices seen on the stand of Messrs. Venner Time Switches, Ltd., was an electrically wound time switch. The winding element consists of a tiny motor of unusual design. A small armature is balanced between two electro-magnets and vibrates with the frequency of the system. By means of an attachment at its centre, it revolves the rotor, the latter embodying a specially designed "free-wheel" clutch. The operation is silent. The makers guarantee the accuracy of the switch to within half an hour per year. It is interchangeable as regards dimensions with the makers' 45-day clock. Another feature of the exhibit was a Venner prepayment attachment, fitted to a Sangamo meter, which is designed to prevent the accuracy of the meter being affected by a varying number of coins being inserted. The "winding stress" is removed from the recording gearing by means of a specially designed fly device. The attachment connects with the ordinary train gear of the meter by the simple engagement of two toothed wheels. By means of a number of price units, each of which completes the train of gearing in the attachment, the reduction can be varied to suit any price per kWh from ¼d. to 1s.



Fig. 10.—Venner Silver Grill.

The Venner silver grill, fig. 10, was another item of interest. It consists essentially of two portions, the top or food-containing receptacle, and the bottom, soldered together at the rims. A space between the two portions is partially filled with oil, which is just in contact with the bottom of the pan. The heating elements are contained in the oil, in direct contact with it, so that the heat is transmitted very rapidly to the pan. The cooking surface is of a special black finish, "Russian iron," which, it is claimed, prevents the taste from any one food being transferred to another. The loading is 600 W. A non-return filling valve is fitted for the oil.

The Venner-Shotter water meter was also to be seen. An invention of Mr. G. F. Shotter, of the North Metropolitan Electric Power Supply Co., it is designed to measure the height or flow of water over weirs or notches. The action depends on the electrical conductivity of solutions, and, in use, the liquid to be measured is used as the electrolyte. Two conducting paths are provided by the solution, one in which the dimensions vary with the depth or flow of the solution, and the other in which the dimensions are constant. By measuring the ratio between the currents that flow in the two paths, a function of the depth or flow of the liquid is obtained.

Messrs. Venner also showed photographs of a new system of pneumatic control, for valves on pulverised-fuel plant and steam mains, which they have developed. The control is claimed to be positive in action and to give a visible indication at any desired point when the operation is completed.

Messrs. Siemens & English Electric Lamp Co., Ltd., showed a selection of Siemens-Xcel electric cookers in various sizes. These embody a new totally-enclosed high-efficiency boiling plate which the makers have developed. A few safety kettles, incorporating a cut-out device to prevent damage if the kettle is boiled dry, were also exhibited. A feature of the display was a new type of cast-iron boiling ring, incorporating the standard cooker boiling-plate element. Other exhibits included a new design of bathroom fire, a new type of bowl fire, and immersion heaters in various sizes and loadings.

The "Electra" lawn mower (Electrical Review, April 15th, 1927, p. 615, in two models, 16- and 20-in. cutting widths, was exhibited by Messrs. Ransomes, Sims & Jefferies, Ltd.

A selection of electric heaters developed since the last I.M.E.A. convention at Glasgow was on view on the stand of Messrs. Young, Osmond & Young, Ltd. The internal construction of the Unity tubular heater has been greatly improved, and the sample shown at Glasgow has been adopted as the standard. The use of porcelain as a support for the element has been abandoned, and a longitudinal mica strip used instead. There is, therefore, the minimum internal mass of material to be heated, and the tube itself begins to warm up rapidly as soon as current is switched on. Although the tube is not lined by insulating material it is impossible to make contact with the tube even in the event of the element breaking, since the distance between the supports is less than the radius of the tube. As the element is designed to work at a black heat, the current density has to be low and the cross sectional area correspondingly large; the chance of a broken element is therefore very small.

In addition to examples of the usual straight tubular heater, some curved tubes were shown. These are suitable for

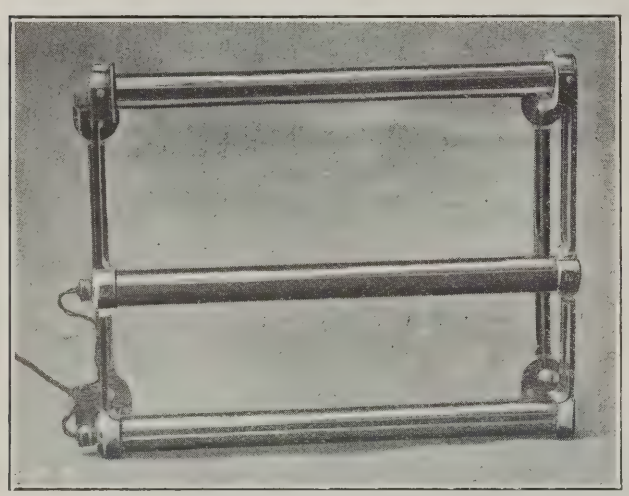


Fig. 11.—Electric Towel Rail.

installation under the curved seats of theatres and kinemas. Electric towel rails, fig. 11, in which the tubular heaters are incorporated, were shown. A feature of interest was a new terminal box for use with double rows of tubes. This ensures correct alignment and simplifies wiring. Other exhibits included tubular radiators and a selection of standard watertight and gas-tight heaters developed for the heating of buildings in which explosive vapours are present.

Among the manufactures of Carron Company on view were electric cookers, fires, irons, wash boilers, and so on. The cookers included model No. 310 F, a feature of which is its porcelain enamelled door and sides. The total loading of the cooker is 6,750 W. A similar type, but for larger households, No. 311, was also shown. Besides a larger oven, this model has three boiling plates. It can also be supplied with porcelain enamelled sides. The total loading is 8,200 W. In another range which was on view, No. 313, the oven and grill are mounted on legs at a convenient working height; it should appeal to those interested in the table form of cooking appliance. In the selection of the electric fires was the company's latest design, No. 271. This is 14 in. wide by 23 in. high, has a loading of 2 kW and is highly finished.

A range of water-heating apparatus was a feature of the display of Messrs. George Nobbs, Ltd. A variety of "Genii" appliances included: "Vectis" local storage-type water heaters with capacities of from 5 to 30 gal. and loadings from 100 W upwards; "Push-system" water heaters suitable for bulkhead or wall fixing, with capacities of from 1¼ to 15 gal. and loadings of 50 W upwards; "Safety" geysers with interlocked switches and water valves, loadings 3 to 40 kW; "National" calorifiers for serving a number of hot-water draw-offs from one central point, suitable for bulk storage by night; and blade-type immersion heaters. A range of water distillers suitable for use in battery-charging stations was also shown. A feature of the stand was a range of central-heating batteries for the hot-air warming of buildings. These have steel housings and loadings varying from 1 to 500 kW.

The "Boby" air-cooled automatic refrigerator shown by Messrs. Robert Boby, Ltd., is claimed to be the first of its kind to be manufactured by a British firm. It is intended for domestic use, and is made up in two styles in cabinets constructed of compressed cork slab insulation. The small electric refrigerator machine is contained in the base of the cabinet, and is completely automatic. The cabinet is at present made in four different sizes—10, 15, 20, and 30 cu. ft.

Messrs. Berry's Electric, Ltd., introduced for the first time some very beautiful designs of "Magicoal" fires in which was incorporated the new "living flame" effect. The first model of this was recently supplied for the Duke and Duchess of York's new residence. Another new exhibit was a radiant heater of the reflector type with a novel heating element. In the 3-kW size of this there are three separate windings on one central rod, which can be switched on one at a time. Each winding is carried from end to end of the bar, so that the heat is distributed over the whole length of the reflector, no matter how many sections are turned on at a time.

The McClary cooker was also shown. We understand that the works which are being erected for the manufacture of this cooker are nearing completion. The McClary cooker is enamelled inside and out. The oven is fitted with removable elements, racks, and so on, making the whole of the interior perfectly plain for easy cleaning.

The "Savage" electric washing machine was another Berry exhibit. This wringerless machine will, it is claimed, do the four operations of clothes washing—washing, blueing, rinsing, and drying—without removing the "wash" from the tub in which it was originally placed.

A feature of particular interest on the stand of the British Thomson-Houston Co., Ltd., was a new type of motor which embodied many valuable improvements in design. Two of these machines, one a.c. and one d.c., were of the same rated output and had identical essential dimensions, a feature of great importance to builders of machines intended for different supply systems. The motors will run at any angle and can be supplied with simple enclosing covers to give any desired form of protection. An interesting point in connection with the rotor of the squirrel-cage type of motor is that there are no joints in the cage. The aluminium bars and end-rings are cast in one piece by a patented centrifugal process which ensures uniformity of texture and eliminates the tendency to fracture.

A range of "Inventum" apparatus attracted a good deal of attention on the stand of Messrs. Drake & Gorham, Ltd. One exhibited article, the "Domestic" cistern, is particularly recommended for use where small quantities of water are required at frequent intervals. A gallon and a half of water at 195 deg. F. is available about 1½ hours after switching on. It has a loading of 500 W, and is complete with a 3-pin plug and safety socket. It is thermostat controlled. An unusual

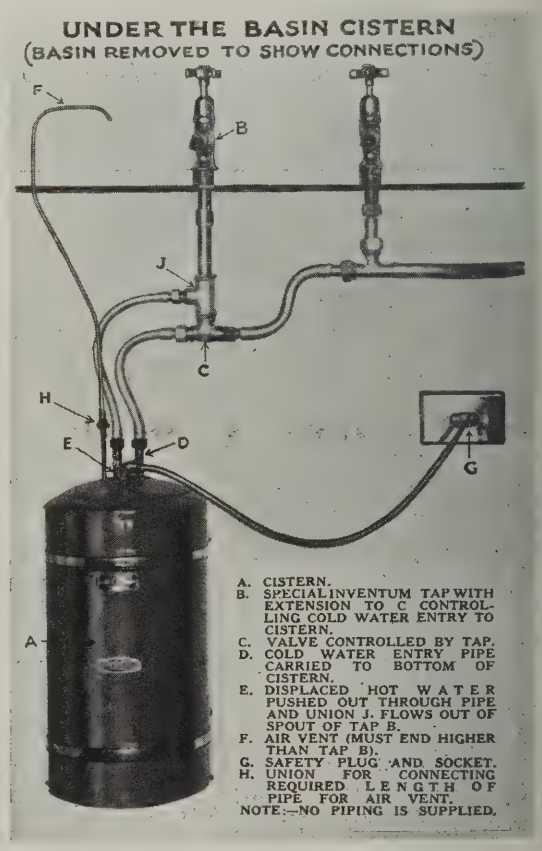


Fig. 12.—New "Inventum" Cistern.

exhibit was the "Under the Basin" cistern. This has been developed to meet the situation in cases where space shortage does not permit the use of the "Domestic" model. Fig. 12 shows the working arrangement of the apparatus. The special tap, which is fixed on the basin, controls the inlet of cold water into the cistern, and the hot water displaced flows out of the same tap. The capacity and loading of the apparatus are 1½ gal. and 500 W, respectively. It is supplied with a 3-pin plug and socket. The "Bath" 500-W cistern was also shown. This is intended for the small household where one or two baths are taken each day. It is provided with brackets at the back for wall fixing.

A variety of electric heating, cooking, and water-heating apparatus was to be seen at the display by Messrs. Belling and Co. The electric cookers, vertical and horizontal, included some specially designed for hiring purposes. These are equipped with enclosed-type boiling plates, plug-in elements, and an enamelled hob. A number of new designs of electric fires, industrial and domestic, were also part of

the exhibit. A sectional view of a fire, showing the details of construction, attracted attention. Other apparatus exhibited included immersion heaters in actual use, and some new models of electric boiling plates and grillers. An efficient switch and interlocking plug-socket was shown.

MESSRS. L. G. HAWKINS & COMPANY, LTD., had a fairly comprehensive display of electric domestic apparatus, including cookers, washers, cleaners, ironers, percolators, and toasters. The "Electrolux" products, the cleaner and refrigerator, were on view at the stand of MESSRS. ELECTROLUX, LTD., who also had an enormous automobile model of the cleaner on view near the Opera House.

A wide range of electric domestic apparatus was exhibited by the BRITISH ELECTRIC TRANSFORMER CO., LTD. Included in the cookers was a new model, No. 722, which is designed to meet the requirements of 12 persons. It has a higher oven than its predecessor, No. 669, 18 in. instead of 14 in. Three boiling rings are fitted, as previously. The interior of the oven is in a removable-box form with a "dished" back and all-rounded corners. In all cases except the small model, No. 703, the Tricity cookers now have fuses and reciprocating switches in compartments under the hob.

A standard wash boiler seen on this stand has an element of the clamped type, a special method of stud reinforcement being a leading feature. The loading is 3.5 kW. The tap is at a suitable height from the ground, whilst its position in the container is such as to ensure all the water not being drawn off without the boiler being tipped forward.

A feature was a new breakfast cooker, shown for the first time. Of cast-iron throughout, this is a very strong appliance. Several designs of Sun Ray radiators were also shown.

The ELECTRICAL ASSOCIATION FOR WOMEN was represented by a stand with a collection of literature and particulars of the constitution and objects of the Association.

The Electricity Department of the Corporation of Buxton (Mr. A. Bishop, engineer and manager) had a stand setting forth the conditions of supply and a new tariff which is being introduced in the borough, including hire-purchase terms.

A striking exhibit was that prepared by the Electric Lamp Manufacturing Association, comprising features which were shown for the first time. We reproduce a photograph of one of these—a model engineering workshop, fig. 13, made by Messrs. Partridge's Models, Ltd., complete with miniature machine tools, hand tools, benches, &c., and equipped with two systems of lighting with tiny lamps, to



Fig. 13.—An E.L.M.A. Model Workshop.

show the difference between good and bad illumination practice. Other models for the same purpose represented a draper's shop-window and a business office.

Mr. GEORGE WILKINSON, M.I.E.E., in conjunction with Messrs. MEASUREMENT, LTD., had an interesting display of his patent "Losles" electric thermostats and water heaters, in operation, one set piece consisting of a fan and a radiator alternately cooling and heating a thermostat which alternately switched on one and the other in the vain hope of attaining a stable condition. The "Losles" thermostat has been greatly improved in design and construction since it was first introduced; experience has shown the weak points, which have been eliminated, the present pattern being very substantial and the regulation close; it is made in sizes from 5 to 30 A, and for voltages up to 500 V. One of the exhibits was a water heater of novel design; it consisted of a heating element immersed in oil in a copper tube, to be fixed at the bottom of a water tank. The oil forms the medium conveying the heat to the water surrounding the tube, and the variation of its volume with temperature serves to actuate a mercury switch controlling the circuit.

Messrs. BERRY'S ELECTRIC, LTD., in addition to their exhibit, opened a special showroom in the town, where an exact copy of the Duchess of York's fireplace was shown, as well as some score other patterns of the "Magicoal" fire, the McClary cooker, and other domestic apparatus. A centre of attraction after dark was a window arranged by E.L.M.A. to show a statuette with a background of drapery, illuminated from several concealed sources with ever-changing combinations of coloured light.

Messrs. W. T. HENLEY'S TELEGRAPH WORKS CO.'s travelling demonstration van, which we illustrated last year, was at Buxton, and was open for inspection.

A Large Electric Clock.

The tower clock at the new Canadian Houses of Parliament, Ottawa, is to be electrically operated, and will control the hour and quarter striking on the 53-bell carillon.

OF particular interest in connection with the new Canadian Houses of Parliament which are to be opened at Ottawa this year, is the electrically-operated clock with which the tower is being equipped. It is being installed by Messrs. Gillett & Johnston, Ltd., who are also supplying the large carillon of 53 bells in conjunction with which the electric clock will work.

The clock has four dials of bronze, glazed with white opal glass, each 15 ft. 9 in. in diameter. The hands are of copper, to the architect's design, while the motionwork is of the firm's standard construction. The motionwork wheels and also the nests of bevel wheels are constructed on the bed-plate

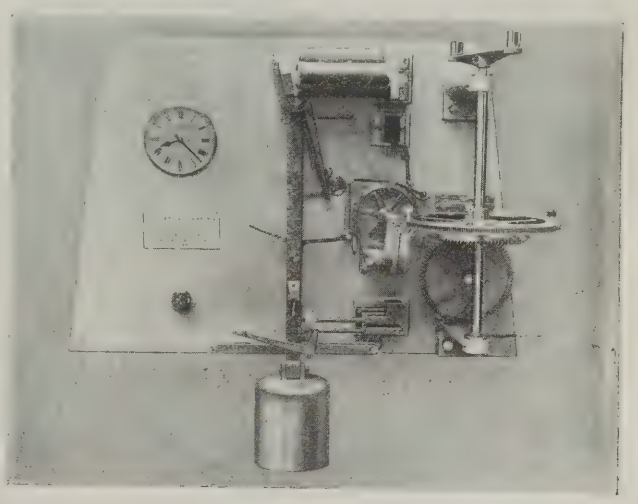


Fig. 1.—Clock Movement.

and plummer-block system, which gives great rigidity and accessibility for oiling and cleaning. The universal joints and connecting rods are all of unusually large scantlings, minimising the torque and back-lash, while still allowing for perfect freedom of action.

The timepiece portion of the clock movement, fig. 1, is of the Hipp type in its most modern and improved form. The motive power for the pendulum is obtained from accumulators used in the Parliament Buildings for other purposes. The current energises two very-large-capacity magnets which apply the driving power to the heavy pendulum with a smooth and silent action. When the arc of the pendulum falls to a predetermined amount, due to the work being done in turning

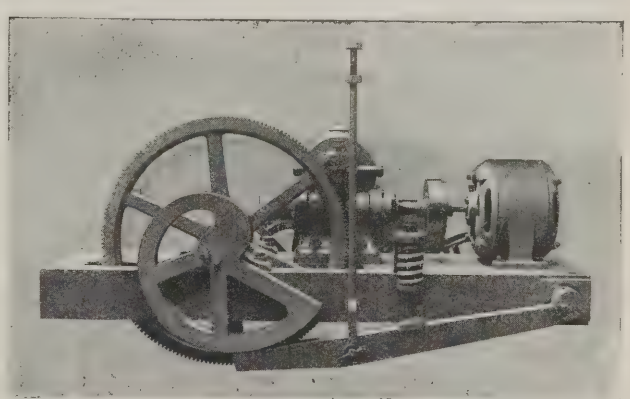


Fig. 2.—Striking Mechanism.

the hands, a wiper toggles in a steel notch and completes the circuit through the magnets, the impulse so given to the pendulum rapidly bringing this back to its maximum working arc. As a pendulum doing so much work cannot possibly keep accurate time, it is arranged that the hands reach each half-minute about 2 seconds in advance of the actual time, and that they are released by the impulse of the master-clock circuit exactly at each half-minute. An indicating dial in circuit with the master clock is incorporated in the design of the timepiece movement. All the parts are placed on the machined front surface of a deeply ribbed, vertical casting, and are well arranged for easy access. This timepiece is placed on a concrete base on the floor of the dial chamber in a glazed case.

The striking and quarter mechanism is fixed at a suitable lower level in the tower, beneath the heaviest bells. The striking gear consists of a cast-iron bed-plate on which is mounted a 1½-h.p. electric motor supplied from the 550-V.

2-phase, 60-cycle power mains. A single cam is driven by means of worm-wheel and spur reduction gear, and lifts the 560-lb. hammer (see fig. 2). Special automatic switchgear of a very simple and durable type is fitted for starting and stopping the motor, which is accomplished on the warning system by the closing and opening of a contact on the timepiece. The contact starts the motor, and a count wheel attached to the striking gear opens the switch for stopping the motor.

The Westminster quarter gear, fig. 3, is identical in action with the striking gear as far as the motor worm-gear and switch-gearing are concerned. Heavy steel cams operate the

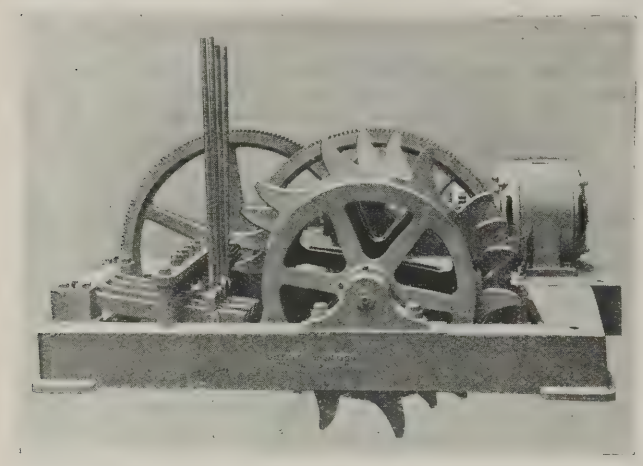


Fig. 3.—Quarter Mechanism.

forged quarter levers. The motor drive not only eliminates the manual labour of winding exceptionally heavy weights, but as the speed of the motor is constant and it has a large excess of power beyond what is actually required, the timing of the blows is claimed to be exceptionally crisp and accurate, although unusually heavy hammers of necessarily varying weights are in action.

The true Westminster quarters are played and the hours are struck on the bourdon bell of the carillon, which weighs 10 tons.

Indian Electrical Imports.

Figures for 1925-26 and 1926-27 Compared.

(FROM OUR INDIAN CORRESPONDENT.)

THE following are details of the imports of electrical machinery and apparatus into India during the year 1926-27, compared with the previous year 1925-26, notes of increases or decreases being added :—

	1926-27. Rs. lakhs.	1925-26. Rs. lakhs.	Inc. or dec. Rs. lakhs.
Electrical machinery of all kinds—			
Total	228	222	+6
Control and switchgear	32	36	−4
Generators, alternators and dynamos	49	42	+7
Motors	29	35	−6
Transformers	23	18	+5
Turbo-generator sets	8	28	−20
Other sorts	87	63	+24
From United Kingdom	186	184	+2
,, Germany	11	9	+2
,, United States	23	20	+3
Electric fans and parts thereof—			
Total	31	28	+3
From United Kingdom	21	16	+5
,, Italy	6	6	—
,, United States	1	2	−1
Electric wires and cables—rubber insulated—			
Total	29.81	37.32	−7.51
From United Kingdom	28	34	−6
,, Germany	1	2	−1
,, Netherlands	0.24	0.54	−0.30
,, United States	0.32	0.23	+0.09
Insulations other than rubber—			
Total	29	23	+6
From United Kingdom	26	21	+5
Bare copper wire (electrolytic), other than telegraph and telephone wire—			
Total	19.1	15.33	+3.77
From United Kingdom	16	12	+4
,, Netherlands	0.1	0.83	−0.73
,, Japan	—	0.50	−0.50
Telegraph and telephone wires and cables—			
Total	0.96	2	−1.04
From United Kingdom	0.83	2	−1.17
All electric wires and cables—			
Total	81.85	77.12	+4.73
From United Kingdom	71	68	+3
,, Germany	4	5	−1
,, Netherlands	2	2	—
,, Japan	0.4	0.84	−0.44
,, United States	4	0.28	+3.72
Telegraph and telephone instruments and apparatus—			
Total (mainly from U.K.)	4.75	7.67	−2.92
Electric glow lamps—			
Total	21	20	+1
From United Kingdom	8	8	—
,, Germany	1	1	—
,, Netherlands	8	6	+2
Electric lamps, other sorts—			
Total	10.93	4.22	+6.71
From United Kingdom	0.61	0.45	+0.16
,, Germany	0.69	0.51	+0.18
,, United States	9	3	+6
Parts and accessories of electric lamps—			
Total	7	3	+4
Batteries—			
Total	10	8	+2
From United Kingdom	4	4	—
,, United States	4	2	+2
Carbons, electric (including furnace electrodes)—			
Total	0.63	0.62	+0.01
From United Kingdom	0.40	0.41	−.01
Accumulators (including parts)—			
Total	16	11.88	+4.12
From United Kingdom	13	9	+4
,, United States	1	0.88	+0.12
Condensers, electric—			
Total	2	0.26	+1.74
Electric bell apparatus (not telegraphic or telephonic)—			
Total	0.7	0.17	+0.53
Electric lighting accessories and fittings (including switches)—			
Total	15.41	15.47	−0.06
From United Kingdom	11	9	+2
,, Germany	3	2	+1
,, United States	0.93	4	−3.07
Meters—			
Total	5.91	6.68	−0.77
From United Kingdom	5	5	—
,, Germany	0.47	0.93	−0.46
Electrical instruments (other than telegraphic and telephonic)—			
Total	2.68	4.21	−1.53
From United Kingdom	2	2	—
,, United States	0.23	2	−1.77
Electromedical apparatus (including X-ray apparatus)—			
Total	1.75	2.55	−0.80
From United Kingdom	0.45	1	−0.55
,, United States	0.60	1	−0.40
Switchboards (other than telegraph and telephone) —			
Total (mainly from U.K.)	4.13	3.15	+0.98
Electrical goods and apparatus, not enumerated—			
Total	37	30	+7
From United Kingdom	23	18	+5
,, Germany	6	5	+1
,, Japan	1	2	−1
,, United States	6	4	+2
Total of electrical goods and apparatus	251	226	+25
From United Kingdom	169	152	+17
,, Germany	22	22	—
,, Netherlands	10	8	+2
,, Italy	7	7	—
,, Japan	2	3	−1
,, United States	33	23	+10

Indian Duties on Battery Chargers.

By a recent ruling of the Indian Central Board of Revenue, battery chargers imported into India will be classed as machinery (subject to a 2½ per cent. duty) if they embody rotary convertors requiring more than 0.25 b.h.p., otherwise they are subject to a duty of 15 per cent. Battery chargers which employ transformers cannot be classed as machinery, and are subject to a 15 per cent. duty as "implements, instruments, &c."

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

Motor-Operated Rheostats.

A recent introduction of Messrs. Ernest F. Moy, Ltd., Greenland Place, Camden Town, London, N.W.1, is a range of motor-operated rheostats specially designed for use in connection with remotely controlled switchgear. Fig. 1 shows a typical example of this equipment. This has a load capacity of 470-160 A, and a resistance of 1.1 ohms. The apparatus is constructed about an angle-steel frame on a cast-iron base, the sides and back being protected by perforated sheet-steel. The motor is housed in the base and drives the sliding brush vertically over the resistance contacts, by means of a square-thread screw and nut, through a totally enclosed worm gear. Limit switches are fixed at each end of the brush path, which stop the motor and leave it ready to restart in the opposite direction as soon as the control switch is reversed. The switches replace themselves automatically when the brush moves away from the end position. The resistance is in the form of nickel-copper wire clamped direct to substantial arms which form the switch contacts, so that no intermediate connections are used. The arms are carried on heavy slate bars mica-insulated from the frame. The apparatus can be made for any working capacity and voltage.

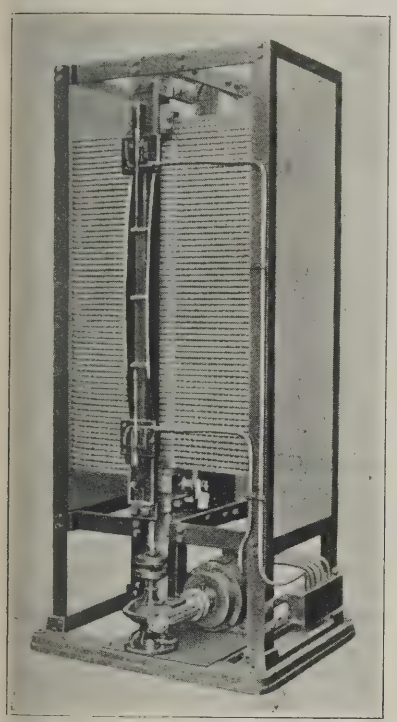


Fig. 1.—A Motor-Controlled Rheostat.

Lead Headed Nails.

We have received from Mr. T. F. Snow, 247, Shakespeare Road, Loughborough Junction, S.E.24, some samples of lead-headed nails which he is producing, and which are claimed to be particularly useful in connection with the fixing of cables of electrical, telephone, and wireless installations. The new nails differ from the old type in that the tops of the heads are not covered, so as to avoid the hammer making contact with the lead and loosening it. The nails are made in six sizes, from 1 in. to 3 in. for wall fixings, and in two sizes, 1 in. and 1¼ in., for use on woodwork. The fixing tags vary from ⅝ in. to 1¼ in. in length.

The Empson Emulsifier.

The seasonal variation in supply and demand, the vagaries of the weather, and the prohibition of the use of food preservatives have hitherto militated against the general use of cream in restaurants, bakeries, and private households. Fortunately, however, a new method of dealing with the problem of cream supply has come to the fore, which consists in emulsifying the ingredients of natural cream, when and as required, by dissolving dried powdered milk in water, adding unsalted butter, heating the liquid in order to melt the fat, and then passing the mixture through an emulsifier, whence it issues in a condition ready for use. By this process cream of any desired thickness can be produced by simply varying the proportions of the ingredients; moreover, the cream can be "whipped" immediately it leaves the machine, without cooling on ice, and will keep for two or three days longer than natural cream. The complete apparatus, fig. 2, consists of a mixing tank fitted with an electric heater of from 1 to 4 kW, according to size, and a patented pump of special form, the whole being collapsible for cleaning purposes. The pump is provided with a screw propeller and guide vanes, and it lifts the solution from the bottom of the tank and discharges it over the surface, thus entraining the fat which tends to float; the device is more effective, and consumes less driving power, than the ordinary paddle stirrer, and it delivers the mixture to the emulsifier at a constant rate of flow and in constant proportion throughout the run, thus obviating hand regulation as the level of the liquid falls in the tank; its capacity is about 900 gallons per hour. The emulsifier consists of a disk-like high-speed rotating drum, made in three pieces and held together by a single nut, designed to produce violent turbulence, the liquid being forced to flow outwards through a series of "whirlpools" which cause intimate mixing. This vortex action constitutes the principal novelty of design, and is the subject of the main patent held by Capt. A. W. Empson, 26, Bridge Road, Taylor's Lane, Willesden, London, N.W.10.

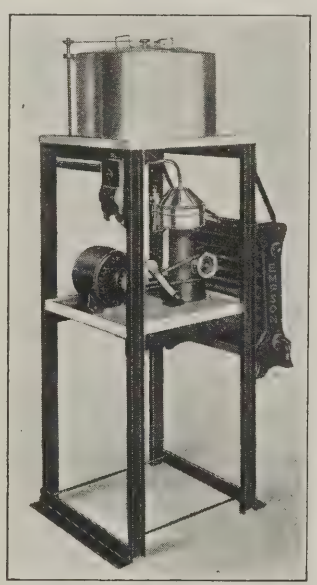


Fig. 2.—The Empson Emulsifier.

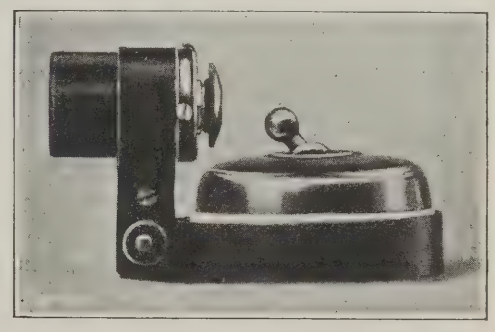


Fig. 3.—Switch Timing Attachment.

Actually the liquid passes through four vortices in series, involving seven abrupt changes of direction before the emulsion is discharged into the collecting chamber surrounding the drum, whence it flows over a cooler through which tap water is circulated. The E B-type emulsifier illustrated herewith, which should have many more applications than that mentioned above, will make from 1 to 5 gallons of thick cream at a time, and has a capacity of up to 20 gallons per hour; it is driven by an electric motor of only ½ h.p., which also drives the pump mixer in the tank. The base of the machine measures 20 in. by 24 in., and its overall height is 62 in.

An Automatic Switch-Timing Attachment.

An attachment for use with an ordinary tumbler switch, to allow switching-off to be done automatically after periods of from a few seconds to 15 minutes from the time of setting, has been placed on the market by Messrs. F. A. Wilkinson and Partners, Ltd., Gretton, near Kettering, Northamptonshire. It should prove useful in those cases where double-switching arrangements do not exist. Fig. 3 shows the device in position; it is not electrical and is merely clamped round the base of the switch. The device is operated by means of air pressure on a suitable piston. Operation of the latter throws the switch handle over at the correct moment.

The air is compressed by pushing the piston backwards till it is locked by a convenient catch. The release of the catch puts the piston and plunger in action. The time setting is effected by turning the knurled knob at the end of the plunger, a release valve being opened to an extent depending on the turn of the knob.

A Small Electric Cleaner.

An advertisement in *Electrical Merchandising* depicts a small electric vacuum cleaner, the "Presto-Junior," which is being marketed by the Metal Specialities Manufacturing Co., 338-350, North Dedzie Avenue, Chicago. It appears to be so arranged that the whole apparatus, driving unit, dust chamber, and accessories, is carried and operated by one hand, after the style of the whisk broom. This should prove particularly useful for cleaning staircases, &c. It is claimed that the appliance is capable of doing the work usually allotted to machines of the larger size.

Short-Wave Wireless Telegraphy.

A Novel Theory of the Skip Distance which agrees closely with the Observed Results.

By T. L. ECKERSLEY.

(*Review of a Paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE paper deals with the state of short-wave practice and theory, and describes experiments made in order to elucidate transmission phenomena, and certain theoretical developments based on the investigations. It involves a breakaway from the traditional views of simple ray refraction, which reflects the essential divergence of the ideas presented from those previously published; the diverse systems in use indicate how far we are from finality in this matter. The ray theory, developed from the original work of Eccles and Larmor, has been pursued to the bitter end in this country, but is by no means universally accepted; Dr. Meissner, in particular, has developed another theory based on experimental transmission to Buenos Aires. In the author's opinion the ray theory as developed by Americans (Taylor and Hulbert, Heising, Shelleng and Southworth, Baker and Rice) neglected the very important factor of the absorption of energy in the ray, and he attempts to show that this theory plays a dominant part in practically all transmissions. His experiments should throw light on the nature of transmission as well as on the practical design of suitable aerials for short-wave working. Theory and practice are inextricably involved in this latter question: for instance, it has been proposed to use aerials which radiate their energy upwards in order to take advantage of the reflection from the Heaviside layer; Marconi's Co. favours the beam radiating more or less horizontally, with a vertically polarised wave, while Alexanderson in America appears to regard the horizontally-polarised wave as being the more favourable for transmission, and uses a horizontal doublet for the purpose. It is therefore of considerable practical importance to decide whether the vertical or horizontal rays are the more effective, but in previous attempts to calculate polar diagrams the problem has always been simplified by assuming that the earth is a perfect conductor, which may lead to very considerable errors, because the corrections due to the imperfect conductivity of the earth include terms which involve the product of the frequency and resistivity, and therefore become significant in the short-wave range. In the first section of the paper the author therefore takes into account the finite conductivity of the earth and calculates the approximate polar diagram for the case of a vertical doublet situated at a height above the surface of the earth. An immediate consequence of his theory is that the aerial radiates practically nothing horizontally (except in the immediate neighbourhood of the transmitter), for when the earth is not perfectly conducting, the absorption of the rays propagated horizontally is so great that all the lower rays are more or less completely absorbed, which is a radical departure from preconceived ideas. It is shown that the intensity of low-angle transmission is increased by raising the transmitting aerial; but, on the contrary, for high-angle transmission, a half-wave aerial situated near the earth's surface is practically as good as any other.

In order to make practical use of this we require a knowledge of the best angle of elevation for transmission over any required range. In the next section of the paper an account is given of direction-finder experiments designed with a view to the determination of the nature of transmission on short waves; in particular the angle of incidence of the incoming (and therefore by the reciprocal theorem the outgoing) rays is studied, the conclusion being reached that in long-distance transmission the ray traiectory has a shallow angle of elevation, 15 deg., and follows the great-circle path.

The third section of the paper contains the results of a series of long-distance transmission tests; waves between 25 and 10 m. were used, and experiments were made which indicated the superiority of a raised doublet over one at the ground level.

In the last section the general theory of ionic refraction is discussed in the light of these and other experimental results. The effect of attenuation due to the collision of electrons with molecules is especially stressed, and a novel theory of the skip distance is put forward which has the merit of agreeing closely with observed results.

The ray theory has been successfully used to explain and compute the "skip distance," the evidence for the existence of which effect has been largely accumulated by Hoyt Taylor in America. It seems to be an undoubted fact that in the neighbourhood of a short-wave transmitter, signals drop in intensity very rapidly with distance, may disappear entirely at distances of 100 or 200 miles, and then begin to increase again to a maximum and finally die away at very great distances. The distance skipped in this way appears to depend on the wave-length, season, and local time. It increases with increasing frequency, is greater at night than in the day, and in winter than in summer. The suggestion is, of course, that the greater the frequency is, the less the bending and the further off the main target of the rays.

If we consider the sheaf of rays sent out by the transmitter, the lower-angle rays find their target at a great distance; as the angle is raised the target point approaches to some minimum value d_1 corresponding to some angle θ_1, and as the ray angle is still further increased the target point recedes again until at $\theta = \theta_0$ the ray escapes from the earth altogether. By making certain assumptions with regard to the heights of the refracting layers and the distribution of density in them, chiefly chosen, it appears, from the point of view of mathematical convenience, that good agreement between the calculated and observed values of d_1 has been obtained; but when it comes to comparing observed and calculated *intensities* the picture presented by the calculation seems to the author to be very wide of the mark. One consequence of the ray theory that is significant is that, apart from the direct ray, absolutely nothing should be obtained within the "skip distance," and that there is practically a discontinuity at the skip distance. In actual fact conditions are nothing like this. Heising, Shelleng and Southworth have made simultaneous measurements at various distances from short-wave stations working on 66 and 44 m. and, beyond a slight dip at regions of about 150 miles, there is no sign of a complete disappearance and sudden commencement of signals beyond the skip distance; in their measurements there is only an increase of about 10 to 1, which may possibly be exceptional. If we take the change in strength at AGB (at Nauen), for instance, during the late afternoon and evenings, as an indication of a transition into the region within the skip distance, as night falls the roughly measured intensity change may be as much as 1,000 or 10,000 to 1; but whatever amount the ratio of intensity of the signals within and without the skip distance may be, the form of the intensity diagonal distance curve seems to be a smooth curve, and there is every indication of high-angle reflected or scattered energy within the skip distance, contrary to the ray theory. The author feels that he will be guilty of suggesting the heresy that the escaping ray theory of the skip distance is by no means proved, and suggesting an entirely different alternative theory.

The only evidence we have is that within the skip distance the indirect rays (reflected or refracted) are either not present (complete skip), or are present with very diminished intensity. We know that the high-angle rays do not get back to earth, but this does not prove that they escape—they may be absorbed in the upper regions of the atmosphere; if this is the case the estimates of the minimum wave-length (for long-distance transmission) based on a supposed maximum density, are absurd. In order to compare them with Heising, Shelleng and Southworth's actual measured values of the density in the region of the "skip" distance, the results of the author's computations are reproduced (in the original paper) in the form of curves in which intensity is plotted against distance. The general form of the two are similar, but the calculated intensities at 300 miles and over are in general too great; if we assume that there is a lower fringe to the layer, slightly ionised and reaching down to levels of 15 to 20 km., there will be added attenuation practically proportional to the range which will be responsible for the major portion of the long-distance attenuation and which will tend to better the agreement between the observed and calculated characteristics. Similar arguments apply to night transmission, where there is the additional evidence of a low-density fringe in which the "squeak X's" are produced. The author's view of the two layers is this: a lower daylight layer is situated in regions between 50 and 70 km. from the earth, in which the density increases so rapidly with level that there is very little penetration (for long-distance glancing-angle incidence), with a lower fringe (of small electronic density) in which the main long-distance attenuation, which must be present, occurs. The path of the ray through the lower fringe (over long distances) will, in general, be more or less independent of the wave-length, so that attenuation will be characterised by a falling off in proportion to the square of the frequency, as has actually been found in the short-wave range. Similar considerations apply at night time, with added complications due to the rotation of the plane of polarisation as the ray travels along the earth's magnetic field, and of the double refraction effects due to the same cause.

This theory seems to the author to be capable of dealing with, and explaining, a very much wider range of facts than the simple ray theory; in particular it links long- and short-wave transmission in a perfectly reasonable way, and accounts for the contrast in long- and short-wave daytime transmission characteristics, in respect of seasonal and magnetic disturb-

ance effects. It naturally explains the increase of range with frequency (short-wave day transmission) and requires a plausible constitution of the upper layers in agreement with the evidence from other sources (in particular diurnal magnetic variations) and leaves no important fact unexplained.

It seems to be an undoubted fact that there is a short-wave limit below which it is impossible to get long-distance transmission. It seems probable that the limit for night transmission is in the neighbourhood of 17 m., although the echo effect seems to show that under certain conditions waves as short as 14 or 15 m. may get through 20,000 km. of darkness.

In daytime the short-wave limit does not seem to have been reached at 10 m. A recent experiment on 8 m. (using the same transmitter and power as in the other short-wave experiments) seems to indicate that this is below the limit, as nothing was received in Sydney, Montreal, New York or South Africa, so that the limit appears to lie between 8 and 10 m. This short-wave limit has received a very natural explanation on the ray theory, *i.e.*, it is supposed that the density in the upper layer is not sufficient to bend even the horizontally-transmitted rays back to earth, so that all the rays escape. The author is not inclined to accept this explanation, chiefly on the ground that there is evidence of high-angle rays, within the skip distance, of even the shorter waves (20 to 25 metres), which on the ray theory should be entirely absent; or we may put it in another way: observations within the skip distances suggest very strongly that the layer is rich enough in electrons to bend even the high-angle rays back to earth, but, of course, with much diminished intensity.

In the calculations for the skip distance the attenuation in the main layer for small angles of elevation, and for a sufficiently long wave-length (some 40 m.) (apart from the lower fringe) was found to be so small as to be negligible (actually the attenuation should have been greater, on account of the increased ray length in the layer occasioned by the earth's curvature) because at these glancing angles (and for sufficiently long wave-lengths) the penetration and ray path in the main layer is so small as to introduce but little attenuation; but, as the wave-length is reduced, the penetration and ray length in this layer rapidly increase and will reach a stage at which attenuation begins to be important, so that for sufficiently short waves the rays will be able to penetrate this layer and not get out again even at glancing incidence.

The picture that the author has of transmission on different wave-lengths is this: For waves above the limiting wave-length this attenuation constant is small, and long-distance glancing-incidence transmission takes place in the space between this main layer and the earth. Penetration into the main layer is small, and the whole attenuation is small and caused by the sparsely populated fringe below the layer, but directly the wave-length is made shorter than this short-wave limit, and the main ray penetrates well into the main layer, absorption sets in and further long-distance transmission is impossible. This theory applies to both day and night transmission with suitable values for τ in each case. This is essentially a modified form of layer theory.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

A Radio-Telephone Loud-Speaker.

I have read with considerable interest the article on this subject by Mr. E. W. Braendle, A.M.I.E.E., in the current issue of the Review. Since it appears that Mr. Braendle claims to disclose the construction of a speaker which will give very good reproduction, sufficiently good, in fact, to do justice to the quality of the B.B.C. transmission, I venture to suggest that on his own showing his speaker does not fulfil these conditions, and I think many readers would be glad to learn his justification for various statements.

First of all, "mobility" and "rigidity" of cone diaphragms are mentioned: I should like very much to learn what is indicated by these two terms, and in what way they are desirable or undesirable features of a diaphragm. Next, Mr. Braendle makes not the slightest reference to the drive and its influence upon the diaphragm, and the correlation of the two. The type of drive employed cannot possibly energise the diaphragm so as to give an even response over a useful frequency band. Space does not permit me to explain why this is so, but readers who are unfamiliar with such matters can refer to the subject in a standard text-book.

Perhaps the most amazing point in Mr. Braendle's article is the curve, fig. 6, showing, apparently, the impedance of the windings of the speaker at various frequencies. In the first place, let it be most emphatically stated that the most useful form of loud-speaker curve is one showing audio response plotted against frequency. Another extraordinary point is that this curve is taken only across a very small frequency band, *i.e.*, frequencies from about middle C to about 2½ octaves above middle C, that is, roughly, 250 to 1,500 cycles. Over this very small compass the impedance of the windings varies from 8,000 to 35,000 ohms; but, as previously mentioned, this type of curve indicates very little of the performance of the speaker. If, then, Mr. Braendle intends us to infer that the usefulness of his speaker is represented by these graphs, we may assume that it gives substantially no bass. So far as the treble is concerned, the curve still seems to be rising; therefore it is not possible to infer what happens.

My own experience of commercial loud-speakers leads me to believe, when comparing them with that of Mr. Braendle, that his speaker falls far short of some of the best cone balanced-movement-driven speakers. I happen to have a very accurate response curve showing loss or gain in T.U. in the response of a well-known commercial cone, which reproduces fairly evenly over a band extending from approximately 50 to 5,000 cycles. In the case of a coil-driven speaker the response is substantially perfect, and on one laboratory model frequencies as low as 25 cycles can easily be reproduced. This means, of course, that the speaker can reproduce the lowest organ notes, whereas on many types, and, I would suggest, the one under consideration, they would be entirely absent. Perhaps Mr. Braendle would be good enough to explain the various points which I have raised.

Paul D. Tyers.

Watford, *June 6th*, 1927.

Single-phase Induction Motor Starting Devices.

The remarks of Mr. W. S. Daniels in his discussion of my recent article on the above subject are rather difficult to understand.

If Mr. Daniels reads through the article carefully he will find no claim that the Ferraris-Arno method of working is a new one, and therefore the historical information given in his letter is rather superfluous. In fact, I should expect that anyone possessing any knowledge of the system at all would fully appreciate the fact that it was developed during the early times of motor development.

My object in writing about the Ferraris-Arno system is fully set out at the commencement of the article, which was intended for the average engineer not possessing, or interested in, the information relating to patents given by Mr. Daniels, and I can therefore only conclude by thanking Mr. Daniels for bringing to my notice Hobart's "Electric Motors," which I had overlooked at the time of writing the article.

G. Windred.

London, *June 11th*, 1927.

A Commutation Problem.

Please allow me to thank Messrs. H. Joseph and P. Oaks for their views on the above problem. Regarding Mr. Joseph's suggestion of the trouble being mechanical, it is not so, as the commutators were certainly faultless in this respect, and I feel confident that the responsibility lay on the electrical design.

In explanation of my suggestion that the conductors were 7½ degrees out of place, I may be wrong, but the following is my reasoning: there are 12 slots and 24 commutator bars; in each half-slot (top or bottom) there are 2 coil sides, A and B, taped together. If the brushes be set so that the A wires are exactly right for commutation, the B wires, which, according to their commutator bars, should be 360/24=15 degrees ahead, or behind, are to that extent wrong, as their average position is the same as the A conductor, being mixed up, or "mushed," with them.

The idea was that in practice the brushes would be adjusted so that instead of A being right and B 15 degrees out, each would be 7½ degrees each way, and this is the best obtainable.

Briefly, even if by subdividing the coils as above, the reactance is sufficiently reduced so as to obviate sparking from that cause, there is a lower limit to the number of slots, due to the above reasons.

A. D. Griffiths.

Caergwrle, *June 10th*, 1927.

The Ideal Wiring System.

My attention has been called to a letter on page 910 and to an editorial note thereon. The suggestion is that a lead-covered cable in contact with perfectly dry plaster can be corroded by the plaster. I think it may be stated with absolute certainty that no chemical action could take place under such circumstances.

With regard to the last lines of your editorial note, I do not think any cable maker would subscribe to the statement that it is well known that lead sheathing should not be laid in contact with plaster. Practically all lead-covered surface wiring systems are in contact with plaster, and corrosion is practically unknown; notwithstanding the statement that the lead-covered cable in question was perfectly bonded, all investigations so far have shown that chemical action between lead and plaster is due to electrical leakage and points to imperfect bonding.

L. B. Atkinson.
The Cable Makers' Association.

London, *June 10th*, 1927.

Power Supply for Wireless Sets.

I read with interest the article by "G. F. J.," on his experiences with eliminators for a.c. mains, and I wondered if any of your readers had tried ordinary "power" valves for this purpose, using them with the grid and plate joined. I have an eliminator using a "Stentor Four" valve and the output is:—11 mA. at 220 V, 18 mA. at 180 V, and 30 mA. at 120 V, these figures being obtained with the filament run at only 3 volts. I think this is as good a performance as those mentioned by your contributor; it could no doubt be improved on by running the filament at its normal 4 volts, or by using valves of the "super power" class.

F. B.

June 12th, 1927.

Metal-clad Draw-out Switchgear.

The article by Mr. T. Carter on the above subject in your issue of May 27th, far from being a comparison of the horizontal and vertical types, appears actually to be a eulogium in one definite cause, the supporters of which might have become restive due to the ramifications of the manufacturers of the vertical units. Certainly any intelligent engineer, if he had the patience to read the whole of the article, would lay it aside with the conviction that Mr. Carter had failed in the object for which he set out, that is, to have us all believe that the horizontal draw-out type of unit is the embodiment of everything that is perfect.

If, as I believe to be the case, Mr. Carter resides in the Newcastle district, he will undoubtedly have had abundant opportunities of thoroughly examining that type of switchgear which he prefers, and having, so to speak, been brought up in its neighbourhood, one can understand his preference.

The first portion of his closing paragraph reads as follows:—

"If I have succeeded in expressing myself as I have wanted to do, I will have made it clear that the balance of advantage lies with the horizontal type *for small and moderately large units.*"

This, in my opinion, amounts to a complete refutation of the advantages which Mr. Carter is careful to assign to the horizontal type of unit, as clearly the question of suspended weight, accessibility, and compactness in the case of the vertical type, is of far less moment in relation to small and moderately large units, than with the very large sizes.

Mr. Carter may be certain of one thing, namely, that where the makers of the vertical type claim weatherproofness, capability to deal with short circuits, and any other attribute which is inherent in that particular design, they will have taken great care to ensure that their claim is a sound one, and not merely made regardless of truth.

The best answer to Mr. Carter's apparent condemnation of the vertical type of unit is the enormous number of these units which are being continually manufactured.

There are occasions when horizontal gear is preferred to vertical gear, and *vice versa*; why not let it rest at that without "trumpeting" one type to the detriment of the other?

W. B.

Manchester, *June 9th*, 1927.

Reviews.

The Practical Telephone Handbook. Seventh edition. Joseph Poole, A.M.I.E.E., Wh.Sch., and others. Pp. xxv + 870; figs. 637. London: Sir Isaac Pitman & Sons, Ltd. Price 18s. net.

The fact that this handbook, which is really a compilation of the work of a number of writers, has reached its seventh edition shows that it has not lost in popularity as time goes on. One of the earliest of manuals devoted exclusively to telephone matters, it has maintained its place as a student's text book on that subject for many years, practically unchallenged. The present edition is a revision of the previous one, which has been increased by the addition of 146 pages and over 100 illustrations. Several of the chapters have also been wholly rewritten. The fact that the author and his coadjutors are on the staff of the British Post Office may be taken as a sufficient guarantee of their ability to provide the reader with reliable descriptions of the standard practice which has been adopted in this country. There are, in all, thirty-seven chapters dealing successively with batteries, receivers, transmitters, sub-station apparatus and instrument connections, intercommunication, switchboard apparatus, relay and lamp signalling, P.B. exchanges, magneto exchanges, common battery systems, junction line working, trunk and party line working, power plant, aerial and underground construction, loaded lines, multiplex telephony, submarine telephone cables, testing, telephonic repeaters, wireless telephony, automatic exchanges, and traffic and development studies; from which it will be seen that the writers have covered a somewhat extensive field within the scope of one volume.

In the chapter dealing with secondary batteries the old chemical formula for discharge is still retained, no mention being made of Fèry's equations representing the actions of charge and discharge which it is usual to give as an alternative, if not a more correct, explanation of what takes place. It would also be interesting to know how the empirical formula for the ampere-hour capacity of a cell is arrived at.

The chapter on receivers and transmitters is well up to date. In the latter class a brief but suitable description is given of the 2 L.O. broadcasting transmitter.

Additional matter has been added to the previous work on exchange working, particularly in the case of junction and trunk line developments. This was rendered necessary by the interposition of automatic with manual exchanges.

Chapter XXXII on telephone repeaters, although necessarily restricted to a general outline of the methods employed, will, nevertheless, give the reader an accurate knowledge of this recent and important branch of telephony.

It is stated that there are large numbers of trunk circuits up to 200 miles in length which consist of two-wire repeater circuits working on 20 lb. and 40 lb. conductors, instead of 100 lbs. upwards to 800 lbs. per mile as in the case of aerial trunks not furnished with repeaters. This is economy indeed.

The chapter on wireless telephony gives a fairly adequate account of the methods and progress in this field. The theory of the action of the two-electrode and triode valves is given, and also an explanation of the method of heterodyne reception. The transmitting arrangements at Daventry broadcasting station are described and a simplified diagram of the circuits is appended.

Automatic telephony occupies over 100 pages of the book and is probably the most important feature of the work.

Descriptions are given of the various systems now in operation, including the "Director" system, which has been adopted for the London district, and a number of excellent inset diagrams are given. It is observed, however, that fig. 647 is missing and has not been inserted between pages 772 and 773 as stated on page 769.

The book closes with a chapter on miscellaneous applications, including a description of the structure and operation of the modern loud speaker, and a series of useful tables is given in an appendix.

As a practical handbook on the subject of telephony the book justifies its recommendation as a suitable text-book for the City and Guilds of London Examination in that subject.

Electrical Condensers. By Philip R. Coursey, B.Sc., F.Inst.P., M.I.E.E. Pp. xxiv+637; figs. 514. London: Sir Isaac Pitman & Sons, Ltd. 1927. Price 37s. 6d. net.

The author of this book draws attention in the preface to the remarkable development which has taken place in the use of condensers during recent years, both in the sphere of radio communication and also in that of heavy electrical engineering. The extensive field of application of the electrical condenser renders a work of the kind under review very opportune. The author has treated his subject on a very broad basis, the matters dealt with ranging from the theory of the dielectric circuit, to details of manufacture of condensers for industrial purposes.

The opening chapter deals with the fundamental properties of the condenser and with its behaviour on both d.c. and a.c. circuits. After a historical survey of the development of the condenser, the author proceeds to deal in detail with the properties of dielectrics, with the measurement of these, and with the important subject of dielectric losses. A chapter is devoted to the calculation of the capacities of condensers of various types from their geometrical properties. As the author generally starts from basic principles in his theoretical investigations, we think that the derivation of the constant for the conversion of capacities from electrostatic to electromagnetic units might have been given. The subject of this chapter is continued to the calculation of the capacity of overhead lines, aerials, and underground cables. The reference to the latter is very slight, and the difficulties attendant upon the use of insulated cables, at pressures above 22 kV, are merely the subject of a passing notice. A lengthy chapter of a descriptive nature deals with the use of condensers for radio work, this being followed by a detailed treatment of the design of condensers of this description. A good chapter follows on the measurement of capacity, in which the theory of the various methods available is fully worked out, and the practical details of the several tests are adequately set out. In the chapter on variable condensers for radio work the author discusses very fully the problem of the design of condensers in which the capacity is a required function of the displacement of the movable member. A number of descriptive chapters follow, in which the details and manufacture of condensers with air, glass, paper, mica, and liquid dielectrics are very fully dealt with. The use of condensers for protection against over-pressures in high-tension transmission systems is described, and there is a brief chapter dealing with the use of condensers for the correction of power factor in industrial a.c. supply circuits. This last chapter is little more than a brief sketch of the subject, and in a work of this character might with advantage have been considerably amplified. The reference to the synchronous condenser is rather misleading. The function of this machine for power factor correction is so different from that of the static condenser, and its property of having the wattless current supplied under easy, or even automatic, control is so valuable that a comparison of the two types is hardly possible. A remarkable feature of the work is the lengthy

bibliography, extending to no fewer than 100 pages, and containing over two thousand references.

Mr. Coursey's book will, perhaps, be of greater interest to those concerned with radio work than to power engineers; the bias, as would be expected from the professional connections of the author, tending decidedly in the direction of the former field. As a work of general reference it will be of considerable value to all engineers, but we fear that the scope of its appeal will be somewhat restricted by its high price.

Notes on Electricity as Applied to 1926 Artillery. Pp. vii+254; figs. 86. London: H.M. Stationery Office, 1927. Price 2s. net.

This little work is intended as a handbook of instruction relating to the various apparatus used in the Artillery Service, and it is prefaced by an account, in simple, non-mathematical language, of elementary electrical theory. The first part of this theoretical section deals with the effects of electricity, and with the simple properties of electrical circuits. In the effort to compress a wide subject into a restricted compass, conciseness is sometimes obtained at the expense of clearness. The last sentence on p. 39 is ambiguous in that it appears to imply that a direct current cannot be produced by electromagnetic induction; whilst the explanation of virtual values of alternating quantities given in the footnote on p. 40 is far from happy. The customary term, impedance, is preferable to "apparent resistance" for the quotient of volts by amperes in an alternating-current circuit, and this latter expression is better used for the quantity, volts²/watts, which in a circuit embracing an iron core, is different from the actual resistance as measured by direct-current methods. Part 2 deals very satisfactorily with the construction and principles of operation of simple direct-current instruments, with the measurement of resistance, the theory and use of the potentiometer, and with the use of the detector for simple testing. Part 3 deals simply with primary and secondary batteries, wiring, telephones, and electrical machinery. In the diagram, on page 75, of the method of charging an accumulator from the supply mains, the battery is shown connected in the positive main of a two-wire system. A note should have been made of the desirability of inserting the battery in the earthed pole when the direct-current supply is obtained from a three-wire system.

The last section of the book deals with the details of actual Service apparatus, and sets out full directions for its use. The very full accounts of various telephone equipments will be found of considerable use, and a lengthy description of the Fullerphone is included in this section. The book concludes with a number of questions involving simple arithmetical work; references are made to the several paragraphs in the book which these questions are intended to illustrate; and the answers to the questions are given. It seems rather a pity that the latest suggestion of a capital "omega" as a symbol for "ohms" is not used, instead of the obsolete and inconvenient "O."

Although we have had occasion to offer a few criticisms on relatively minor matters relating to this book, we are pleased to say that it has been very well and skilfully written to meet the needs of those approaching the study of electrical matters for the first time. We think that the book will be found very useful to elementary technical students, wiremen, and telephone linesmen and maintenance men who require a simple account of the rudiments of electrical theory, instruments, measurements, and signalling apparatus.

Television. By A. DINSDALE, A.M.I.R.E. Pp. 62; illustrated. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. net.

In this little book the author outlines the history of "television," which he defines as "vision by telegraphy"—certainly not a sound or appropriate expression, as in television there is no permanent record of the images transmitted. He explains the nature of the problem to be solved, and briefly describes the earlier attempts to overcome the great difficulties that were met with, leading up to the Baird "Televisor," which is dealt with as fully as circumstances permit. The treatment of the subject is highly optimistic, the author being an enthusiastic admirer of Mr. Baird's achievements, which he regards as successful, though he admits that "at present the transmitter has not emerged from the laboratory"; progress is "continuing at a rapid rate," and we hope that eventually the inventor's dreams will be fully realised.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

32,444. "Telephonic receivers." M. Graham, A. Graham (legal representatives of E. A. Graham, deceased), and W. J. Rickets. December 23rd, 1925. (Cognate application 32,938/25.) (271,125.)

32,491. "Control of electric orchestral instruments of the organ type." A. Barbieri. December 23rd, 1925. (271,126.)

1926.

1,427. "Telephone systems." Standard Telephones & Cables, Ltd., A. M. Searle, and J. H. E. Baker. January 18th, 1926. (271,128.)

1,765. "Arrangements for actuating apparatus by telegraphic and like light current impulses." E. O. Symonds. January 21st, 1926. (271,129.)

3,753. "Television and like apparatus." R. S. Clay. February 9th, 1926. (271,131.)

3,952. "Smoothing or filter circuits for use in conjunction with thermionic valves." R. S Atherstone. February 11th, 1926. (271,132.)

4,295. "Variable electric condensers." R. Woods. February 15th, 1926. (271,137.)

4,337. "Wireless receiving instruments and loud speakers or other telephone receivers." R. H. Coaks. February 15th, 1926. (271,139.)

4,417. "Circuit arrangements for selectors in automatic and semi-automatic telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. February 16th, 1926. (271,142.)

4,480. "Discharge tubes having an enclosed arc discharge." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). February 16th, 1926. (271,144.)

4,594. "Electric reading lamps." R. Kaplan. February 17th, 1926. (271,148.)

4,633. "Two-way terminal adaptor switch." F. G. Woodall. February 18th, 1926. (271,150.)

4,684. "Protective arrangements for a.c. electric circuits." A. Reyrolle and Co., Ltd., and R. W. Biles. February 18th, 1926. (271,153.)

4,715. "Telegraph systems." Automatic Telephone Manufacturing Co., Ltd., and H. H. Harrison. February 18th, 1926. (271,155.)

4,820. "Thermostatic regulation of current flow in electric currents." General Electric Co., Ltd., A. Kinnes, and M. H. Hunt. February 19th, 1926. (271,158.)

4,883. "Direct-current rotary transformers with arbitrarily variable subdivision of pressure." A .Della Riccia. February 19th, 1926. (Addition to 172,969.) (271,161.)

4,884. "Direct-current rotary transformers with arbitrarily variable subdivision of pressure." A. Della Riccia. February 19th, 1926. (Addition to 172,969.) (271,162.)

4,898. "Tuning wireless circuits." J. Vaughan-Sherrin. February 20th, 1926. (271,163.)

4,962. "Tanks for electrical apparatus." A. W. G. Tucker and Ferranti, Ltd. February 20th, 1926. (271,168.)

5,175. "Tuning of electric circuits containing relays or other electro-responsive movable devices." Westinghouse Brake & Saxby Signal Co., Ltd. May 21st, 1925. (252,325.)

5,202. "Telephone systems." Standard Telephones & Cables, Ltd., and E. P. G. Wright. February 23rd, 1926 (271,176.)

5,582. "Electrical terminals." R. E. Worsley. February 27th, 1926. (271,180.)

6,379. "Rotary electric switches." Oliver Pell Control, Ltd., and C. Oliver. March 8th, 1926. (271,191.)

6,866. "Receiving apparatus for wireless telephony and telegraphy." G. King. March 12th, 1926. (271,197.)

8,064. "Loud-speakers and like sound-reproducing devices." V. Himmer. March 24th, 1926. (271,207.)

8,520. "Manufacture of electrodes, welding rods, and the like." B. Turner and Ferro-Arc Welding Co., Ltd. March 29th, 1926. (271,209.)

8,542. "Thermoelectric cooking ovens." S. Sacerdote. March 29th, 1926. (271,210.)

9,227. "Batten lights and footlights." Holophane, Ltd., and R. G. Williams. April 7th, 1926. (Cognate application 259/27.) (271,212.)

9,431. "Daylight lamps." A. C. W. Aldis. April 9th, 1926. (271,213.)

9,868. "Thermionic valve amplifying systems." British Thomson-Houston Co., Ltd., R. C. Clinker, and G. S. C. Lucas. April 14th, 1926. (Cognate application 11,442/26.) (271,222.)

10,219. "Vibration-resisting filaments for electric incandescent lamps and similar devices and method of making the same." British Thomson-Houston Co., Ltd. April 17th, 1925. (250,974.)

10,912. "Condensers for use in radio signalling apparatus and the like." R. Hodson. April 26th, 1926. (271,229.)

11,629. "Electromagnet switches or relays." General Electric Co., Ltd., A. Kinnes, and M. H. Hunt. May 3rd, 1926. (271,235.)

11,867. "Electric circuit-breaking apparatus." English Electric Co., Ltd., and R. A. R. Bolton. May 6th, 1926. (271,238.)

13,709. "Electromagnetic sound-reproducing systems." Brandes Laboratories Inc. January y28th, 1926. (265,123.)

14,483. "Radio receiving apparatus." Igranic Electric Co., Ltd., and P. W. Willans. June 8th, 1926. (271,253.)

14,948. "Frame and other closed aerials." Burndept Wireless, Ltd., C. F. Phillips, and P. K. Turner. June 14th, 1926. (271,257.)

15,157. "Direct-current dynamo-electric machines." G. A. Juhlin and Metropolitan-Vickers Electrical Co., Ltd. June 16th, 1926. (271,261.)

15,374. "Screen for telephones." E. L. Dunand. June 18th, 1926 (271,262.)

16,292. "Telephone plugs and the like." E. Whiteley. June 28th, 1926. (271,271.)

18,778. "Electric switches." G. B. Handley and C. H. Parsons, Ltd. July 28th, 1926. (271,288.)

19,739. "Watertight electric blasting fuses." N. Schmitt. August 10th, 1926. (271,295.)

19,936. "Resistance thermometers." W. H. Apthorpe and Cambridge Instrument Co., Ltd. August 12th, 1926. (271,296.)

21,973. "Sound amplifiers." R. H. A. Englund. September 6th, 1926. (271,307.)

22,345. "Electrical condenser." Dubilier Condenser Co. (1925), Ltd. October 31st, 1925. (260,555.)

22,862. "Thermionic valve amplifying systems." British Thomson-Houston Co., Ltd. November 14th, 1925. (261,343.)

24,317. "Electric motor control systems." British Thomson-Houston Co., Ltd., and E. B. Tuppen. October 1st, 1926. (271,313.)

25,064. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. January 12th, 1926. (264,451.)

25,728. "Electric relays." Automatic Telephone Manufacturing Co., Ltd., and R. W. Tarrant. October 15th, 1926. (271,318.)

26,994. "Electromagnetic sound-reproducer or loud speaker." Brandes Laboratories Inc. September 13th, 1926. (271,326.)

27,528. "Wireless aerial." C. E. Thomason. November 3rd, 1926. (271,331.)

28,420. "Process for the production of a fast adhering metal coating on insulating sheets, especially for the preparation of electric condensers." Dubilier Condenser Co. (1925), Ltd. November 12th, 1925. (261,392.)

30,172. "Lubrication systems for electric motors." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. November 29th, 1926. (271,343.)

30,298. "Radio-signalling systems." British Thomson-Houston Co., Ltd. November 30th, 1925. (262,152.)

30,791. "Electric bright annealing furnaces." Siemens-Elektrowarme-Ges. December 5th, 1925. (Addition to 252,405.) (262,468.)

31,598. "Amplifiers for gramophones, telephonic loud speakers, and the like." T. H. Tuite. December 13th, 1926. (271,351.)

1927.

1,957. "Systems of electric motor control." British Thomson Houston Co., Ltd. January 22nd, 1926. (264,875.)

5,276. "Electric hair-curling apparatus." H. Rochat. March 1st, 1926. (266,740.)

6,034. "Protected plug-in inductance coils." E. L. Wildy and London Electric Wire Co. & Smiths, Ltd. March 3rd, 1927. (271,384.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERCRAVE.—Houses (200), for the Welsh Anthracite Collieries, Ltd.

ALTRINCHAM (CHESHIRE).—Housing scheme (40), for the U.D.C.; surveyor.

ASHFORD (KENT).—Additional 60 houses, for the U.D.C.; E. Clark & Sons, builders, Melton Mowbray.

AYLESBURY.—Conversion of the Old Manor House into home for mental defectives, for Bucks. C.C.; county architect.

AYRSHIRE.—Shops, hall, and temple for Lodge Troon Navigation, Troon (£4,000); J. R. Johnstone, architect, Troon.

BARLBY.—Factory, foreshore of River Ouse; Yorkshire Sugar Co.

BISHOP AUCKLAND.—Electric washing plant at Maternity Home; Durham County medical officer.

BLACKBURN.—Additional 96 houses, Brownhill, for the T.C.; borough engineer.

BRISTOL.—Crematorium, for the T.C.; H. G. Malcolm Laing, Lincoln's Inn, architect; Alfred Dowling & Son, contractors, 125, North Road, Bishopston.

BULFORD.—School, for Wilts E.C.; director of education, Trowbridge.

CALNE.—School, for Wilts. E.C.; director of education, Trowbridge.

CARLYLE.—Housing scheme (100), with electrical work, for Lanarkshire C.C.; P. C. Smith, District Offices, Hamilton.

CHELTENHAM.—Proposed medical baths at Winter Garden; borough engineer.

CHERTSEY.—Additional 50 houses, for the U.D.C.; Mr. Parker, architect.

CHESTER.—Public offices, Northgate Street, for the T.C.; Charles Greenwood, city engineer.

CHESTERFIELD.—Extensions, Furnace Hill Works; Morgan Crossley & Co., Ltd. Extensions, Portland Works; Robinson & Son, Ltd.

CHIPPING NORTON.—Boys' secondary school, for Oxfordshire E.C.; director of education, Oxford.

COLCHESTER.—Housing scheme (70), for the T.C.; borough surveyor.

CONGLETON (CHESHIRE).—Extensions, Brown Street Mill (£15,000), for W. A. Lowe & Co.

DEWSBURY.—Additional housing scheme (200), for the T.C.; borough surveyor.

DORKING.—Secondary school, for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

DOUGLAS (ISLE OF MAN).—Electro-medical pavilion, Noble's Isle of Man Hospital; J. E. Teare, architect, 46, Athol Street.

DUMBARTONSHIRE.—School at Kirkintilloch (£11,000); clerk, Education Authority, Dumbarton.

DUNDEE.—Shops for Eastern Co-operative Society, Ltd.; the manager.

ECCLES.—Additional 78 houses, for the T.C.; borough surveyor.

EDINBURGH.—Conversion of Calton Prison into headquarters of Scottish Command; officer commanding. 570 houses at Prestonfield for Corporation; city architect.

EPSOM.—Re-organisation of institution laundry, with electrical work (£6,502), for the B.G.; the clerk.

FELIXSTOWE.—Bandstand, enclosure and dancing kiosk (£13,000), for the U.D.C.; surveyor.

FENTON.—Oil depot and offices, Argyle Street; Shell-Mex, Ltd.

FIFE.—Extensions at Adamson Cottage Hospital, Cupar; the medical superintendent.

GLASGOW.—Picture house at Carntyne; Messrs. Rosslyn Mitchell & Tullis Cochran, writers, agents. 250 steel houses, Clydebank; Atholl Steel Houses, Ltd.

HALESOWEN.—Conversion of Cornbow House into council chamber and municipal offices, for the U.D.C.; surveyor.

HASTINGS.—Orthopædic and isolation departments, Royal East Sussex Hospital; Percy H. Oxley, architect, 29, Havelock Road.

HEMSWORTH.—Cinema and dance hall; W. P. Peters, architect, 125, Vicar Lane.

HEYSHAM.—Congregational Church, Sefton Road; Messrs. Baines, architects, Morecambe.

HULL.—Installation of electric lighting, Boulevard secondary school; Education Committee.

IRISH FREE STATE (TRANMORE, Co. WATERFORD).—Waterworks scheme, including pump and filtration plant for the County Board of Health; J. F. Delaney, 97, Stephen's Green, Dublin.

KERESLEY.—Cinema, Bennett's Lane, for F. Voce.

KINGSTON-ON-THAMES.—Y.M.C.A. headquarters, Eden Street (£6,000); J. P. Blake, architect.

LONDON (FINCHLEY, N.).—40 houses, Leslie Road and Church Lane; W. Hollis, Junr.

(WOOLWICH, S.E.).—Houses (360), for the T.C.; John Laing and Son, Ltd., builders.

(STREATHAM, S.W.).—School (£18,762), Streatham Vale, for London E.C.; F. & T. Thorne, builders, Isle of Dogs.

LYMINGTON (HANTS.).—Infirmary, for the B.G.; John Bevir, architect, St. Thomas Street.

MITCHAM.—Wilson cottage hospital (£25,000); Chart, Son and Reading, architects.

MOTHERWELL.—Extensions to county hospital, with two new pavilions, operating theatre, &c., for Lanarkshire C.C.; the clerk, Glasgow.

NORTHALLERTON.—Factory extensions, for the Linoleum Manufacturing Co.

NORTHAMPTON.—Grand stand, offices, &c., Weedon Road; Northampton Football Club. Works extension, Fetter Street; Phipps & Son.

OSSETT.—Alterations, Station Road; Yorkshire Penny Bank, Ltd. Housing scheme, Swithenbank Estate; borough engineer.

OXTED.—Secondary school, for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

PLYMOUTH.—Development, Whitleagh Estate, Higher St. Budeaux; A. Searle & Son. Development, Barne Estate, St. Budeaux; Body & Son. Premises, Mutley Plain; Plymouth Savings Bank. Café and shops, Keyham Road; C. R. Emmett. Foundry, Dartmouth Road, Birmingham Aluminium Casting Co., Ltd. Works, Beakes Road; World's Wear, Ltd. Smallpox hospital, Sparwell; borough engineer.

PURLEY.—Fire station and firemen's houses (£9,351), for the U.D.C.; C. H. Gibson, Ltd., builders, Croydon.

ROCHDALE.—'Bus garage, Mellor Street, housing scheme (188), Castleton Estate; S. H. Morgan, borough surveyor, Town Hall.

ROTHERHAM.—Engineers' workshops, Thames Street and Mary Street; Duncan White (Engineers), Ltd. Electric light installation, Thornhill School; Education Committee. 'Bus garage, tramways depot (£9,950), for the T.C.; borough engineer.

ROWLEY REGIS.—Houses (146), for the U.D.C.; J. Harper and Sons, builders, Blackheath, near Birmingham (78), and Butler Bros., builders, Erdington (68).

RUABON.—Cinema, New High Street, for the Cambrian Border Cinemas Co., Ltd.

RUSHDEN (NORTHANTS.).—Church, for the Wesleyan trustees; secretary.

ST. ALBANS.—Council offices, for the R.D.C.; Mance & Ross, architects, 32, St. Peter's Street.

SMETHWICK.—96 houses by direct labour, Manor Road; borough engineer.

TILBURY.—Church (£4,000), for the Wesleyan trustees; C. M. Shiner, architect, Grays.

TONBRIDGE.—Housing scheme (40), for the U.D.C.; surveyor.

TORQUAY.—Stores at refuse destructor for Corporation; R. Wilkins & Sons, Ltd.

TUNSTALL.—Oil depot and garages, Scotia Road; Anglo-American Oil Co., Ltd.

UDDINGSTON.—Housing scheme (172), with electric lighting, for Lanarkshire C.C.; P. C. Smith, District Offices, Hamilton.

WELLINGTON (SALOP).—Re-erection of saw mill premises, for Groom & Sons (several thousand pounds).

WEST YORKS.—School, at Bramley and Wickersley; Education Department, County Hall, Wakefield.

WHITCHURCH (SALOP).—Housing scheme (42), for the U.D.C.; surveyor.

YORK.—Extensions, tram depôt, Piccadilly; tramway manager.

The Electrical Review

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THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

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Contents:

	PAGE
Our Hundredth Volume	1001
The I.E.E. Wiring Rules	1002
Engineering Finance, Economics and Organisation	1002
The Contractors' Convention	1002
The Growth of the B.I.F.	1003
Preserving the Amenities	1003
Our Service Department	1003
The Institution of Electrical Engineers (*illus.*)	1004
Swiss Railway Electrification, by H. W. Schuler (*illus.*)	1007
Ironclad Switching Systems	1009
Japan and the Electrical Industry, by A. Riddle	1010
Wireless Batteries, by Paul D. Tyers	1012
Business and Industrial Notes	1014
Lighting and Power Notes	1018
Tramway and Railway Notes	1020
Telegraph and Telephone Notes	1021
Radio Notes	1021
Contract Information	1021
Forthcoming Events	1023
Notes	1023
Institution Notes	1025
Our Personal Column	1025
Financial Section—	
New Companies Registered	1026
Official Returns of Electrical Companies	1026
Financial Section—*continued.*	
City Notes	1027
Stocks and Shares	1029
Our Foreign Electrical Trade	1031
South African Electrical Trade	1032
Radio Battery Eliminators, by P. R. Coursey and H. Andrewes (*illus.*)	1033
Mixed Pressure Colliery Turbines	1035
Electrical Measurement of Temperature, by J. Hall	1036
A New Direct-Current Meter (*illus.*)	1037
Electricity Supply in the West Midlands, by S. T. Allen	1038
Electromagnetic Couplings (*illus.*)	1039
New Electrical Devices, Fittings and Plant (*illus.*)	1040
Parliamentary News	1041
Correspondence—	
E.h.p. Transmission with 33,000-Volt Cable	1041
Cheaper Wiring	1041
Metal-clad Draw-out Switchgear	1041
Legal	1042
Reviews	1042
Published Specifications	1043
Trade-mark Applications	1043
New Work for Contractors	1044

Our Hundredth Volume.

WITH this issue the hundredth volume of the ELECTRICAL REVIEW is completed; it is an event of some significance, bearing silent testimony to the age of an industry which, however, as industries go, is still in its youth, with the prospect before it of unbounded prosperity when it is in its prime. Nearly five years ago we celebrated the fiftieth anniversary of the birth of this journal; the reason why the two dates do not coincide is that during its early years only one volume was completed each twelvemonth.

Starting on November 15th, 1872, as "The Telegraphic Journal," on January 15th, 1873, it added the sub-title "and Electrical Review." Turning over the old volumes, it is interesting to observe that the former title gradually shrank whilst the latter was printed in larger and larger type, until in 1882, when for the tenth volume the present format was adopted, the telegraphic title became subsidiary, and in 1892 it disappeared completely. That gradual change was symbolic of the great transformation that was taking place in electrical engineering—the growth of a new and vastly greater branch from the parent stem, the extension of the electrical field into all departments of civilised existence.

Yet our first issue was not wholly devoted to telegraphic subjects; pure science was also represented, a new thermo-pile was described having "an intensity equal to that of 60 Daniell elements," and an automatic arc lamp was illustrated. "City Notes," then as now, dealt with finance and industry, noting the opening for traffic on October 21st of the British Australian Company's cable which afforded direct communication between London and Melbourne. This year, in our hundredth volume, we have recorded the opening of a channel of communication between those cities without the use of a cable—the beam wireless system, which is a no less meritorious achievement than the former.

An outline of the history of the ELECTRICAL REVIEW was given in the Jubilee number of November 17th, 1922, but the keynote of that issue was "Looking For-

ward." Continuing in that vein, it would be interesting to speculate upon the appearance and contents of the 200th volume; when that appears, we fancy, the all-electric age will have arrived. Dr. Ferranti's dream of electricity at ½d. per unit will have been realised, our railways—if transport still goes by land—will be electric, and the "grid" will not only have been completed but superseded by directional radiation of electric power.

The I.E.E. Wiring Rules.

The new (ninth) edition of the I.E.E. Regulations, just issued, takes the place of the edition which was published in 1924 and subsequently amended by leaflets. It is stated that it contains some alterations which had become urgent, but as no one can cheerfully face the task of comparing the two volumes line by line, we venture to express regret that no indication of the places where changes have been made appears in the text. Had this been provided, men who were familiar with the text of the Eighth Edition (if they existed, outside the ranks of the Wiring Regulations Committee) could easily have brought their information up to date.

The fact that a Tenth Edition was on the stocks has been more or less widely known; it is now officially announced, together with the glad news that it will take a simpler form than that which is now current. To expect a wireman to be *au fait* with a book containing 128 Regulations and 14 tables is to ask too much of any man; it defeats its own object. The Home Office plan of issuing a comparatively short set of Regulations and supplementing it with an explanatory memorandum is much better. In the I.E.E. code the attempt has been made to deal with every case that is met with in electrical installation work, instead of stating broad principles, laying down a few definite and essential requirements, and relegating long-winded definitions, explanations, and alternatives to an appendix or a separate memorandum.

Anyone who turns over the pages of the book must recognise at once its resemblance in some respects to an engineering specification, although its use as such is expressly deprecated, or to a text-book, which again is declared to be no part of its purpose; moreover, it possesses some of the characteristics of an Act of Parliament. There is far too much verbiage, and too little is left to common sense. It may be argued that common sense is scarce; our reply is that a man without common sense will take little heed of rules, long or short. We should like to know how many installations carried out since 1924 comply strictly with the regulations. Does any?

Engineering Finance, Economics and Organisation.

The speeches delivered last week at the luncheon of the British Engineers' Association were commendably brief and businesslike. Mr. H. J. Ward, the president, with a few appropriate sentences, introduced the principal speakers —Mr. Reginald McKenna, the head of our largest Bank, and Sir Arthur Balfour, chairman of the Committee on Industry and Trade. Each of these gentlemen knew exactly what he was going to say and how to say it.

The Association passed a resolution early in the year asking that an inquiry should be held into the theoretic basis and practical technique of our credit and currency system, including the Bank of England as the central institution and custodian of our monetary resources. Mr. McKenna felt that the resolution was a wise one and should have been acted upon by the Government without delay, but the Chancellor of the Exchequer thought differently, or to be precise, he was not aware of any sufficient grounds to justify such an inquiry, which, he said, would have an unsettling effect in many directions. Mr. McKenna's speech was a reply to the Chancellor. He showed what had been happening along the same lines in many other countries which were not afraid of an "unsettling effect," and added that it would not be very difficult to give sufficient reasons why we should hold such an inquiry. None of the countries which had reformed their financial institutions had copied the Bank of England, but they had adopted some system similar to the Federal Reserve Act of the United States. This surely suggested that there was something for us to inquire into. We had no generally accepted body of opinion in this country; an inquiry would help us to form such, and on the basis of a well-informed public opinion we could establish the finest system in the world.

The speech of Sir Arthur Balfour, who stands high in the industrial world, as Mr. McKenna does in that of finance, was devoted to the International Economic Conference at Geneva from which he had just returned. He paid a tribute to Mr. Bremner, the Director of the British Engineers' Association, for the service he had rendered by preparing for the Conference the "finest document on engineering ever produced in this country," a document which was the admiration of the representatives of all the fifty nations represented at Geneva. Among the conclusions reached at Geneva was one that cartels and industrial agreements could only be applied to relatively few industries, namely, those where the article produced was similar and comparable in different countries. It was proved to be a fallacy that tariffs could be reduced by means of cartels; sometimes the reverse occurred. The Conference held that tariffs were too high, too complicated, and too often changed. It was obvious that new productive plant was being put up, though the world already had more than was needed. Subsidies were a curse; the more trade and commerce were left to people who understood them and were left alone by Governments and politicians, the more business we were likely to do. Sir Arthur asked what steps were to be taken to bring the recommendations of the Conference home to the people. Such bodies as that Association should play a part in such a direction. All trades in this country should be organised as they were. In future we should have to spend a great deal more money upon our trade organisations if we wished to compete with foreign countries. More brains from the industries themselves—especially from the younger men—must be brought to bear upon Trade Association matters; such organisations should not be run by "officials." Some kind of International Association was needed and younger men should acquaint themselves with the subject of international negotiations. Sir Arthur made the familiar but still painfully true remark, that hard work and better organisation were what were needed to bring the world right —fancy schemes must be abandoned. If we wished to defeat Sovietism we must organise as quickly as possible to develop the stream of better trade which was indicated by last year's return—and give employment to our people; we must work together better, each striving in his own works to reduce grievances—the food upon which Sovietism throve.

Mr. Bremner, the closing speaker, referred to the difficulties of the engineering industry, adding that the work contributed by individual firms in support of his Association was so small as to be a grave reflection. It was deplorable that they should find it necessary to augment their subscription income by means of revenue derived from extraneous sources such as an engineering directory and British Empire Exhibition profits. He appealed to the industry to find the money and the other necessary support for maintaining efficient trade organisations.

The Contractors' Convention.

The Electrical Contractors' Association is making excellent progress. Its membership has passed the thousand mark, and in many directions members are feeling the benefits of the Association's added strength. The papers presented at the second annual Convention of the E.C.A. Allied Associations at Scarborough this week were of a high order and were full of interest not only to the contractors to whom

they were addressed, but to supply authorities and other members of the electrical industry.

Next week we shall deal with some of these papers, but here we may say briefly what each was about. Mr. Grierson, in "Some Interesting Points in Connection with Modern Installation Work," stressed the need of the contractor for less stringent conditions; the present ones, if those quoted are indeed fair samples, certainly bear hardly upon members of the trade. Care was counselled in fixing costs of quantities and time of an indefinite nature. Mr. Grierson's text was "Union is Strength," and he said that a "hundred per cent." membership of the E.C.A. would lead to a vast improvement in the conditions under which electrical installation work is carried out.

Mr. J. Kirkham's paper aims at showing how narrow a margin separates success from failure in the electrical contracting industry, and stresses the need for proper costing—as distinct from mere accounting. Methods of dealing with the many items not relating to particular jobs are outlined, and not only contractors will find the paper worthy of study. In his concluding address the new president, Mr. W. A. Shaw, expresses the necessity for more contractors' showrooms, and Mr. H. F. Walker deals with this matter in his paper to-day on "The Electrical Showroom as a Commercial Proposition and its Relation to the Industry." It must be said, however, that the author places first in his list of factors essential to progress the reduction of the cost of electricity to an absolute minimum. The electrical education of the public comes second, and harmony within the industry third. He agrees with the maintenance of permanent displays by municipal supply authorities, but says that these should not be employed for the discouragement of private enterprise; their object should be purely educational—for the sale of more energy. Mr. Walker submits that the contractors are the people to set up the showrooms which will be necessitated by the development of the industry, and deals in detail with the organisation and arrangement of such showrooms.

The Growth of the B.I.F.

WHEN discussing the future of the British Industries Fair in our issue of April 1st (p. 502) we advocated as one way of overcoming the difficulty of expansion at the London end the transfer of certain classes of exhibits, including those of electrical and allied classes, to Birmingham, where there is abundant site space available. We are not familiar yet with the nature of the new arrangements, but it would seem that the difficulty referred to has been negotiated satisfactorily, from the official standpoint at all events, for we learn that for the Fair which is to be held from February 20th to March 2nd, 1928, the exhibition area in London will exceed the space provided there last time by 100,000 square feet. At Castle Bromwich, Birmingham, extensions of 80,000 square feet are to be made. We are informed that the space already applied for in the Birmingham section amounts to double that taken by the corresponding time last year. We are glad to note this, but not in the least surprised, for the enterprise shown by the Birmingham Chamber of Commerce has been one of the outstanding features of the development of the Fair during the last few years. It is certain that unless the Chamber, through its electrical members, had taken up our particular branch of the trade two years ago, there would have been little left by way of electrical exhibits. The assistance that it has been our privilege to render in connection with its progress has been given because of our firm conviction that the electrical and allied trades should fill an increasingly important place in the Fair. An exhibition held under Government auspices to impress buyers with the character, variety and extent of British products must, of course, contain a strong representation of British electrical manufactures. Yet we do well to remember that, however important we may regard it, the electrical is but one out of a host of sections, and innumerable considerations have to be borne in mind in settling matters of general policy.

Any doubt that has been expressed regarding a possible abandonment of the Fair, under the Government economy plans affecting the Department of Overseas Trade, is set at rest by the official intimation that the Government has leased the White City for the London Section for the necessary periods in 1928, 1929, and 1930. Application forms have been sent out to approximately 10,000 British manufacturers regarding this Section, and no doubt the Birmingham authorities will soon be proceeding energetically with their electrical and other activities. Their space application forms have already been circulated. What they asked last February was that different branches of industry should guarantee certain support for a period of years. With three Fairs assured, perhaps this may be a reasonable basis upon which electrical exhibitors can discuss various matters, including maybe the question of date which some seem to think should be reconsidered.

Preserving the Amenities.

WRITING to the *Morning Post*, the Countess Bathurst expresses apprehension lest one effect of the national scheme of electricity supply be to string unsightly overhead mains on hideous steel masts across Britain's beauty spots, as, she says, has happened in Switzerland and Italy. Prof. J. A. Fleming, in reply, points out that the alternative of underground cables which the Countess advocates is not practicable at 135,000 volts, but he puts forward the interesting suggestion that all lattice towers, outdoor switchgear, and transformer stations should be painted green or brown, or whatever colour best matches the prevailing tint of the landscape. In Switzerland, he says, this practice is being adopted, and certainly it appears to be commendable, even though it affords only a partial remedy for the complaint. Dr. Fleming adds that in England little or no attention is being paid to this question; lovely districts have been recklessly disfigured in Wales, but in Switzerland care is taken to place power stations and lines as far as possible from such places.

Now is the time—before the "grid" has begun to take shape—to impress this important consideration on the minds of the responsible authorities. The national interconnecting mains must inevitably be overhead, but something can be done to mitigate their ugliness; how obtrusive overhead construction can be the Post Office has shown us with its lines of 50 or 100 conductors running across the country.

Our Service Department.

JUDGING by the diffidence with which inquiries are sometimes addressed to us, it would appear that some of our readers are not yet aware of the existence or, at any rate, of the functions of our Service Department. That branch of our activities, as its name implies, was developed for the express purpose of affording information on any subject within our province to any reader who is in need of it; we receive some thousands of inquiries every year, and are happy to be able to satisfy by far the most of them. All answers are sent by letter, as soon as possible, provided that a stamped addressed envelope is enclosed with the inquiry. Occasionally we have to appeal to readers for the solution to a poser, and we are grateful to the many correspondents who have responded to our invitation. We hardly need say that requests for detailed specifications, data for winding magnets and armatures, and similar matters which fall more appropriately within the scope of a consulting engineer's practice are not suitable for treatment by our Service Department, though many inquiries of this class are received; its aim is rather to serve as an encyclopædia of facts and data which are already in existence but which the reader is unable to set hand on—an electrical reference bureau, so to speak—and thus to serve the needs of the industry. We much prefer to receive inquiries by letter rather than by telephone, for many reasons.

The Institution of Electrical Engineers.

Summer Meeting at the North-Eastern Centre.

(*Continued from page* 970.)

On the Wednesday morning the North Tees generating plant of the Newcastle-upon-Tyne Electric Supply Co., Ltd., and associated companies* was inspected, luncheon being provided at the power station by the Company, which is the largest concern of its kind in this country. Its area of supply covers 1,600 sq. miles, populated by some two million people, and the number of generating stations running in parallel with the system is 34, their yearly output being approximately 1,000,000,000 kWh; the number of stations owned or operated by the Company is 20, their yearly output being approximately 900,000,000 kWh (200,000,000 of these units are generated by means of waste heat). The demand on the Company's system is 175,000 kW; the route length of cables laid and overhead lines erected is 1,550 miles; the route length of 66,000-volt cables and lines is 60 miles, and the route length of 20,000-volt cables and lines is 400 miles. The number of sub-stations is 626, whilst the horse-power connected to the system is 665,000, and the annual average rate of h.p. connected during the last ten years has been 30,600 h.p. The number of consumers supplied directly and in bulk from the system exceeds 100,000, those connected directly to the Company's system exceeding 60,000 (more than 16,000 new domestic consumers were connected during the year 1926). The number of collieries supplied is 180. The capital expenditure has been £11,700,000. Situated at Haverton Hill, in the County of Durham, on the north bank of the River Tees, opposite to the town of Middlesbrough, the site covers 56 acres, with a river frontage of nearly half a mile; "A" station was put into commission in 1920, and the first part of the "B" station in 1923. The former contains two 20,000-kW Metropolitan-Vickers machines, each consisting of a high- and low-pressure turbine, and two 10,000-kW 11,000-volt alternators, in tandem, running at 2,400 r.p.m. The turbines are of the single-flow type, in opposition, and the last stages of the low-pressure turbines are of the multiple exhaust design. The two generators are normally operated as one unit, but are coupled together through switchgear so that either can be used separately. The ten boilers, by Babcock & Wilcox, Ltd., each have a capacity of 42,000 lb. per hour. The steam pressure is 475 lb. per sq. in., and the temperature is 700 deg. F.; five boilers are fitted with reheaters, which raise the temperature of the steam to 520 deg. F. in its passage from the high- to the low-pressure turbines of each machine. There



Fig. 3.—The North Tees "A" and "B" Power Stations.

* See Elec. Rev., July 4th, 1924.

are no economisers; in their place air heaters have bee installed by means of which the hot gases passing fro the boilers are used to raise the temperature of the a supplied to the grates to about 400 deg. F. All t boilers discharge into one brick chimney with commo fan equipment. Provision is made for oil firing fi boilers. The feed water is heated, first, by steam draw at two stages from the low-pressure turbines, and the by steam taken from the high-pressure exhaust, its fin temperature being 300 deg. F. The pumps are ele trically driven, with steam-driven pumps in reserv and the air from the alternators passes to the boiler a ducts. The ash conveyors are of the suction type.

The "B" station contains one 20,000-kW "Metr vick" generator similar to those in the "A" statio and two 25,000-kW 11,000-volt Parsons sets, which co sist of high- and low-pressure reaction turbines and single alternator; the low-pressure cylinder is of t double-flow pattern with twin condensers. The speed 2,400 r.p.m., and in the case of these machines, t steam entering the low-pressure turbines is not r heated.

Steam can be interchanged between the "A" an "B" stations; in the latter, eight boilers manufacture by Babcock & Wilcox, Ltd., each have a normal capacit of 75,000 lb. per hour, 475 lb. per sq. in., and a tem perature of 750 deg. F. As in the case of the "A station, air heaters are used instead of economisers, an the feed water is heated by steam extracted from th turbines, but its layout differs from that of the "A boiler house in that each boiler has its own chimney an a separate equipment for the induced and force draught (fig. 3). The alternators are provided with



Fig. 4.—Bishop Welldon and Guests at Durham.

closed air circuit, the air being cooled by the condenser circulating water. The ash conveyors are of the water trough scraper type supplied by the Underfeed Stoker Co., Ltd.

The condenser circulating water pump house, which is common to both stations, contains four vertical centrifugal pumps manufactured by Gwynnes Engineer-

ing Co., Ltd., each being capable of delivering 1,560,000 gallons per hour. The main switchgear was manufactured by Messrs. A. Reyrolle & Co., Ltd. The generators feed straight into the mains; there are, however, two sub-stations on the site, in one of which the pressure is raised to 20,000 volts for supplying distant consumers, and in the other to 66,000 volts for linking-up the Company's stations on the River Tyne. The 44,000 kVA of step-up transformer plant now available is to be increased to 68,000 kVA in the near future. The network in Middlesbrough and other districts south of the river Tees is connected to the station by twenty cables laid in a trench dredged in the river bed at a depth of 30 ft. below low water. The control room is equipped with a large diagram showing the southern portion of the high-pressure system, which enables the engineer-in-charge to have full control of the distribution of load in this area. Employés are provided with houses on an estate laid out by the Company on garden city lines in the village of Billingham, about a mile from the power station. There are seventy-three houses, all of which are equipped for electric heating and cooking.



Fig. 5.—At the Hebburn Switchgear Works.



Fig. 7.—Assembling for the Official Photograph.

On the Wednesday afternoon the main party proceeded to Durham to visit the cathedral, the old monastry with its 14th century kitchen, library which contains the Cuthbert relics and Lindisfarne Gospels, and numerous other features of interest. Tea was served on the Deanery lawn by the kindness of Bishop Welldon, D.D.



Fig. 6.—Group at Armstrong College, Newcastle.



Fig. 8.—Some of Messrs. Reyrolle's Visitors.

Meanwhile, a subsidiary party had gone to the pit-head of the Blackhall Colliery of Messrs. Horden Collieries, Ltd., where tea was served by the Company, which also facilitated the visitors' descent to part of the underground workings. Situated on the sea coast about five miles north of Hartlepool, the sinking of this pit through heavily watered strata was completed in 1913; the colliery is electrically driven throughout in conjunction with the Horden and Shotton pits, which were already supplied with electricity by the Cleveland and Durham Electric Power Co. Turbo-generators are installed at both places, driven by exhaust steam from the winding, fan, and other steam engines, and operate in parallel with the C. & D.E. Power Co.'s system, which carries the peak load and into which surplus electricity is delivered by the colliery plant. The incoming 20,000-volt supply is delivered to the sub-station by three separate feeder cables and stepped down to 3,000 volts by means of three 1,500-kW transformers, all motors over 50 h.p., including those driving the winders, fans, and air compressors being operated at 2,900 V, 40 cycles, 3-phase; smaller surface motors are supplied from two 200-kVA 2,900/440-volt transformers. Two 100-kVA and one 200-kVA motor-generator sets have been installed for lighting purposes, and the larger electrically-driven equipment includes Belliss & Morcom air compressors (two of 535 b.h.p. and one directly driven by a "Metrovick" 1,175-b.h.p. motor), two 350-b.h.p. fans, three Sulzer centrifugal pumps of 710 b.h.p., one 125 and one 100 b.h.p. endless-rope haulage systems, and a 300-b.h.p. main and tail haulage set, whilst the screens, washery, saw mill, and fitters' shop are also motor driven. The electric winders at the North and South pits are duplicate Metropolitan-Vickers-Markham sets: their 1,500-h.p. motors operate at 2,700 volts, 3-phase, 40 cycles, with Weir liquid controllers and oil-immersed reversing switches.

To comply with the request for one free evening during the week, no formal plans were made for the Wednesday evening, which enabled a number of the visitors to the Deanery to remain longer in Durham City, a centre of learning and the mining industry, to see more of its cathedral and castle. Situated together upon an eminence within a horseshoe bend of the River Wear, the old castle was built to protect the Benedictine Abbey from attack, and was for centuries the fortress of the Prince Bishops of Durham, who possessed exceptional power and privileges, many of which were ceded to the Crown in 1836, and in that year the Castle was appropriated to the uses of the University of Durham, which was founded in 1832. Parts of the first castle, still extant, are acknowledged to be some of the finest ex-

amples of early Norman architecture, whilst the cathedral is of magnificent proportions; it is the shrine of the northern Saint Cuthbert, commenced in 1093.

On the Thursday one party toured the Ford potteries of Messrs. C. T. Maling & Co., Ltd., who claim to be the oldest private firm of white earthenware manufacturers in the British Isles; the business was started 165 years ago, and the "A" pottery, which has converted 120 tons of clay into nearly half a million pots per week, has been entirely driven by electric power for the last 25 years, the largest grinding motor being of 200 h.p. All the machinery in the "B" pottery is now also electrically driven, over 60 motors of from 50 h.p. downwards being in use, the plant being capable of converting 200 tons of clay into nearly a million articles of ware per week. Messrs. Maling are said to be pioneers in the use of leadless and innocuous glaze, which has been employed by them for at least 27 years. They

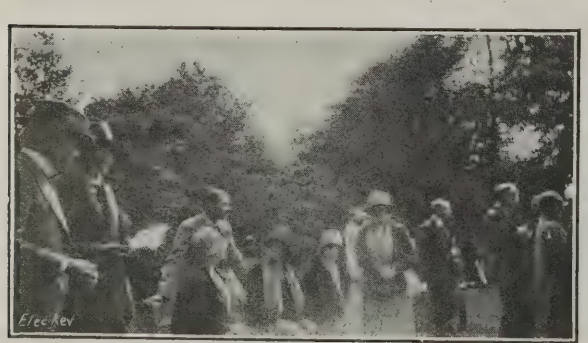




Figs. 9 and 10.—In the Precincts of the Deanery at Durham Cathedral.

were the makers of the handsome souvenir ware distributed to each participant in the I.E.E. meeting this year.

An alternative Thursday morning visit was to the Elswick works of Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., which for a period of 37 years supplied an unbroken line of chief constructors to the British Navy, a remarkable record. The present works of the Company at Elswick, Scotswood, and Openshaw (Manchester), and the shipyards cover more than 300 acres (200 shops), and can normally afford employment for 23,000 people, which figure was at times trebled during the late war. H.M.S. *Nelson*, the largest and most up-to-date warship completed recently, happened to be lower down the river at the time of the visit. The Elswick works were started in 1847 to manufacture







Figs. 11, 12 and 13.—Snapshots During Tea on the Deanery Lawn at Durham.

hydraulic cranes, and bridge and other constructional work was also undertaken. The Company's first connection with the War Office was in 1854, and the first three-pounder breech-loading rifled gun is still preserved and may be seen at Elswick. In 1863 British Government orders ceased, and W. G. Armstrong and Co. and the Elswick Ordnance Co. were amalgamated under the title of Sir W. G. Armstrong & Co., and directed their energies towards the acquisition of a foreign connection for ordnance. It was not possible to manufacture guns for long without becoming interested in warships, and shipbuilding was carried on a Elswick until 1918, when it became essential, owing t the increasing size of ships, to find a yard below th Tyne bridges, and in consequence the Armstrong yar came into being; apart from ships built during th late war, the new yard achieved some wonderful result in the repairing of damaged ships. In 1883 the stee works at Elswick were opened for the supply of gu steel, as well as of steel castings for marine, locomotive and general engineering work. The steel foundry stil continues, but the main supplies of steel are now fur nished by the Openshaw works of the Company at Man chester. Acquired in 1897 when the business of Si Joseph Whitworth & Co. was absorbed, the last-named works include the armour-plate plant as well as the machine tool and other departments. In 1897 works were started at Scotswood for the manufacture of ammunition, and since the late war have been reorganised for the manufacture of locomotives, marine, and gas and oil engines, as well as shell. In 1915 the works at Gateshead were purchased, and the subsidiary companies which have been acquired from time to time together normally employ some 30,000 workpeople.

After luncheon at the Grand Assembly Rooms, Newcastle, alternative visits on Thursday afternoon were to the Ford Potteries and to the fine recently-opened library of Armstrong College, Newcastle's seat of learning, which is an integral part of the University of Durham. The College was founded in 1871, and a special feature of the Electrical Engineering Department is the large use made of three oscillographs by students in every year. A recent gift is an experimental steam turbine, presented by Sir Charles Parsons, and the Dean Lake Laboratory of Electrical Engineer ing contains machinery aggregating 300 h.p. in small sets, transformers, and testing apparatus. The first experiments with high-voltage electroculture in this country were made 25 years ago in conjunction with the late Prof. Lemstrom by the Electrical Engineering and Botany Departments, whilst more recent work has been connected with the adaptation of electricity to coal mining, with the electrical ignition of gases, and dielectrics, with which Dr. W. M. Thornton is closely associated.

(To be continued.)

Swiss Railway Electrification.

Some particulars of the electrical equipment at, and constructional details of, the Seebach outdoor sub-station, one of 22 sub-stations which are being erected to supply 1,000 miles of route of the Swiss Federal Railways.

By H. W. SCHULER, Electrical Engineer, Swiss Federal Railways.

THE Swiss Federal Railways are electrifying their lines according to a programme which provides that by the end of 1928 one half of the system, including about 1,000 miles of route, will be entirely electrically operated. Over the electrified portion more than 75 per cent. of the whole traffic will be carried. Four Federal Railway power stations and two private companies will supply the energy for this service. Single-phase current at 15 kV will be generated by hydro-electric machines and transmitted to different feeding points, either by 15-kV underground feeders or 60-kV overhead transmission lines. The energy transmitted by the 60-kV lines will be transformed to 15 kV in 22 sub-stations distributed along the railway lines. Of these, five of the indoor type were built and equipped between 1919 and 1922; they are situated along the St. Gothard line between Lucerne and Chiasso. As the building costs of these were rather high, the type was abandoned in favour of the outdoor sub-station. First calculation and then experience showed that a saving of from 25 to 30 per cent. could be effected by installing all the h.p. apparatus and lines in the open. A reduction in the time expended in erecting the apparatus, the clear and simple lay-out of the h.p. lines and connections, and the ease with which extensions can be made are some of the advantages which were found to be inherent to outdoor sub-stations. Between 1923 and 1925 nine such sub-stations were built, and provision has been made for eight more to be put in operation.



Fig. 1.—Seebach Outdoor Sub-station.

The sub-station at Seebach, fig. 1, which was ready for service in August, 1925, represents the most recent type of outdoor sub-station so far built on the system. The structure lies in a hollow, and the apparatus is partly concealed, a matter of great importance in Switzerland, and especially in the environs of Zurich.

A 60-kV transmission line, consisting of four 95-mm. copper cables, arranged in two independent loops, transmits the energy from the sub-station at Brugg, which is fed by a transmission line coming from the St. Gothard power stations. A branch line from this will supply the sub-station at Steinen. Space and apparatus are already provided for a transmission line to Gruze, where a sub-station is being built for feeding the lines going to the eastern part of Switzerland.

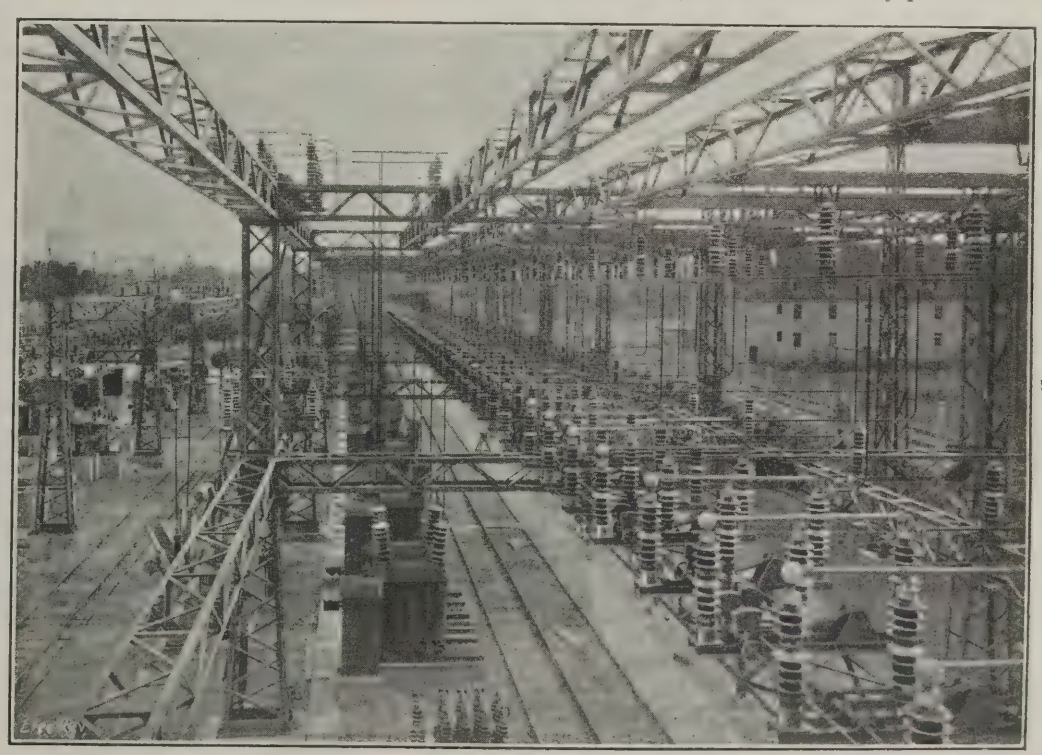


Fig. 2.—Switching Arrangements at Seebach.

The Seebach sub-station has to feed the contact lines of the different railroads branching off to the suburbs of Oerlikon. Duplicate bus-bars are provided. The transmission lines to Brugg-Rapperswill (Steinen) and Gruze are so arranged that one of their two loops goes to one half of the bus-bar system, and the other loop to the remaining section. By this arrangement numerous switching possibilities are given by which any service emergency can be met. Each transmission line

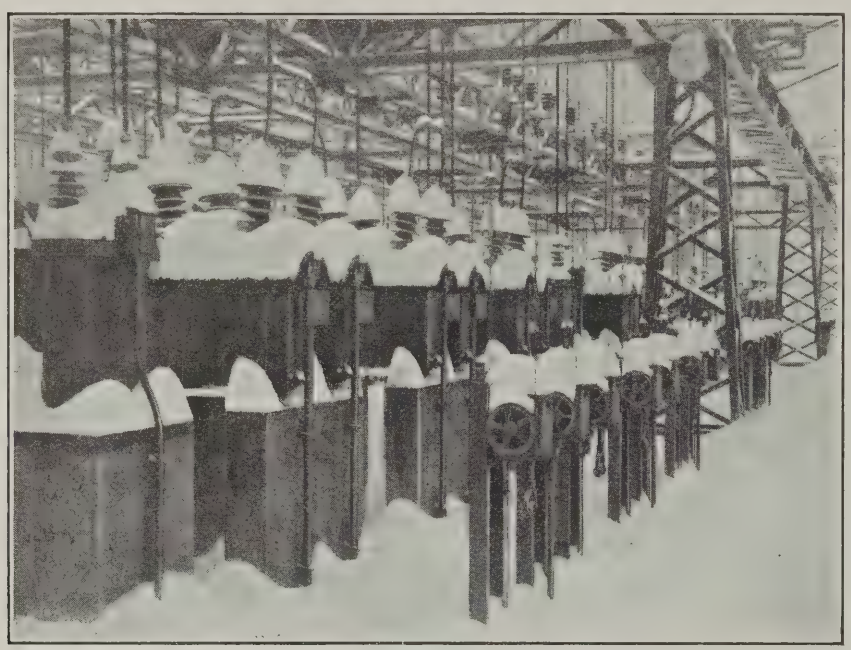


Fig. 3.—Circuit Breakers under Winter Conditions.

is equipped with pressure and current transformers for the measuring instruments and overload relays. Special earthing knife switches are also provided on the lines. Fig. 2 shows the switching arrangements; the transformers are connected to the two bus-bar systems in a similar manner to that employed for the transmission lines. The circuit breakers for the 60-kV lines and the transformers are designed to carry 200 A at 80 kV and to break a load of 450,000 kVA. They are constructed of two single-pole units coupled together by a suitable link connected with the operating mechanism. This mechanism, with the breaker-tripping apparatus, is mounted in a sheet-iron box separate from the breaker. Both hand operation and electrical remote control are provided for. The closing solenoid operates the breaker in half a second, its operating load being 38 A at 220 V. When opening the circuit, the breaker first inserts a 5,000-ohm resistance, and the remaining load is then interrupted by six contacts simultaneously. Each circuit breaker complete weighs 12,540 lb. and contains 4,840 lb. of oil. The 15-kV sides of the transformers are connected to the corresponding bus-bars by s.p. switches, the bus-bars being in turn connected to the contact-line bus-bars through main feeding breakers. These are designed for a working pressure of 24 kV, and have a breaking capacity of 250,000 kVA; they each have four contact bridges which operate in succession when opening the circuit, introducing suitable resistances at the intermediate stages. In parallel with each main feeding breaker is a 2,000-ohm testing resistance and the current transformer of an ammeter for indicating the line conditions when the breaker operates on short-circuit, and so preventing the closing of the breaker on "dead short." The resistance will carry its "short-circuit" load, 7.5 A, for 10 minutes without getting overheated. Should it become too hot, a maximum-temperature indicator will signal the abnormal condition to the operator.

The feeders to the different contact lines are branched off the contact-line bus-bar by means of small oil circuit breakers of limited breaking capacity. Each one of these lines can be earthed by a special knife switch, and sectionalising knife switches divide the bus-bars up according to the different railroad lines which have to be fed. In the case of a disturbance in one of the main feeding breakers, the line circuit breakers belonging to it can be connected to the next main feeding breaker by closing one of these knife switches. Fig. 3 shows these breakers under winter conditions. The single-phase transformers are designed for a continuous output of 3,000 kVA at 0.75 p.f. On the 60 kV side the middle point of the transformer winding is connected to earth through a resistance of 60,000 ohms. A current transformer in the earth circuit trips by means of special relays the transformer circuit breakers in the case of an earth developing on the line. On the 15-kV side one end of the winding is directly connected to the rails of the railroad passing by the sub-station. The windings consist of circular coils, concentrically arranged and held together by spring clamping rings. The end turns are especially heavily insulated to provide against damage due to excess voltages, the puncture voltage between turn and turn being at least equal to the line voltage. Resistance thermometers are installed in the upper coils of the 15-kV windings. Any serious change in the oil level in the transformer tank is automatically signalled to the switchboard operator. The bushings are filled with oil, those on the 15-kV side being in direct connection with the oil in the tank, those on the 60-kV side being separately filled with oil

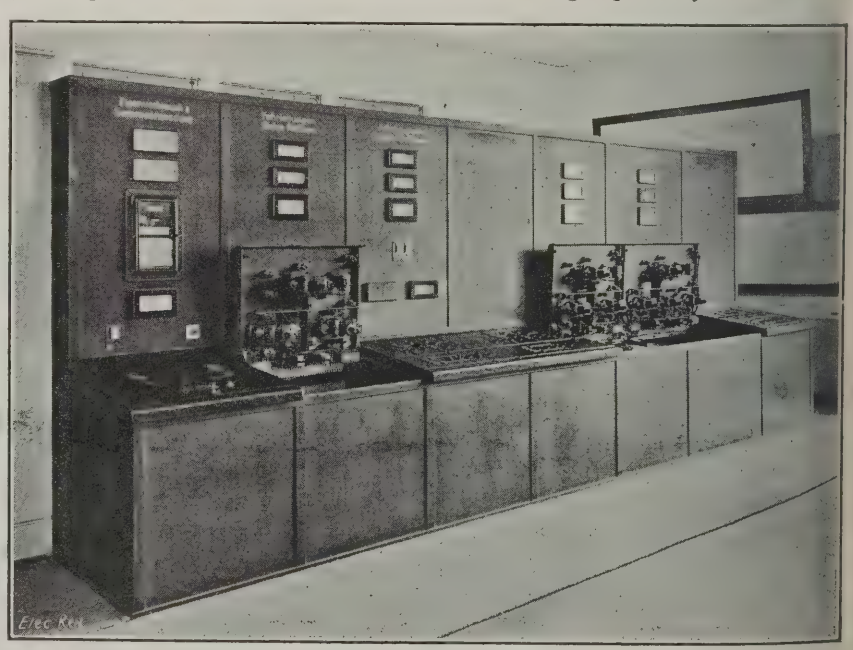


Fig. 4.—Control Board.

and provided with a top glass to allow for expansion of the oil. No special lightning arresters, either on the 15- or on the 60-kV side, are installed, so far with no serious consequences.

All the oil-containing apparatus installed outdoors is mounted on concrete foundations, while the knife switches and bus-bars are mounted on an iron girder

framework. The knife switches are operated from the ground by cables and levers. All the bus-bar and other h.p. connections are by means of copper pipes of 30-mm. external diameter. Tracks are led to each piece of heavy apparatus to facilitate its transportation to the repair shop, the concrete foundations being at a suitable level. All the girders and apparatus are earthed by means of copper strip.

The girder construction weighs over 100 tons and covers a surface of 25,000 square feet.

After the installation was completed, a pressure of 120 kV was applied to the 60-kV apparatus for from 10 to 30 sec. at intervals of 5 minutes. The 15-kV equipment was subjected to 50 kV for 5 minutes. The bushings and insulators had also to resist for 5 minutes testing pressures of 57.5 and 150 kV respectively, under a 45-deg., 4-mm.-per-min. rainfall.

All the measuring, signal and remote-control wires installed out of doors are lead-sheathed.

The switch-house is situated above the cable room and overlooks the whole of the outdoor equipment. Fig. 4 shows the control board for the 15-kV switchgear; signalling lamps and position indicators for the knife switches are so arranged as to represent diagrammatically the lay-out of the equipment. The auxiliary switchgear for the sub-station is mounted on a separate switchboard. Two 50-kVA, single-phase transformers give a 220-V supply for heating purposes and for two 20-kW motor generators for supplying d.c. A 220-V storage battery supplies the lighting and remote-control equipment, and a small 12-V battery serves for feeding the signalling circuits. A system of telephones connects the switchroom, the railroad, and the State system.

At present only three of the main transformers are installed, and two of the six transmission lines are in operation. Arrangements have been made to facilitate extending the sub-station, if necessary, in the future.

Ironclad Switching Systems.

A Review of the Subject from the Point of View of the User.

By a Supply-Station Engineer.

THE debate which has been started in the Electrical Review regarding ironclad draw-out switchgear is one that interests every follower of progress.

It has to be borne in mind that Mr. Thomas Carter, M.I.E.E., in introducing the subject has limited his remarks to a certain range. Taking his first point, the superior mechanical principle employed, it must be admitted that less energy is required to remove a horizontal switch to the isolated position than in the case of the vertical type. This object is achieved at the expense of floor space.

Regarding the mass of the frames, in the vertical type, by reason of the increased height, the supporting structure has to be of fairly stout section to give the necessary stiffness; in the horizontal form, a cantilever construction has proved in the larger sizes of gear to be less economical than the form in which a frame of uniform section along the whole length of travel is used. When the question of accessibility is considered, such as attention to the contacts of an isolated switch, the tanks are removed by merely lowering them in the vertical type, which here possesses a great advantage; a small passage-way at the rear enables ready access to be obtained to all parts.

In the power station a separate supporting structure is not necessary for the vertical type; cross beams of suitable section forming the floor for an upper deck can be arranged in the design of the building. Guides similar to those used for lifts can be provided for the tanks, and very little obstruction to inspection is then experienced.

Work has to be done in the space between bus-bar and feeder orifices, and the selector plugs. In the case of the horizontal gear this is no easy job; one has for the moment to assume the attributes of a snake, which is a difficult task for those inclined towards rotundity. On his score the vertical gear, if provided with more than one point of access, is much better. Increased distance between orifices and plugs can easily be provided in the vertical gear.

With the usual constructions of horizontal gear, access to the back main contacts is difficult, and front access is obstructed by the presence of the lowering truck; hence the complete removal of the tank and obstruction of the passage during maintenance work is usually forced upon the operator. Self-contained lowering gear certainly modifies the case, but does not solve the other difficulties that arise.

The argument that both types need the same two plane motions is weak, in that whilst it embodies an undeniable truth, it is not practical. The complete removal of the tank or the circuit breaker in gear of good accessibility need only occur in a small percentage of the number of operations for isolating and inspection purposes.

In a large power station there is no great objection to the provision of a runway for a removal truck to run the whole length of the switchboard directly underneath the switch tanks of vertical gear.

It may be admitted that looking into orifices is easy on horizontal gear, but that is only part of the story; when all is said and done, how often does one need to look into these places? When work has to be done on these shrouded contacts, the complete removal of the horizontal switch is usually required; the vertical switch is merely lowered to the bottom or lowest position as a whole.

My previous remarks apply to the operation of earthing feeder contacts where through switch earthing has not been adopted, and to the cleaning or removal of plugs for selection purposes. Practical experience is here the only guide; if those who discuss this point say otherwise, they have surely forgotten theirs. Mr. Carter, when he speaks of the accessibility of horizontal-gear plugs, has in his mind only the single bus-bar type; accessibility is reduced when two or more bus-bars are installed, and on large gear access to the middle phase, bottom bus-bar selector plug is by no means easy.

The cable box of a horizontal switch is a neat arrangement and houses the necessary cable terminals and current transformers in a compact construction. If access to current transformers is desired, the designs at present made to provide this feature seem to indicate that the horizontal gear does not lend itself well to such a provision.

An easily accessible cable dividing box should help towards more satisfactory jointing, but beyond that, the situation of the box is not in itself very important. The important feature is the arrangement of the cable; sharp bending must be avoided.

To my mind the logical place for the cable runs of the vertical gear is overhead, with suitable protection against possible rising flames; the cables could be laid upon a concrete platform over the full width and length of the passage-way at a height level with the top of the bus-bars. The extra height need be little, and easy bends to the cable boxes, suitably designed, could readily be allowed.

The over-all height from the bottom of the cable basement need not be larger than from the floor level to the top of the cable chamber in the new lay-out.

In basements it is common practice to run the cables along the walls; in this case all the cables are liable to damage from fire at any one switch. If faced with the problem of installing either gear, whose service happens to be important, in limited headroom, I should consider the advisability of providing a cable passage of narrow width, with wall cleats for the cables, and a brick wall dividing the cable-way and switchroom. In the case of basements, if neither is provided with cable runs below the floor, horizontal gear may score by a foot or so in the matter of headroom. In the matter of the width required, horizontal gear is at a distinct disadvantage.

With regard to the question of damage to bus-bars, it is reasonable to expect that a serious explosion may cause damage to both types, as in either case the bus-bars are situated but a short distance away from the seat of trouble—the switch tank.

On vertical gear, failure of the top plate, or blow-off of the tank, is likely to do damage to the bus-bars. Perhaps, to meet this point, the bus-bars of vertical gear may be placed at one side and not vertically over the switch tanks; in this case, no inherent advantage of either type is of much importance. A failure from explosion occurs at the weakest point, and I see no reason why, with a clear space underneath, switches should seek heaven as their home. Overhead bus-bars are at a disadvantage when oil fires occur, and are then more likely to be damaged unless suitably protected. For those who prefer everything except bus-bars to be metal-clad (and recent installations demonstrate the existence of this school of thought), bus-bars can be mounted in cubicles on a floor above and the usual ironclad switchgear beneath; this should satisfy all doubts regarding the vulnerability of bus-bars.

In the event of severe electromagnetic forces, the bus-bars of the horizontal as well as the vertical gear are subject to reactive forces, which are equal and opposite; from a mechanical point of view the vertical downward isolating style can be designed so as to be capable of coping with the stresses in a direct line, but in present types of horizontal gear this is not so true.

The mounting of two circuit breakers in one tank does not give sufficient advantage to justify the extra outlay; it has disadvantages of great importance, neutralising to a large extent the value of the provision of duplicate bars.

Oil selector switches of good design are costly, and I hold that the capital is more economically spent on duplicate circuit breakers. Plug selection is slow in operation; speed in operation adds much to the value of duplicate bus-bar systems and speed in selecting is likely to be of increasing importance in power stations where the division of bus-bars has to be carried out. For important circuits, duplicate circuit breakers offer real advantages, and interlocking arrangements are less complicated.

If, on the occurrence of fire, it were feasible to play a hose upon the flames without causing damage to near-by switchgear, one could almost say that ironclad gear was as safe as could be. But talking of fires, whether likely or not, is disconcerting when the subject is switchgear, and perhaps not very tactful. Protection from dripping water is an inherent quality of the vertical gear; when dampness has to be considered, as is in some cases important, neither type scores.

The horizontal draw-out pattern was developed in the first instance, I believe, for single bus-bar systems; then their size was moderate, but now the largest are far from small. Switching practice is undergoing a change; the switch-houses of large power stations are designed to suit the gear, and a switch is now given a good deal of respect and is not put in an odd corner as heretofore. One or two feet of space must not unduly interfere with design.

Horizontal gear has served its users well, though its life has to a large extent been blighted for a long time owing to the disfavour shown to ironclad gear in the past. Vertical gear, with certain minor improvements in design, will, I think, take the field, albeit the rightful ground of the other's preparation, for the moderately large and super-power stations' requirements.

Where oil-filled gear is used, precautions must be taken, by division into compartments, to prevent any large quantities of oil running away from bus-bar chambers. Drains and channels in floors can help to prevent burning oil from spreading in the event of tank failure.

The two types have here been considered purely with regard to their inherent qualities; where present designs have been referred to, no one design alone has been held in mind.

I hold that the alleged weaknesses attributed to the vertical draw-out gear by correspondents are not incapable of improvement by design towards the attainment of a complete solution of all difficulties. The vertical downward draw-out is meant where not specifically mentioned. In conclusion, I would say, to preclude any suggestion of manufacturing interests, that I am not connected with any manufacturing concern—a fact which will, I think, be evident from the diversity of my criticisms.

Japan and the Electrical Industry.

By A. RIDDLE, A.C.G.I.

THROUGHOUT the short history of the electrical industry there is nothing to equal the rise of Japan as a power-producing country, or of its people as a power-using community.

Electricity is in general use, both for lighting and power, to an extent which, to the conservative English mind, is almost incredible. Throughout the whole country there is but one illuminant, and it is almost impossible to find a house which does not use electricity for lighting at least. In Tokyo itself, a city of two million inhabitants, the proportion of houses not wired for lighting is a negligibly small portion of 1 per cent. The same applies to the rural districts, where even the most distant settlement seems to get a connection on to a transmission line. Most of the house wiring, it is true, would not satisfy the demands of the English insurance companies, but this leads one to think that England perhaps is suffering from too much legislation in this respect. Throughout Japan all the dwelling houses are built of timber and paper; and in such a country, where the effects of a fire would be devastating, electricity is regarded as the only safe illuminant, coal gas being rightly regarded as a dirty, dangerous, and poisonous thing to have about the house. Further, the use of electric power is becoming more and more popular both for cooking and heating, and applications for connections are being received at such a rate that in many cases the supply companies are finding great difficulty in keeping ahead of the demand. Farmers, too, attracted by cheap rates, are rapidly adopting electric power for pumping, irrigation, sericulture, the tea industry, and in all the subsidiary agricultural operations.

The reason for such a general use of electric power is

apparent from a study of the physical characteristics of the country. Japan is a mountainous country with abundant water supplies, huge natural reservoirs, narrow gorges and countless waterfalls, so that it is one of the most easily adapted countries in the world for hydro-electric development, and something like 80 per cent. of the power generated in the country is developed hydro-electrically. There are some very fine examples of steam stations, but the majority of these plants are used for standing by, or for assisting at the low-water periods of the year. Transmission and distribution, too, present a much easier problem than in most countries, for by far the greater part of the population is congregated in the valleys, so that a concentrated load is almost always assured, and in no case is the load very far removed from the generating centre. In addition, there are abundant supplies of home-grown timber suitable for transmission lines, and copper is mined in quantities more than sufficient to meet all home demands. Endowed, then, by Nature with such resources and conditions, Japan has been enterprising enough to develop them to the full, with the result that ample supplies of cheap power are available everywhere, and further schemes are being projected to ensure adequate supplies of power in the future. The rate at which the demand for power is growing may be gauged by the fact that one company, the Tokyo Dento Kabushiki Kaishu (Tokyo Electric Light Company) has an available plant of 600,000 kW, which is almost double what it was before the great earthquake of 1923, and more than treble the figure for the early part of 1921. This figure of 600,000 kW is made up of 313,000 kW in hydro-electric stations, and 70,000 kW in steam plant, while the balance of 217,000 kW is purchased from subsidiary companies. The company owns over 2,000 miles of e.h.p. line and a further 48,000 miles of distribution line.

A study of the financial position of this company is of interest. The company commenced business some 40 years ago, and it now occupies the foremost position in the industry, with a stupendous paid-up capital of 345 million yen (10 yen equals £1 approximately), and incidentally it is the largest limited liability company of any sort in Japan. Although the amount of capital is not the only criterion of the position of the industry, it is indicative of its scope, and there are about 15 supply companies in Japan which have a paid-up capital of over ten million yen.

This company operates over an area of about 9,000 square miles in the Tokyo district, and has over 1¼ million lighting customers on its books, and a further 50,000 taking power. In spite of the magnitude of these figures, it is of interest to note that in April of this year the Ministry of Communications rejected an application from the company to extend its area of supply on the grounds that the power available is not, and has not been, sufficient to meet the demand. The view of this authority is that in 1929 there will be a shortage of power in the company's area; the reply of the company is that it is taking all steps necessary to ensure an adequate supply in the future.

A company of this size might appear to be too ponderous for successful management. Such, however, is not the case; for, while putting aside ample reserves, a dividend of 11 per cent. per annum has been maintained over the past three or four years. Indeed, this figure is just the average paid in 1926 by 18 of the largest supply companies whose financial position has been studied.

There are two systems in general use for charging purposes. One, a flat rate per mensem for a lamp of given consumption, which is accompanied by a reduction in the rate for an increase in the number of the lamps in use. The other system is the meter system, which promises in time to displace the flat-rate system entirely. The average charge for lighting is about 20 sen (about 5d.) per kWh, and for power about 7 sen (1.75d.) per kWh. These figures are for the small consumer. Big consumers are, of course, given special rates and so are the farmers. Farmers are given cheap rates owing to the fact that during the summer months, when the demand for power for domestic purposes is at its minimum, the rains are heaviest, and there is a big surplus of power available from the late spring until the early fall. It is just between these times that the farmer's need for power is greatest. By the organisation of a farm electrification society a campaign was started to educate the farmers concerning the possibilities of electricity, and the response has been extremely satisfactory.

Regarding the power plant in use, most of the Japanese engineers have a strong leaning towards American machinery, chiefly, perhaps, by reason of the large use of hydro-electric plant. Good examples of Swiss, German, and American water wheels are found, but one good station has four Pelton wheels, each rated at 10,000 h.p., by Boving. The Japanese manufacturers, however, are rapidly introducing their own designs, and in a few years outside manufacturers may experience great difficulty in finding a market for their products in Japan.

As far as steam plant is concerned, one hears nothing but praise for the British turbine and generator, while for steam raising, Babcock & Wilcox boilers are rightly regarded as the world's best. In one station at Nagoya, belonging to the Toho E.P. Co., were installed boilers by Messrs. Babcock & Wilcox, Ltd., generating 648,000 lb. per hour at 350 lb. pressure. These boilers are the largest ever erected in Japan, and it is the first plant to adopt high steam pressures. The generators were by the General Electric Co.—two of 35,000 kW each; but the station will have an ultimate output of 140,000 kW. It was cheering to see the condensers made by Messrs. W. H. Allen and British drive to nearly all the auxiliaries. The coal-handling equipment, however, was of Japanese design throughout.

The time taken to erect the station is worthy of note, as it is typical of the electrical movement in Japan. The design work of the stations was commenced in February, 1924, and the work of construction began in the following October. By October, 1925, the first 35,000-kW set was in commercial operation. This machine was dismantled after the shop test at Schenectady, and not only the windings of the stator, but also the laminations came separate from the stator casting. Those who are acquainted with the time usually required for setting up a big machine and putting it into operation will be interested to know that the entire work was completed in three months after its arrival in Japan.

Great attention is being paid to switchgear, which is nearly all of American make or made by Japanese affiliated companies, to American designs. Here, again, British manufacturers will have great difficulty in finding a sale for their goods in Japan owing to the lower price of the locally-built product. Nearly all the power is dealt with at outdoor transformer stations, as much as 200,000 kVA being operated at one such station, and Japanese-built switchgear up to 154,000 volts is giving excellent service.

The switchboards at all the modern stations are of the very highest class, and the designs generally show great attention to detail. One particularly good example of a Japanese-built board is at the Aso station for the Toho E.P. Co. The switchgear is controlled from a benchboard equipped with mimic buses and mimic disconnecting switches to facilitate speedy and accurate operation; and test terminals are provided so that all meters, instruments, and relays can be quickly and easily tested. Temperature indicators are also mounted on the control board so that the heating of the windings of the generators and transformers can be checked under all conditions.

As far as power cables are concerned, the market for British cable is practically dead. Paper cables are now being made in Japan up to 33,000 volts, and cables are being exported. One or two of the big power companies, however, placed useful orders for e.h.p. cables in German hands during 1926. The cable-making industry

is being pushed forward, and although the value of the cables imported during the past few years shows an upwards tendency, the increase is very small compared with the increase in value of the cables manufactured in Japan. The situation regarding insulated wires is even worse. The post-war figures for the value of imported insulated wires fluctuates considerably with a general tendency to rise, but the values in all cases are considerably less than the figures for 1912 and 1913, and this in spite of the enormous increase in the wiring business of the country.

The import figures for boilers and electrical machinery have shown a general tendency to increase during the past four or five years, and in view of the continued developments there should be good markets for all big plant for the next few years, but competition will be keen, not only with America, but with Japanese manufacturers as well. The local manufacturers are themselves building turbo-generator sets of 20,000 kW, and for marine work turbines of much greater output have been built.

Another department of the industry which has advanced considerably during the past few years is the manufacture of porcelain. The Japanese, for many centuries skilled in the manufacture of porcelain, have of late years turned their attention to the manufacture of high-quality electrical porcelain. Insulators for voltages up to 220,000 are being made by several firms, and the porcelain work is always of the best. The brown glazing, however, in some cases, is not up to the best standards, and the ironwork leaves a considerable margin for improvement. All the Japanese transmission lines up to the highest voltages are now fitted with locally-made insulators. 154,000 volts is the highest in operation at present, but lines at 220,000 volts are projected. An export trade is being built up, and there are increasing exports to India, Canada, and the United States.

Concerning the future there is still a great possibility for our manufacturers of large plant, as big developments are being projected for several years ahead. The Toho E.P. Co. is about to float a new company with the object of exploiting certain water resources. The scheme involves the construction of power plants with a capacity of 100,000 kW, together with transformer stations and transmission lines. The estimated cost of construction is 50 million yen for power stations and a further 10 million yen for sub-stations and transmission lines.

The Shinetsu E.P. Co. is also planning a hydro-electric station on the Shinano river, with a probable output of 160,000 kW; and the Tokyo E.L. Co. is preparing plans for a steam station on the outskirts of Tokyo with an output of 30,000 kW.

One of the last acts of the Ministry of Railways under the recently deposed Wakatsuki Cabinet was to sanction the expenditure of over 100 million yen on the development of several electric railways.

One of the direct results of these developments is that the Japanese, long seeking an outlet for their ever-increasing population, are turning their attention to an alternative by introducing new industries or developing old ones. The result is that the exports of the staple manufactured goods, particularly raw silk, cotton tissues and yarns, knitted goods, paper, pottery and porcelains, show a big increase over those of the past four or five years, and it is likely that this increase will continue.

True it is that Japan is at present passing through a financial crisis, but this could, and possibly should, have been met some four or five years ago. Some of the smaller banks are bound to crash, and some adjustment of economic conditions will follow, but this may leave the country in a healthier and fitter condition to compete for the world's trade.

British manufacturers should mark that these people, physically and mentally alert, and for centuries highly skilled as artisans, are determined to take a leading place amongst the manufacturing nations of the world, and that they are putting a tremendous energy into modern manufactures, with a decided inclination towards the electrical industry.

Wireless Batteries.

Some suggestions as to the correct methods of charging various types of batteries and of equipping a battery-charging depot.

By PAUL D. TYERS.

ALTHOUGH the actual charging of an accumulator is quite a simple matter, and should present very little difficulty even to those who have only a rudimentary knowledge of electricity, when one is confronted with the problem of charging a large number of wireless accumulators the procedure is far from straightforward.

The chief difficulty lies in the fact that the number and capacity of cells which have to be charged are never constant, thereby necessitating a considerable amount of flexibility in the charging plant. The position is further complicated by the fact that the trader may be called upon to charge simultaneously perhaps a six-volt 60-A (actual) cell and a two-volt slow-discharge small-capacity cell. Obviously, it is very inefficient to use the same plant for charging both types of cell.

When the available supply is d.c., the best method of charging a moderate number of batteries is, of course, to connect them all in series and simply put them across the mains in series with a suitable resistance, so that the charging current is reduced to the maximum charging rate of the smallest cell. The more nearly the total voltage of the cells in series approaches that of the supply the more efficient will the system become, in so far as cost of charging is concerned. If only a few cells were connected in this way a large amount of power would be lost in the series resistance, and the cost of charging two or three cells would be almost prohibitive. In fact, it would show no useful profit. If the charging rates of a number of cells are very different, it is once more inefficient to use a general series connection, reducing the charging rate to the maximum for the smallest cell, since the small cells would be charged long before the others. Very small cells, such as the well known Exide D.T.G. and D.F.G., are very conveniently charged from direct-current mains by connecting them in series with carbon-filament lamps, which can be paralleled until the desired charging current is obtained.

When the supply available is alternating current, much greater flexibility can be obtained. The current, of course, has to be rectified, and as there are so many forms of rectifiers or complete charging plants now on the market, each possessing some particular advantage, it will be advisable to consider them in some detail. Alternating-current charging plants can be roughly divided into three classes: motor generators or dynamos driven by a.c. motors; synchronous rectifiers; and dis-

charge tube rectifiers, such as mercury-vapour lamps or discharge tubes of the type used in the "Tungar" or Philips rectifiers. Should an a.c. motor be available, the simplest form of charging plant would probably be a shunt-wound dynamo driven by the motor. The output rate of the dynamo will be considered later in these notes. The synchronous rectifier is, in many respects, preferable to a motor generator, since it is less complicated mechanically. Moreover, it is somewhat easier to maintain in good running order, the only attention required being that of keeping the rectifying brush-gear and commutator clean. The output of a synchronous rectifier is also very easily controlled by the use of a suitably tapped transformer. There are several excellent plants of this description on the market at the present time, and they are supplied with the necessary switchgear. The third class of rectifier, the discharge tube, may be divided into two groups, the mercury-vapour lamp and other discharge tubes. Discharge tubes, such as the "Tungar" and Philips rectifiers, are incorporated in complete chargers, and are suitable for delivering comparatively small outputs. This type of plant is best suited to the dealer who has only a few cells to charge more or less regularly. Such apparatus possesses the advantage of requiring no attention whatever, since there are no moving parts. The mercury lamp is, perhaps, one of the best rectifiers to use when a large current is required. The writer has had experience of this type of apparatus working at fairly high currents, with very excellent results. One advantage of the discharge type of rectifier lies in the fact that if the supply fails, the cells cannot discharge through the apparatus, thereby obviating the necessity of complicated cut-outs or other form of protection gear.

One of the most important, and probably the most difficult, points to decide when installing a charging plant is that of its rating. The first step is obviously to estimate the number of cells that will have to be charged, and the number that may require to be charged at any given time, presumably, a full working day. The rating can then best be determined by adding about twenty-five per cent. to the total wattage which has to be dealt with during a full working day. Suppose, for example, this amounts to 500 W, one next has to consider how this output is to be delivered from the plant. For example, one might have a 50-V plant delivering 10 A, or a 25-V plant delivering 20 A. If all of the cells were to be charged in series, one would require a high-voltage low-current plant, while, if the cells were to be charged in parallel, the converse would be true. It has already been pointed out that where cells of various voltages and capacities will have to be charged, it is almost essential to utilise some form of series-parallel connection. In this case some compromise has to be adopted. For moderate-sized installations it is usually found convenient for the maximum current to be not more than twice that of the maximum charging rate of the largest cells which are likely to be obtained. If the number of cells is likely to be small, the amperage may then be conveniently chosen at a little more than the maximum for the largest cell. It is almost impossible to charge very small cells from a big plant with any reasonable degree of efficiency unless a comparatively large number can be connected in parallel. Charging stations which cannot conveniently reduce the rate below two or three amperes are well advised to charge small cells, such as the D.T.G. and D.F.G., from a large accumulator through a small regulating resistance. It is absolutely essential that this type of cell should not be charged at too high a rate.

Some care should be exercised in the layout of the charging system, the most desirable feature being that of the separation of the cells and bus-bars from the plant. A room in which a large number of cells is constantly being charged rapidly becomes filled with very corrosive acid fumes, and these are likely in time to damage the apparatus. If possible, the plant, switchgear, and other apparatus should be kept in one room, and the various bus-bars and accumulators located in another room, which should be well ventilated. A very good arrangement consists in taking the output from the rectifier through fuses and an automatic cut-out, if the rectifier is of the type requiring one, to a series of feeders, each provided with a switch, ammeter, fuse, and a small regulating resistance. These should then be led to the charging room, a common negative bus-bar being employed, and, preferably, differently coloured positive bus-bars being connected to the feeders.

The ideal position for an accumulator during charging, and one which is recommended by fire insurance companies, is upon a glass plate mounted on a lead-covered bench or shelf. If more than one shelf is used, the distance between them should be several feet, in order to minimise fire risk from celluloid cells.

No modern charging depôt is now really complete without facilities for charging high-voltage accumulators. Perhaps one of the best arrangements is the "Tungar" high-voltage unit, which utilises a high-voltage low-current valve. High-voltage accumulators are usually made up of medium-voltage units, and these can then be charged either in series or in parallel, according to the rating of the charging plant. If small h.p. accumulators have to be charged only on rare occasions, an ordinary thermionic rectifying valve, or two or three connected in parallel, may be used. The charging current for h.p. batteries is best regulated with a high resistance, and a high-reading milliammeter.

Apart from the actual electrical charging, it is very important to keep the cells in good chemical condition. On no account should acid be allowed to come into contact with brass terminals, and should this occur, the acid should be neutralised, and the terminals carefully washed and coated with vaseline. This is a most important point. The specific gravity of the acid should also be kept correct, and for this purpose a really accurate hydrometer should be used. Only best accumulator acid and distilled water should be employed, and a really good acid pump is certainly a necessity. There are, of course, many other accessories which are useful, such as apparatus for determining the leakage between adjacent celluloid cells by the manometer tube method. A really accurate low-reading voltmeter while, perhaps, not being a necessity, is an exceedingly useful adjunct to a well-equipped charging depôt.

Tramways and Light Railways Association.

The annual congress of the Association will be held at Bath next week. The chairman and directors of the Bath Electric Tramways, Ltd., will hold an informal reception on Wednesday evening, June 29th, and on Thursday, after a civic welcome by the Mayor, Alderman Cedric Chivers, J.P., and the Mayoress, Madame Sarah Grand, a paper on "Some Aspects of Local Passenger Traffic" by the late Mr. W. E. Hardy, M.B.E., managing director of the Bath Electric Tramways, will be read and discussed. Luncheon at the Grand Hotel will be given by the chairman and directors of the Bristol Tramways and Carriage Co., Ltd., and afterwards the members will visit Cheddar and Wells. On Friday the annual general meeting will be held, and a paper on "Modern Tramway Equipment" will be read by Mr. A. V. Mason, deputy general manager of the London group of tramway companies, and discussed. The members will be entertained at luncheon by the chairman and directors of the Bath Electric Tramways, Ltd., at the Guildhall. In the afternoon a visit will be paid to the Roman Baths and Pump Rooms, followed by a tour of the surrounding country. A reception at the Pump Rooms by the Mayor and Madame Sarah Grand, followed by an entertainment and dancing, brings the proceedings to a close.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Our Trade Names Supplement.

The fifth of our Quarterly Supplements of Trade Names of electrical products accompanies the present number of the ELECTRICAL REVIEW.

A Travelling Exhibition.

The accompanying illustration shows how the Nelson Corporation Electricity Department camouflaged one of its vehicles upon the occasion of the Reedyford hospital gala and Lancashire fire brigade demonstration on June 11th. The skirting of the superstructure was illuminated with



A Gala Display by Nelson Electricity Department.

electrical slogans and the surrounding shelf bore examples of the usual domestic appliances. The display attracted a great deal of interested attention, and should result in more business for the Department.

Australian Demand for Increased Duty on Batteries.

Applications for increased import duties on electric batteries were made recently to the Australian Tariff Board. The Clyde Engineering Co. asked for the imposition of duties amounting approximately to 60 per cent. on British batteries and 72½ per cent. on others. The company's representative said that at present British batteries were imported at a price 15 per cent. lower than the Australian production cost. The annual requirement for motor-cars was about 60,000; if the duty was imposed his company would undertake to increase its plant, &c., within three months, to give an unlimited supply of batteries. Another company, On Masse Batteries, Ltd., promised to raise its production to 2,000 a week if duties of 47½ per cent. and 60 per cent. were imposed on British and other batteries. A representative of an American company said that Australian firms were assemblers rather than manufacturers, and he suggested a reduction in the present rates of duty. His company had abandoned the idea of erecting an Australian factory as the demand was not large enough to be remunerative.

Unemployment.

There was an increase of 104,187 in the number of registered unemployed during the week ended June 6th. At that date the total was 1,089,700, as compared with 985,513 on May 30th, and 1,609,119 on June 7th, 1926 (coal dispute period). The increase is attributed to the Whitsun holidays.

Radio Patents in Australia.

As we have already reported, large firms in Australia have challenged and have refused to pay the patent royalties charged by Amalgamated Wireless (Australasia), Ltd. *The Times* reports that before the Royal Commission on Wireless on June 15th, Mr. Fisk, the managing director, declared that the company had spent £200,000 on patents and research and had only received £76,000 from royalties.

The "Electrical Review" Index.

The Index to Vol. C. (for the half-year ending June 30th, 1927) will be published shortly, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes, or wish to retain it for reference. Application should be made to the Publisher, 4, Ludgate Hill, E.C.

Employment during May.

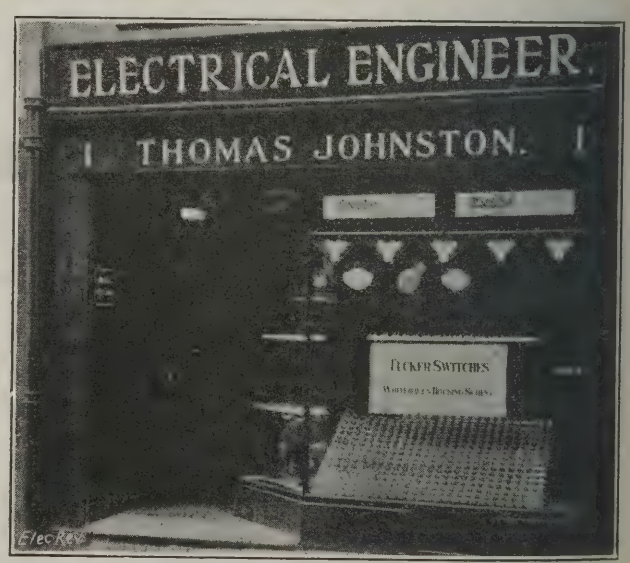
According to this month's *Ministry of Labour Gazette* employment in the engineering industry during May was still slack on the whole, but continued to show improvement in all sections; in the motor vehicle and electrical sections it remained fairly good. The "overall" percentage of unemployment in the industry fell from 9.7 to 8.7. The proportion in electrical engineering decreased from 5.6 to 5.1 per cent. There was an increase in unemployment in the electrical wiring and contracting industry—from 7.4 to 9.1 per cent. In the electrical cable, wire and lamp manufacturing group there was a slight improvement, the unemployment figure falling from 7.7 to 7.4 per cent. The actual numbers of unemployed in the branches of industry mentioned were as follows:—Engineering, 87,444 (including electrical engineering, 3,919); electrical wiring and contracting, 1,260; and electric cable, wire and lamp manufacturing, 6,476.

Local Exhibition.

SOUTHAMPTON.—The Corporation Electricity Department is holding a special fortnight's display of "Magnet" domestic appliances (General Electric Co., Ltd.), at its showrooms. "Magnet" appliances also figure in the displays arranged by the local contractors for the occasion.

A Tucker Switch Display.

A very effective display of Messrs. J. H. TUCKER & Co.'s tumbler switches has been made by Mr. T. Johnston, of Whitehaven, who recently received a contract to wire 108 houses upon the Corporation's Bransty housing estate. Mr.



Tucker Switches at Whitehaven.

Johnston has decided to employ Tucker switches exclusively. A view of Mr. Johnston's shop window showing the batteries of Tucker switches which are being used in the houses appears herewith.

Increased Austrian Duty on Insulators.

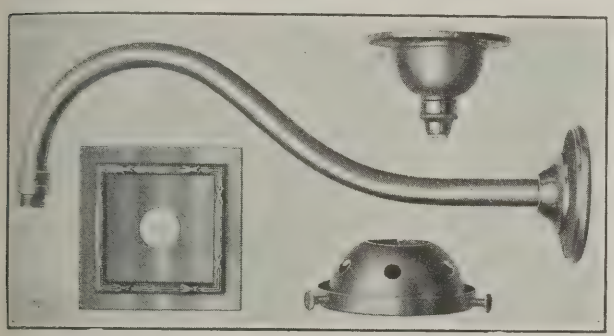
The Austrian Government proposes to increase the import duties on a number of articles, including shaped parts of insulating materials (except porcelain, glass and hard rubber) for electrical purposes, not equipped, weighing more than 600 gr. each. The proposal is to raise the rate from 25 to 60 gold kr. per 100 kg.

Electric Power in Industry.

Preliminary Report No. 15 upon the 1924 Census of Production was published with the *Board of Trade Journal* for June 16th. It shows that in the wall-paper trade there was 811 kW of generating plant, as compared with 850 kW in 1912. The aggregate capacity of installed electric motors was 1,678 h.p., and power for 1,683 h.p. of these was purchased. The capacity of the generating plant used by the fertiliser, glue, sheep dip and disinfectant trades rose from 870 kW in 1907 to 3,528 kW in 1924. There was a total of 23,606 h.p. of electric motors, power for 19,688 h.p. of which was purchased. There was a reduction in the capacity of generating plant installed in the starch, blue, and polish trades, from 970 kW in 1907 to 402 kW in 1924. The total electric motor horse-power was 11,922; power for 7,117 h.p. was purchased. There was 124 kW of plant in the packing trade, and 3,005 h.p. of electric motors (power for 2,982 h.p. purchased).

A Birmingham Fittings Factory.

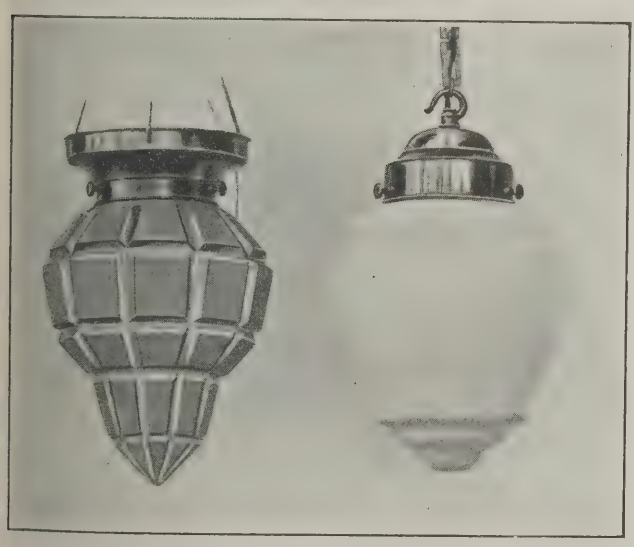
One of the most up-to-date factories for the production of electrical fittings is the St. George's Works of MESSRS. JOHN LAWTON & SONS, LTD., Harford Street, Birmingham. The company's resources enable it to carry out all the processes from pressing and spinning to electro-plating and polishing.



Electrical Fittings by John Lawton & Sons, Ltd.

A very wide range of fittings is produced; for instance, the company makes 160 varieties of switch plates, 40 types of brackets, 90 ceiling plates, and 60 galleries. The first illustration depicts an example of each of these fittings.

Typical lighting fittings manufactured by the company are shown in the second illustration. The left-hand pattern is



Two Totally-enclosed Lighting Units.

a totally-enclosed fitting of moulded glass for ceiling mounting; the other is also of the totally-enclosed dustproof type but of opal glass. The latter is provided with a chain of rectangular links, through which the flexible is threaded.

Patent Restoration.

An order has been made restoring Patent No. 200,963 of 1922, granted to M. W. W. Mackie, for "Improvements in Dynamos and Motors."

The Department of Overseas Trade.

The Parliamentary Correspondent of the *Daily Telegraph* says that the agitation for the retention of the Department of Overseas Trade appears likely to be successful, and Members of Parliament who have interested themselves in the matter feel that the battle is as good as won. In the case of the other two Ministries under sentence of extinction—the Department of Mines and the Ministry of Transport—the Government will, it is stated, stand firmly by its decision.

The Timber Market.

Our timber trade correspondent reports that the demand for all house and general building timbers, as well as for pine and spruce poles, continues to be well maintained. Stocks of such woods at docks, prior to the opening of navigation, had declined considerably in volume; the new arrivals, however, will soon bring them up once more to the general average of the past six years, although the better demand should not make stocks unwieldy throughout the summer. The hardwood market, although showing a lack of activity, is firm, as with the exception of American supplies, stocks are from low to moderate. With the expected decline in receipts from the United States, however, in consequence of the floods in the Mississippi Valley, the hardwood market is likely to show still further firmness.

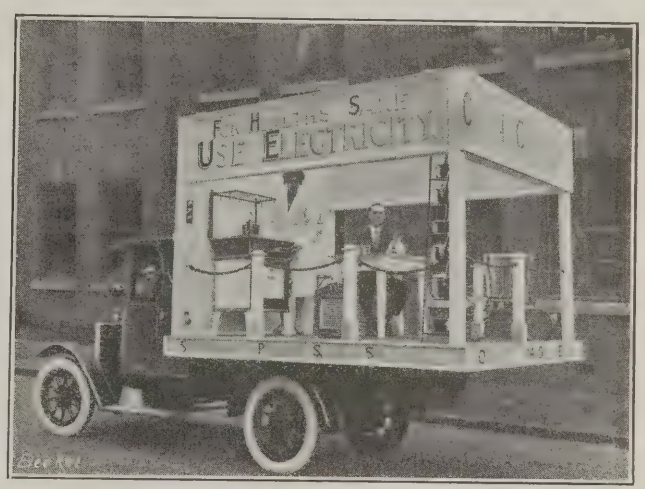
Wages in the Engineering Industry.

The unions concerned in the negotiations for increased wages in the engineering industry have issued ballot papers to their members for voting upon the employers' offer of 2s. per week increase to plain time workers. The executives of the unions are leaving the matter solely in the hands of their members, making no recommendation for either acceptance or rejection. A bare majority will be sufficient to carry the proposal and the papers are to be returned by July 20th.

A meeting of the London Joint Engineering Trades Committee was to be held this week to consider the situation.

Electricity in a Birmingham Carnival.

On June 11th a flag day and carnival were held in aid of the Birmingham hospitals and the City Electric Supply Department took advantage of the opportunity to make a display of domestic appliances. This was mounted on a lorry, as shown in our illustration, and comprised a cooker, geyser, wash-



Display by the Birmingham Electric Supply Department.

boiler, radiators, kettle, iron, toaster, coffee percolator, fan and lighting fittings. The superstructure was inscribed with electrical slogans.

Southend Traders and Municipal Showrooms.

The Southend, Westcliff, and District Chamber of Trade has sent a letter to the Town Clerk suggesting that if electricity showrooms are erected they should not be used as sale rooms, as electrical traders of the borough had satisfactorily supplied past demands for electrical fittings and appliances, and also for the wiring of houses, &c.

Trade Announcements.

Mr. H. WORTON, of Trinity Square, Nottingham, has opened a branch of his electrical business at the Crescent, Spalding.

The PARSONS OIL ENGINE CO., LTD., has opened an office at 3, Victoria Street, S.W.1 (telephone: Victoria 2525). This office will be in charge of Mr. C. Wright.

Mr. GEORGE D. JONES, electrical engineer, late of F. J. Jones and Sons, of The Eastgate, Chester, announces that he is continuing to carry on business at 6, Seller Street, in the city.

Mr. J. H. MOORES, who has represented the Igranic Electric Co., Ltd., for some years in the North-Western counties, has joined the staff of Messrs. John Moores & Co., Ravald Street Works, Salford, manufacturers of insulating materials.

LIGHTING TRADES, LTD. (incorporating J. & W. B. SMITH, LTD.), has removed its offices to Oriel House, 30-31, Farringdon Street, E.C.4. The company's showrooms are nearing completion.

MESSRS. PARMITER, HOPE & SUGDEN, LTD., have appointed Mr. J. A. Anderson, 1, Eldon Square, Newcastle-upon-Tyne, as their sole representative for the North-East Coast district. He is handling the sales for this district of their Aeroflex h.p. and l.p. fuse-gear, and other products.

Messrs. J. MACGREGOR & CO. have removed to 4, Denmark Street, Charing Cross Road, W.C.2. 'Phone: "Gerrard 7302-7303."

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New Catalogues and Lists.

The VISCO ENGINEERING CO., LTD., 162, Grosvenor Road, S.W.1.—A pamphlet advertising the "Visco" air filter for motor vehicles, &c.

The ELECTRICAL EQUIPMENT & CARBON CO., LTD., 109-111, New Oxford Street, W.C.1.—List No. S.C.9, giving details and prices of "Siemens" therapeutical carbons.

Also a monthly stock list of motors, generators, bell transformers, carbons, &c.

The RELIANCE TELEPHONE CO., LTD., Goschen Buildings, 12-13, Henrietta Street, W.C.2.—A cut-out advertising the company's intercommunication systems—installation and maintenance.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—An illustrated and priced catalogue dealing with "Tangent" electromotor sirens for works, &c.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—Folder No. 4140/4, advertising "Cosmos" fans; also a photograph of a window display for the use of dealers in these fans.

TURNER BROS. ASBESTOS CO., LTD., Rochdale.—A card advertising ebony "Sindanyo" insulating board for switch panels, &c.

The CRESSALL MANUFACTURING CO., LTD., 31 & 32, Tower Street, Birmingham.—Leaflet E.F.B.1927, illustrating and describing the "Cressall" electric fire bar. Priced.

AUTOMATIC & ELECTRIC FURNACES, LTD., 173-175, Farringdon Road, E.C.1.—Bulletin No. 38, "The Correct Hardening of Tool Steel," by A. R. Page, giving the results of experiments with a Wild-Barfield electric hardening furnace.

SHEFFIELD STEEL PRODUCTS, LTD., Templeborough Works, Sheffield.—A reprinted article upon the manufacture of files by the company.

SIEMENS-SCHUCKERT (GREAT BRITAIN), LTD., 109, Kingsway, W.C.2.—An illustrated pamphlet advertising the company's automatic intercommunication system.

MESSRS. J. G. STATTER & CO., Queen Anne's Chambers, Westminster, S.W.1.—Leaflets No. X203a, dealing with a.c. and d.c. circuit breakers for currents up to 1,000 A, and No. X225, describing ironclad circuit breakers (Home Office type). Illustrated and priced.

The IGRANIC ELECTRIC CO., LTD., 147, Queen Victoria Street, E.C.4.—An illustrated brochure dealing with the construction and operation of the company's seven-valve neutrosonic radio receiver. Particulars of accessories are also included.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD. (Engineering Department), Holborn Viaduct, E.C.1.—A small priced booklet advertising the company's plywood backboards. It has stiff covers forming a reproduction of one of the boards.

MESSRS. JAMES MCMILLAN & CO., Clun House, 17, Surrey Street, W.C.2.—A pamphlet describing "Pripp" electric lighting fixtures for sewing machines.

MESSRS. HOPKINSONS, LTD., Britannia Works, Huddersfield.—Three illustrated pamphlets dealing respectively with a steam isolating valve, the "Hopkinson-Ferranti" valve, and the "S.P.S." valve.

The PLAN CLIP CO., 4, St. Paul's Churchyard, E.C.4.—A booklet dealing with a system of filing drawings, blue prints, &c.

The BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—An illustrated pamphlet containing full details and prices of a new series of 2-V valves. Also copies of the instruction sheets which are packed in the cartons.

Dissolution of Partnership.

POTTS & CO., electrical and mechanical engineers, Longton, Stoke-on-Trent.—Messrs. W. J. Potts, A. L. Vass, and D. Humpherson have dissolved partnership. Debts will be attended to by Mr. T. N. Elliott, District Bank Chambers, Longton, the receiver.

Bankruptcy Proceedings.

J. TURNER, 62, Blackburn Road, Great Harwood, Lancs., electrician.—The receiving order in this matter was made recently on debtor's own petition. The statement of affairs shows liabilities of £855, against net assets of £294. The first meeting of the creditors was held recently at the Official Receiver's office, Preston. The following are creditors:—

	£		£
Beardsall, E., & Co., Ltd.	31	General Electric Co., Ltd.	88
Beaten Metal Co.	26	W. T. Henley's Telegraph Works Co., Ltd.	45
Baxendale & Co., Ltd. ...	65	McGrath, J. & J.	44
British Insulated Cables, Ltd.	19	Northern Steel & Hardware Co., Ltd.	76
Crypto Electrical Co., Ltd.	48	Turner (Mrs.)	260
Palmer, Riley Co., Ltd.	28		

T. W. THOMAS, trading as T. W. Thomas & Co., electrical contractor, Clarendon Road, Middlesbrough, Yorks.—The public examination of this debtor was held recently at the Court House, Middlesbrough. Debtor's liabilities were put down at £916, against assets of £317, leaving a deficiency of £599. Debtor attributed his failure to bad debts and lack of capital. The examination was adjourned.

J. TURNER, 62, Blackburn Road, Great Harwood, Lancs., electrician.—The public examination of this debtor was held on June 15th at the County Court House, Blackburn. The statement of affairs showed liabilities of £856, against assets of £295. Debtor attributed his failure to the illness of h wife, heavy household expenses, keen competition, and insuf cient work. The examination was closed.

T. F. COLLIER, Union Street West, Oldham, electrician.—The adjourned public examination of this debtor was hel recently at the Court House, Oldham. The Official Receiv stated that the debtor had been asked to amend his statemer of affairs, but there was some difficulty with regard to i Debtor said he would be able to pay his creditors 20s. in th £, but he was told that he should enter all the items in th account and stipulate which were disputed. The examinatio was therefore adjourned.

J. STEPHENSON (J. Stephenson & Son), plumber and electr cian, 36 and 37, Flowergate, Whitby.—Trustee, Mr. M. W Chapman, Golden Lion Chambers, Whitby, appointe June 13th.

D. M. STRODE, engineer, 44 to 50, Osnaburgh Street, N.W and 6 and 7, Creed Lane, E.C.—Last day for proofs for div dend, June 30th. Trustee, Mr. E. H. Hawkins, 4, Charte house Square, E.C.

W. T. SMITH, electrical and mechanical engineer, 60, Hamp den Street, Bolton.—Last day for proofs for dividend July 2nd Trustee, Mr. J. G. Grant, Senior Official Receiver, Byron Street, Manchester.

G. S. HALL (G. S. Hall & Co.), electrical engineer, 55, Malde Road, New Malden, and late of 8, Malden Road.—Receivin order made June 15th, on a creditor's petition. First meeting June 28th, public examination July 29th, both at Carey Street W.C.

J. T. NICHOLS, 4, Glebe Road, Kingsland Road, Dalston, an Rye House, Highams Park, wireless parts merchant.—Receiv ing order made June 15th on a creditor's petition. First meet ing, June 27th, public examination, July 29th, both at Care Street, W.C.

J. SPAVEN, electrical and mechanical engineer, 51 and 53 George Street, Bradford.—Receiving order made June 15th, o debtor's own petition.

W. A. BARKER and F. G. H. BARKER (Barker Bros.), elec trical engineers, 554a, Dudley Road, Wolverhampton.—Receiv ing order made June 14th, on debtors' own petition.

H. A. SANDERS, electrical contractor, The Black Cat Restau rant, Chawston, Beds.—Last day for proofs for dividend June 24th. Trustee, Mr. H. Ball, Duke Street, Bedford.

C. HUBBARD, electrician, 13, Magdalen Street, Norwich.—Second and final dividend of 2s. 8d. in the £, payable a the Official Receiver's office, 9, Queen Street Chambers Norwich.

G. C. LAZENBY, wireless engineer, 29, Old Town Street Plymouth.—First meeting held June 21st, at 11, St. Aubyn Street, Devonport. Public examination, July 22nd, at the Western Law Courts, Guildhall, Plymouth.

G. J. C. THORNE and A. H. THORNE (Lawrence Electrica Trading Co.), electrical engineers, late of 159, High Street Notting Hill, W.8.—Trustee, Mr. D. Williams, Official Re ceiver, Carey Street, W.C., released June 9th.

Company Liquidations.

ELECTRICAL WHOLESALE SUPPLIES (LEICESTER), LTD., 58, Halford Street, Leicester.—A meeting of creditors was held recently at 25, Friar Lane, Leicester, when Mr. J. A. Hopps, the liquidator, submitted a statement of affairs which showed ranking liabilities of £1,929. The indebtedness to the trade was £1,028, and there were cash creditors for £901. The net assets were £398, leaving a deficiency of £1,531. Mr. Hopps reported that the company was registered on July 3rd, 1924, with a nominal capital of £3,000. The issued capital was £1,050, and those shares were allotted in equal proportions amongst Messrs. G. H. Gelsthorpe, T. Gelsthorpe, and J. T. Kemp, who had acted as directors. During the first year the turnover was £5,489, and there was a net loss of £97. In the following twelve months the turnover fell to £4,856, with a net loss of £602. Between July and December of last year the sales were only £1,167, and there was a loss of £925. During the present year there had been a further loss on the trading of £494. A resolution was passed confirming the voluntary liquidation of the company with Mr. Hopps as liquidator. The following are creditors:—

	£		£
Woolf, Arnold	30	Perfecta Seamless Tubes, Ltd.	96
Electric Cables, Ltd. ...	73	Standard Metals, Ltd....	64
Kemp, J. T., Ltd. ...	382	Smith, J. & W. B. ...	36
Midland Manufacturing Co.	22	Balkan Electric Co. ...	32
Armorduct Cable Co. ...	41	Pooley, H., & Son ...	21
L. Mitchells & Son ...	35	Hopps & Bankart ...	26

DE LEEUW & CO., LTD., Sentinel House, Southampton Row, W.C.2.—Under the compulsory winding up order made against this company last October, the report of Mr. J. Barwick Thompson, Official Receiver and liquidator, has been issued to the creditors and shareholders. The accounts lodged show liabilities of £2,269, against assets valued at £191, and a deficiency of £5,178 as regards contributions. The Official Receiver reports that the company was registered as a private company in April, 1925, with a nominal capital of £500, increased in January, 1926, to £10,000, and was formed to carry on business as general agents, dealers in radio appliances, electrical apparatus, &c. The company acquired Mr. Henry De Leeuw's in-

rest in certain agency agreements, the purchase price of £500 eing satisfied by the allotment of shares. The business was onfined principally to the sale of Freed-Eismann wireless sets id components. An agreement stated to have been entered ito with that company cannot be traced; Aldis (a director) ates that it was last in the possession of De Leeuw. In or out October, 1925, De Leeuw proceeded to America with ie object of obtaining confirmation of the agreement with ie Freed-Eismann Company. For this purpose, a sum of 200 was borrowed from a moneylender and subsequently paid. In March, 1926, De Leeuw obtained from another oneylender sums amounting to over £500 against cheques awn on the company's banking account. The directors state at this was done without their knowledge. White (a former rector) states that the moneys were used by De Leeuw to quire 500 preference shares of the company. Further moneys mounting to £200 were borrowed in April, 1926, from another oneylender who subsequently presented the petition upon hich the winding-up order was made. Both De Leeuw and hite signed the promissory note; Aldis denies any knowledge the transaction. Proceedings were commenced against the mpany and in July, 1926, judgment for £230 was obtained gainst the company, De Leeuw and White. Owing to the nsatisfactory financial position of the company which had en brought about by the transactions entered into by De eeuw, he was requested to resign. The board then instructed ie company's auditors to investigate the position and to epare accounts, and extreme difficulty had been experienced. appears, however, that the trading from the date of incor- ration to May 22nd, 1926, resulted in a net loss of £1,930. cluded in the accounts is a sum of £994, representing moneys awn from the company's funds by De Leeuw which he had t satisfactorily accounted for. De Leeuw has left the untry and is believed to be in Holland. The failure of the mpany is attributed by White to extravagance on the part De Leeuw and to heavy overhead charges. In the opinion the Official Receiver the failure is due to the moneylending ansactions entered into by De Leeuw, and to the depletion the company's funds by moneys received by him for which e has not accounted. The failure was contributed to by the nission of the other directors to exercise any control over e Leeuw.

Neutron, Ltd., Sentinel House, Southampton Row, W.C.—he report of Mr. J. Barwick Thompson, Official Receiver, on the liquidation of this company has been issued. The state- ent of affairs discloses total liabilities of £9,534 (unsecured 8,092); assets valued at £1,441; and a deficiency of £8,592 ith regard to contributories. The company was registered a private company in May, 1924, with a nominal capital £500, its objects being to carry on business as manufac- rers and buyers and sellers of substances used as crystal tectors, and in particular the crystal known as "Neutron." he company acquired the goodwill and assets of a business rried on by Bennison and De Vries. The consideration as fixed at £394, which was satisfied by the issue of fully- id shares. Bennison acquired 135 shares, and transferred em to W. Wolsey, a director, in July, 1926. Later, three bentures for £100 each were issued to Bennison for moneys leged to have been advanced by him. It appears that at ie date the debentures were issued the company owed ennison about £50 only, and later the company lent to m £350 and a further sum of £120. In March, 1926, Benni- n appointed a receiver and manager on his behalf, and acted as such until July, 1926. Wolsey states that shortly ter the incorporation of the company Bennison approached m as a partner of the firm of V. Zeitlin & Sons with a ew to obtaining financial assistance, and in the result an reement was entered into whereby Zeitlins were appointed le distributors for Great Britain and Ireland of "Neutron" ystals. There were agreements with other firms for dis- ibuting crystals, and the position with regard to these ill require the consideration of the liquidator. In April, 26, other debentures for £1,000 were created, and on the me date a debenture for £250 was issued to Fitton Smith id Co., Ltd., for cash. In May, 1926, it was reported at a ard meeting that Fitton Smiths had made further advances nounting to £915, and a debenture for £900 was issued. was also reported that Fitton Smiths had endorsed one the company's bills for £400 and had guaranteed a debt £633 due by the company, and a further debenture for ,000 was issued. Later, a further debenture for £400 was ued to Fitton Smiths in respect of an advance made by em, with the result that they held debentures talling £2,550. The company's borrowing powers were nited to the amount of its issued capital, and questions ose as to the validity of the debentures. An extraordinary eeting was held, at which a resolution was passed author- ng the directors to borrow to the extent of £5,000. At e same meeting it was resolved that debentures for £3,150 ould be issued to P. G. Marr & Co., Ltd. (the successors Fitton Smith & Co., Ltd.) in settlement of the moneys e to them in respect of the £2,550 debentures previously ued and other moneys advanced. As those debentures re issued within three months of the commencement of winding-up for a past consideration, they would appear be void. In November, 1926, the creditors were asked accept 3, 6, 9 and 12 months' bills in respect of their ims, but the proposals fell through. In these circum- nces Marrs declined to finance the company further. There were a number of judgments against the company, and in January last it was decided to put the company into voluntary liquidation. On the same date Bennison appointed a receiver on his behalf. At an extraordinary meeting a resolution for the appointment of Mr. M. D. Booth as voluntary liquidator was proposed, but was not carried, and on January 28th a creditor presented the petition upon which a winding-up order was made on February 15th, 1927. On February 17th, 1927, P. G. Marr & Co. appointed a receiver. At a later date the receiver on behalf of Bennison retired; the receiver appointed by P. G. Marr & Co. had not taken any action. The trading account shows that the net sales amounted to £68,588, and there was a gross profit of £16,828, which is carried to the deficiency account. Wolsey attributes the failure of the company to excessive advertising and to extravagant management. In Bennison's opinion the failure of the company is due to excessive advertising and insufficient working capital. He also states that the company kept a large and expensive staff and incurred losses in connection with wireless sets. The Court, on March 7th, appointed Mr. M. D. Booth, chartered accountant, of 40-43, Norfolk Street, Strand, London, W.C.2, liquidator of the company with a committee of inspection.

Yates & Thom, Ltd.—Winding up voluntarily. Liquidators, Mr. F. Thom and Mr. W. H. Davies, Canal Engineering Works, Blackburn. Meeting of creditors, July 1st, at Canal Engineering Works. Particulars of claims to the liquidators by August 2nd. (This notice is formal, all creditors have been, or will be, paid in full.)

Manda Motors, Ltd.—A meeting of members is called for July 18th, at the offices of Messrs. Fincham, Partridge & Co., 3, Warwick Court, Gray's Inn, W.C., to hear an account of the winding up from the liquidator, Mr. A. H. Partridge.

Alkum Electrics, Ltd.—Liquidator, Mr. T. W. Meldrum, Portland House, 73, Basinghall Street, E.C., released June 3rd.

Electrical Engineering & Equipment Co., Ltd.—A meeting of members is called for July 18th, at the office of Messrs. Deloitte, Plender, Griffiths & Co., 5, London Wall Buildings, E.C., to hear an account of the winding up from the liquidator, Mr. R. Kettle.

Private Arrangements.

A. E. Humphreys, 20, St. James' Square, S.W.1, electrical engineer and contractor.—A meeting of creditors was held on June 13th, when it was stated that the liabilities to creditors amounted to £2,640. The assets at cost figures were said to total £1,379. The debtor started business in November, 1925, with a capital of £250, borrowed from five persons; the whole amount was still owing. The sales and work done up to the current month had been £6,054. There was a gross profit of £457, and the office expenses had been £393. The drawings of Mr. Humphreys were £814 and the salaries had been over £5 weekly. The debtor had done considerable work at Thorne and Ashton-under-Lyne, and there was still work in hand. The debtor had been contracting for some time for fitting electrical apparatus in houses. Six or seven writs had been served on him, and a bankruptcy notice. The debtor had been working under contract for some time for the House Builders' Association, and the secretary of that concern said that the Association would continue to give the debtor contracts if he were allowed to carry on. No definite resolution was passed; the opinion was expressed that the matter should be dealt with privately. The following are creditors:—

	£		£
British Insulated Cables, Ltd.	148	Siemens Bros. & Co. ...	118
Tucker, J. H., & Co., Ltd.	27	Borman & Co., E. ...	144
Callender's Cable & Construction Co., Ltd. ...	137	Sharp & Fisher	25
Baxter & Caunter, Ltd.	41	General Electric Co., Ltd.	120
Electrical Conduits, Ltd.	132	White, W., & Co.	343
Siemens Electrical Works	458	Young & Wildsmith ...	37
		Wandsworth, E.	28
		Imperial Lighting Co. ...	47

Deeds of Assignment.

B. Wilson, wireless engineer, 261, Hornsey Road, N., Ivy Place, Swansea, and 59, East Street, Leicester.—Last day for proofs for dividend, July 31st. Trustee, Mr. G. E. Rolt, 28, Watling Street, E.C.

R. G. Cronyn (Radio Sets and Supplies Co.), 3, King Street, Maidenhead.—Particulars of claims by June 24th, to the Trustees, Mr. W. J. Osborne, Balfour House, Finsbury Pavement, E.C., and Mr. C. Latham, 78, New Oxford Street, W.C.

Recent Contracts.

Messrs. Worthington Simpson, Ltd., have secured a contract for the supply of one 9-in. single-stage high-lift centrifugal pump, capable of delivering 2,000,000 gallons of water per day, against a head of 170 ft., for the Reading Water Works. This pump will run at a speed of 1,500 r.p.m., and will be driven by a 140-b.h.p. Crompton protected type auto-synchronous motor, and is a duplicate of a set previously supplied. These electrically-driven pumps replace the steam pumping plant consisting of a high duty Worthington engine supplied in 1900, and mark the conversion of the Bath Road pumping station into an electrically-driven one. The steam installation is to be retained for stand-by duty.

An important contract covering the main switchgear and a considerable amount of auxiliary apparatus for extensions to the Portobello station of the Edinburgh

Corporation has been placed with the METROPOLITAN-VICKERS ELECTRICAL CO., LTD. The equipment includes a 9-panel extension to the existing main 6,600-V switchgear, a 13-panel, 400-V station service board, and four 15-panel switchboards for the boiler house, together with a 230-V power-station battery and extensions to the station telegraph system. The extension to the main switchgear will include eight 6,600-V metal-clad oil circuit-breakers which, the company states, will be larger than any of this type yet constructed. The circuit-breakers are a development of the "Metro-Vick" "K" type gear, metal-clad and compound-filled, each unit having a rupturing capacity of 1,500,000 kVA. Each circuit-breaker will weigh approximately 11 tons, and each complete unit with its bus-bars, selector switches, and isolating switches, will weigh about 20 tons. A complete system of interlocks is provided to prevent incorrect operation and accident. The circuit-breakers, bus-bar selector switches, and feeder isolating switches, will be electrically operated. By this means the complete control of all switching operations is placed in the hands of one operator.

The METROPOLITAN-VICKERS Co. has also received an order for an electric winder equipment, arranged for double drum operation, for installation at the Choppington Collieries. The winder will be of the a.c. geared type, with a motor of 100-260 h.p., operating at 450 r.p.m. The drive will be transmitted through a double helical reduction gear, giving a speed of 36.55 r.p.m. on two cylindrical drums, each of 7 ft. diameter. One drum will be keyed to the shaft while the other is driven through a clutch, whereby the relative drum positions may be adjusted to allow drawing from different levels without loss of time and output. The maximum depth to be worked is 660 ft., and the winder is to deal with a net load of 1 ton, giving an output of 45 tons per hour. The equipment will include a "Metro-Vick" liquid controller with automatic accelerating gear, and pillar type switchgear with an electrically-operated contactor type reversing switch. A Lilly overwind and overspeed device will be fitted. The mechanical parts are to be supplied by Messrs. John Wood & Sons, Ltd.

Unemployment in Germany.

The Berlin correspondent of *The Times* states that the German unemployment returns for the second half of May show a further decrease in the number of persons in receipt of relief. On June 1st, the number was 649,000, as against 746,000 on May 15th. During the whole of May the number decreased by about 221,000. This does not include the figures for emergency relief, which are published monthly and have of late been in the neighbourhood of 220,000.

Book Notices.

"Four-Place Mathematical Tables with Forced Decimals." By F. S. Carey, M.A., and S. F. Grace, M.Sc. London: Messrs. Longmans, Green & Co., Ltd. Price, 1s. net.—This book contains the usual tables covering the field of practical mathematics, but the tables have been devised to secure greater accuracy in the fourth figure of the values of the functions set out. It is believed that the errors in the values given after interpolation rarely exceed unity. This result is brought about by means of forced decimals and improved devices for interpolation. The forced decimals are indicated by the type in which the decimals and differences are printed, according to whether the approximation given is in excess of the true value or otherwise.

"Miscellaneous Publications of the U.S.A. Bureau of Standards." No. 90, "Directory of Commercial Testing and College Research Laboratories" (15 cents.)

"*Journal* of the Institution of Electrical Engineers." Vol. LXV. July, 1927. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"Simplified Practice," by C. Chisholm. Pp. xii+151. London: Chapman & Hall, Ltd. Price 12s. 6d. net.

"Repair Shop Diagrams and Connecting Tables for Induction Motors," by D. H. Braymer and A. C. Roe. Pp. xiii+232; figs. 161. McGraw-Hill Publishing Co., Ltd. Price 12s. 6d.

"The Modern Electrical Engineer," by A. Arnold. Four vols., fully illustrated. London: Caxton Publishing Co., Ltd. Price £3 18s. complete.

Social Events.

The Elliott Social Association (Elliott Bros. (London), Ltd.), held its annual sports meeting and garden fête on June 11th. The representatives of the company included Sir Keith and Lady Elphinstone, Mr. W. O. Smith, Mr. and Mrs. L. W. Smith, Mr. and Mrs. A. W. Atkyns, and Mr. and Mrs. R. O. Smith. A very varied programme of sports was successfully carried out and there were numerous side shows. Lady Elphinstone presented the prizes. Music was provided by the Greenwich British Legion Band, and there was dancing until a late hour under the direction of Mr. P. R. Harriss.

The Power Contracts (Batwin) Sports Club, Football Section, held its annual dinner on June 11th, at the Imperial Hotel. After speeches by Messrs. T. H. Windibank, E. H. Bates and R. O. Clark, a very entertaining musical programme was provided.

The fifth annual sports and gala of the Siemens Sports Club took place on Saturday last, at the club's sports ground, Park Lane, Charlton. In spite of the somewhat showery weather, the affair was well attended, and capital sport was witnessed. Much amusement was caused by the humorous items, which included dribbling the football, egg and spoon race, three-legged race, tilting the bucket, cigarette race, &c. Child... were specially catered for in the amusement fair in anot... part of the ground. Credit is due to the organising comm... tee for the way in which the various items were run ... without hitch or unpunctuality. The proceedings w... enlivened by an excellent programme of music rendered ... Callender's Cable Works Band. The prizes were distribut... by General Sir H. de la Poer Gough.

The Oil, Chemical and Colour Exhibition.

An International Oil, Chemical and Colour Trades Exhibiti... was held at the Royal Agricultural Hall, London, N., fr... June 11th to 18th. There were few exhibits of an electri... nature, apart from motor-operated colour grinders and mix... and kindred machinery. International Combustion, Lt... extended the scope of the grinding machinery class by showi... coal pulverisers, the principal object in the display being ... "Raymond" mill. In addition the company showed ... example of the "Hum-mer" electrically-operated jiggi... screen, which is intended mainly for coal. A screen of anoth... pattern, the Sturtevant "Vibro-moto," was exhibited ... Messrs. Stevens & Manning. Pulverised fuel equipment w... also shown by the Buell Combustion Co., Ltd.; this consist... of two- and three-stage "W.A.C." pulverisers, a "Kek" ce... trifugal grinding mill, and samples of burners. Oil engin... appeared on the stands of Blackstone & Co., Ltd., a... Tangyes, Ltd. Among the latter's exhibits was a 19-b.h.... cold-starting engine driving a generator for the lighting ... the stand. Several examples of their rotary air compresso... driven by incorporated motors were shown by Messrs. Berna... Holland & Co. The chief exhibit was an 800 cu. ft. per minu... set for working at pressures up to 60 lb. per sq. in. Moto... formed an integral part of some of the mixers shown ... Messrs. Joseph Foster & Sons.

For Sale.

The clerk and steward, Prestwich County Mental Hospit... invites offers for surplus generating plant, motors, &... Messrs. Fuller, Horsey, Sons & Cassell will sell by auctio... on July 14th, at the Baltic Exchange, E.C., electrical pow... plant, &c. (See our advertisement pages to-day.)

Prices of Materials.

In their report on the lead market, Messrs. James Forst... and Co. state under date June 18th:—"Little change ... apparent in the general position of the metal. Consumers ... this country, in view of the renewed decline in prices, a... buying as little as possible. On the other hand, arrivals a... quite moderate, largely due to the better demand on the Co... tinent, and, apart from warehouse stocks, there is little prom... lead available. . . . As far as the near future is concerne... supplies are likely to be on the short side." Board of Trad... returns for May, 1927, indicate:—Imports 21,573 tons, expor... 1,446 tons, leaving for home absorption 20,127 tons.

Messrs. F. Smith & Co. report, June 21st: Copper (ele... trolytic) bars, £60 2s. 6d., 2s. 6d. dec.; ditto ditto sheet ... no change; ditto ditto wire rods, £70 2s. 6d., 2s. 6d. dec ... ditto ditto h.c. wire, no change.

Messrs. James & Shakspeare report, June 21st: Copp... bars (best selected), sheet and rod, £84, £2 dec.; Englis... pig lead, £25 10s., 10s. dec.

Messrs. Edward Till & Co. report, June 21st: India-rubbe... Para fine, 1s. 4½d., 1d. dec.

Lighting and Power Notes.

Arbroath.—STREET LIGHTING.—The Arbroath Electric Ligh... and Power Co., Ltd., has renewed the contract with the Tow... Council for street lighting at the present charge of £15 10s... per lamp per annum.

Belgian Congo.—ELECTRICAL DEVELOPMENT.—Plans hav... been drawn up for the establishment of a 10,000-h.p. plant b... the Société Minière Kilo-Moto to utilise the water power o... the River N'Zoro in the Belgian Congo. The energy generate... would be used to operate the dredges used for gathering th... gold-containing gravel at the bottom of the River Kibali, an... for the treatment of the gold quartz at the Moto mines.

Bethesda (North Wales).—INAUGURATION OF ELECTRICIT... SUPPLY.—An electricity supply for the district was commence... recently. The scheme has been carried out by the Pirelli ... General Cable Works, Ltd., at a cost of over £7,000. Th... plant has a capacity of 100 kW, but the maximum load a... present is 60 kW. Next winter 148 street lamps will be pu... into commission. Mr. H. Owen, Bethesda, was the consultin... engineer.

Bradford.—INSTITUTION SUPPLY.—The Corporation Healt... Committee has approved the recommendation by the city ... electrical engineer (Mr. T. Roles) for the provision of a new ... high-speed engine and generator, complete with foundations ... steam piping, switchgear, &c., at a total estimated cost o... £1,650, at the Grassington Sanatorium, and has authorised ... application for sanction to borrow the necessary sum.

ELECTRICITY EXTENSIONS.—The Corporation Electricity Com... mittee has prepared a scheme for the provision of a sub-

tation for the Low Wells district and the laying of distributing mains at a cost of £7,538. The Committee has voted sum of £20,000 for mains extensions.

Burton-on-Trent.—Year's Working.—The accounts of the Corporation electricity undertaking (manager and engineer, Mr. T. Hall) for the year ended March 31st last, record a total income of £102,700, as compared with £94,937 in 1925-26. Owing to the higher cost of coal, working expenses increased from £46,498 to £62,611, leaving a gross profit of £40,089 (£48,439), to which were added rents from Wetmore Road cottages, making a total of £40,337 available. Capital charges, &c., absorbed £35,747, leaving a net surplus of £4,590, of which £2,000 was transferred to the district fund, and the remainder to the renewals fund. The previous year's working resulted in a surplus of £15,153. The capital expenditure during the year amounted to £61,868, bringing the total up to £569,748. The sales of electrical energy increased from 15,628,445 to 15,729,071 kWh, and the average price obtained per kWh from 1.42d. to 1.52d. The energy sold for power purposes fell by 4.16 per cent., but this was counterbalanced by an increase in the cooking and heating supplies of 52 per cent. The maximum supply demand rose from 5,500 to 7,750 kW.

Colne.—Year's Working.—The total income of the Corporation Electricity Department during the past year was £39,434, an increase of £4,447. The increase in electricity sold was 249,064 kWh, or 7.85 per cent. The ratio of working costs to net revenue was 64 per cent., solely due to the coal dispute.

Continental.—Italy.—The Rome correspondent of the *Financial News* reports that the recent loan issued in the New York market by the Società Elettrica dell' Isarco, amounting to $5,000,000, is to be used for the completion of the electric plant at Cardano, on the Isarco river, near Bolzano. The plant is expected to be completed by 1929 and will have an annual output of 500,000,000 kWh.

Switzerland.—What will be the largest hydro-electric undertaking in Switzerland is at present in course of construction by the Oberhasli Kraftwerken Gesellschaft. The scheme provides for the establishment of three plants at Handeck Boden and Innertkirchen to utilise the water power of the Upper Aare river. The preliminary work at the largest plant, that at Handeck, is so far advanced that orders for the electrical machinery have been placed. When complete this station will comprise four vertical-spindle generators, each with a capacity of 28,000-32,000 kVA, supplying at 11,000 V at 500 r.p.m. At present only two are to be installed by the Oerlikon Maschinenfabrik, these being the largest units so far adopted in the country. The weight of the rotors without turbine wheel will, it is stated, be 68 tons, and of the complete generator 165 tons. It is expected that the new alternators will be ready for their tests by May of next year.

Cumberland.—Electricity Supply.—Application is to be made by the Allerdale Coal Co., of Workington, for an Order to supply electricity to Maryport, Arlecdon, Aspatria, Harrington, Frizington, and other parts of West Cumberland. The company proposes to utilise coke oven gas for the generation of electricity.

Dorchester.—Increased Charges.—The Corporation Electricity Committee has recommended an increase of charges of ½d. per kWh.

Dundee.—Electricity Supply.—Mr. D. H. Bishop, Corporation electrical engineer, in a report, explains the city's position under the Central Scotland Electricity Scheme. Irrespective of the existence of the Central Board, Mr. Bishop points out, it would have been, and still is, necessary to add further boilers, auxiliaries, coal handling plant, &c., at Carolina Port in order to meet increasing demands, and to obtain the full output of the present turbo-generating plant. If the Corporation were to be allowed to develop individually, in the absence of the scheme, it would soon be necessary to consider the installation of another large turbo-alternator of about 15,000 kW. The maximum load which could be safely carried on the four small generators at Carolina Port is about 22,000 kW, supposing that the large generator was out of commission. If the rate of increase during the last few years were taken as a guide for the future, this load would be attained in the winter of 1928-29, so a new generator should normally have been ready for the winter of 1929-30. As the scheme does not contemplate connecting up Dundee till 1930-31, it appears that, unless fresh turbine plant is allowed to be installed before then, considerable risks will have to be run.

East Elloe.—Electricity Supply.—The Rural District Council has given permission to the Boston and District Electric Supply Co., Ltd., to supply electricity throughout this area. The company has agreed to do so subject to the Sutton Bridge and Long Sutton Councils allowing it to supply their districts.

East Ham.—Loan Sanctioned.—The Corporation Electricity Committee has received sanction to the borrowing of £9,000 for mains extensions, switchgear, and plant.

East Kent.—Inquiry.—An inquiry was held at Deal on June 16th by Sir W. F. Marwood relative to the proposal of the South-East Kent Electric Power Co., Ltd., to use overhead lines for the supply of electricity to Deal, Walmer, Sandgate, and Eastry. The company will take a bulk supply from Betteshanger Colliery, and on its behalf it was stated that the route for the overhead cable had been selected to avoid houses, trees, and other obstructions, and to interfere as little as possible with the normal course of agriculture. The cost of the overhead lines (5½ miles) would be £12,000, and if underground lines had to be used the cost would be increased to £24,000. The principal objections by those concerned near Sandgate were interference with cultivating arable and market garden land by poles, and the alleged inadequacy of the compensation offered.

Glasgow.—Refuse Disposal Plant.—The engineer and manager of the Electricity Department, in a report to the Corporation Cleansing Committee, states that in connection with the generator house at the new refuse disposal works he has noted that no special provision appears to have been made regarding a 3-phase, 440-V, 50-period supply to the charging plant to be installed in the garage to be attached to the new works; that the two 500-kVA transformers at present arranged for and intended for the operation of the various motors used throughout the works would no doubt be able to supply the 300 kW required for charging purposes, but that this would leave a somewhat inadequate margin for emergency. In order that adequate provision may be made to meet the garage requirements, he suggests that either two 750-kVA transformers be substituted for the two 500-kVA transformers provided for by the contract, at an estimated additional cost of £600, or that one additional 500-kVA transformer, with switchboard, &c., be installed, at a cost of £1,000. The special sub-committee, having had submitted to it a letter from Messrs. Heenan & Froude, Ltd., stating that the two 500-kVA transformers have now been completed and cannot be altered, has agreed to recommend that no alteration be made in the existing arrangement.

Hastings.—Loan.—The Town Council has applied for sanction to a loan of £53,389 for additional plant at the Broomgrove power station, *viz.*: Turbo-alternator, £22,675; boiler and economiser, £14,000; cooling tower tank, £2,550; two cooling towers, £3,190; pipe work, £5,962; instruments and sundries, £550; cables, £1,620; contingencies, £2,542.

Huntly (Aberdeenshire).—Electricity Scheme.—The Town Council is considering a scheme for the introduction of electricity into the burgh. The maximum h.p. available will be 250, and the estimated cost is between £16,000 and £17,000.

Inverness.—Electricity Supply.—In reply to critics of the Town Council's action in taking over the electricity undertaking at a cost of £80,000, Provost MacEwen at the last meeting stated although the accounts had not been adjusted he understood that the gross profit on the undertaking for the period of ten months was over £12,000. The net profit, after charging interest and sinking fund, was over £7,000.

Supply to Railway Company.—A request from the L.M.S. Railway Company for a reduction in the rate for the electricity supplied was considered. The company pointed out that the rate of 3d. per kWh which it was charged for power was higher than anywhere else, and that if the Council could meet the company in the matter, it would be prepared to install new plant at its works at Inverness and would probably use an additional average consumption of 100,000 kWh per annum. It was agreed that the company be offered a rate of 1½d. per kWh.

Japan.—Electrical Developments.—It is understood that the Tokyo Dento K.K. has decided to extend its Senju power station to a capacity of 75,000 kW by the end of 1928.

The Korean Hydro-Electric Co. has decided to buy generators from the Siemens and water turbines from the Voigt companies for its first power station. The water turbines will be of 32,000 kW.

It is reported that the railway authorities have decided to commence the construction of the Shinano-Gawa hydro-electric power stations this fiscal year, for which land will be purchased and a light railway will be built.

London.—Islington.—The Electricity Committee has received sanction to borrow £72,000 to cover expenditure incurred and estimated to be incurred in respect of distributing works during the period from April, 1926, to March, 1929.

Lowestoft.—Electricity in Bulk.—At a recent meeting of the Corporation Electricity Committee, the Town Clerk submitted a report of an interview with the Electricity Commissioners on the question of the draft agreement for the bulk supply of electricity by the Great Yarmouth Corporation to the Lowestoft Corporation. Lowestoft's contention that the agreement should place upon the Yarmouth Corporation the obligation to provide any plant necessary to enable it to meet future requirements was upheld by the Commissioners. They had been unable to agree upon the terms of the clause providing for a sliding scale in the "unit" charge for electricity based upon the cost of coal to the Yarmouth Corporation. Lowestoft also submitted that the minimum annual payment of £12,000 was excessive, and it was agreed that for the first full year of operation the minimum charge should be £9,490, £11,000 for the second year, and that the minimum charge of £12,000 should be made after that period. The Yarmouth Corporation objected to a penalty clause which Lowestoft had inserted in the draft agreement, but the Commissioners agreed that Lowestoft was entitled to have such a clause. Yarmouth also took exception to the insertion in the agreement of a

clause removing all possible doubt as to whether Lowestoft should be entitled as authorised undertakers to demand or take a supply of electricity from the Central Electricity Board under the terms of the Electricity (Supply) Act, 1926, if and when such supply became available. On this point the Commissioners will settle a clause for insertion in the agreement. The Commissioners reserved their decision regarding other minor points. The Electricity Committee has reported that as it will not be possible to procure a bulk supply of electricity from Yarmouth during the coming winter months, arrangements have been made with Messrs. John Chambers, Ltd., for the use of the firm's generating station at Oulton Broad in order to augment the output from the Council's electricity works. The Committee is entering into an agreement with them for the use of this plant from September 30th, 1927, to April 30th, 1928, and for such further period as it may be required in consideration of payment of £300 per annum.

Lymington.—Electricity Charges.—In reply to a communication from the Electricity Commissioners, the Rural District Council has decided to acquiesce in an application of the Town Council for an Order reducing the price of electricity from 1s. to 10d. per kWh as from June 30th next. The Lymington Electric Light & Power Co., Ltd., has intimated that it will not oppose such an Order.

Manchester.—New Plant.—The Corporation Electricity Committee has voted the following estimates:—Generating stations, land, buildings, machinery, &c., £308,400; distributing stations, transforming stations, and High Street stores, land, buildings, machinery, &c., £44,600; mains and services, £349,000; motors, cookers, and meters, £44,000; street lighting, £6,000.

Northern Ireland.—Lisburn (Co. Antrim).—From a statement made at a recent meeting of the Urban District Council it would appear that the proposed scheme by a private company to supply the town with electricity is being held up, owing to the Electricity Commissioners objecting to the clauses giving the Council the right to acquire the undertaking at any time after the end of ten years, and compelling the company to pay to the Council a "royalty" of ¼d. on every kWh sold within the district at a price exceeding 2½d. The Commissioners are not prepared to approve the agreement until both clauses are excluded.

Oxford.—Proposed Purchase of Undertaking.—The Town Council has decided to obtain counsel's advice as to the legal position in respect of the purchase of the undertaking of the Oxford Electric Co., Ltd.

Paisley.—Electricity Supply.—The Town Council has decided to undertake the wiring and lighting of the common stairs, passages and private courts in all suitable properties by electricity at a charge of £1 per lamp per annum. The public lighting of the whole town is now provided entirely by electricity, special distributing cables having been laid in every street. It is intended to lay a service cable from the street lighting cables to each block of tenement houses and to feed the common stair lights for the whole block from one service. All the stair lights as well as the street lighting will thus be controlled at the power station. It is expected that the scheme will be completed within two years.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Richmond (Surrey).—Reductions ranging from ¼d. per kWh in the case of small consumers.

Bedworth.—Lighting: From 7d. to 6d. per kWh.

Shipley.—Inauguration of New Plant.—The inauguration ceremony in connection with the change over from local generation to a 33,000-V supply from the Yorkshire Electric Power Co., which takes place at the Council's electricity works on June 30th, will be performed by Sir Andrew Duncan, chairman of the Central Electricity Board, in the presence of a gathering including representatives of all the principal electricity undertakings of West Yorkshire. Shipley is the first town in this area to effect this change over.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Urban District Council of New Hunstanton, authorising it to supply in the urban district and the parish of Hunstanton, Mr. F. H. Grace to supply in the parishes of Thornbury, Olveston, and Alveston, and the Lichfield Corporation to supply in certain parishes in the rural district of Lichfield.

The Cannock Chase Colliery Co., Ltd., has applied for an Order to make provision for the transfer to the company of the undertaking authorised by the Chasetown and District Electricity Special Order, 1924.

Swansea.—Electricity Extensions.—The Corporation Electricity Committee has considered a comprehensive mains scheme prepared by the borough electrical engineer for the St. Thomas area, and has instructed him to carry it out at a cost of about £11,500.

The Committee has also instructed the electrical engineer to carry out the necessary works in connection with the laying of the following e.h.p. mains, &c.: E.h.p. main, &c., from Winch Wen sub-station to Llansamlet colliery (£4,357); e.h.p. loop into Maesteg sub-station from G.W. Railway, one main for alternate feed to Maesteg or G.W. Railway (£475 disconnecting tee pillar at Wychtree Bridge for junction Morriston, Llansamlet, copper pit brickworks, &c. (£250).

Uttoxeter.—Electricity Scheme.—The report of M. W. C. C. Hawtayne, of London, who was consulted by th Urban District Council with reference to the provision an electricity supply for the town, has been received. Th Council has decided to apply for an Order authorising it t develop a scheme and lay distributing mains throughou the town. A supply of electricity in bulk will be obtaine from Burton-on-Trent. The estimated cost of the scheme i £16,650 for the first year, rising to £22,500 in the third yea and it is anticipated that a supply will be available in abou a year's time.

Watford.—Loans.—The Corporation Electricity Committe has received sanction to a loan of £50,000 for mains an services.

Application is to be made for sanction to the borrowing o £2,000 for mains and sub-station kiosks in connection wit the supply of electricity to Bourne End, and £1,000 for publi lighting at Garston.

Tramway and Railway Notes.

Bradford.—Loans Sanctioned.—The Ministry of Transpor has sanctioned the borrowing by the City Council of £2,50 for purposes of the railless trolley vehicle undertaking i respect of the cost of additional overhead equipment for through service between Oakenshaw and the centre of Brad ford. Sanction has also been received to the borrowing of sum not exceeding £17,020 for the provision of 12 motor omnibuses for the Tramway Department.

Colne.—Year's Working.—The revenue from the Corpora tion tramway undertaking during the past year was £23,971 a decrease of £818, due to the replacement of the Laneshaw bridge cars by motor-omnibuses, and to loss of revenue during the general strike. The receipts per car-mile were 23.09d., an increase of 1.5d.

Continental.—Poland.—A special commission appointed by the Polish Minister of Communications has inspected the construction work on the Warsaw-Grodzisk suburban electric railway line. The line will probably be ready for use towards the end of September; it will greatly relieve the Warsaw-Vienna line and improve direct communications.—*Reuter's Trade Service* (Warsaw).

Huddersfield.—New Depot.—The Tramways Committee has recommended the erection of a large new depôt for the department's motor-'buses to hold 64 vehicles.

India.—Railway Electrification.—A comprehensive scheme for the electrification of the suburban service on the Eastern Bengal Railway has been drawn up and submitted to the Railway Board. The details of the scheme are not yet available. After the approval of the Railway Board, the scheme will have to be approved and sanctioned by the Secretary of State and thereafter be placed before the Railway Finance Committee of the Legislative Assembly and ultimately before the Indian Legislature.

The North-Western Railway's programme for electrifying its stations is making rapid progress. The work at Ferozepore and Multan will be completed within the next two months. At Peshawar and Bhatinda, work on the generating plant will be started soon, while estimates have been sanctioned for the electrification of Lyallpur, Sukkur, and Rohri.

Liverpool.—Overhead Railway.—The Liverpool Overhead Railway Co. changed over to the Corporation power supply on June 19th and closed down its own generating station. Electricity is being supplied at 520 V d.c. from three of the Corporation's sub-stations.

London.—Proposed New Route.—The *Daily Telegraph* reports that a proposal by the L.C.C. to construct a new tramway route to the Crystal Palace—which originated as far back as 1898 when a company proposed to build a light railway—has reached another stage. The Camberwell Borough Council has been asked by the Finance Committee to veto the L.C.C.'s proposal. The L.C.C. asked whether, in the event of its deciding to seek Parliamentary powers in respect of the construction of tramways from West Norwood to the Palace, the Borough Council would be prepared to consent to any of certain alternative routes being used. Six points are tabulated by the Camberwell Finance Committee against the scheme. These include the suggestion that there is no necessity for a tramway route inasmuch as better methods are now available, and it is questionable whether the route would be remunerative. The addition of tramways, it states, would add to the congestion of the roads, and the proposed route is also unsatisfactory.

Telegraph and Telephone Notes.

Argentina.—POST OFFICE AND TELEGRAPHY.—The primary object of the Executive Power during the past year has been to obtain the perfect operation of the Postal and Telegraph services. This important public service has been carried on regularly notwithstanding its extraordinary growth and the shortage of *personnel*, each day more apparent. On July 12th last was inaugurated the Library and Museum of Posts and Telegraphs, as also the Philatelic Section as a part of the same. An arrangement made with the Union Telephone Company, in the Federal Capital, and the Telephone Company in Tucumán, has enabled the Executive Power to endow both localities with the service known as "telephonegrams." During the year 1926 there was a great increase in the movement of internal postal and telegraphic drafts amounting to 2,176,499 items for a total of $78,601,612.63 m/n. and in that of telegraphic orders 137,944 items for a sum of $9,026,132.43 m/n. The total of declared values received was 413,844 items for a sum of $57,958,382.06 m/n., the dispatches being 472,193 for $64,974,290.49 m/n. The telegraph lines on December 31st last amounted to 44,248 kilometres in extent and to 114,318 kilometres of development.—*Financial Times.*

Sweden.—LONG-DISTANCE TELEPHONE.—Telephone communication between Stockholm and Paris was opened on June 16th and worked excellently. There were only eleven conversations.—*Reuter's Trade Service* (Stockholm).

A preliminary service was also made available between Stockholm and London on June 22nd daily from 3 p.m. to 8 a.m., with a reduced call fee at night.

The Telephone Service.—NEW EXCHANGES.—New central battery exchanges at Dudley Hill and Low Moor are to be followed shortly by one at Idle, where the site has been secured at The Grove.

The new automatic telephone exchange at Halifax was inaugurated on June 18th, the change-over from the old exchange being made at 2 p.m.

United States.—TELEPHONE DEVELOPMENT.—The *Daily Telegraph* reports that of the total number of telephones in the United States nearly two-thirds, or, in round figures, 11,400,000, are in domestic use, and serve about 10,700,000 families. In England, where approximately 1,500,000 telephones are in use, only one-third, or 500,000, are "family 'phones."

Radio Notes.

Australia.—PROPOSED NEW STATIONS.—Some time ago a sub-committee was appointed by the New South Wales Cabinet to inquire into a proposal for the erection of a Government super-power wireless station near Sydney and six relay broadcasting stations in country areas. It is said that the sub-committee's report is favourable to the scheme, which is receiving Cabinet consideration.—*Reuter's Trade Service* (Sydney).

Greece.—NEW MARKET.—His Majesty's Consul-General at Salonica (Mr. F. E. Crow) reports that the Wireless Telegraphy Board in Athens has decided to allow the use of radio-receiving sets in Salonica and Cavalla. The necessary licences for the installation of receivers must be obtained from the Wireless Department of the Post Office in Athens. For the time being permission will only be granted to Greek subjects, but it is thought that the privilege will shortly be extended also to foreigners. Macedonia is a virgin market for the sale of wireless apparatus. British manufacturers wishing to do business there should therefore communicate at once with local dealers and agents, quoting prices and sending illustrated catalogues in French, if possible, as well as English. The names of the principal dealers in electrical goods, also those of small dealers in wireless apparatus, can be furnished on application to the Department of Overseas Trade.

South Africa.—SINGLE MANAGEMENT—The recently-formed South African Broadcasting Co., after having taken over and resuscitated the Johannesburg station, has since also purchased the Cape Town station and entered into an agreement with the Durban Town Council to take over its station, which is unique in South Africa in being owned by the municipality, and the transfer takes place on July 1st next. With all the South African broadcasting stations now under one management, it is intended to interconnect them all with land lines and take full advantage of relaying, and it is hoped, by establishing further relay stations, to enable the small crystal user to benefit in various parts of the country. The new company, being also interested in the African Theatres Trust, intends to transmit items from various theatres with greater variety of artistes than there is under present arrangements.

United States.—EXPORTS.—The United States Trade Commissioner at Ottawa has reported to the Dominion Bureau of Statistics that the exports to Canada of radio sets and parts from the United States during the calendar year 1926 amounted in value to £2,872,991, and included the following items: 32,768 receiving sets, worth £1,238,680; 96,059 valves, valued at £113,837; and £1,520,474 worth of parts and accessories.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—August 15th. Postmaster-General's Department. One 55-ton 3-motor-type electrically-operated overhead travelling crane. (A.X. 4727.)*

August 16th. Automatic telephone exchange equipment. (B.X. 3566.)

November 14th. State Electricity Commission of Victoria. Two 10,000-kW back-pressure turbo-generators and accessory plant.

SYDNEY.—July 18th. Municipal Council. Boiler-house equipment for the Bunnerong power station. (B.X. 3531.)*

August 15th. Generator neutral earthing resistance. (B.X. 3550.)*

Cheadle and Gatley.—June 28th. Electricity Department. Static transformer, e.h.p. switch cubicle, and transformer switch and distributor kiosk. (June 10th.)

East Ham.—June 29th. Education Committee. Wiring at Mondega Road School. Secretary, Mr. F. R. Thompson, Education Offices, Town Hall, East Ham, E.6.

Edinburgh.—June 25th. Education Authority. Electric light and power installation at Bellevue Technical and Commercial School. Schedules, Mr. J. A. Carfrae, architect, 3, Queen Street, Edinburgh.

Flint and Hope.—July 5th. Flintshire E.C. Electric light installation at schools. Mr. R. G. Whitley, county architect, Mold.

Harrogate. — June 27th. Electricity Department. Transformers, meters, house-service fuse boxes. (June 17th.)

Halifax.—June 25th. T.C. Wiring 118 houses, Albert Road, for electric light; borough engineer. (Returnable deposit of £2 2s.)

Hazel Grove and Bramhall.—June 28th. Urban District Council. 2,800 yd. .06 3-phase, 6,600-V cables, including laying and accessories. (June 17th.)

Huddersfield.—July 4th. Education Committee. Electric light installation, Almondbury, Berry Brow, Crosland Moor and Paddock schools. Borough architect, 26, Ramsden Street.

India.—SIMLA.—July 25th. India Stores Department. Electrical cooking appliances for the Government House, New Delhi. (B.X. 3575.)

Kirkcaldy.—July 2nd. Electricity Department. L.p. a.c. distribution, l.p. and e.h.p. cables, boxes, and roadwork. (June 10th.)

Leamington Spa.—July 1st. Town Council. Five centrifugal pumps, with five electric motors, suction and delivery piping, valves, automatic control gear, &c. Particulars from Mr. S. C. Eagles, civil engineer, 71, Temple Row, Birmingham.

London.—STEPNEY.—July 11th. Electricity Supply Department. Boilers and boiler-house accessories, turbo-alternator, condenser, accessories, and switchgear. (June 3rd.)

LEWISHAM.—July 4th. Board of Guardians. Steam and electric steriliser plant, for the operating theatre. Mr. G. W. Martin, consulting engineer, 33, Arran Road, Catford, S.E.

Lurgan.—June 30th. Electric lighting plant, pump, &c., for the Maralin rectory and church. Specifications from Mr. C. Nicholson, secretary, Maralin, Lurgan.—*Irish Electrician.*

Newcastle-under-Lyme.—July 11th. Electricity Supply Department. 350-kW rotary convertor, with e.h.p. and l.p. switchgear. (See this issue.)

New Zealand.—Wellington.—August 9th. Public Works Department. 1,500 suspension insulator strings and 470 strain insulator strings. (B.X. 3533.)*

August 18th. Corporation Tramways. One electrically-operated tramcar traverser. (A.X. 4801.)

September 13th. Two sets 110-kV outdoor switchgear for the Waikato electric power scheme. (B.X. 3579.)

October 4th. Batteries and charging sets for Mangahao electric power scheme. (B.X. 3580.)

Plymouth.—July 6th. Mental Hospital Visiting Committee. 50-h.p. oil engine electric generating set for the mental hospital, Blackadon. Town clerk, Municipal Buildings.

Pudsey.—June 28th. Electrical installations for 96 houses, Smithroyd Park. Specifications, &c., from Mr. B. H. Noble, borough surveyor, Town Hall.

Shitlington, West Riding.—July 19th. West Riding Education Committee. Electrical installation for the Middlestown new school. Specifications, &c., from Education Department, County Hall, Wakefield.

Singapore.—July 25th. Municipal Commissioners. One 10,000-kW turbo-alternator and condensing plant. (See this issue.)

Smethwick.—June 25th. Smethwick and Oldbury Joint Hospital Committee. Electric lighting installation at the Holly Lane Hospital. Mr. F. Chapman, clerk.

South Africa.—Cape Town.—June 30th. South African Railways and Harbours Board. Gasfilled and vacuum lamps for 12 months. (B.X. 3518.)* Telegraph material. (B.X. 3519.)*

Pietermaritzburg.—July 13th. City Council. Single- and 3-phase electric motors and starting switches for 12 months.—City Electrical Engineer. *South African Mining and Engineering Journal.*

Southend-on-Sea.—July 6th. Light Railways and Electricity Department. L.p. and e.h.p. cables for 12 months. (June 3rd.)

July 5th. 3,000 meter boards. (June 17th.)

Whitehaven.—July 1st. Rural District Council. Installing two miles of overhead cable and erection of fittings, &c., in connection with the electric lighting of streets at Moresby Park Village. Mr. W. J. Goode, engineer and surveyor, Union Hall, Whitehaven.

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Basingstoke.—Town Council. Accepted:—

Wiring 126 houses for electric light at £639.—T. M. Kingdon & Co. (Thirty-nine tenders were received, the highest being £2,400.)

Birmingham.—Board of Guardians. Accepted:—

Wiring contract for the Western Road Institution (£115).—T. Glover.

Bradford. — Health Committee. Grassington Sanatorium :—

One 75-kW high-speed engine (£396).—Belliss & Morcom, Ltd.

One 75-kW direct-coupled generator (£329).—English Electric Co., Ltd.

Overhauling and repairing horizontal engine (£120).—Newton, Bean & Mitchell.

Tramways Committee.

100 steel tramcar tires for D.K. trucks (£235).—Vickers, Ltd.

Government Contracts.—The following contracts were placed by various Government departments during May, 1927 :—

Admiralty Contract and Purchase Department.

Electric cable.—British Insulated Cables, Ltd.; Edison Swan Cables, Ltd.; General Electric Co., Ltd.; Siemens Bros. & Co., Ltd.; Enfield Cable Works, Ltd.

Electric hot cupboards.—Benham & Sons, Ltd.

E.h.p. cables.—W. T. Henley's Telegraph Works Co., Ltd.

Aluminium alloy lamp fittings.—General Electric Co., Ltd.; W. McGeoch & Co., Ltd.; Engineering and Lighting Equipment Co., Ltd.; J. Beresford & Sons, Ltd.

Motor reducer set.—Laurence, Scott & Co., Ltd.

Electric bakery plant.—Carron Company.

Motor-driven pumps.—J. Stone & Co., Ltd.

Switch and sockets.—General Electric Co., Ltd.

W/T valves.—Mullard Radio Valve Co., Ltd.

War Office.

Overhead travelling electric crane.—Royce, Ltd.

X-ray sets.—Solus Electrical Co.

Air Ministry.

Accumulators.—C. A. Vandervell & Co., Ltd.

Amplifier.—Gambrell Bros., Ltd.

Battery charging panels (various stations).—Harland Engineering Co., Ltd.

Motor-generator sets (various stations).—General Electric Co., Ltd.

Stand-by generating sets (Kenley and Suttons Farm).—Aster Engineering Co. (1913), Ltd.

Underground cables (Upper Heyford).—Malcolm & Allen, Ltd.

W/T transmitting station (Mitcham).—Pearce Bros.

Delco ignition spares.—Delco-Remy & Hyatt, Ltd.

Receivers.—H. W. Sullivan, Ltd.

Telephone and headbands receivers.—Standard Telephones and Cables, Ltd.

Transmitting and receiving sets.—Marconi Wireless Telegraph Co., Ltd.

Post Office.

Telephone apparatus.—Ericsson Telephones, Ltd.; International Electric Co., Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.

Testing, protective and miscellaneous apparatus.—Phœnix Telephone & Electric Works, Ltd.

Battery stores.—Hart Accumulator Co., Ltd.

Terminal blocks.—T. De la Rue & Co., Ltd.

Battery boxes.—Siemens Bros. & Co., Ltd.

Cable (various).—British Insulated Cables, Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.; Union Cable Co., Ltd.

Casing and cover.—W. Duncan Tucker & Sons, Ltd.

Joint box castings.—United Steel Co., Ltd. (T. Butlin and Co. Branch).

Cords for telephones.—London Electric Wire Co. & Smiths, Ltd.

Ironwork.—Bullers, Ltd.

Mouthpieces.—North British Rubber Co., Ltd.

Distribution cable plugs.—Siemens Bros. & Co., Ltd.

Wire.—W. T. Henley's Telegraph Works Co., Ltd.

New lift and extension to existing lift, Post Office Stores Department.—W. Wadsworth & Sons, Ltd.

Radio station switchgear and cabling (Portishead).—Drake and Gorham, Ltd.

Valve transmitter (Humber).—Radio Communication Co., Ltd.

Telephone Exchange equipment.—Lofthouse Gate (Wakefield Multi Office Area) : Siemens Bros. & Co., Ltd. Sub-contractors : Small Electric Motors, Ltd., for ringing machines. Goole (Yorks) : Siemens Bros. & Co., Ltd. Sub-contractors : Hart Accumulator Co., Ltd., for batteries; Crompton & Co., Ltd., for ringing machines; English Electric Co., Ltd., for charging machines. Harpenden (Herts) : Siemens Bros. & Co., Ltd. Sutton (Surrey) : General Electric Co., Ltd. Sub-contractors : Chloride Electrical Storage Co., Ltd., for batteries; Crompton & Co., Ltd., for machines. Archway (N.) : General Electric Co., Ltd. Sub-contractors : D.P. Battery Co., Ltd., for batteries; Crompton & Co., Ltd., for machines. Wilmslow (Cheshire) : General Electric Co., Ltd. Maryland (E.) and African and Eastern Trade Corporation, Ltd. (Liverpool) : Standard Telephones and Cables, Ltd. Chapeltown (Leeds) and Shrewsbury : Automatic Telephone Mfg. Co., Ltd. Cobham (Surrey) : Ericsson Telephones, Ltd. Liverpool Warehousing Co., Ltd. (Liverpool), G. Salter and Co., Ltd. (West Bromwich), Shell-Mex, Ltd. (W.C.), Accles & Pollock, Ltd. (Oldbury) : Relay Automatic Telephone Co., Ltd.

Crown Agents for the Colonies.

Cables.—W. T. Henley's Telegraph Works Co., Ltd.

Generators.—Electric Construction Co., Ltd.; J. Stirk and Sons, Ltd.

Insulators.—Taylor, Tunnicliff & Co., Ltd.

Switchgear.—British Thomson-Houston Co., Ltd.

Telephones : Standard Telephones and Cables, Ltd.

Train lighting equipment.—Chloride Electrical Storage Co., Ltd.; J. Stone & Co., Ltd.

Transformers.—British Electric Transformer Co., Ltd.; Brush Electrical Engineering Co., Ltd.

Irish Free State.—Controller of Stores (Posts and Telegraphs).

Broadcasting apparatus.—British Thomson-Houston Co., Ltd.; General Electric Co., Ltd.

Cable (various).—Routledge & Co.

Cable drums.—Siemens Bros. & Co., Ltd.; McMillan and Co.

Jacks (telephone).—Phœnix Telephone and Electric Works, Ltd.

Platinum contacts.—Marconi (Ireland), Ltd.

Radiators.—British Thomson-Houston Co., Ltd.

Receivers (for telephones).—Ericsson Telephones, Ltd.

Relays (for telegraphs and telephones).—Standard Telephones and Cables, Ltd.

Sets (for telegraphs and telephones).—Hart Accumulator Co., Ltd.
Switches.—Walters Electrical Manufacturing Co., Ltd.
Thermographs.—Cambridge Instrument Co., Ltd.
Transmitters.—Phœnix Telephone and Electric Works, Ltd.
Wireless telephone installations.—Marconi (Ireland), Ltd.
—*Irish Electrician.*

Llanfairfechan.—Urban District Council. Accepted:—
Mains (cables).—British Insulated Cables, Ltd.
Trenching and cable laying.—Durnford Construction Co., Ltd.
Transformers and switchgear.—English Electric Co., Ltd.

London. — SHOREDITCH.—Lighting Committee. Recommended:—
Ventilating equipment at Evelyn sub-station (£460).—Davidson & Co., Ltd.
Ash-handling and storage plant at the Whiston Street generating station (£1,055).—Fraser & Chalmers Engineering Works.
New feed water mains in connection with the boiler extension at Whiston Street (£700).—Babcock and Wilcox, Ltd.
Air filter at Coronet Street sub-station (£180).—Davidson and Co., Ltd.
L.p. cable (£1,172).—W. T. Glover & Co., Ltd.

HAMMERSMITH.—Electricity Committee. Recommended:—
Three 250-kW, eight 200-kW, and three 50-kW air-cooled transformers (£3,044).—British Electric Transformer Co., Ltd.
E.h.p. ironclad switchgear (£793).—Metropolitan-Vickers Electrical Co., Ltd.
60 h.p. switches (£917) and twelve 10,000-amp. circuit breakers (£107).—J. G. Statter & Co.
Three 6-way and two 4-way l.p. fuse units (£108).—Lucy and Co., Ltd.
11,000-V, 6-core cable (£2,147).—Hackbridge Cable Co., Ltd.
Repair and overhaul of single-phase switchboard (£121).—Switchgear & Cowans, Ltd.

Manchester.—Tramways Department. Accepted:—
Fifty type W.T. 31K. motors (50 h.p. rating).—General Electric Co., Ltd.

South Africa.—DURBAN.—Municipal Council. Accepted:—
Cables and switchgear in connection with the linking-up the Congella power station and the municipal power station:—
Cables (£25,172).—British Insulated Cables, Ltd.
Switchgear (Congella) (£5,864); ditto, municipal power station (£1,592).—A. Reyrolle & Co., Ltd.
Regulators and reactances (Congella) (£3,008); reactors (municipal power station) (£617).—Metropolitan-Vickers Electrical Co., Ltd.

JOHANNESBURG.—Municipal Council. Accepted:—
1,000 primary fuses and plugs (£317).—South African General Electric Co., Ltd.
3 miles h.d. trolley wire (£288).—British General Electric Co., Ltd.
24 6,600/110-V, single-phase potential transformers (£200). A.E.G. Engineering Co. (S.A. Proprietary), Ltd.
One mile h.p. cable (£1,031).—W. T. Henley's Telegraph Works Co., Ltd.
—*S.A. Mining and Engineering Journal.*

Stretford.—Health Committee. Accepted:—
Electrolysing plant at Empress Street depöt (£118).—Mather & Platt, Ltd.

Electricity Committee. Accepted:—
Electric lamp columns (56s. 3d. each).—R. A. Bradshaw and Son.

Wakefield.—Housing Committee. Accepted:—
Wiring 200 houses on the Snapethorpe estate.—J. E. Fowler.

Woodford.—Urban District Council. Accepted:—
Installation of internal telephone system at Council offices, and maintenance.—Commercial Telephone & Electrical Co.

Forthcoming Events.

Electrical Contractors' Association.—June 22nd to 25th. Scarborough Annual Conference.

Physical Society.—Friday, June 24th. Imperial College of Science, S. Kensington, S.W. 5 p.m. Ordinary meeting.

Institution of Mining Engineers.—June 29th to July 1st. Newcastle-upon-Tyne. General meeting.

Tramways and Light Railways Association.—June 29th to July 1st. Bath. Annual Congress.

Institution of Electrical Engineers (South-Midland Centre).—Thursday, June 30th. Visit to Dolgarrog.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

DAYKOL daylight fittings.
TELLUS vacuum cleaners.

Readers occasionally desire to be put in touch with companies undertaking to finance hire-purchase schemes for domestic apparatus, such as vacuum cleaners, cookers, &c. We should be glad to learn the name of any reliable concern of this nature.

Notes.

Electrical Questions at the League of Nations.

Mr. D. N. Dunlop has been appointed the British representative on the Permanent Committee on Electrical Questions set up by the Advisory and Technical Committee for Communications and Transit of the League of Nations. The agenda for the meeting held in November, 1926, included the three following matters:—

(*a*) The ratification of the conventions adopted in 1923 relating to the transmission in transit of electric power, and to the development of hydraulic power.

(*b*) The establishment of an international centre of information.

(*c*) The relations of the Committee with other international organisations dealing with electric questions.

Mr. Dunlop, in addition to being director of B.E.A.M.A., is chairman of the International Executive Council, World Power Conference, and of the British National Committee.

The Use of Photo-Electric Cells in Photometry.

Amongst the papers read at the meeting of the Optical Society on June 9th was one by Mr. T. H. Harrison, Ph.D., B.Sc., who gave a description of apparatus and experiments designed for obtaining the highest accuracy and precision in the photometry of electric lamps, using photo-electric cells. Although the methods adopted were not novel, every care had been taken to obtain the highest sensitivity in the photo-electric current measuring apparatus and to maintain the lamps at a steady accurately-known voltage. It was claimed, therefore, that the results were useful in showing the maximum capabilities of photo-electric cells when used in the usual manner with a sensitive electrometer or electroscope. The actual results obtained were tabulated, and an examination was made of the sources of error to be expected, of the method by which they might be avoided, and of the computation of the accuracy of the results.

The I.E.E. Wiring Regulations.

We have received from the Institution of Electrical Engineers a copy of the 9th edition (May, 1927) of the "Regulations for the Electrical Equipment of Buildings," which is published by Messrs. E. & F. N. Spon, Ltd., price 1s. 6d. (cloth), or 1s. (paper), plus postage 2d. Copies can also be obtained from the Institution.

A footnote states that this edition contains a number of alterations which had become urgent, but does not differ considerably from the eighth edition. It appears that the alterations and additions approved by the Council on July 16th, 1925, and issued in the form of a pamphlet have been incorporated in the text of the 9th edition, but a comparison of the two books indicates that there are many minor additions and omissions, transpositions, &c., which render the task of identifying the changes very laborious. For instance, the old Regulation 64, "Main Switchgear," has in modified form been included under the more appropriate heading, "Control of Supply," Regulation 94, in the new issue. The total number of clauses remains at 128, and of the tables at xiv. Appreciable alterations have been made in Tables IV, vulcanised rubber cables; V, impregnated-paper and lead-covered cables; VI, flexible cables for use with portable appliances; and VIII, flexible cords. These changes are mainly in the current-carrying capacity; in some cases the amperage has been increased by 40 or 50 per cent. (flexible cords), or 30 per cent. (flexible cables for portable appliances) throughout, but in others the changes are partly one way and partly the other.

The Wiring Regulations Committee has in preparation a Tenth Edition, which, with a view to simplification, may differ materially from the Ninth in respect of arrangement and wording.

The Extra-High-Pressure Conference at Paris.

The headquarters of the British members attending the above conference will be the Hotel Campbell, 47, Avenue de Friedland. This hotel is quite near the Salle Hoche, where the conference will take place, and will form a very convenient place of meeting for those attending the conference, even if they do not happen to stay at the hotel.

Centenary Lecture.

In a lecture recently given by Dr. J. A. Fleming in connection with the centenary celebrations of University College, University of London, he referred to the strides which had taken place in the work of electrical communication and to the contributions made by men like Alexander Graham Bell. Although the practical applications of electricity had largely come from America, the fundamental ideas were to a great extent due to British scientists. Dr. Fleming said it was the electrical engineer who met those imperative needs which the pressure of population on the means of existence brought about.

The I.M.E.A. Exhibition.

In addition to the exhibits referred to in our last three issues at the exhibition of apparatus held in connection with the Convention of the Incorporated Municipal Electrical Association at Buxton, some items which should not be passed over were seen on the stand of Messrs. B.E.N. PATENTS, LTD. A feature of this stand was the "Ben-Myers" car-washer. This is an electrically-driven outfit by means of which, it is claimed, a car can be washed in 20 minutes. The pump is totally enclosed and runs in oil. All the parts are interchangeable and easily accessible. The water stream can be instantly regulated to any pressure up to 400 lb. per sq. in. A variety of portable electric tools included recently introduced models of electric hand saws with 6-, 8- and 10-in. diameter saw blades; a range of electric drills driven by motors of ¼, ⅓, ½ and 1 h.p. for drilling holes in steel up to 1¼ in.; the "Speedway" portable hammer, a suitable device for drilling in concrete, brick, stone, and so on, made in two sizes, capable of drilling ½-in. and 1-in. holes at 3,000 and 1,800 blows per min., respectively; and the U.L.A. general utility tool with the necessary attachments for grinding, scratching, buffing, sawing, drilling, and other operations. A feature of the apparatus shown was the "Alta" lock mortiser, an electrically-driven apparatus which, it is claimed, will cut an ordinary mortise in less than a minute; stock cutters of ⅝ in. and 1¼ in. are available for this machine. The "Turner Timer" commutator for Ford automobiles was to be seen on this stand; it is claimed that the long hot spark created by the wide wipe contact results in a saving of 10 to 15 per cent. in petrol consumption. Some "Maimin" electric cloth cutters were also shown; the "Maimin Automatic" cutter employs a straight knife and is carried on a bracket; the "Maimin Six" model is of the circular-knife type and is carried in the hand. Each model carries a guiding lamp. Other exhibits included snap ball joints, and a variety of portable "Alta" electric tools.

Short-circuit Fuse Tests.

On Tuesday next, June 28th, Messrs. Parmiter, Hope and Sugden, Ltd., by the courtesy of the St. James' and Pall Mall Electric Lighting Co., London, will carry out a series of short-circuit tests on their fuses at the Marshall Street, Beak Street, power station of the St. James' Co. Those interested may obtain invitations to be present at the demonstration from the London office of Messrs. Parmiter, Hope & Sugden, Ltd., 25, Victoria Street, Westminster, S.W.1. The tests will be on similar lines to those which took place in Manchester in March last year.

Institution of Civil Engineers' Exhibition.

In connection with the conversazione of the Institution of Civil Engineers, held at the Institution on June 15th, a number of engineering models, pieces of scientific apparatus, &c., were exhibited. Included in the items shown was the Yarrow-Hyde bed which is designed to promote sleep by imitating as far as possible, in amplitude and frequency, the motion of a train on the Canadian Pacific Railway; Sir Alfred Yarrow, the originator of the bed, during a journey from Vancouver to Montreal, found that he slept much better when the train was in motion than when it was still. The bed is hinged at the foot, and a simple harmonic motion is applied to the head of the bed by means of an electrical drive through a double eccentric. At the points of synchronism of the two eccentrics the bed has its maximum and minimum lifts, giving a gradual rise and falling off of the motion. A model for demonstrating the flow of lubricant in a bearing was shown by Prof. B. P. Haigh, D.Sc., and Mr. F. W. Thorne, A.M.Inst.C.E. The Selenyi method of measuring vacuum in electric lamps was exhibited by Mr. J. T. Randall, M.Sc., of the Research Laboratories of the General Electric Co., Ltd. This was also exhibited at the Royal Society's Soiree this year, and described in the ELECTRICAL REVIEW on May 27th, p. 836. The same applies to a new thermostat which was shown by Lt.-Commander F. J. Campbell Allen and Mr. A. E. Salisbury (ELECTRICAL REVIEW, May 20th, p. 792). The National Physical Laboratory had a number of exhibits, which included apparatus for measuring the speeds of vacuum pumps and gas analysis apparatus utilising high-frequency vibrations. Exhibits by Mr. T. Gill, International Standard Electric Corporation, included: apparatus for precision measurements of circuit efficiencies as used on the Anglo-American Transatlantic telephone service; apparatus for comparing the qualities of two loud-speakers; photographs of the radio-telephone equipment at the Rugby radio station; and photographs illustrating the progress of telephony in Spain. An experimental exhibit by Mr. Leonard Andrews, M.B.E., demonstrated the principle of kinetic elutriation, which, it is suggested, may have a field in connection with the use of pulverised fuel. The treatmen provides for the disassociation of the particles bound togethe by surface tension, imparting a high velocity to the particle and passing them through a vortex chamber wherein, unde the combined influences of centrifugal force, gravity and edd currents, they automatically arrange themselves in tw separate streams of water, carrying coarse and fine particle respectively.

Smokeless Fuel.

According to the *Morning Post*, the Government has agree to contribute, under the Trade Facilities Act, a sum which i stated to be £100,000 towards the establishment of a nev company to be known as Fuel Utilisation, Ltd. This compan will operate works at Richmond for the production, on a experimental basis, of smokeless fuel and motor spirit. Th plant has been designed by the Fuel Research Division of th Scientific and Industrial Research Department, and was chose after an exhaustive investigation of coal distillation plants al over the world. The investigation has been conducted, unde the supervision of Sir David Milne Watson, by the Gas Ligh and Coke Co., which is associated with the new undertaking The works will be operated intensively for three years to pro vide working data. At the expiration of this period the result will come under review, and the works will be extended on commercial basis, or closed down altogether.

Inquiry into an Acton Explosion.

An explosion which occurred at Acton on February 19th last and resulted in the destruction of premises in Beaconsfield Road, and injuries to the occupants (proving fatal in one case), was the subject of an inquiry which was opened a Acton Town Hall on June 17th, by Mr. G. Scott Ram M.I.E.E., and Dr. J. S. Haldane, F.R.S., who were appointed by the Electricity Commissioners under the provisions of the Electricity (Supply) Acts, to report upon the matter. The supply is given by the Metropolitan Electric Supply Co., Ltd. The explosion occurred in the early hours of the morning, and about that time a fault developed in the electrical distribution system at that point. The reason for the explosion is obscure. Among the theories put forward is one to the effect that bitumen gas was generated from a feeder cable which was laid in bitumen in the road, and was burned out at one point, and that the explosion was due to the ignition of this gas. On the other hand, it was suggested that the explosion might have resulted from an escape of coal gas. The circumstances with regard to the electrical fault were stated to be as follows. There was a distributor along the road on the opposite side to that on which the destroyed premises were situated, and, parallel with it, a "Dialite" feeder, which latter was laid in bitumen, about twenty years ago, by the Acton U.D.C., before the Metropolitan Co. took over the supply. From the distributor there was a branch at right angles, crossing the road, from which the destroyed premises were supplied. This distributor crossed the feeder. Evidence was given by Mr. A. Richardson (mains foreman to the Metropolitan Co.) to the effect that he had received a telephone message from the substation that a fault was developing on the feeder. The area having been isolated, he found that a fault had occurred in the distributor at the point where it crossed the feeder; the latter was burned away for a distance of about 18 in. on either side of the junction. From a point half way across the road, and in the direction of the feeder, the distributor was bared. He considered that a fault had occurred in the distributor, at a point about half way across the road, and had developed away from the destroyed premises and towards the feeder. When the distributor was taken out, it was found that from the middle of the road to the service box outside the destroyed premises it was in good condition, and the service cable showed no signs of a short circuit. Nine months earlier the occupier of the destroyed premises had complained of an odour, and he (Mr. Richardson) had opened the ground to investigate. On that occasion he had noticed a smell of coal gas, which might have been due to leakage under the ground. Cross-examined by counsel for the Gas Light & Coke Co., witness agreed that there had been trouble with the electrical distribution system at this spot on three occasions in about three years.

Other evidence was given by a number of witnesses, including representatives of the Metropolitan Co., and the inquiry was adjourned until June 20th. The Court intimated that it would inspect the ground in the area affected before the resumption of the proceedings.

Among those who gave evidence on June 20th was Dr. C. J. J. Fox (Messrs. Cross & Bevan, consulting and analytical chemists), who considered it improbable that the explosion was due to bitumen gas; the destruction was out of all proportion to the volume of gas that would be generated. Apart from that, the gas would have been diluted with air to such an extent that the mixture would not have been explosive.

Mr. Hugh Bourne, M.I.E.E. (Messrs. Albion T. Snell and Partners), who gave evidence on behalf of the owner of the destroyed premises, thought that the initial fault took place in the bitumen feeder itself, and that the distributor crossing the road was destroyed as the result of the temperature of the gases generated by the fault in the feeder.

Witnesses were called on behalf of the Gas Light and Coke Co., whose evidence was to the effect that there had been no complaints with regard to the escape of gas in the neighbourhood.

Mr. Frank Hipwell (secretary of the Metropolitan Electric Supply Co.) said that the policy of the company was to

replace the bitumen cables with paper-insulated cables. Approximately £60,000 had been spent on these replacements. It was suggested by Mr. Trevor Watson (on behalf of the Gas Light and Coke Co.) that the company's decision was dictated not merely by financial considerations, but because it knew that bitumen cables were likely to cause danger. Witness did not agree.

Dr. R. V. Wheeler said that, assuming no match had been lit on the premises at the time of the explosion—and the evidence was that no match had been lit—it was just conceivable that the gases rapidly evolved from the bitumen might have been projected through the conduit into the building at a sufficiently high temperature to cause them to ignite of their own accord when they came into contact with air. Another possibility was the presence of an electrostatic charge at the orifice through which the gas flowed, if it were flowing at a sufficiently high speed.

The tribunal will report to the Electricity Commissioners in due course.

Scottish Electrical Contractors.

The annual meeting of the Electrical Contractors' Association of Scotland was held in Glasgow on June 8th; the president, Mr. William Mackintosh (William Douglas, Ltd., Edinburgh), presided. Satisfactory reports were submitted from the branches and the committees of the Central Board, and a substantial increase in membership was again reported. Views were exchanged as to the results of the E.D.A.-E.L.M.A. campaign, and reference was made to the new campaign meditated by E.D.A. for the coming winter. The following new office bearers were elected:—President, Mr. James Allan (Malcolm and Allan), vice-president, Mr. J. J. Foggo (Messrs. John Foggo & Sons). After the meeting the members present were entertained to lunch by the Glasgow Branch in the Royal



Scottish Electrical Contractors.

Hotel, and in the afternoon the usual golf match, East *v.* West, was played at Erskine Golf Course, on the banks of the Clyde. Rain fell heavily on the motor run down to the course, but later the sky cleared. All the members took some part in the match, the non-golfers acting as honorary caddies for the time being. The match resulted in a win for the East by nine matches to six and at a gathering which followed, the Pratt Trophy, which was instituted in 1914, was presented to Mr. A. J. Shand, chairman of the Edinburgh Branch, by the new president, Mr. Allan. Some of the members who took part in the match appear in the accompanying picture.

Week-End Conference.

"Wage Payments and Incentives and Women in Industry" is the subject for discussion to be opened by Miss Caroline Haslett, director of the Electrical Association for Women, and secretary of the Women's Engineering Society, at a week-end conference promoted by the National Industrial Alliance. This gathering has been arranged at the Retreat, Pleshey, Chelmsford, for July 2nd-3rd, 1927. The guests will be equally representative of employers and employés. Accommodation is still available, and particulars will be furnished on application to the Secertary of the Alliance, 25, Queen Anne's Gate, S.W.1.

Electrical Association for Women.

Members of the South Wales and Monmouthshire Branch of the E.A.W., on June 15th, attended a demonstration of clean milking, given under the auspices of the Glamorgan Agricultural Committee, by Miss V. D. Harrison, at Mr. J. H. Merrett's farm at Penylan.

The Electrical Trades Benevolent Institution.

An extraordinary general meeting of this Institution is to be held at 36/38, Kingsway, on Wednesday, June 29th, at 2.30 p.m., to confirm the resolution passed at the annual general meeting held on April 28th that the new rules as submitted be approved and adopted.

Appointments Vacant.

Telephone maintenance inspectors (250 taels per month; tael=2s. 6d.) for the Shanghai Mutual Telephone Co., Ltd. Junior charge engineer for the Gloucester Corporation Electricity Department. Assistant engineer for the Bhatpara Power Co., Ltd. (See our advertisement pages to-day.)

Late Legal.

Alleged Conspiracy to Defraud.—At the Mansion House on Tuesday last the adjourned summonses against Sir Charles Buckworth Herne-Soame, Bt., Edward Warden, Col. Edmund Octavius Eaton, and Robert George Harley were again called. The charges against them were that between January, 1914, and the present time they had "conspired together, and with other persons, to cheat and defraud such persons as might receive prospectuses and pamphlets issued by the Chalk Fuel and Gas By-Products Corporation, Ltd."; and of conspiring "to obtain money from them by falsely pretending that certain reports appearing in the prospectuses and pamphlets were true." The prosecution stated that Col. Eaton was unable to attend on account of ill-health, and that Sir C. Herne-Soame, who was prepared to attend, had been advised that his presence was not necessary in view of the other defendant's condition. Harley was in court, but Warden was absent. The summonses were further adjourned until September 21st.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. Bancroft Gherardi, vice-president and chief engineer of the American Telephone and Telegraph Co., has been elected president of the American Institute of Electrical Engineers for the year commencing August 1st.

We regret to learn that Mr. John Roberts, borough electrical engineer of Durban, has broken down in health. He is now recuperating in the Cape, and, we are pleased to hear, is regaining his health. His assistant, Mr. E. Poole, has, in the interim, been appointed acting borough electrical engineer.

On the occasion of his marriage, Mr. A. C. Watts, of Tunbridge Wells, has been presented with a chiming clock by the electrical contractors of Tunbridge Wells, with a similar clock by the electrical contractors of Sussex, and with a coffee service and inlaid tray by the staff of the Premier Electrical Co.

Mr. N. R. Keast, of Wrexham, has been appointed mains engineer by the Lowestoft Corporation Electricity Supply and Tramways Department.

Mr. A. B. Eason, assistant engineer in the Engineer-in-Chief's Office in the G.P.O., has been promoted to the position of executive engineer.

Obituary.—Mr. G. E. Tripp.—The death occurred in hospital at New York, following an operation, on June 14th, of Mr. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric and Manufacturing Co. He was 62 years of age. Mr. Tripp was a prominent figure amongst American electrical industrial leaders, and in addition to his connection with various non-electrical corporations, he was also associated with the Radio Corporation of America and the International Radio Telegraph Co. Getting on for twenty years ago he took a foremost part in the reorganisation of the street railway system of New York and during the war he was made a brigadier-general and made huge purchases of materials on behalf of the U.S. Government.

Mr. H. Morris-Airey.—We regret to record that Mr. Harold Morris-Airey, C.B.E., M.Sc., M.I.E.E., died at Southsea on Sunday, aged 47 years. For the past seven or eight years he had been chief technical adviser at H.M. Signal School, R.N. Barracks, Portsmouth, where he had been engaged on wireless telegraph apparatus development for the Navy.

Mr. W. M. Rogerson.—We deeply regret to record that Mr. William Michael Rogerson, borough electrical engineer and manager of Halifax, passed away suddenly on Thursday last week. He was present at the convention of the I.M.E.A. at Buxton, but for some time past he had not been in the best of health and after his return home he was obliged to remain there for some days. With the permission of his doctor, we understand, he proceeded to a meeting of his Committee on the morning of the 16th inst., but on entering the Town Hall he had a heart attack, from which he never recovered. Mr. Rogerson, who has thus died in harness, was 55 years of age. He had been at Halifax since November, 1901, proceeding there from Nottingham, where he was chief assistant electrical engineer for seven years. When he took up his Halifax post the plant capacity was 3,000 kW; to-day it is 31,000 kW. He was devoted to his work and took pride in the development of his undertaking and especially in the linking-up of the Halifax and Huddersfield systems. For a short period he was both borough electrical engineer and tramways engineer, but latterly the offices have been separated. Mr. Rogerson acted in an advisory capacity to the Government in connection with the lengthy negotiations in regard to the Aire and Calder electricity district scheme. During the war he was an officer in the Halifax Volunteers. He was a member of the Institution of Electrical Engineers. His numerous friends in the electrical industry will, we are sure, desire to associate themselves with us in our expression of sympathy with his widow and four daughters in their tragic loss. The funeral took place

on Monday. The bearers were six employés of the Electricity Department who had served under him for many years. The flag at the Town Hall was at half-mast. Those present at the funeral, in addition to Mrs. Rogerson, the daughters and other relatives, included a large number of members of the Corporation, Corporation officials, the staff of the electricity works, representatives of the Halifax Electrical Employés' Federation, the Social and Athletic Society of his department, representatives of electrical manufacturing concerns, city and borough electrical engineers from various parts, &c.; 120 employés of the Electricity Department, and 40 tramway employés walked in the procession.

Mr. M. Cookson.—The death has occurred at Kilda, Victoria, of Mr. Maynard Cookson, who for many years was in business as an electrical engineer in Southport. He went to Australia nearly four years ago.

Will.—Sir Wm. Mackenzie, chairman of the Brazilian Traction, Light and Power Co., and various other South American electrical companies, left £17,249 personal estate in England.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Neutron (1927), Ltd.—Private company. Registered June 11th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers and buyers and sellers of chemical compounds, metals, and mineral ores; manufacturers of and dealers in mineral ores and other substances used as crystal detectors for wireless receiving sets, and in particular the crystal known as "Neutron"; to acquire the trade marks "Neutron," numbered respectively 452,957, 452,958, 457,747, and 465,321. The first directors are:—P. G. Marr, "Crossways," Whiteman's Green, Cuckfield, Sussex, merchant; W. Holt, address not stated; C. J. S. Norris, "Maylus," Norbury Crescent, S.W.16, C.A. Qualification: 1 share. Solicitors: John Hands & Son, 97, Gresham Street, E.C.2.

J. & C. Manufacturing Co., Ltd.—Private company. Registered June 9th. Capital, £1,250 in 750 ordinary "A" shares of £1 each, and 1,000 ordinary "B" shares of 10s. each. Objects: To acquire the business of manufacturers of and dealers in wireless telephony appliances now carried on by the proprietors of the J. & C. Wireless Company at Brighton. The first directors are:—N. G. Johnson, Le Pride, Henfield, Sussex; C. L. Clayton, Badger Wood, Fulking, Sussex; C. Hastings, 7, Northfield Road, Stamford Hill, N.; Secretary: C. Hastings. Solicitors: F. H. Nye, 15, Prince Albert Street, Brighton. Registered office: Royal Crescent Works, Marine Parade, Brighton.

Devereux, Ltd.—Private company. Registered June 13th. Capital, £1,000 in £1 shares. Objects: To acquire the business of an electrical engineer and manufacturer carried on by H. Devereux, at 1, Yukon Road, Balham, as "The Ajax Company," and to carry on the business of repairers of and dealers in electrical machines, including wireless telephony and telegraphy, &c. The first directors are:—H. Devereux (permanent managing director and chairman), 101, Tooting Bec Road, Upper Tooting, S.W.17, electrical engineer; E. le Maistre, 2, Furzedown Drive, Tooting Bec Common, S.W.17, general practitioner. Registered office: 1b, Yukon Road, Balham, S.W.12.

Mercury Electrical Appliances, Ltd.—Private company. Registered in Edinburgh June 17th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, &c. The directors are:—H. Manfred, 8, Westmorland Street, Glasgow, chemist; W. Morrison, 524, Cathcart Road, Glasgow, traveller. Qualification, 50 shares. Registered office: 158, Howard Street, Glasgow.

South American Public Utilities Trust, Ltd.—Private company. Registered June 14th. Capital, £110,000 in 80,000 ordinary shares of £1 each and 120,000 8 per cent. cumulative preference shares of 5s. each. The preference shares have priority for return of capital. Objects: To acquire shares, stocks, and securities of any company (wherever incorporated) formed for the purpose of constructing, purchasing, leasing, or otherwise acquiring, maintaining and working in any part of South America, tramways, railways, omnibuses, or other form of public transport, or of generating and supplying electricity for light, heat, power, and other purposes; to hold, sell, dispose of, or deal in such shares and securities; to construct or acquire, maintain and work tramways, railways, and omnibuses, and to generate and supply electricity in any part of South America, &c. The subscribers (each signing for one preference share) are:—D. Kemsley, Thrifts Hill, Theydon Bois, Essex, gentleman; E. J. McLellan, 130, Church Road, Upper Norwood, S.E., gentleman. Solicitors: Johnson, Jecke and Colclough, 24, Austin Friars, E.C.2.

Tully Gas Plants (1927), Ltd.—Public company. Registered June 16th, with a nominal capital of £140,000 in 300,000 10 per cent. non-cumulative participating preference shares of 1s. each and 500,000 ordinary shares of 5s. each. The objects are to acquire the undertaking and assets of Tully Gas Plants, Ltd., to adopt an agreement between Gas & Fuel Plants, Ltd., and its liquidators of the first part, Tully Gas Plants, Ltd., and its liquidator of the second part, Low Temperature Carbonisation, Ltd., of the third part, and J. Morgan, as trustee for and on behalf of the company, of the fourth part, and to carry on the business of gas, electrical, mechanical and general engineers, contractors, electricians, founders, smiths, manufacturers and suppliers of and dealers in gas, electricity, motive power, water and light, &c. The minimum cash subscription is 7 ordinary shares. The first directors are:—F. R. Wade, The Priory, Redbourne, Herts.; C. H. Parker, The Glen, Codsall, near Wolverhampton. Qualification (except first directors), £10 shares or stock. Remuneration: £150 each per annum (chairman £50 extra), free of income tax. Secretary: J. H. Macaulay. Solicitors: Jenkins, Baker & Co., 3, London Wall Buildings, E.C.2. The registered office is at 3 and 4, Clement's Inn, Strand, W.C.2.

Brockbank & Powell, Ltd.—Private company. Registered June 15th. Capital, £2,100 in 2,000 5 per cent. non-cumulative preference shares of £1 each and 2,000 ordinary shares of 1s. each. Objects: To carry on the business of importers, exporters, consulting and general engineers, mechanical, metallurgical, electro-metallurgical, and electrical engineers, &c. The first directors are:—C. J. Brockbank, F.C.I.C., 1,039, Oak Lane, Philadelphia, Pa., U.S.A., metallurgical chemist; H. H. Powell, A.M.I.E.E., Palace Chambers, Bridge Street, Westminster, S.W.1, engineer (both permanent, subject to each holding one share). Solicitors: Godfrey and Robertson, 40, Chancery Lane, W.C.2. Registered office: Palace Chambers, Bridge Street, Westminster, S.W.1.

Radi-Arc Electrical Co. (1927), Ltd.—Private company. Registered June 15th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical and mechanical engineers, designers, &c. The directors are:—S. Blaiberg, 42, Fairhazel Gardens, Hampstead, N.W.6; Violet Erdman, 65, Fitzjohn's Avenue, Hampstead, N.W.3. Solicitors: A. W. Osmond, 6, South Square, Gray's Inn, W.C. Registered office: Bennett Street, Chiswick, W.4.

Reid Power Development Co., Ltd.—Public company. Registered on June 16th, with a nominal capital of £25,000 in 23,000 10 per cent. preferred participating ordinary shares of £1 each and 40,000 deferred ordinary shares of 1s. each. The objects are to acquire a licence from Electric Bulk, Ltd., to develop and form a company to erect a super-power station under the Reid Power process, and to carry on the business of promoting electricity and lime producing, and generally that of a contracting, commercial, financial, developing and producing association, especially with regard to electrical, lime, scientific, and geological matters, &c. The minimum cash subscription is 7 preferred participating ordinary shares. The first directors are:—Lt.-Col. the Hon. H. Scott Davey, C.M.G., 9, Somerset Place, Bath; Major Arthur H. Wodehouse, 32, Upper Gloucester Place, Dorset Square, N.W.1. No share qualification required. Remuneration, £100 each per annum (chairman £150). Secretary: R. Elliott. The registered office is at 30, St. Swithin's Lane, E.C.4.

Official Returns of Electrical Companies.

Frank Craft (Castleford), Ltd.—E. V. Williamson, of 7, Greek Street, Leeds, ceased to act as receiver and manager on May 31st, 1927.

Racon Electrical Co., Ltd.—Capital, £100 in £1 shares. Return dated December 9th, 1926 (filed March 8th, 1927). All shares taken up. £100 paid. Mortgages and charges, nil.

Simmonds & Stokes, Ltd.—Capital, £10,000 in £1 shares. Return dated February 14th, 1927. 7,521 shares taken up. £1,521 paid, £6,000 considered as paid. Mortgages and charges at date of return: £3,350. Since issued: £50 debentures on March 29th, 1927.

Martletts, Ltd.—Capital, £6,000 in 5,000 preference shares of £1 each and 40,000 ordinary shares of 6d. each. Return dated December 31st, 1926 (filed January 12th, 1927). 3,002 preference and 40,000 ordinary shares taken up. £1,352 paid (being 9s. per share on 3,000 preference and £1 on 2 preference shares), £1,000 considered as paid on 40,000 ordinary shares. Mortgages and charges, nil.

Cymbal, Ltd.—Capital, £200 in 2s. shares. Return dated December 31st, 1926 (filed March 18th, 1927). 1,000 shares taken up. £100 paid. Mortgages and charges: £163 5s. 3d.

Duff Bros., Ltd.—Capital, £2,100 in 2,000 "A" ordinary shares of £1 each and 1,000 "B" and 1,000 "C" shares of 1s. each. Return dated January 12th (filed April 5th), 1927. All shares taken up. £2 paid, £2,098 considered as paid. Mortgages and charges, nil.

Illuminated Advertising Co., Ltd.—Capital, £1,000 in 500 preference and 500 ordinary shares of £1 each. Return dated March 1st, 1927. 500 ordinary and 478 preference shares taken up. £978 paid. Mortgages and charges, nil.

Philips Lamps, Ltd.—Capital, £50,000 in £1 shares. Return dated June 9th (filed December 6th), 1926. All shares taken up. £50,000 paid. Mortgages and charges, nil.

Electro-Mechanical Supplies, Ltd.—Capital, £3,000 in £1 shares. Return dated January 14th, 1927. 999 shares taken up. £999 paid. Mortgages and charges, nil.

Atmos Electrical Co., Ltd.—Capital, £2,000 in 1,000 preference and 1,000 ordinary shares of £1 each. Return dated December 4th, 1926. 750 ordinary shares taken up. £250 paid, £500 considered as paid. Mortgages and charges, nil.

Luminograph Co., Ltd.—Capital, £1,000 in £1 shares. Return dated January 14th, 1927. All shares taken up. £1,000 considered as paid. Mortgages and charges: £1,500.

Power Securities Corporation, Ltd.—Capital, £2,000,000 in 1,000,000 preference and 1,000,000 ordinary shares of £1 each. Return dated March 2nd, 1927. 500,000 preference and 500,000 ordinary shares taken up. £1,000,000 paid. Mortgages and charges, nil.

Wakelins Wireless Co., Ltd.—Capital, £2,500 in 1,250 ordinary and 1,250 preference shares of £1 each. Return dated December 14th, 1926. 135 ordinary shares taken up. £102 paid. £33 considered as paid. Mortgages and charges, nil.

District Lighting Supply, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926 (filed April 28th, 1927). All shares taken up. £1,000 considered as paid. Mortgages and charges, nil.

Read & Morris, Ltd.—Capital, £2,000 in 1,940 ordinary shares of £1 each and 1,200 founders' shares of 1s. each. Return dated December 31st, 1926 (filed March 23rd, 1927). 1,200 founders' shares taken up. £30 paid. £30 considered as paid. Mortgages and charges, nil.

Willet & Robinson, Ltd.—Capital, £7,000 in 3,000 "A" cumulative preference, 1,000 "B" preference, and 3,000 ordinary shares of £1 each. Return dated August 19th, 1926 (filed March 22nd, 1927). 2,000 "A" cumulative preference and 2,000 ordinary shares taken up. £4,000 paid. Mortgages and charges, £390.

Acme Electric Lamp Co., Ltd.—Capital, £1,000 in £1 shares. Return dated June 30th, 1926 (filed April 16th, 1927). All shares taken up. £2 paid. £998 considered as paid. Mortgages and charges, £2,551.

G. S. Hawker, Ltd.—Capital, £1,000 in £1 shares. Return dated April 4th, 1927. 750 shares taken up. £250 paid. £500 considered as paid. Mortgages and charges, £900.

Tungsram Electric Lamp Works (Great Britain), Ltd.—Capital, £100 in £1 shares. Return dated February 28th, 1927. 10 shares taken up. £10 paid. Mortgages and charges, nil.

Electro-Plant, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926 (filed April 13th, 1927). Two shares taken up. £2 paid. Mortgages and charges, nil.

Sherborne Electric Supply Co., Ltd.—Capital, £15,000 in £1 shares. Return dated April 7th, 1927. 12,031 shares taken up. £12,031 paid. Mortgages and charges, nil.

Bann Syndicate, Ltd.—Capital, £10,000 in £1 shares. Return dated January 14th, 1927. 8,002 shares taken up. £8,002 paid. Mortgages and charges, nil.

Schall & Sons, Ltd.—Particulars filed of £12,000 debentures authorised June 8th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Bordesley Electrical Accessories Co., Ltd.—Capital, £5,000 in £1 shares. Return dated March 4th, 1927. 4,812 shares taken up. £2,500 paid. £2,312 considered as paid. Bank overdraft, £1,509 10s. 9d.

Accumulators (Birmingham), Ltd.—S. R. Worley, of 23, Bush Lane, Cannon Street, E.C., ceased to act as receiver or manager on June 3rd, 1927.

Rose Bros. Electrical Co., Ltd.—T. G. Weavers, of 4, Drapers' Gardens, E.C., was appointed receiver and manager on June 7th, 1927, under powers contained in debenture dated July 1st, 1925.

Whittaker Bros., Ltd.—Capital, £7,000 in 1,000 cumulative, 5,000 "A" ordinary, and 1,000 "B" ordinary shares of £1 each. Return dated December 31st, 1926. 3,907 (class not stated) shares taken up. £3,207 paid. £700 considered as paid. Mortgages and charges, nil.

Liskeard Gas and Electricity Co., Ltd.—Memorandum dated June 1st, 1927, endorsed on debentures dated January 21st, 1926, securing increase in rate of interest from 5 per cent. to 6 per cent.

General Radio Co., Ltd.—Particulars filed of £20,000 debentures authorised June 3rd, 1927, and covered by trust deed of same date, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £15,000 (at 2 per cent. discount). Trustees: Redeemable Securities Investment Trust, Ltd., Broad Street House, E.C.

City Notes.

Callender's Cable and Construction Co., Ltd.

The balance of profit for the year ended December 31st last is £356,525, as compared with £368,644 in 1925. After providing for interest, depreciation, preference dividends, &c., and adding the balance brought forward (£611,338, less £329,022 transferred to reserve), there is a balance of £496,287 available. From this a dividend of 15 per cent. is declared (5 per cent. already paid) on the ordinary shares, leaving £376,287 to be carried forward. An increase of £300,000 in the capital was authorised in June last year; 200,000 shares have been issued as a bonus to the shareholders, leaving 200,000 available for future issue. The company's operations were seriously affected by the general strike and the coal stoppage. The factory was entirely closed for several days, chiefly owing to the failure of the power supply. Subsequent manufacture at Erith was seriously hampered by difficulty in obtaining supplies and by costly and inadequate transport. Consequently there was a small decline from the record profit of 1925, but in the circumstances the directors consider the result satisfactory. The operations at the Anchor Works were less seriously interrupted, as they were able to carry on without cessation of production. They also suffered, however, from increased costs of supplies and transport, and had shown a reduction of profit. The report refers to the passing of the Electricity (Supply) Act and the commencement of operations by the Central Electricity Board, and says that meanwhile several of the existing undertakings are making large developments, and considerable orders have been placed with the company for work thus resulting. Since the beginning of the year there has been a strong and healthy demand for cables and wires, and both the Erith and Leigh factories were well occupied and in excellent condition. It has taken longer than was anticipated to bring the Okonite-Callender Co. of America into full and profitable operation, owing largely to the changed condition of the cable industry in the United States, where new methods and standards have been adopted which have entailed considerable changes in that company's production and policy. In the meantime, however, the company has secured many large contracts and is producing cables of the highest quality of the type and for the pressures now required in America. The directors regret that Mr. A. W. Tait, C.B.E., has, owing to his other engagements, found it necessary to retire from the board. They desire to place on record their high appreciation of the services which Mr. Tait rendered to the company during the period of his association with it. Meeting: June 30th.

W. T. Henley's Telegraph Works Co., Ltd.

The accounts for the year ended March 31st last show a profit of £306,985 (against £311,029 in 1925-26). After providing for debenture interest, depreciation, &c., and adding £503,779 brought forward (less directors' bonus, £2,500), the amount available is £753,055. From this £50,000 is transferred to reserve, and income tax is paid, as well as the preference and interim ordinary dividends, leaving £619,953. The directors recommend a final ordinary dividend of 2s. 6d. per share (making 4s., or 20 per cent., for the year), together with a bonus of 1s. per share. This will leave £506,203 to be carried forward. Satisfactory progress was made during the year, although some inconvenience and additional expenditure were caused by the industrial troubles. The directors do not consider it necessary to increase substantially the amount carried forward, and accordingly recommend the payment of a cash bonus. Sir George Sutton, Bt., has retired from the office of managing director, but continues to supervise the business as active chairman. Mr. A. E. Salmon, who has been for many years secretary of the company, has been elected a director, and will continue to devote his whole time to the service of the company. Meeting: July 1st.

Greenwood & Batley, Ltd.

A final dividend of 2½ per cent. has been declared, making 5 per cent. for the year, as for 1925-26.

Telephone Manufacturing Co., Ltd.

The annual meeting was held on June 17th, Mr. F. T. Jackson (chairman) presiding. In presenting the report and accounts (Electrical Review, June 10th, p. 941) Mr. Jackson said that the balance sheet of the British Installation Companies showed satisfactory results considering the industrial troubles of last year. An increased profit had been earned, and their indebtedness to the company had been reduced by £19,000 to £78,000. The business done by the subsidiaries during the first five months of the current year showed a substantial increase, and that improvement was expected to continue. The effects would not all be felt in the current accounts, for the contracts were spread over a period of years. The Australian subsidiary had now recovered and was earning satisfactory profits. The Continental Companies had also made small profits, and were gradually reducing their indebtedness to the parent company. As so large a contingency reserve was not now necessary, part of it was being used to write off premiums and expenses on the bonds redeemed, and that item was cleared out of the balance sheet. £12,000 had been written off out of profits for obsolete apparatus. The parent company had secured a number of substantial contracts during the year, but their completion was delayed by the general strike, and a considerable volume of orders was carried forward to 1927. Mr. Jackson criticised the short-sighted policy of the Government in delaying telephone development. Competition was very keen in the automatic telephone business, but the company refused to take orders which did not hold out the prospect of a reasonable profit. He condemned the present policy of confiscating surplus revenue earned by the telephone service, stating that it should be used for development purposes, and he considered that the Government was not the proper body to run the system. He suggested an organisation on the lines of the Metropolitan Water Board or the Port of London Authority. Capital could be raised by the issue of telephone bonds at a fixed rate of interest. With the present lack of orders, experienced men had to be discharged, and when work did come a new body of men had to be trained. With regard to the company's future, the chairman said that it seemed as though it would continue to be fairly busy for some time to come. Apart from public telephone work, it had other work which was growing and expanding.

British Empire Trust Co., Ltd.

Addressing the shareholders at the annual meeting on June 14th, Mr. J. Davidson (deputy chairman and managing director) said that they had been able to increase the preferred ordinary dividend from 5 to 6 per cent. and the deferred ordinary dividend from 7 to 8 per cent., and to transfer £100,000 to reserve. The time had come when they could revert to the payment of interim dividends. He proceeded to review the position of the companies in which they were interested. The British Columbia Electric Railway Co., Ltd., he said, continued to expand, and the outlook for the current year was encouraging. The West Gloucestershire Power Co. was similarly situated. Political conditions in Mexico showed little, if any, improvement, but in spite of that the business of the Monterey Railway, Light & Power Co. increased during the past year, and the company was able to continue the payment of interest on its "A" first mortgage debenture stock and provide for the sinking fund relating to that stock. The new Canadian & Foreign Securities Co. should be as successful as the old Canadian Northern Prairie Lands Co. The report of the Canadian Western Lumber Co. was satisfactory. The Winnipeg Electric Co. was favourably placed, and had successfully conducted a customer-ownership campaign. The chairman concluded with a reference to the company's Canadian gas interests.

Whitehall Electric Investments, Ltd.

The report of this company was reviewed in our last issue (p. 985). The annual meeting was held on June 16th, when the Hon. Clive Pearson (chairman), who presided, said that in five years they had written off £695,000 in respect of debenture discount and stamp duties, leaving only £36,766 to be dealt with. After visiting Chile, he (the chairman) was well satisfied with the company's properties. The directorates of the Chilena and Valparaiso companies were confident that they were only at the threshold of the business which lay before them. Excellent progress had been made with the 22,000-kW hydro-electric plant on the Maipo river, and it was felt to be certain that the plant would be in operation by April next. Although Mexican conditions had not improved the companies in which they were interested reported relatively satisfactory results. The company's income for the past two years had been derived as to 80 per cent. from Chile and 20 per cent. from Mexico. He believed that there would be a satisfactory outcome of the present situation in Mexico and that there would be an improvement in income from that source.

Sphere Investment Trust, Ltd.

The report of this company (formerly the United Electric Tramways of Montevideo, Ltd.) for 1926 states that the whole of the company's tramway interests in Montevideo and some other assets have been sold to the Atlas Light & Power Co., Ltd. The outstanding debenture stock was satisfied by 5 per cent. debenture stock of the Atlas Co. The Trust has now no debenture stock outstanding, and possesses 450,000 7 per cent. cumulative preference shares and 500,000 ordinary shares of £1 each of the Atlas Co., with certain other investments. The change of name and the subdivision of the £5 shares were confirmed by the Court in March last. The revenue account for 1926 shows a credit balance of £33,872, taking no account of any final dividend to be declared on the ordinary shares of the Atlas Co. The directors recommend the payment of a dividend of 2 per cent. on the ordinary shares, leaving £1,872 to be carried forward. The retirement of Mr. H. F. Gunning from the board and the appointment of Messrs. D. M. Touche and A. J. Side as directors are mentioned in the report. Meeting: To-day (Friday).

Delhi Electric Tramways and Lighting Co., Ltd.

The combined net revenue of the tramway and lighting undertakings for 1926 amounted to £49,539, as compared with £45,019 for 1925. After crediting profit on exchange, &c., deducting general expenses and debenture interest, and adding £2,142 brought forward, there remains £51,849. The general reserve receives £15,001, depreciation and renewals £14,024, taxation reserve £7,000, and employés' provident fund £585. Dividends of 12 per cent. on the preferred and participating shares and 11.1724 per cent. on the ordinary shares are recommended, absorbing the whole of the available balance. A draft agreement for a bulk supply from the Government generating station is in the company's possession. Mr. A. W. R. Lovering was appointed a director during the year. Meeting, June 28th.

Fellows Magneto Co., Ltd.

The annual meeting was held on June 15th. Mr. V. L. Fellows (chairman) presided and presented accounts covering the two years ended December 31st last. He said that during 1925 the company ceased to make magnetos, and the directors were unable to present a balance sheet until the plant was written off. It was finally disposed of in February last. Since January 1st, 1926, they had established twelve successful provincial branches, and sales were showing a steady increase. The whole of the working capital was now really provided by the bank, which was requiring the reduction of its advances. After some discussion the report was adopted, and subsequently resolutions were carried providing for the reconstruction of the company upon the lines mentioned in our issue of June 10th, p. 941.

New Issue.

Lancashire Electric Light & Power Co., Ltd.—On Tuesday last this company offered for subscription £1,000,000 of 5 per cent. redeemable debenture stock at the price of £95 per cent. The stock is redeemable in 1980 or earlier at the option of the company. The proceeds are to be applied in providing for the purposes of the undertaking, including the erection of a power station at Kearsley and repaying bank advances. The initial plant at the Kearsley station will comprise four 42,000-h.p. sets and provision is to be made for the installation of two further sets. The first portion is expected to be put into operation by the end of 1929. Last year the company had a maximum demand of 80,000 h.p. on a plant capacity of 103,000 h.p.; the amount of energy sold was 146,580,000 kWh. The issue having been over-subscribed many times, the list was closed at 10 a.m. on Tuesday.

Aron Electricity Meter, Ltd.

The accounts for the past year show a net profit of £9,041 (as compared with £11,424 in 1925), and to this is added a balance of £2,942 brought forward, making £11,983. It is proposed to transfer £1,000 to reserve (against £3,000) and to pay a dividend of 6 per cent. on the ordinary shares (the same), leaving £2,376 to be carried forward. Meeting: June 28th.

Ransomes, Sims & Jefferies, Ltd.

The profit for the year ended March 31st last was £18,887 and the addition of £58,599 brought forward makes available £77,486. The directors do not feel justified in recommending the payment of an ordinary dividend, and after transferring £10,000 to reserve propose to carry forward the balance of £56,487.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

London Electric Supply Corporation.—199,800 ordinary shares of £1 each, fully paid, Nos. 499,501 to 699,300.

Pennsylvania Water and Power.—429,848 shares of capital stock of no par value.

Cape Asbestos Co., Ltd.

From the 1926 profits (amounting to £36,766 plus £10,491 brought forward), £15,000 has been transferred to reserve; a dividend of 10 per cent. is recommended on the ordinary shares and a similar dividend on the preference shares. £11,757 is carried forward.

United Water Softeners, Ltd.

Out of a profit of £20,770 for 1926 (against £19,091) the directors are again paying an ordinary dividend of 2s. per share, free of tax. The shareholders are offered, at 15s. each, 36,750 £1 shares in the Buell Combustion Co., which the company has received for its "Kek" interests.

British Electric Traction Co., Ltd.

This company's annual meeting was held on Tuesday last. A report will appear in our next issue.

Kidderminster and District Electric Lighting and Traction Co., Ltd.

The total net receipts for 1926 were £7,545, and to this figure is added £454 brought forward, making £7,999. Of this £1,000 is allocated to renewals, and £800 to reserve. The directors propose to pay an ordinary dividend of 2½ per cent. and carry forward £465. After providing for renewals, the profit of the Kidderminster & Stourport Electric Tramway Co. is £99. This is added to £625 brought in and the whole is carried forward.

Chile Telephone Co., Ltd.

It was reported last week that the purchase of the company's business by the International Telephone & Telegraph Corporation had been completed. The latter has already acquired control of All-American Cables, Inc., and the Montevideo Telephone Co., Ltd.

Guest, Keen & Nettlefolds, Ltd.

The net profit for the year ended March 31st last fell from £948,298 to £909,278. The balance brought forward is £235,639, which makes available £1,144,917. The ordinary dividend is maintained at 10 per cent. free of tax, and £208,451 is carried forward.

Anglo-Argentine Tramways Co., Ltd.

A dividend of 2s. 9d. per share has been declared on the 5½ per cent. first preference shares and one of 3s. per share on the 6 per cent. second preference shares, in respect of the half-year ending June 30th.

James Keith & Blackman Co., Ltd.

The directors report improved business during 1926, the net profit amounting to £35,806, as compared with £25,858 for 1925. The ordinary dividend is raised from 10 to 12½ per cent. and the amount put to reserve from £5,000 to £8,000.

Dorman, Long & Co., Ltd.

The directors have again decided to pass the dividend on the non-cumulative preferred ordinary shares, and consideration of the payment of the dividend on the cumulative preference shares is postponed.

Lancashire Dynamo and Motor Co., Ltd.

The holders of the company's debentures are being asked to agree to the postponement of the redemption date for 20 years from June 30th. In consideration of this it is proposed to raise the rate of interest from 5 to 6 per cent.

International Light and Power Co., Ltd.

A dividend of 3 per cent. (less British tax) has been declared on the preference shares in respect of the half-year ending June 30th.

Falkirk Iron Co., Ltd.

From the 1926-27 profits the directors propose to pay a final dividend of 5 per cent., making 10 per cent. for the year as for 1925-26. £10,000 is placed to reserves and £35,596 carried forward.

Lisbon Electric Tramways, Ltd.

The half-yearly dividend has been declared on the 6 per cent. cumulative preference shares.

Swedish-Mexican Company.

The report for 1926 of the *Mexikanska Telefon a.b. Ericsson* states that development proceeded very satisfactorily. Hitherto the company has only carried on the telephone business in Mexico City and environs, but during 1926 an interurban concession was granted for the whole of the republic and for the installation of telephones throughout the country. In order to finance this extension, which has already begun, the share capital has been increased from 5,400,000 kr. to 10,800,000 kr. The net profits are returned at 1,127,000 kr., as compared with 970,000 kr. in 1925, and the dividend is 10 per cent. on the increased capital, as against 12 per cent. on half of this capital in 1925.

German Company.

The *Accumulator Works Company*, Berlin-Hagen, reports that the stagnation in sales in 1925 continued in the first half of 1926, but in the second half a revival took place in automobile and radio batteries. The turnover in large stationary batteries continued to be unsatisfactory. The export business did not improve, and only the hope of better times justified the maintenance of the export organisation. The accounts show net profits of 1,991,000 marks, as compared with 1,929,000 marks in 1925, the dividend remaining at 8 per cent. on the share capital of 20,000,000 marks.

French Companies.

The *Etablissements Gaiffe-Gallot et Pilon* report net profits of 1,727,000 fr. for 1926; the dividend is 60 fr. per share.

The *Société l'Appareillage Electro-Industriel* (*Petrier Tissot et Raybaud*) has decided to pay a dividend of 20 fr. per share out of net profits of 770,000 fr. for 1926.

The *Compagnie Lorraine de Charbons, Lampes et Appareillages Electriques* records net profits of 691,000 fr. for 1926; the dividend is 15 fr. per share.

Stocks and Shares.

Monday Evening.

When Money Matters.

With the near approach of the end of June, it is usual for money conditions to become a little strained, owing to the ordinary seasonal requirements for window-dressing and other purposes. Banks and private firms who have had money out on loan sometimes make the end of June, as they do the end of the calendar year, a convenient peg upon which to hang requests for repayment, and to curtail facilities which would be in the ordinary way granted with little hesitation. Experience looks for tightening of money rates at this time of the year, a tendency that reacts, of course, upon Stock Exchange prices, more particularly those of the gilt-edged variety. Speculative stocks and shares are less influenced by purely financial considerations, though in their case, as in that of the investment securities, the contraction of contango facilities serves to check enterprise on the part of those who look to such assistance for the financing of their commitments.

Brazilian Tractions.

In view of the enormous amount of new capital which has been issued for public subscription during the past few months, and the fact that a good many of the recent comers are still partly paid, the firmness of Stock Exchange markets as a whole is significant of the public's willingness to invest money and of their ability to pay for their purchases. Brazilian Tractions continue amongst the liveliest of the speculative counters, and, although the price has gone back 8 points to 167, this reaction is comparatively trifling in view of the extraordinary rise that has taken place in the shares over the past three months. No fresh developments have been reported from the company, but the market is wedded to the idea that, before long, there will be some kind of bonus, in addition to an increase in the present dividend rate of 6 per cent. per annum. The preferred shares have moved in consonance with the common shares, and are down 7 points at 146.

Ex Dividend Recoveries.

British Electric Traction ordinary has gained another 2 points at 153, there being a steady pressure to buy the stock and a small amount of floating supply on offer in the market to meet the demand. The 6 per cent. preferred has risen to 121½. No changes have occurred in the London group of traction issues. Districts have gone ahead to 63½. A good many stocks and shares are quoted ex the interest and dividends due at this time of the year, amongst these being both classes of Anglo-Argentine Tramways preference and British Columbia Electric preferred and deferred. The disposition is for dividend deductions to be recovered, at any rate in part, almost as soon as they are taken off the prices, from which it is evident that when the quotations are marked ex, the yield on the reduced valuation attracts prompt attention and leads to inquiries for the stocks and shares affected.

New Issues.

New issues continue to make their appearance, though at a slower rate than has recently been the case. The Lancashire Electric Light and Power Company has been offering 5 per cent. debenture stock at 95, a well-secured investment and one that is likely to appeal to the buyer of sound industrial issues. The stock made its appearance under auspices which suggest that, as soon as the stags have completed their operations and the market has settled into a normal condition, there is likely to be a premium of a point or two as the stock becomes absorbed by hands that will hold it permanently. The West Midlands Joint Electricity Authority has been offering two million pounds 5 per cent. stock at 98, of which a quarter is to be allotted fully-paid in part payment of properties to be acquired, and the other 75 per cent. was available for public subscription. The Authority will operate in an area covering a thousand square miles in Staffordshire, Shropshire and Worcestershire, and at the outset will possess generating plant which last year produced nearly 125 million kWh. The first interest payment is one of 12s. 6d. per cent., due in October this year. Redemption at 100 will take place in 1968 or any time after 1948 at the same figure. Underwriters were left with 60 per cent. of their obligations, and the price of the scrip is 1 discount.

London Electrics.

Competition from these newcomers affected the price of the new County of London Electric 5 per cent. debenture recently issued at 96. The premium diminished to about ¾, at which price the stock is obtainable in the market free of stamp and fee, to give £5 3s. per cent. on the money. The first interest payment is one of 28s. 1d. per cent., payable in December this year. No changes occurred in the price of Lancashire shares, which remain at 26s. middle, but Notting Hill preference, which so rarely move, put on 5s. to 10¼, upon a small demand. Edmundsons improved upon their last week's rise, going ahead to 29s. 6d., and the company's preferences strengthened to 24s. Bournemouths parted with a portion of their improvement, coming on offer at £3 a share. No movements of importance have occurred in the London group, a drop of 6d. in City Lights to 27s. being balanced by an advance of the same amount in Kensingtons to 25s. 6d. Yorkshire (West Riding) preference strengthened to 13s. 9d.

The Telephone Octopus.

It was announced from Santiago last week that the sole ownership of the Chile Telephone Company has been acquired by the American International Telephone and Telegraph Corporation as the result of negotiations in London. These negotiations, it need scarcely be said, have been reflected in the steady rise which has lifted the price of Chile Telephones to 7⅞, at which the yield on the money, on the basis of the last dividend, is a meagre 3⅞ per cent. The American International Telephone and Telegraph Corporation is a keen buyer of telephone companies throughout South America, and not long ago acquired control of the Montevideo company. Lately, the remarkable advance in the price of United River Plates has been ascribed to purchases made for the probable purpose of obtaining control by the same omnivorous corporation. The United River Plate report showed an increase of £50,000 on the company's profit last year, to £455,000. The company's meeting, held on Tuesday in this week, was awaited with great interest, it being expected that the chairman would make some reference to the presumed angling by the American concern for the United River Plate company.

Telephony at Home.

Telephone Manufacturing shares, which had a severe fall earlier this month on the issue of a report that was disregarded as disappointing, have been a firmer market round about 7s. The shares are of the nominal value of 10s. each, and the company, having recently paid off its debentures, was expected to be able to declare a modest dividend on the ordinary shares in respect of the year recently ended. This, however, as already mentioned, the directors were unable to recommend. At the meeting last Friday the chairman accused the Government of curtailing expenditure in a Department, that is, the telephone, which is not only revenue-producing, but of importance in assisting revival in trade. He maintained that the telephone service should be handed over to a body run on similar lines to the Metropolitan Water Board or the Port of London Authority, with a man at the head of it who shall be the best business man obtainable, regardless of salary. Additional capital for the telephone service, he argued, could be obtained from the investing public in the shape of telephone bonds. It has long been a matter for criticism, of course, that this country should lag behind other parts of the world in the provision of cheap and efficient telephony. Automatic Telephones are steady at 47s. 6d., and Internationals remain at 39s. 6d.

Wireless.

The rise in Marconis suffered a sharp check, as mentioned last week, upon the opposition that has redeveloped in connection with the arrangements that the directors desire to make in connection with placing the capital account upon a sounder basis. Marconis went back to 20s., but Canadian Marconis, which rumour declares to be the object of desire to the Radio Corporation of America, keep up steadily at their advanced price of 5s. 6d. Other wireless shares are quiet. India-Rubber, Gutta-Percha shares have fallen 2s. 6d. to £1, in consequence of the announcement that no interim payment will be paid on the ordinary shares.

"Dollar" Stocks.

Henleys hold their substantial advance at 4¾, on the increase in the dividend and the important contracts which the company has just secured from the Great Indian Peninsula Railway and the Eastern Telegraph Companies. Whitehall Electric preference remain at 20s. 6d., being a rather better market on the statement by the Hon. Clive Pearson at last week's meeting to the effect that 80 per cent. of the company's income has been derived from Chile and rather under 20 per cent. from Mexico. This sets at rest the doubt which had been felt in regard to the amount of the stock which the Whitehall company possesses in Mexico. The chairman declared his belief that the Mexican Government realises that recent legislation is detrimental to the well-being of the country, which, with its population of 15 millions and great resources, feels the vital necessity for the development which electrical power offers. Mexico Tramways common shares are 2 better, at 26. Amongst other "dollar" stocks, St. Maurice Power 6½ per cent. first debentures are 3 higher at 105. Quebec Power 6 per cent. "A" debentures hardened to 105½. Shawinigan common have gone back to 89½.

Points.

Lisbon Electric Trams rose to 21s. 6d. on the declaration of a 3 per cent. dividend, making 6 per cent. for the year, and the pleasant surprise of a 50 per cent. bonus in £1 ordinary shares through application of £317,000 of the reserve. The company's ordinary shares had been out of the dividend list since 1916 until six months ago, when an interim dividend of 3 per cent. was paid. The Aron Electricity Meter repeats the 6 per cent. dividend on its ordinary shares, the price of which is 16s. 6d. The newly-issued Electric Finance preference are steady at 1s. 3d. premium, and the Newcastle-on-Tyne new shares attract a good deal of business on the basis of 9d. to 1s. premium. Rubber shares enjoyed a little burst of strength on the Government's announcement that it did not contemplate removal of the Stevenson Restriction scheme. The hopefulness so engendered was chastened by a further fall in the price of rubber to 1s. 4½d. per lb.

Share List of Electrical Companies

	Nom.	Dividend. 1925.	Dividend. 1926.	Price June 20 1927.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	59/6	—6d	4 14
Brompton Ordinary	1	10	8⅝	25/-	—	5 12
Charing Cross Ordinary	1	15	8½	25/6	—	5 12
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2
Chelsea	1	12	8¾	25/-	—	5 12
City of London	1	15	10	27/-	—6d.	7 8
do. do. 6% Pref.	1	6	6	22/6	—	5 6
Clyde Valley	1	8	8	30/6	—	5 5
County of London	1	15	7½	28/-	—	5 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6
Edmundson's Ordinary	1	7	8	29/6	+1/3	5 8
do. 7% Pref.	1	6	7	21/-	+6d.	5 16
Elec. Supply Corporation	1	10	10	32/-	—	6 5
Kensington Ordinary	1	15	8	25/6	+6d.	6 5
Lancs. Light and Power	1	7½	7½	26/-	—	5 15
London Electric	1	10	8½	24/-	—	5 16
do. do. 6% Pref.	5	6	6	5⅝	—	5 6
Metropolitan	1	11	8	29/-	—	4 16
do. 4½% Pref.	1	4½	4½	17/-	—	5 8
Midland Counties	1	5½	6	22/6	—	5 6
Newcastle-on-Tyne Ordinary	1	7	5	22/6	—	4 8
do. 5% Pref.	1	5	5	17/6	—	5 14
do. 7% Pref.	1	7	7	24/6	—	5 14
Notting Hill 6% Pref.	10	6	6	10½	+½	5 17
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9
St. James' and Pall Mall	5	17½	8	25/6	—	5 9
South London	1	15	8⅝	25/-	—	5 12
South Metropolitan Pref.	1	7	7	1½	—	6 8
Urban Ordinary	1	7	7	25/-	—	5 12
do. 6% Pref.	1	6	6	1 7/16	—	5 13
Westminster Ordinary	1	15	8½	25/-	—	5 12
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	—	7 6
Yorkshire Elec.	1	8	8	30/-	—	5 6
Home Rails.						
Central London Ord. Assented	Stock	4	4	71	—	5 12
Metropolitan	,,	5	3	60	—	5 0
do. District	,,	3½	3½	63½	—2½	5 10
Underground Electric	£1	Nil	1½	18/-	—6d.	1 13
do. do. Income	Bonds	6	6	102	—	*5 17
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 19
do. Def.	,,	1½	1½	24½	—	6 2
Automatic Telephone	1	8	10	47/6	—	4 3
Chili Telephone	5	5	6	7⅞	—	3 17
Eastern Extension	10	10	10	18⅜	—	*5 6
Eastern Tel. Ord.	Stock	10	10	182½	—	*5 9
Globe Tel. and T. Ord.	10	10	10	18⅝	—	*5 6
do. do. Pref.	10	6	6	11⅛	—	5 8
Great Northern Tel.	10	20	20	28½	—	7 0
Indo-European	25	8½	10	45½	—	*5 7
Marconi	1	Nil	Nil	1	—⅛	...
Marconi-Marine	1	7½	8¾	27/-	—	6 9
Oriental Telephone Ord.	1	12	12	53/9xd.	—	*4 9
United R. Plate Tel.	5	8	8	9¾	—	*4 2
Western Telegraph	10	10	10	17½xd.	—	*5 14
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3 7/16xd	—	8 0
do. do. 2nd Pref.	5	6	6	3 9/16xd	—	8 8
do. do. 5% Deb.	Stock	5	5	72½	+1	6 17
British Electric Traction Ord.	,,	8	8	153	+2	5 4
do. do. 6% Pref.	,,	6	8	121½	+1	6 11
Brazil Traction	100	5	6	167	—8	3 12
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	90½	—	5 11
do. do. Preferred		6¾	6¼	120xd	—	5 4
do. do. Deferred	,,	8	8	155xd	—	*5 8
do. do. Deb.	,,	4¼	4¼	80½	—	5 5
London & Sub. Trac. 5% Pref.	1	Nil	Nil	7/9	—	Nil
London United Tram. Deb.	Stock	4	4	52⅜	—	7 12
Mexico Trams, 5% Bonds	—	5	5	81⅜	—	6 2
Mexican Light Common	100	Nil	Nil	43	—	Nil
do. Pref.	100	Nil	Nil	108½	—2	Nil
do. 1st Bonds	—	5	5	73½	—1	6 16
Yorkshire (West Riding)	1	5	—	8/9	—	...
Manufacturing Companies.						
Babcock & Wilcox	1	13	13	52/6	—	4 19
British Aluminium Ord.	1	12½	10	43/-	—	4 13
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13
British Insulated Ord.	1	15	15	67/6	—	4 8
Brush Ord.	1	10	10	26/3	—	7 12
Callenders	1	15	15	3 7/8	—	4 7
do. 6½% Pref.	1	6½	6½	23/9	—	5 9
Crompton Ord.	1	Nil	Nil	12/6	—	...
Edison-Swan	4/-	10	10	10/	—	4 0
do. 5% Deb.	Stock	5	5	85	—	5 17
Electric Construction	1	10	7½	26/3xd	—	5 14
Enfield Cable Pref.	1	7½	7½	25/6	—	5 17
English Electric	1	Nil	Nil	10/-	—	...
do. do. Pref.	1	3	—	12/6	—	...
Gen. Elec. Pref.	1	6½	6½	23/6xd	—	5 10
do. Ord.	1	7½	—	30/6	—	4 18
Henley	1	20	25	4⅜	—	5 5
do. 4½% Pref.	5	4½	4½	4¼	—	5 6
India-Rubber	1	5	5	1	—⅛	*5 0
Johnson & Phillips	1	17½	12½	2½	—	5 0
Met.-Vickers Ord.	1	8	8	27/6	—	5 11
do. Pref.	2	8	8	28⅜	—	6 14
Siemens Ord.	1	7½	7½	27/6	—	5 9
Telegraph Construction	12	10	10	28½	—	*4 4

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during May, 1927.

THERE was a satisfactory rise in our electrical exports during last month, although as regards the individual items, increases and decreases were equal in number. The principal increase occurred in the case of unenumerated electrical machinery, which was over £66,000 above the April total. Insulated wires and cables also improved, to the extent of £51,564, while important rises were recorded for the other two machinery classes—railway and tramway motors and "other" motors and generators. The exports of unenumerated electrical goods and apparatus showed the greatest fall; the other decreases, apart from that of £16,222 in submarine cables, were not of very great dimensions. As was to be expected, the comparison with May last year shows a heavy increase. On account of the general strike, the exports during May, 1925, reached a low level, though not so low as it might have been. There was, however, one substantial decrease last month, *i.e.*, the fall of £33,516 in telegraph and telephone instruments and apparatus. A decrease in meters and instruments is also to be noted.

The following figures show the distribution of exported electrical machinery:—

Destination.	May, 1926. £	May, 1927. £	Inc. or dec. £
European countries	58,528	104,870	+46,342
Japan	24,475	21,781	− 2,694
South-American countries ...	25,063	69,806	+44,743
South Africa	54,059	99,884	+45,825
British India	91,457	89,567	− 1,890
Australia	90,430	101,295	+10,865
New Zealand	31,779	30,655	− 1,124
Canada	10,991	34,112	+23,121
Other countries	38,401	55,572	+17,171
Totals	£425,183	£607,542	£182,359

The import section was affected to a greater extent by the general strike, and there was an increase last month in every section as compared with May, 1925, while the total increase was proportionately very large. Unenumerated electrical machinery was the class showing the greatest rise. Comparing the figures with April last, it is seen that unenumerated machinery again led the list of increases. There were only three classes which showed a reduction—unenumerated goods and apparatus, insulated wires and cables, and telegraph and telephone apparatus.

The dwindling tendency shown by re-exports continued during May, although, naturally, they were higher than in the corresponding month of last year.

The totals for the completed portion of the year are of a favourable nature, but the imports have risen in greater proportion than the exports.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for May, 1927.	Inc. or dec. as compared with Apl., 1927.	Inc. or dec. as compared with May, 1926.	Electrical imports for May, 1927.	Inc. or dec. as compared with Apl., 1927.	Inc. or dec. as compared with May, 1926.	Electrical re-exports for May, 1927.	Inc. or dec. as compared with Apl., 1927.	Inc. or dec. as compared with May, 1926.
Electrical goods and apparatus (unenumerated)	£186,433	− £34,413	+ £66,164	£96,579	− £1 199	+ £16 387	£4,224	+ £417	− £43
Insulated wires and cables ...	257,913	+ 51,564	+ 58 675	58,866	− 2.1 8	+ 36,918	334	− 420	− 421
Flow lamps	54,211	− 9,369	+ 25,808	21,438	+ 2.077	+ 9 896	1.485	+ 520	+ 1,382
Arc lamps and parts ...	532	− 500	+ 465	4,017	+ 1,777	+ 2,472	51	− 59	− 69
Batteries and accumulators ...	99,828	+ 5,979	+ 36,101	42.593	+ 626	+ 18,(80	718	− 8	+ 119
Meters and instruments ...	30,283	+ 825	− 6,052	29,246	+ 9,690	+ 15 098	253	− 470	+ 17
Carbons	1,952	− 129	+ 477	11,153	+ 2,178	+ 3,904	5	+ 142	− 16
Electrical Machinery—									
Electrical machinery (unenumerated	355 061	+ 66,065	+ 111,871	166,935	+ 19,520	+ 85 939	9,024	− 857	+ 6,575
Railway and tramway motors	63 303	+ 27,958	+ 9,534	—	—	—	—	—	—
Other motors and generators...	189,178	+ 42.538	+ 60,954	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	2,902	− 2,061	+ 65	406	+ 406	+ 378	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	84,242	+ 18,777	+ 32,773	7 042	+ 2,570	+ 2,686	179	− 1,931	+ 164
Submarine telegraph and telephone cable...	33,422	− 16,222	+ 33,176	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	193,471	− 7,368	− 33,516	27.065	− 1,173	+ 3,898	1,517	− 2,231	− 1,305
Totals	£1,552,731	+£143.644	+£394,495	£465,340	+£35,351	+£195,686	£17,790	−£5,181	+£6,403
Increases and decreases for five months of 1927 ...		Exports: + £978,347			Imports: + £381,153			Re-exports: − £6.344	

Remotely-controlled and Automatic Plant.

Some particulars are given in a recently-issued bulletin of Messrs. Oerlikon, Ltd., of the new hydro-electric generating station which has been erected at Ranconniere, Switzerland, for the supply of power to Le Locle, about two miles away. The plant presents the special feature of being controlled automatically, both on the hydraulic and the electrical sides. Two Oerlikon sets, one 500- and one 350-kVA, are installed, and the station is linked up to the Le Locle distribution station, working either alone or in parallel with the neighbouring system. The generators are synchronous induction machines. The governor regulators and the turbine governors are remotely controlled from the Le Locle distribution station, where a secondary regulator is also provided for automatic pressure regulation. Provision is also made for the automatic closing down of the plant in the event of a fault in the pilot cables, racing of the turbine, too great an overload, or excessive heating of the vital machine parts. Details of an interesting outdoor substation which has lately been erected at Berthoud, Switzerland, by the Bernese Power Supply Co., are also given. It serves to step down the pressure from 45,000 V to about 17,000 V, and at the same time to keep the pressure between given limits by regulation. The plant consists at the present time of one 6,000-kVA transformer-induction regulator equipment; provision has, however, been made for two or three further regulators to be installed at a later date. Both the transformer and induction regulator are of the oil-immersed self-cooled type, the transformer being provided with stacks of cooling tubes, while the induction regulator is in an ordinary corrugated iron tank and is designed for regulating the pressure between 14,400 and 17,600 V; it is operated, under normal conditions, automatically by means of a motor controlled by a quick-acting pressure regulator. The motor is arranged in a separate casing on the side of the regulator. The whole operating gear is enclosed and designed so as to meet the special conditions imposed by outdoor mounting.

South African Electrical Trade.

Figures for 1925 and 1926 Compared.

THE following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1926, has been compiled from the recently-issued official trade statistics. The figures for 1925 are added for purposes of comparison, and notes of any increases or decreases are made.

	1925. £	1926. £	Inc. or dec. £
Electrical cable and wire—			
Total	596,000	604,000	+ 8,000
From Great Britain... ...	567,000	554,000	− 13,000
,, United States ...	4,000	5,500	+ 1,500
,, Germany	20,000	41,000	+ 21,000
,, Belgium	2,000	3,000	+ 1,000
Heating and cooking apparatus—			
Total	36,000	69,000	+ 33,000
From Great Britain... ...	24,000	35,000	+ 11,000
,, United States ...	4,000	12,000	+ 8,000
,, Germany	6,000	6,000	—
Meters, electric—			
Total	29,000	34,000	+ 5,000
From Great Britain... ...	21,500	26,000	+ 4,500
,, Germany	5,000	6,000	+ 1,000
,, United States	1,000	1,000	—
Insulators—			
Total	26,000	16,000	− 10,000
From Great Britain... ...	23,000	7,000	− 16,000
,, United States ...	750	6,500	+ 5,750
,, Germany	1,400	1,200	− 200
Electrical material, other—			
Total	33,000	30,000	− 3,000
From Great Britain... ...	20,000	12,000	− 8,000
,, United States ...	7,000	5,500	− 1,500
,, Germany	5,000	4,000	− 1,000
,, Czecho-Slovakia ...	800	—	− 800
,, France	300	4,000	+ 3,700
Electric hand lamps—			
Total	14,000	16,000	+ 2,000
From Great Britain... ...	1,700	2,500	+ 800
,, Germany	2,700	2,500	− 200
,, United States ...	8,000	11,000	+ 3,000
Other electric lamps, globes, bulbs, &c.—			
Total	162,000	141,000	− 21,000
From Great Britain... ...	90,000	80,000	− 10,000
,, Austria	4,000	6,000	+ 2,000
,, Germany	14,000	13,000	− 1,000
,, Holland	33,000	31,000	− 2,000
,, United States ...	16,000	8,000	− 8,000
,, China	3,000	—	− 3,000
Electric lighting outfits, self-contained—			
Total	19,500	25,500	+ 6,000
From Great Britain... ...	2,000	8,000	+ 6,000
,, United States ...	16,000	17,500	+ 1,500
Wireless apparatus and parts—			
Total	102,000	56,000	− 46,000
From Great Britain... ...	84,000	45,000	− 39,000
,, United States ...	7,000	9,000	+ 2,000
,, Germany	4,600	600	− 4,000
,, Denmark	1,700	800	− 900
,, France	1,500	800	− 700
,, Holland	1,600	500	− 1,100
Telegraph and telephone material—			
Total	34,000	62,000	+ 28,000
From Great Britain... ...	16,000	41,000	+ 25,000
,, Sweden	2,000	4,000	+ 2,000
,, United States ...	6,000	4,000	− 2,000
,, Germany	7,600	10,000	+ 2,400
,, Belgium	1,500	3,000	+ 1,500
Batteries, primary—			
Total	22,000	52,000	+ 30,000
From Great Britain... ...	8,000	11,000	+ 3,000
,, United States ...	10,000	31,000	+ 21,000
,, Germany	1,500	3,500	+ 2,000
,, Denmark	1,500	6,500	+ 5,000
Batteries, secondary—			
Total	38,000	60,000	+ 22,000
From Great Britain... ...	8,000	15,500	+ 7,500
,, United States ...	23,000	38,000	+ 15,000
,, Germany	6,000	5,000	− 1,000
Motors—			
Total	146,000	122,000	− 24,000
From Great Britain... ...	102,000	68,000	− 34,000
,, United States ...	17,000	29,000	+ 12,000
,, Germany	16,000	13,000	− 3,000
,, Holland	3,000	7,000	+ 4,000
,, Sweden	5,000	2,500	− 2,500
,, Denmark	2,000	1,500	− 500

	1925. £	1926. £	Inc. or d £
Transformers—			
Total	114,000	62,000	− 52,00
From Great Britain... ...	102,000	40,000	− 62,00
,, United States ...	7,000	12,000	+ 5,00
,, Germany	1,000	6,000	+ 5,00
Dynamos and generators—			
Total	70,000	28,000	− 42,00
From Great Britain... ...	64,000	23,000	− 41,00
,, Germany	3,000	2,000	− 1,00
,, United States ...	3,000	3,000	—
Electrical machinery, other—			
Total	789,000	907,000	+118,00
From Great Britain... ...	592,000	687,000	+ 95,00
,, United States ...	83,000	95,000	+ 12,00
,, Germany	64,000	95,000	+ 31,00
,, Sweden	10,000	4,500	− 5,50
,, Canada	16,000	400	− 15,60
Tramway rails and materials—			
Total	50,000	62,000	+ 12,00
From Great Britain... ...	24,000	29,000	+ 5,00
,, United States ...	19,000	23,000	+ 4,00
,, Germany	5,760	9,000	+ 3,24
Tramway rolling-stock—			
Total	12,000	10,000	− 2,00
From Great Britain... ...	6,000	6,000	—
,, United States ...	6,000	4,000	− 2,00
Engines, oil, petrol and spirit—			
Total	47,000	61,000	+ 14,00
From Great Britain... ...	41,000	46,000	+ 5,00
,, United States ...	5,000	12,000	+ 7,00
,, Germany	1,000	700	− 30
,, Sweden	—	1,000	+ 1,00
Engines, steam and gas—			
Total	105,000	50,000	− 55,00
From Great Britain... ...	103,000	49,000	− 54,00
,, United States ...	1,000	1,000	—
,, Germany	600	—	− 60

In addition to the above the following goods were import as "Government stores":—

Batteries, primary—			
Total	1,500	2,300	+ 80
From Great Britain... ...	1,000	100	− 90
,, Germany	—	600	+ 60
Batteries, secondary—			
Total	2,500	4,800	+ 2,30
From Great Britain... ...	1,000	1,000	—
,, United States ...	400	400	—
,, France	—	3,400	+ 3,40
Heating and cooking apparatus—			
From Great Britain... ...	490	10	− 48
,, United States ...	100	70	− 3
Insulators—			
Total	4,800	6,000	+ 1,20
From Great Britain... ...	4,400	6,000	+ 1,60
,, United States ...	300	—	− 30
Motors and parts—			
Total	1,000	3,000	+ 2,00
From Great Britain... ...	1,000	3,000	+ 2,00
Dynamos and generators—			
Total	6,700	21,000	+ 14,30
From Great Britain... ...	6,000	21,000	+ 15,00
Transformers—			
Total	1,000	400	− 60
From Great Britain... ...	1,000	300	− 70
Electrical cable and wire—			
Total	101,000	87,000	− 14,00
From Great Britain... ...	79,000	60,000	− 19,00
,, United States ...	3,500	3,000	− 50
,, Canada	6,500	500	− 6,00
,, Denmark	10,000	100	− 9,90
,, Germany	500	23,000	+ 22,50
Electrical machinery, other—			
Total	141,000	311,000	+170,00
From Great Britain... ...	133,000	293,000	+160,00
,, United States ...	3,000	14,000	+ 11,00
Telegraph and telephone material—			
Total	190,000	196,000	+ 6,00
From Great Britain... ...	153,000	139,000	− 14,00
,, United States ...	13,000	5,000	− 8,00
,, Sweden	15,000	29,000	+ 14,00
,, Germany	2,000	10,000	+ 8,00

Radio Battery Eliminators.

Appliances for the operation of broadcast radio-telephone receiving apparatus by energy derived from the domestic electricity supply mains.

By P. R. COURSEY, B.Sc., M.I.E.E., and H. ANDREWES, B.Sc., Graduate I.E.E.

(*Abstract of paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

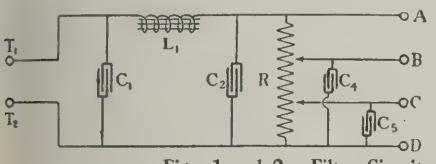
THE modern radio-telephone receiver has to be energised from three distinct sources of sensibly steady direct current, namely :—

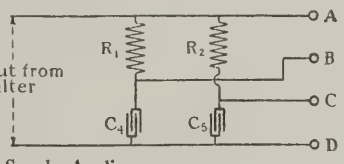
(i) High tension, usually between 45 and 150 volts, and a few milliamperes only are generally required; pressures lower than 45 V are sometimes needed, while more than 150 V is called for by some receiving sets, such higher voltages being very desirable in many cases, but only used as a rule when suitable appliances, other than batteries, are available.

(ii) Low tension, 2, 4, or 6 volts, and a current not exceeding from 1.5 to 2 amperes usually suffices.

(iii) Grid bias, up to about 20 volts, and almost infinitesimal current.

Large-capacity by-pass condensers are usually connected across the h.t. and grid-bias supply terminals; they provide a





Figs. 1 and 2.—Filter Circuits for H.T. Supply Appliances.

means of reducing the accidental, or unavoidable, coupling between various stages of a multi-valve radio receiver, and the possibility of a higher internal impedance in these appliances renders the presence of these by-pass condensers all the more necessary for stable operation.

H.T. D.C. Appliances.—The essential elements of an appliance for use on a d.c. circuit are sketched in fig. 1, which combination acts as a filter to suppress currents of the higher frequencies: the first condenser C_1 by-passes a proportion of the ripple frequencies, since the reactance of the condenser falls for increasing frequencies; the choke L_1 offers an impedance to these ripples, which increases with the frequency, thus allowing only the lower frequencies to pass through to the second condenser C_2 which offers a further selective action similar to the first condenser C_1. The general form of this filter is of the well-known " low-pass " type.

The full voltage across C_2 is obtained from A and D to which the radio set may be connected; with a 200-240-volt supply at least 200 volts is usually available at these output terminals, the difference being the voltage-drop due to the resistance of the choke. Most radio apparatus, however, requires one or more lower voltages in addition to the full output voltage, which may be obtained by a potentiometer across A D such as is indicated by the resistance R in fig. 1, with the two (or more) tapping points connected to the terminals B and C. It is desirable to connect additional condensers (of at least 1 μF capacity) across the additional voltage tapping points, as shown at C_4 and C_5, to provide additional smoothing, but more important is their action in preventing excessive coupling between valves when more than one valve stage is operated from any one tapping point. If the condensers were omitted the varying anode currents drawn by each valve of the radio receiver would be forced to travel through a portion at least of the resistance R, producing across its terminals a voltage-drop of the same frequency, which would in consequence be communicated to the remaining valves in the receiver. Low-frequency oscillations (" howling ") would then be very liable to occur. The low impedance offered by the by-pass condensers C_1 and C_5 to the passage of alternating currents effects a considerable diminution of the voltages available for producing such feed-back effects. It is for this reason also that the capacity of the output condenser C_2 must likewise be large; a minimum capacity of 2 μF is customarily used, but larger values are desirable. A very frequently used arrangement omits the portion of the potentiometer between the tapping point and the h.t. negative terminal D, which modification is shown in fig. 2. This arrangement is simpler and has the additional advantage of somewhat reducing the coupling between different valves, since the total h.t. current is subdivided through different resistance; it results, however, in somewhat greater voltage variation of the tapping points B and C with changes in the load current drawn by the valves.

If a potentiometer arrangement is used, R needs to be high, or it will draw too large a current through the filter. Normally the resistance of the chokes L_1 and L_2 is much in excess of 1,000 ohms, in order to obtain a large inductance in a small space and at a reasonable cost, so that only a few milliamperes can be drawn through the filter without causing excessive voltage-drop. For this reason also the method of fig. 2 is advantageous as it makes a smaller demand upon the filter. Convenient values for R_1 and R_2 are between 10,000 and 100,000 ohms.

H.T. Filter.—With a rectifier, the percentage ripple remaining superimposed on the resulting unidirectional voltage depends upon the output (load) and on the capacity of the smoothing condenser; the larger the condenser the smaller is the ripple voltage.

When, however, a d.c. feeds the filter, the amplitude of the ripple voltage on the system is determined by the generators, &c., on the system, usually of large power capacity, so that the amplitude of the ripple voltage is not very much (if at all) affected by connecting a condenser C_1 across the circuit. The three important factors are :—

(1) The internal resistance of the choke windings as affecting the " regulation " of the apparatus on load.

(2) The resonance, or " pass," frequency of the filter as controlled by the inductance of the choke and the capacity of the condensers, and as affecting its efficiency in removing " hum."

(3) The output impedance of the filter at audio frequencies, as controlled mainly by the capacity of the output condenser of the filter, and as affecting the load which may be drawn from the filter without producing oscillation between the stages of the receiver.

Improvement of all three factors invariably increases the cost of the apparatus. The choke coil and output condenser should be as large as possible, consistent with reasonable cost of the complete appliance, but at the same time the resistance of the choke coil should not be unduly increased to obtain a very high inductance, or the output of the filter will thereby be impaired. Increasing the condenser capacity is therefore of more value than increasing the choke inductance, especially as it also reduces the a.c. impedance of the output circuit. It would appear desirable that the resonant frequency of these two components should be as low as possible, and in any case, if the filter is to be used with an a.c. rectifier, this frequency

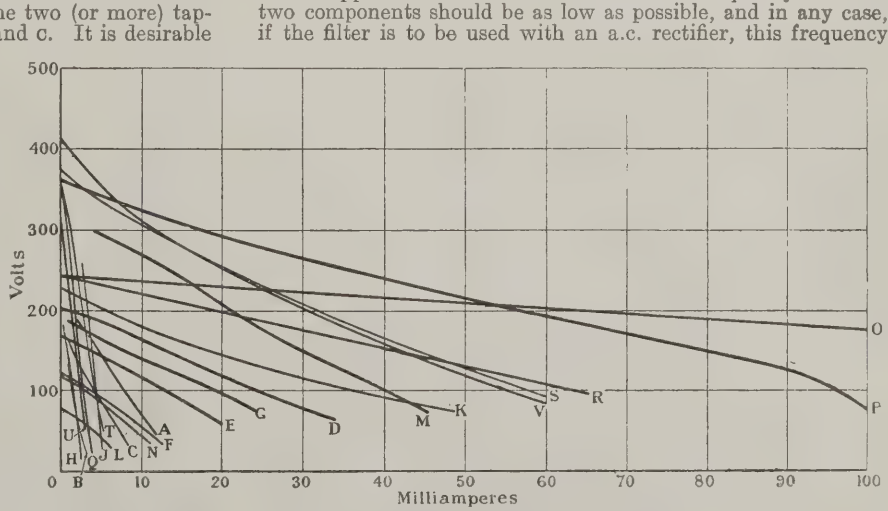


Fig. 3.—Output Characteristics of Commercial H.T. Appliances.

must be below 50 cycles per second. In order that the filter shall be reasonably efficient at this frequency, its resonant or " pass " frequency should apparently not exceed 25 cycles per second. Some curves show a subsidiary " hump " which might have a serious effect on the efficiency of the filter, particularly if it should occur near 50 or 100 cycles; this possibility emphasises the desirability of plotting the frequency characteristics of any filter that it is proposed to use.

Ripple Voltages.—The magnitude of the a.c. ripple in the output circuit permissible without serious effect upon the

quality of the sounds emitted depends upon the design of the receiver itself. Usually the greatest source of disturbance in the receiver is the detector valve; with a given ripple voltage in the h.t. supply to the receiver the intensity of the hum heard in head-phones used with a single detector valve appears to be very much the same as when one or two low-frequency amplifying stages are added and a loud-speaker is used. Over the usual acoustic range of frequencies it appears that approximately equal disturbance is produced by a given ripple voltage, whatever its frequency may be. The result is also affected by the sensitivity of the telephone or loud-speaker at different frequencies, and by the linearity or otherwise of the output of the amplifier with varying frequency. The above statement is therefore likely to be less true with transformer-coupled than with resistance-capacity-coupled amplifying stages. Satisfactory results may usually be expected if the ripple voltage is of the order of 0.1 volt in the h.t. circuit; even with comparatively weak signals 0.2 volt of ripple is not particularly noticeable, except during silent periods of the transmission.

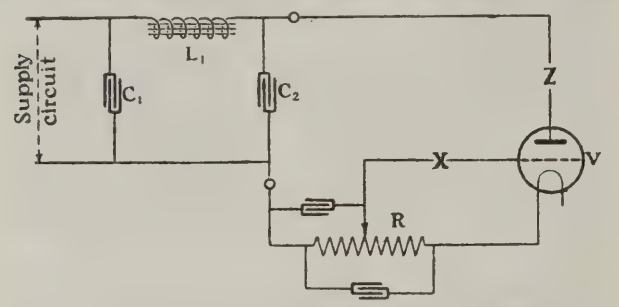


Fig. 4.—Method of Deriving Grid-bias from H T. Appliance.

Rating.—At present there appears to be no definite method of rating these appliances so as to express their output; it is suggested that two or three of the following characteristics might suffice for the purpose:—

(1) The percentage regulation of the output voltage at a stated output current, *e.g.*, 1 mA; this quantity = 100 × voltage-drop at 1 mA output/initial voltage at zero output.

(2) The internal impedance of the appliance expressed in ohms; this quantity = 1,000 × voltage-drop/load current, in mA.

(3) The useful output, expressed in mA for a fixed permitted voltage-drop, say, 33⅓ per cent. from the initial voltage.

(4) The audio-frequency impedance of the output circuit of the appliance measured at some stated frequency, *e.g.*, 500 cycles per second.

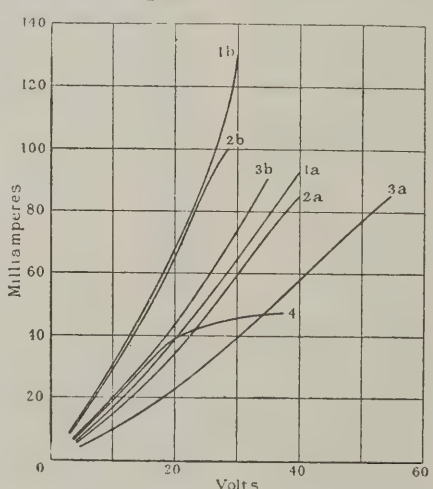
Some idea of the extent of the variation of these quantities for a number of commercial appliances may be obtained from the curves forming fig. 3.

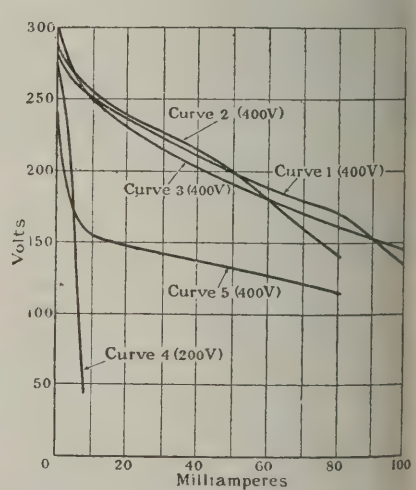
Grid-bias Supply.—A grid-biasing supply from the h.t. appliance itself may be obtained by the insertion of a resistance in series with the negative return lead to the appliance, so that the negative terminal of the supply circuit is more negative than the valve filaments of the radio receiver. A portion of the voltage-drop along the resistance R (fig. 4) can then be used for grid bias, in much the same way as this method has been employed in certain radio receivers and amplifiers to provide the necessary grid bias automatically.

The resistance should be shunted by additional by-pass condensers as shown in the diagram; only one valve V of the receiver is shown and additional grid-bias voltages for other stages in the receiver can be provided if required by additional tapping points on R. The disadvantage of the method is that, since R is in series with the common h.t. supply circuit, if the by-pass condensers shunting it are too small in capacity, there is serious risk of "howling" by reason of inter-stage coupling; the by-pass condensers should preferably be of at least 1 μF each.

H.T. Rectifier Arrangements.—The thermionic valve is customarily utilised as a rectifying means to supply the filter when the appliances are required to operate on a.c. circuits. Any of the more usual types of "receiving valves" may be used for this purpose, preferably by connecting the grid and anode together so as to lower the impedance of the valve; even so, however, the impedance is high enough to account for the limited outputs and poor regulation of some of the eliminators of which the output characteristics are reproduced in fig. 3. Special valves marketed for this particular purpose usually have a low internal impedance to enable them to be used on low-voltage circuits (200-220 volts); for double-wave rectification in the single bulb either two anodes co-operating with a single filament may be used, or two filaments insulated from each other and co-operating with a single anode. In fig. 5 two sets of emission characteristics are plotted, those marked 1a, 2a and 3a being the curves for double-wave rectifiers when only one half is in use (as for single-wave rectification), and are therefore comparable with curve 4, which corresponds to a single-wave rectifier valve; curves 1b, 2b and 3b, show the total emission characteristics of the corresponding valves when both halves are in use.

One or two special valves are now also available in which rectification takes place by means of a species of glow discharge in a rarefied gas; one at least of these functions without any heated cathode and such an arrangement represents a considerable saving in the energy required to operate the complete appliance. Rectification characteristics, including a representative of the above-mentioned special types of valve (curve 5) in addition to those given in fig. 5, are plotted in fig. 6* and represent the output of unidirectional current which can be obtained from them, and the fall in voltage occasioned by increase in the d.c. load current. The internal resistance of these valves varies considerably, not only as between one valve and another, but also in the same valve with different load conditions, the latter being particularly noticeable in the case of curve 5 in fig. 6. It is desirable that the internal resistance should be low, not only in order to improve the regulation and output, but also to reduce the percentage ripple. It is desirable also that the total emission should, in general, be not less than about 100 mA.





Figs. 5 and 6.—Emission and Rectification Characteristics of Special Valves.

L.T. Appliances.—When the available system is direct current, the provision of an l.t. supply to the receiver is comparatively simple, but far from economical, since the current utilised at 4 to 6 volts must be paid for at the supply circuit voltage; the latter may be 250 volts, in which case the efficiency of the arrangement cannot exceed about 2½ per cent., while the remaining 97½ per cent. of the energy taken from the mains must be wasted as heat in the series resistance.

A simple series resistance for heating filaments will produce disturbances in the receiver unless a filter is used, and must be connected to the positive pole of the supply circuit, irrespective of whether or not this is the "live" side; if this is not done, it becomes impossible to obtain the h.t. supply from the same mains circuit. A filter circuit on similar lines to the h.t. filter would be possible, but it would be bulky and costly. In fig. 7 three filtering circuits suitable for l.t. supply are shown; probably the most useful arrangement is provided by a floating battery connected across the l.t. circuit, which is really an adaptation of the shunting resistances, since the batteries merely provide a very low-resistance shunt through which the ripple currents can flow, while the back e.m.f. of the battery prevents unnecessary wastage of energy from the supply circuit. An appropriate series resistance in the supply circuit must be added in a d.c. circuit so as to drop the excess voltage, while for a.c. rectification can be effected at low voltage using a step-down transformer. Even a single floating battery with a simple series resistance provides reasonably effective filtration in most cases, and the resistance should preferably be given such a value that there is a slight balance of current in the direction to charge the battery. The valves used for h.t. supply are in most cases unsuitable for providing sufficient current for the l.t. supply; generally the only available rectifiers are the electrolytic, gas discharge tubes, or solid chemical types, which can provide 1 ampere or over. A true "battery eliminator" has yet to be devised, with the result that the more usually adopted arrangement, particularly for a.c. circuits, is a "trickle charger."

Substitutes.—New valves have recently been developed (patented in 1914) in which the heating of the cathode is effected by means of an internal heating element designed to operate directly off the high-voltage supply mains, or at a low voltage provided by a transformer if the supply is alternating current. Two other solutions of the problem differ markedly from the arrangements so far dealt with; while meeting the requirements to some extent, however, they have disadvantages which have prevented their adoption on any wide scale.

*Curve 4 relates to a single-wave rectifying valve and is consequently plotted at half the total voltage applied for the other curves. All curves were taken with a smoothing condenser of 8 μ F capacity connected across the d.c. load.

The first entails the use of a special generator driven by any convenient motive power, or by a low-voltage accumulator (provided with smoothing means to reduce the ripple) to provide both h.t. and l.t. supplies to the radio set. The second makes use of thermo-electrically generated voltages, the energy being obtained from any convenient heat source, but the method has not been practically utilised to any appreciable extent.

Precautions.—With many of the commonly used arrangements dealt with there is direct electrical connection between the radio apparatus and the supply mains; precautions must therefore be taken to avoid risk of shock or dangerous short-circuits. The danger of shock is to a great extent exaggerated, but that due to burns, or perhaps fire, may be more serious, chiefly because the supply of energy is maintained from the mains, whereas dry batteries or accumulators would soon be discharged under heavy load conditions.

The main risk of serious short-circuit arises from the fact that most supply circuits are earthed at some point of the system, while an earth connection is also needed by many radio receivers. The insertion of a suitable insulated condenser into the normal earth connection of the radio receiver will not interfere with its normal radio operation, but will obviate any risk of short-circuit; the circuit to which they are connected should of course be properly fused to guard against ordinary insulation failure in the appliance itself. Condensers in the filter circuits, as well as the above-mentioned earthing condenser, should comply with the newly issued British Engineering Standards Specification (No. 271, 1926), when the circuit voltage is in the neighbourhood of 200 volts. When the appliances are used on a.c. circuits, the use of double-wound transformers in the rectifiers should provide adequate protection against short-circuits from the supply mains, provided that the insulation of such transformers is of reasonable quality. The Wiring Rules Committee of the Institution of Electrical Engineers has under consideration a regulation dealing with these matters.

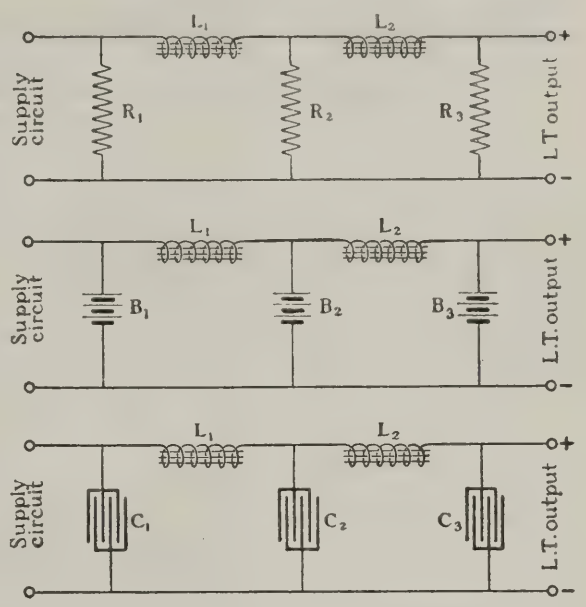


Fig. 7.—Filter Circuits for L.T. Supply Appliances.

Mixed-Pressure Colliery Turbines.

A comparison between the capital outlay and annual cost of high-pressure and mixed-pressure steam turbines for electric power production for colliery use.

(*Review of a paper read before the* Association of Mining Electrical Engineers.)

MANY colliery winding engines are steam driven and exhaust freely to the atmosphere. The steam thus exhausted may be utilised to drive a mixed-pressure turbo-generator set for the production of electricity, and under certain conditions this may be a very attractive proposition; in some cases, however, it may be more economical to install a high-pressure turbine and to disregard the low-pressure steam available.

At a recent meeting of the London branch of the Association of Mining Electrical Engineers, Mr. W. F. Bishop (branch president) occupied the chair, when Mr. C. H. Naylor compared the two above-mentioned schemes: assuming a 750-kW turbo-alternator installation, he indicates that the initial cost of h.p. plant will be £10,198 and that a m.p. set will cost £3,178 more; the difference in capital outlay will bear an annual charge of £435.

Assuming that l.p. steam is available for eight hours per day for 300 days per year; coal of 12,000 B.th.u. to cost £1 per ton; a boiler efficiency of 70 per cent.; full-load output for eight hours and half-load for 16 hours per day, if sufficient l.p. steam is available for full load on the turbine, the h.p. set will cost £4,620 per annum, and the yearly saving in favour of the m.p. set will be £1,345. If sufficient l.p. steam is available for only half load, the saving in favour of the m.p. set will not exceed £43. If the winding engines do not operate and it becomes necessary to drive the m.p. set with h.p. steam, there will be a loss against the m.p. set of £1,025.

The figures thus show that it is not worth while installing a m.p. set in preference to a h.p. set if the l.p. steam available is not more than sufficient for half load. However, the author's results are based entirely on his assumed operating conditions, and each case therefore needs to be examined on its merits; his paper is intended to outline a method of doing so.

Discussion in London.

Mr. Humphrey M. Morgans pointed out that the author had said that turbo compressors could be made of a capacity down to 2,000 cu. ft. per minute, and he (Mr. Morgans) wondered if the performance of a compressor of such a capacity would compare with that of a good reciprocating compressor. He also mentioned the effect of placing condensers alongside the turbines instead of beneath them, having in mind a case in which condensers were arranged alongside the turbines, the latter exhausting from the top, a horizontal pipe going to the condensers, and it had been said that by that arrangement nothing had been lost in vacuum, but that a lot had been saved in connection with foundations. Generally speaking, he believed the use of mixed-pressure turbines in this country would decrease: a colliery steam winder which was using unknown quantities of steam offered a good chance for making economies by putting in a mixed-pressure turbine, but if the management turned out the steam winder and put in a high-pressure turbine and an electric winder instead it would do much better in most cases.

Mr. C. H. Naylor replied that it was much more convenient to situate the condenser below the turbine, and it was only when there were difficulties in connection with the sinking of foundations, or something of that kind, that the condensers were placed on a level with the turbines. A steam winder having a steam consumption of about 40 lb. per brake h.p. was about the best one could get, and such a winder compared favourably with electric winding for any given colliery, but it did not compare favourably with electric winding in the case of a group of collieries.

Mr. McShea emphasised the importance of considering the effect of back pressure on the primary engine, allowing an extra 5 lb. back pressure in the exhaust main for each engine. On the whole he considered that the effect on the cost of running the primary engine, as the result of putting a mixed-pressure turbine on the end of it, was to increase that cost from 5 to 20 per cent., according to the type of primary engine and the conditions under which it was running; that should be debited against the mixed-pressure turbine. The improvement in the prospects of electric winding made it very doubtful whether the use of the mixed-pressure turbine could be justified at all nowadays, except in purely exceptional cases.

Mr. C. H. Naylor replied that the loss was not more than about ½ lb. when a steam accumulator of the gasometer type was used, so that one had not to debit the winding engine very greatly in that case.

Captain A. C. Sparks (in a written communication) referred to the author's statement that the mixed-pressure set obtained low-pressure steam for nothing; presumably the whole of the cost was transferred to the winders, which appeared to be the only source of low-pressure steam suggested. That appeared hard on the winder, which, in any case, would have a larger steam consumption when working in conjunction with a mixed-pressure set, owing to increased back pressure; he suggested, therefore, that some charge must be made to the mixed-pressure set.

Mr. C. H. Naylor pointed out that before a mixed-pressure turbine was installed, the steam was discharged into the atmosphere, but he agreed that back pressure against the winding engines was incurred, and that that should be debited against the mixed-pressure turbine.

Mr. C. H. Roddis referred to a case in which there had been rapid erosion of turbine blades, which was thought to be due to water, but the erosion ceased when de-aeration plant was installed.

Electrical Measurement of Temperature.

A Comparison of the Thermo-Electric and Resistance Methods of Pyrometry employed in Industry.

By J. HALL, B.Sc. (*Résumé*)

IN a paper on "Thermo-Electric and Resistance Pyrometry in Industry," read before the Society of Chemical Industry, Chemical Engineering Group, the author describes the methods of measuring temperature in industrial practice by means of resistance thermometers and thermocouples. A review is given of the theory of the thermodynamic scale, leading up to its reproduction for the methods referred to. In a typical example of a platinum resistance thermometer, the fundamental interval is shown to be as nearly as possible 1 ohm, a convenient value in ordinary commercial practice, though for work of the highest precision a fundamental interval of about 10 ohms is preferable.

Two methods of eliminating the resistance of the leads connecting the thermometer with the bridge are considered; the compensating-lead method devised by Callendar, and that employed in the "distance thermometer" used at lower temperatures. In the Callendar method a Wheatstone bridge of some sort is necessary, and for workshop use a convenient form is said to be the Whipple self-contained indicator of the Cambridge Instrument Co., Ltd. The scale is drawn so that a change in resistance of 1 ohm in the thermometer circuit shifts the balance-point on the slide wire from 0 deg. C. to 100 deg. C., and thermometers of 1 ohm F.I. are used. The variations in the constant for reasonably pure wire would not be likely to cause a greater error than 2 deg. C. at 1,000 deg. C. or 0.5 deg. C. at 500 deg. C. An ice reading should always be taken before and after using the thermometer for precision work, but there is no necessity for the frequent determinations of the other fixed points. It is necessary in industrial practice to use heavy sheaths, such as a porcelain tube enclosed in an outer iron tube, for the protection of the bulb. An accuracy of ± 1 deg. C. at 100 deg. C. can be attained, it is claimed, on this type of instrument if the indicator has been standardised.

The two-lead "distance thermometer" is usually made direct reading by using the out-of-balance current in the Wheatstone network to give an indication of the resistance, the three arms of the bridge not containing the thermometer remaining fixed. This method involves the adjustment of the battery current to a predetermined value. This type of instrument is not used for such high accuracy as the four-lead types, and is generally confined to fairly low temperatures—up to about 200 deg. C.

In dealing with thermocouple instruments the method of balancing out the additional junctions introduced by the measuring instrument are explained and illustrated.

A comparison is drawn between thermocouple instruments employing a rare metal, usually platinum-rhodium, and those using a base metal. The e.m.f. of the rare metal couple is of the order of 0.01 mV per deg. C., while that of the base metal couples is about five times as great. The advantage of the higher e.m.f. is more than counterbalanced by the fact that the alloys used cannot be made as homogeneous as the platinum alloy. The high e.m.f. of base-metal couples makes possible the employment of relatively robust measuring instruments, and the cheapness of the wires enables heavy-gauge couples to be used. "Hoskins" alloys, marketed in this country by the Foster Instrument Co. and known as chromel and alumel, stand up well against oxidation. The accuracy attainable in the best circumstances likely to be met in works practice with base-metal couples cannot be reckoned better than ± 10 deg. C. at 800-1000 deg. C., and it is not advisable to use base-metal couples for long periods at these high temperatures, though the Hoskins alloys can be calibrated up to 1,300 deg. C. With rare-metal couples, however, ± 3 deg. C. can be obtained with a little care, and temperatures up to nearly 1,600 deg. C. can be measured if it is possible to protect the couple adequately from reducing gases, while 1,400 deg. C. can be regarded as well within the reach of ordinary technical practice. Rare-metal couples are usually made of wire either 0.5 mm. or 0.6 mm. in diameter.

The author describes and compares the potentiometer and galvanometer methods of e.m.f. measurement. The former has the drawback from the industrial point of view of requiring the instrument to be set for each reading, an operation it is desirable to avoid if the observations are to be made by comparatively unskilled workmen.

A brief outline is given of the procedure for obtaining the fixed points where the calibrations are carried out in the works. The freezing points are conveniently observed by melting the metals in tall pots, keeping the surface covered with a layer of powdered graphite. The thermocouple should be protected by a small porcelain or silica sheath.

If the potentiometer is available, the e.m.f.'s at a series of these fixed points may be determined, and the e.m.f.-temperature curve then drawn.

The insulation of the thermo-couples and various constructional details are considered in detail, and in conclusion the author deals with the difficulties of obtaining the thermo-junction at the same temperature as that of the material concerned with. The most difficult problems are in the measurement of a gas flowing in a flue which is at a different temperature. Haslam and Chappell suggest drawing the gas at high speed past the couple inside a radiation shield, in order to put up the rate of heat transfer by conduction.

In an interesting discussion which followed the reading of the paper, it was pointed out that the chemical engineer wanted an instrument which would give an accuracy of ½ deg. at 1,000 deg. C. after the thermo-couple had had to be retrieved from the furnace by its cable. Another necessity called for was constant calibration of thermo-couple instruments in use, because the magnet could never be relied upon to be permanent. It was claimed that although the platinum-rhodium couple might give a greater accuracy than the base metal device, it was certain there would be a larger bill for repairs; for general works use a more robust instrument was desirable, even if the accuracy was out by 20 deg. in 1,000 deg. Where rare-metal couples were used, very great care must be taken to protect them from contamination. It had been found to pay to use rare-metal contacts for the switches.

One speaker emphasised the necessity of getting rid of the prejudice against the use of pyrometric instruments in those works where it had been the practice to rely on rule-of-thumb methods.

From the commercial point of view it was pointed out that one of the first essentials of the instruments was high internal resistance, which was very difficult to get at a low price if the instrument was also to be robust and stand up to workshop conditions. Advice was given to keep away from resistance thermometers because of the frailty of the bulb and the difficulty of obtaining constant voltage from the accumulators. For temperatures from 200 to 2,000 deg. F. it was possible to purchase a base-metal thermo-couple at a comparatively low price, and most manufacturers to-day could guarantee an accuracy of plus or minus 1 deg. The costs of the base-metal and rare-metal couples was in the ratio of 10 to 1 in favour of the former, and, apart from the heavy industries, it was not likely that temperatures above 2,000 deg. F. would have to be measured.

It was further claimed that there were industries in which an accuracy within 50 deg. was good enough, for which base-metal couples were suitable. A nickel-nichrome couple had been used for many years, both for scientific and rough work; it was most excellent and not expensive. The coil in the instrument of the Hoskins Thermo Couple Co. was referred to as of a peculiar metal which apparently it was impossible to solder.

The view was taken that it spoke well for this country that we were in the position we were to-day in regard to such instruments, because America at one time had got a long way ahead of us in the manufacture of instruments for recording temperatures accurately.

Canadian Radio Production in 1926.

The production of all radio apparatus and accessories in Canada during 1926 was valued at $6,277,544, f.o.b. factory, in addition to which furniture manufacturers sold wireless cabinets to the value of $708,658. The details of the production were:—

	1926. $	1925. $
Batteries	2,276,747	2,238,169
Condensers	13,281	41,626
Panels, dials and switches ...	29,895	88,103
Microphones, loud-speakers	146,074	412,556
Transformers	26,855	36,816
Valves	1,261,803	1,299,684
Complete sets	2,253,098	2,667,999
Miscellaneous	269,791	325,675
Total	$6,277,544	$7,110,628

Wireless receiving licences issued during 1926 numbered 207,328, compared with 134,486 in 1925, and broadcasting licences issued rose from 55 to 96. Imports of wireless apparatus from the United States amounted in value to $2,872,991.—*Reuter's Trade Service* (Ottawa).

A New Direct-Current Meter.

An improved type of d.c. motor meter which has recently been introduced has an improved characteristic and several new features of design.

A D.C. mercury motor meter which has recently been developed by MESSRS. FOX & OFFORD, LTD., represents a considerable deviation from the usual design of this class of apparatus, with, it is claimed, corresponding improvement in both its operation and facilities for maintenance.

The Lawson meter, fig. 1, is really the outcome of a number of patents which have been taken out from time to time by Mr. W. Lawson, meter superintendent of the Birmingham Corporation Electricity Supply Department. Fig. 2 shows the meter with the cover removed.

Perhaps the outstanding feature of the apparatus is its greatly improved characteristic curve. Fig. 4 shows an average curve obtained from tests on a dozen of the meters; it will be seen that the overload "droop" is negligible. This improvement is brought about by means of special dampers in the mercury bath, which take the place of the usual compensating coil. There are one fixed and one movable damping vanes. They are placed under the rotor, the "covered" area of which varies according to the disposition of the movable element, which affords a convenient means of regulating the speed of the rotor. An external lever, fig. 3 right, is provided for the necessary adjustment. The fixed portion of the damper covers the bottom slipper, but is insulated from it by means of very fine paper. The damper is secured to the moulding by means of three feet which are embedded in the compound.

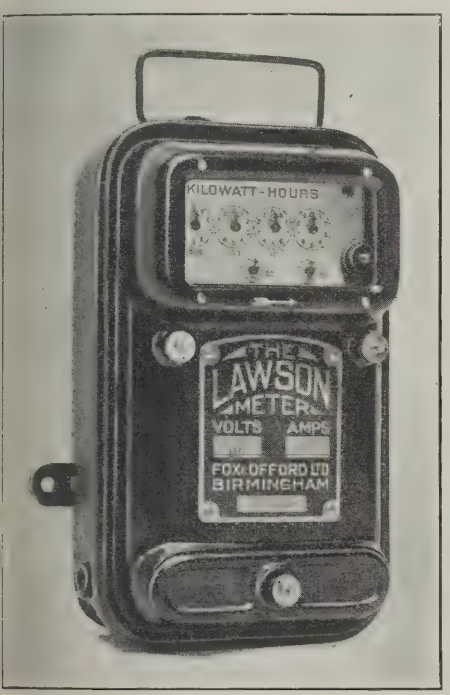


Fig. 1.—Lawson Meter.

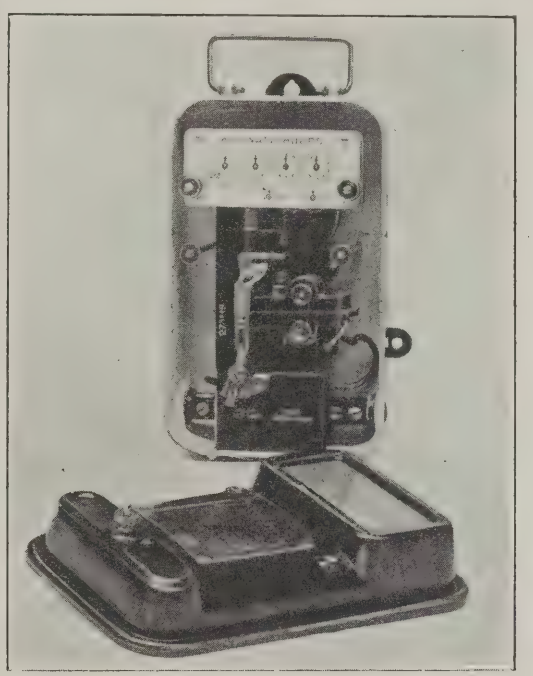


Fig. 2.—Meter Interior.

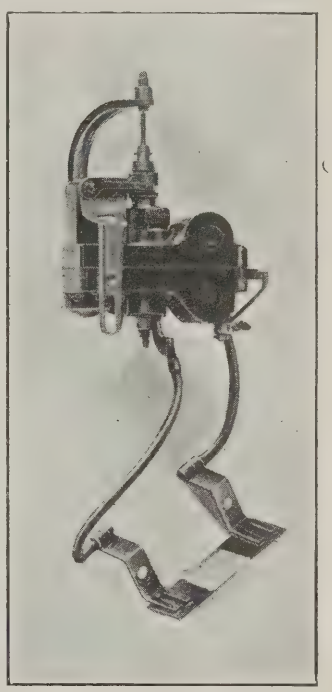


Fig. 3.—Mercury-Bath Unit.

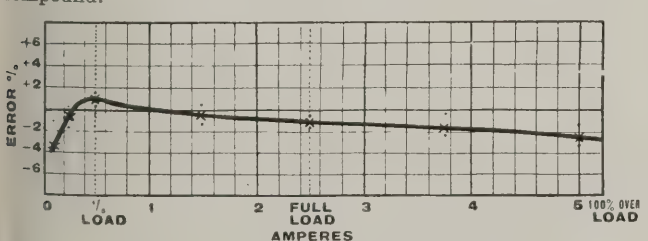


Fig. 4.—"Average" Characteristic Curve.

The mercury bath itself is claimed to be unique. It is made of a bakelite composition, moulded in two parts, and is easily removable as a complete unit, fig. 3, so that repairs can be carried out in the test room. The actual working clearance inside the bath is from 37 to 40 "thousandths." The bath unit is secured to the permanent magnet by means of two thumb screws which, in addition to the terminal screws, are the only ones it is necessary to manipulate in order to remove the unit. For given sizes of meters the bath units are interchangeable.

To render the bath removable entailed a great deal of research which resulted in the provision of special soft-steel slippers moulded into the bakelite. When the unit is put in position the slippers slide between the poles of the magnet and become convenient pole pieces. The design of the bath was only rendered possible by the ability to mould the slippers into the bakelite. It is claimed that the bath is the only moulded one on the market.

As shown in fig. 3, the unit carries both the jewel and the driving pinion, a bracket attached to the moulding carrying the upper or guiding bearing. In connection with the spindle a special sealing device is employed. The upper part of the spindle carries a cone collar which acts as the necessary coupling for the pinion. A special ebonite bush in the top section of the moulding surrounds the spindle. By means of an external lever the bush is raised so that a suitable leather washer in the top is brought into contact with the cone, so locking the spindle and sealing the chamber against leakage of the mercury. The cone is of nickel silver and gives the correct balance to the rotor so that it floats in the mercury. A bakelite filling screw is provided in the top of the bath unit.

As indicated in fig. 3, the larger meters have their shunts soldered directly across the bath leads, so that there is no fear of the shunts getting mixed when interchanging the units. By means of a special tool the shunts are "pinched" for the purpose of calibration.

An unusual and interesting method has been adopted for securing the counter. Two pillar screws project from the interior and are provided with a screwed sleeve and a collar on each. The counter is "dropped" over these sleeves, which can be turned by a large D thumb washer located on the front ends. The adjustment of the position of the counter can therefore be determined with great accuracy and ease. Suitable lock-nuts are, of course, provided.

The permanent magnet lifts out from the case by means of three screws. The whole of the interior of the meter is carried on external bars at the back of the apparatus, and it is on these bars that the meter is hung. The terminals are moulded into ebonite blocks and side-entrance leading-in is provided.

The case is of light sheet-steel and for any size up to 20 A the meter weighs 7½ lb. By means of suitable feet the meter is arranged to stand upright on the bench—a useful feature in the test room. The meter can at present be made for pressures up to 500 V and loadings up to 150 A.

It is interesting to note that about 5,000 of the meters have been supplied to the Birmingham Corporation, and that some have been on circuit for about 18 months and given very satisfactory results.

Marking Vacuum Cleaners for Denmark.

By a recent Government decision, as from July 1st, all foreign vacuum cleaners imported into Denmark must be marked with their place of origin.

Electricity Supply in the West Midlands.*

By S. T. ALLEN, Chief Engineer and Manager, West-Midlands Joint Electricity Authority.

ONE of the fundamental faults of early legislation was its encouragement of small isolated electricity supply areas, with an almost entire absence of encouragement of co-ordination as between supply authorities and failure to appreciate the necessity of standardisation.

The great war opened our eyes to the position we were drifting into; it showed how essential electric power was to our manufacturing and industrial life, and the importance of the conservation of coal.

In the Midlands, in 1916, a committee of chief electrical engineers was formed to deal with an area embracing the counties of Warwick, Worcester, Stafford, and Salop, and part of Hereford; the area was divided into eastern and western sections, roughly corresponding with the frequencies of supply (25 and 50 periods) prevailing in those portions, and a separate committee was formed for each section. Thus arose the committee of electrical engineers in the district which was then styled the "North-West Midlands District," which was responsible for initiating the work which culminated in the formation of the first Joint Electricity Authority to commence practical operation by itself on the lines of the Electricity (Supply) Act of 1919. This Committee in March, 1918, recommended to a conference representing the various authorised electricity supply undertakers in Staffordshire and Shropshire the setting up of a Joint Electricity Board for the district. A technical committee appointed by the Conference, of which the author was chairman, drew up a report on the subject, which became the basis of the scheme that is now being operated, with little alteration; the report embodies conclusions similar to those of the Coal Conservation Committee and the Williamson Committee appointed by the Government which led to the establishment of the Electricity Commission. The Committee approved the report, and after the passing of the Act of 1919 a scheme was prepared and submitted to the Electricity Commissioners.

An inquiry was held by the Commissioners in February, 1922, as the result of which a new conference was formed representative of electricity supply undertakers south of Stafford, in Staffordshire and Shropshire; a new scheme was prepared, and after a further inquiry in October, 1924, was approved by the Electricity Commissioners, who issued a draft Order in November constituting the amended area an electricity district by the name of the West Midlands Electricity District. A final inquiry was held in December, 1924, and an Order made which was confirmed by Parliament in December, 1925, after nearly 10 years' work on the subject, involving an immense amount of discussion and negotiation.

The area controlled by the Joint Electricity Authority for the West-Midlands Electricity District covers over 1,000 square miles, a very large part of which has no public supply of electricity. The Authority consists of 23 members representative of all the interests concerned. Its first duty was to complete the transfer of the generating stations of the existing authorised undertakers to the Authority on approved terms; the transfer will take place after due notice has been given and when the Authority's technical scheme, interlinking mains, &c., are ready. The whole of the generating stations, land, buildings, and machinery (with the exception of West Bromwich, where the land and buildings will be leased and the machinery purchased) will be transferred to the Authority; the existing owners will retain their main switchboards, which will be used in the future purely as feeder switchboards for the distribution of bulk supplies. The price agreed upon for the transfer is uniform, and is based upon the original cost, less depreciation. The whole of the generation will be carried out under one control, and the electricity required by the existing owners of generating stations will be sold to them at cost. The scheme is a co-operative movement to provide electricity at the lowest possible price—lower than if the existing generating stations continued independent operation—to the whole area.

Given control by one competent large body, it was obvious that single large base-load generating stations with large units of plant and low costs of production could be erected to provide for all future requirements, and the trunk mains interconnecting them with the existing stations would supply also the new districts. Distribution will be carried out by the existing authorised undertakers, except in the areas not hitherto covered, where the Joint Authority will probably be the distributor. Supply will, as far as practicable, be standardised as regards current, frequency and pressure. The standard transmission pressure will be 33,000 V for the primary mains and 11,000 or 6,600 V for the secondary mains.

The following generating stations will be utilised and possibly extended, namely:—Birchills (Walsall), Ocker Hill (Tipton), Black Lake (West Bromwich), and Commercial Road (Wolverhampton); other stations will be utilised for the time being. Immediate provision will have to be made for the erection of a new capital station at Ironbridge, and subsequently a further capital station. Interconnecting lines will also be required during the first stage of development between the above-named stations, as well as bulk supply lines to Shrewsbury and Wellington.

Since the Authority came into being last year it has formed a committee to deal with the technical and engineering aspects of the work, and another to deal with the financial and legal aspects. A building was purchased in Wolverhampton, the centre of the District, which is being adapted for central administrative offices at an estimated cost of £11,000. The Technical Committee commenced work at once, and the author's estimates, covering expenditure of 3½ million pounds, have already been started. Work on the 33,000-V interlinking transmission mains is being pressed on with all speed, and the Birchills and Ocker Hill generating stations are being extended at an estimated cost of £366,000. Orders have been placed for 18 large step-down transformers for the linking-up scheme, and an order for 33,000-V, 500,000-kVA capacity and other switchgear costing about £125,000 has just been placed—one of the largest single orders for switchgear ever placed in and for this country. On account of the high value of the short-circuit currents which have to be allowed for, this switchgear is of a special heavy type, individual units weighing as much as 8½ tons and requiring over 10 h.p. to complete the closing operation. New generator switchgear is being erected at each of the existing generating stations in place of the present generator switchboards, which will be retained by the present owners.

The site of the Ironbridge station is at Buildwas Junction on the River Severn; the station will be designed for a capacity of 160,000 kW, and will be built in sections forming complete connected generating stations. The keynote will be simplicity with commercial efficiency, and the author hopes that by the time the plant is ordered sufficient experience will have been gained to warrant drastic changes in the methods of steam raising and fuel preparation. He hopes that investigations and satisfactory experiments will have so far advanced as to warrant the inclusion of low-temperature carbonisation plant at the Ironbridge station, and provision will be made for the adoption of such plant even if it is not put down in the first instance. He expects that, apart from the necessity of such plant from a national point of view, its use in connection with large power plant will eventually be found to bring about a higher commercial efficiency.

Turning to the Act of 1926 and its relation to Joint Electricity Authorities, the author points out that the Central Electricity Board will not (save under exceptional circumstances) own the generating stations like the West-Midlands Joint Electricity Authority. It may choose one or more of the stations of that Authority to be "selected stations," but cannot give supplies to authorised undertakers in the District without the consent of the West-Midlands Authority. The West-Midlands electricity scheme is not a Government scheme put into operation as a result of the new Act.

If it is shown that there is a demand for electricity supply in any part of the District not already covered, with a reasonable prospect of its being remunerative, the Authority is under obligation to submit proposals for the supply of that area to the Electricity Commissioners; the scheme may include the provision of a main sub-station, main cables, and other sub-stations and distribution mains and services, together with the supply of installations and apparatus to consumers, the provision of local showrooms, &c.

The days have gone by when electricity was considered a luxury for the rich; it is now a necessity for all classes. A supply is being given in thousands of the smallest class of houses in the West-Midlands District, and it is hoped that, having regard to the facilities that will be offered to would-be consumers, there will be such a universal demand for electricity that the prices which it will be possible to charge will benefit the whole district, that existing industries will be greatly improved, and new industries established. A spirit of co-operation and enthusiasm is necessary; petty dissensions must not be allowed to mar the issue. The author hopes that those interested in the gas industry in the area will not make the mistake of opposing electricity supply development, as it will be against their own interests to do so. Experience shows that the gas supplies have steadily increased with the increase of electricity supply. The Authority is considering the possibility of incorporating a low-temperature carbonisation plant in the Ironbridge generating station scheme, which will allow of the production of large quantities of oil, motor spirit, and rich gas, so that it may yet offer the gas concern cheaper supplies of gas and co-operate with it as far as that is concerned.

* Abstract of an informal address delivered to the Chamber of Trade, Wellington, May 24th, 1927.

Electro-Magnetic Couplings.

Some Applications of the Forster Clutch and Generator Drives.

An interesting feature of many of the new hydro-electric stations in the course of construction in Italy is the use of electro-magnetic clutches for coupling up the turbines and the generators. The design which is being generally adopted is that which has been developed by a Swiss engineer, Herr Paul Forster, two of whose clutches—one designed to transmit 6,000 h.p. at 100 r.p.m. and one for 5,000 h.p. at 85 r.p.m.—have been employed on steel-rolling drives for some time past. It was the success which attended the Forster clutch under the extremely onerous conditions obtaining in rolling-mill driving that led the engineers of the new hydro-electric station at Farneta, near Parma, Italy, to decide to adopt the principle in connection with the driving of their electric generators. Fig. 1 shows a sectional view of the clutch and illustrates its working. A feature of the design is the use of stationary exciting coils, which obviates the necessity for slip-rings and brushes as in the case of electro-magnetic clutches with rotating coils. Some idea of the size of the stationary-coil frame is indicated by fig. 3. A Forster clutch to transmit 17,000 h.p. is stated to weigh under 8 tons and to require for its operation an excitation loading of 2.5 kW, d.c. Non-magnetic iron is used for the double cone and the frictional surfaces are all metallic.

When completed, the plant at the Farneta station will comprise four sets, each of 12,000-kVA capacity, designed to run at respective speeds of 420, 500, 504 and 600 r.p.m. The clutch-operating switch will be mounted close to the turbine starting and stopping mechanism, so that at any time when the load on the station falls off, any one of the turbines can, after de-clutching, be brought to a standstill. The clutches are being designed with a high factor of safety, and will be capable of transmitting a maximum of 17,000 h.p. at 500 r.p.m. When

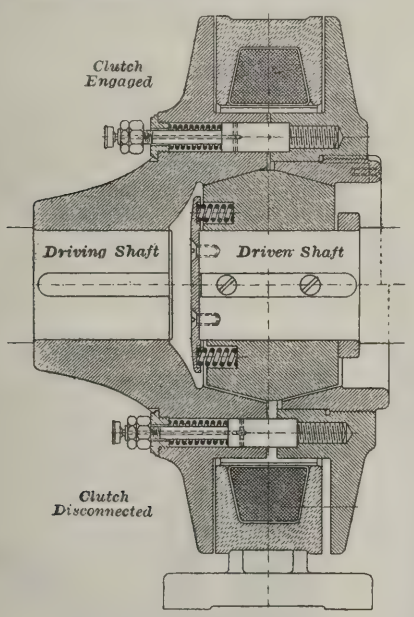


Fig. 1.—Forster Clutch ; Section.

disconnected from their respective turbines the generators will remain connected to the electrical circuit, and will be run as synchronous motors; by suitable adjustment of the field-regulating resistances they will be fed with the wattless current and so utilised as phase adjusters. When it becomes necessary again to use the machines as generators, the turbines will first be started and speeded up to a little more than the normal speed and the clutch then engaged, when, after the necessary adjustment of the turbine inlet valve, and the field regulators, each set will once more resume its normal function of power generation.

Another interesting feature of the new station is that although the four generators are of equal capacity, two are of the ten-pole type, while the others each have twelve poles. This is to allow the station to feed two different distributing systems at different frequencies. The peak loads for the systems occur at different times of the year and by means of a Forster clutch between each pair of alternators, each one can be connected up, with the other one, to the faster or slower turbine, as the case may be, thereby providing additional plant capacity on one of the 42- or 50-cycle systems, as required, without additional plant in the station. The change-over from generator or phase corrector to frequency converter can be effected without operating the main switch.

A similar application of the Forster electro-magnetic clutch can be seen at the recently completed Predaro power station of the Società Ozola of Milan. From the diagram, fig. 2, for which we are indebted to the *Schweizerische Bauzeitung*, it will be seen that the shafts of the two turbines and the generators are all in line with clutches suitably arranged between them, the normal speed being 500 r.p.m. One of the generators is an asynchronous machine and the other synchronous. The former is so constructed that it can be run either as a

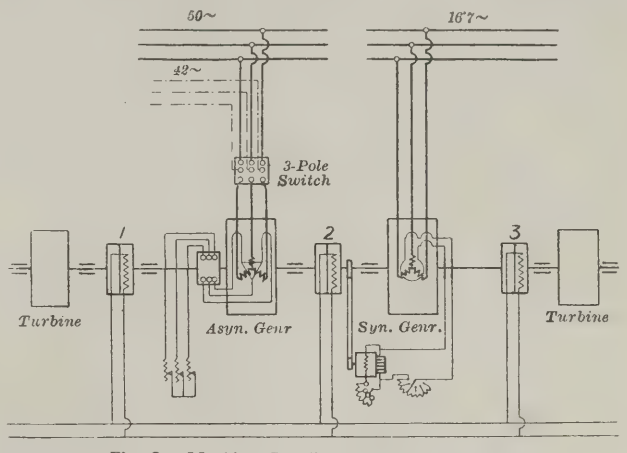


Fig. 2.—Machine Coupling at Predaro Station.

generator or a motor. In addition it has two separate windings—one for ten and one for twelve poles—and at practically a constant speed of from 500 to 504 r.p.m. can be run on or generate either 42- or 50-cycle current. As a motor the machine develops up to 10,000 h.p. and is started by a liquid resistance, by means of which it is also possible to effect a slight adjustment of the speed. The synchronous machine, which has a capacity of 8,500-kVA at 500 r.p.m., is used to generate 16.7-period a.c. for electric-railway operation.

By means of the three clutches, the following combinations of the two turbo-generator sets are possible :—

1. With clutches 1 and 3 engaged and No. 2 disconnected, both sets are generators, one producing either 42- or 50-period current, and the other supplying at 16.7 periods.
2. With clutches Nos. 1 and 3 disconnected and No. 2 engaged, the generators work as frequency converters, feeding from either system and supplying the other.
3. With clutches 1 and 2 engaged and 3 disengaged, both the generators can be driven by the left-hand turbine.
4. The synchronous generating set can be cut out of the railway-supply circuit,when, after disengaging the clutch and stopping the turbine, the generator can be run as a phase corrector.

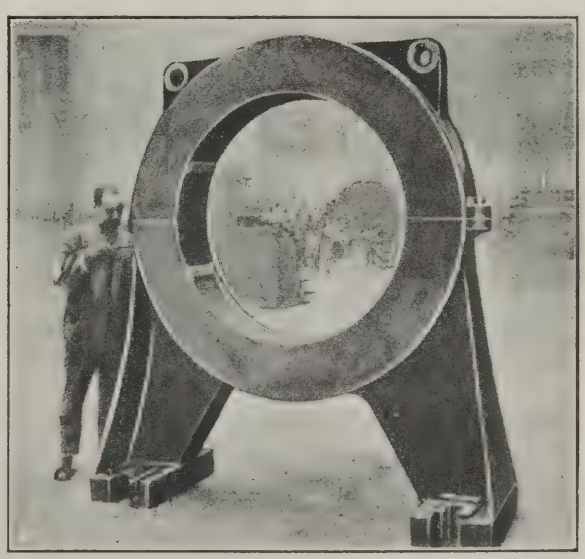


Fig. 3.—Stationary-Coil Frame.

The Forster clutch is also adaptable for use in connection with high-speed steam as well as hydraulically operated plant. An example of this kind is to be seen at the municipal station in Turin, where a steam turbo-generator set which develops 14,500 kVA at 3,000 r.p.m., is coupled up by an easily-dismantled mechanical clutch. When the load on the station is low, the generator is connected by a Forster clutch to an asynchronous motor and used as a phase corrector.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

Non-Pitting Control Apparatus.

A recent development of the DUNDEE ELECTRICAL REPAIRS CO., LTD., Guildhall Works, Erskine Street, Dundee, is a range of starting and control pillars for d.c. motors in which is embodied a patented method of eliminating the burning and pitting of the contacts and brushes usually associated with the short-circuiting type of apparatus. The result is achieved by the introduction of a second short-circuiting brush, which is carried by a common brush arm, but insulated from the main brush. By means of a contactor the auxiliary or leading brush is rendered dead when in the act of making contact with one of the studs, and does not carry the load until full-contact area is established. A second set of contacts is employed to provide the necessary timing for the contactor. Fig. 1 diagrammatically represents the arrangement. The switch arm 4 moves in the usual way over a number of main contacts, cutting out the resistances 10-13. The arm carries both the main and leading brushes, vertical, which are in permanent contact with the fixed horizontal contacts. The contactor 20 is arranged to open and close at predetermined periods by means of the upper timing contacts, which are fed from the main brush circuit. The contacts are so spaced that connection is not made with any of the timing contacts until the leading brush is in full connection with the next stud. The operation of the contactor then puts the two brushes in parallel until full contact is made by the main brush. Fig. 2 shows a starting pillar with the panel slid forward, displaying the apparatus described.

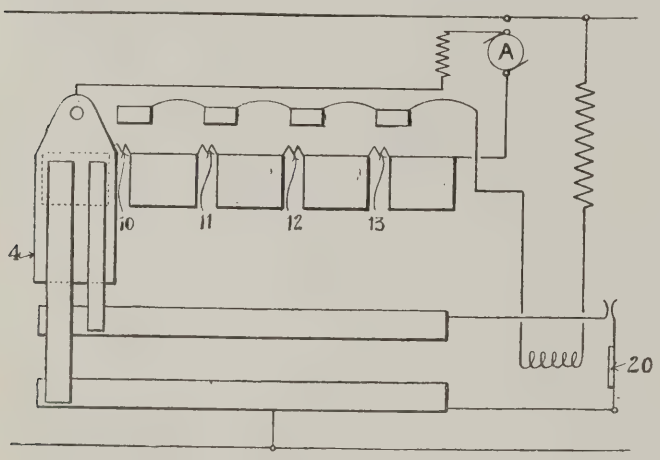


Fig. 1.—Non-Pitting Starter Connections.

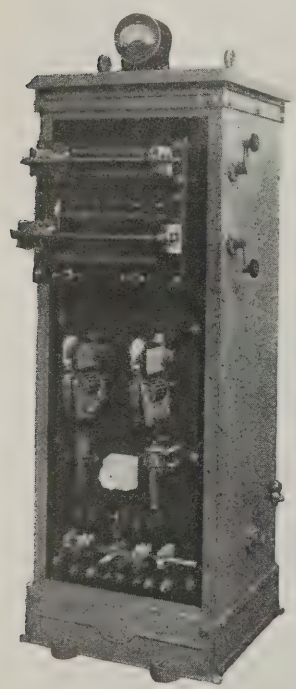


Fig. 2.—Starting Pillar.



Fig. 3.—Type C.T.T.E. Cable.



Fig. 4.—Type C.T.T.D. Cable.

C.T.S. Trailing Cables.

The advantages offered by c.t.s. cable have led to its use under conditions probably more severe than was originally anticipated. In many cases the cable is called on to stand up to severe mechanical compression, due to such occurrences as roof falls, and so on. With a view to providing additional protection to such rough treatment, MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, London, E.C.1, have designed some special types of c.t.s. cable. In all, five types of multi-core c.t.s. cable are provided. Class C.T.T.A. is the ordinary 3-core type with one insulated earth core. Class C.T.T.B. is similar, but the cores are covered separately with c.t.s., in addition to the usual external sheathing, thereby offering increased resistance to compression of the dielectric between the conductors.

An insulated earthing core is a feature of the next two classes, C.T.T.C. and C.T.T.D. In addition, each core is covered with a supplementary earthing conductor, consisting of a tinned copper braid, which is in contact throughout the whole cable length with the main earthing conductor. The first of the last two mentioned classes is insulated and sheathed similarly to class C.T.T.A., while the latter, fig. 4, has its cores reinforced separately with c.t.s. sheathing, in addition to the external sheathing.

For use in connection with certain protective systems, such as the Williams-Rowley, a further class, C.T.T.E., has been devised. This cable, fig. 3, has an earthing and a pilot core. In addition, a supplementary earthing braid is embedded in the external sheathing. The cores are also reinforced with c.t.s.

A New Theatre Switch.

The accompanying illustration, fig. 5, is of a new s.p. switch which has been designed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, specially for service in theatres and places of that description. The principal features are indicated. The pedestal which supports the handle lever is separate from the contact blocks, and when the circuit is broken is entirely insulated from the current-carrying parts, which are of low current density. Both contacts have a simultaneous quick-break action. Provision is made for front connections so that the terminals are easily renewable.

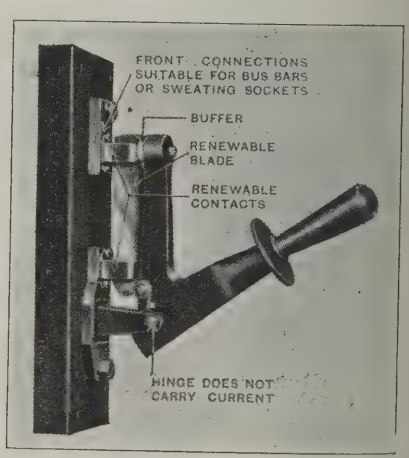


Fig. 5.—Theatre Switch.

A V-Chain Drive.

What is described as Cork's spring-clip transmission chain V belt is a development of MESSRS. CORK'S SPRING CLIP CHAIN BELT CO., Upton Road, Bexleyheath, Kent. It consists of a standard cycle chain, over which spring clips are sprung and secured to the projecting ends of the link pins. Compressed fibre pads are inserted in the sides of the clips, and are tapered at 28 deg. so as to afford a convenient V drive. The result, it is claimed, is a hard compressed belt, free from stretching or slipping. Owing to the increased strength of the chain a smaller "belt" can be used. A clip wrench is employed to remove the clips from the chain, in order to avoid undue side pressure of the pads.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Re-assembly.

Parliament re-assembled on Monday, June 13th.

"Beam" Communication with South Africa.

On June 14th, Sir W. MITCHELL-THOMSON informed Mr. DAY that the official seven-day test of the beam wireless stations for the Anglo-South African service had not yet begun, but the contractors expected to be able to hand the stations over for the test at an early date.

World Copper Syndicate.

On June 14th, Sir E. CECIL asked the President of the Board of Trade whether his attention had been drawn to the fact that, consequent upon the activities of an international copper syndicate, British manufacturers of finished copper products had been placed at a considerable disadvantage, in the absence of a free market, in purchasing the supplies necessary for their trade requirements; and whether he would consider taking steps to encourage by any practicable means producers of copper in the British Empire, so that this country should not be at the mercy of foreign syndicates for its supplies of copper in the event of any national emergency.

Sir P. CUNLIFFE-LISTER said he was aware that a large proportion of the producers of copper in the United States had formed a company to regulate the sale of raw copper outside that country, and that important European interests were also parties to the arrangement. He was further informed that since the formation of the company the prices quoted to British consumers had frequently been higher than the equivalents of the prices quoted to American consumers. It was clearly of great importance that British users of copper should be able to obtain supplies on terms as favourable as those given to their competitors, and he would welcome the development of copper production and refining within the Empire.

The London Joint Authority Bill.

The House of Commons Committee (presided over by Sir Arthur Shirley Benn) upon the Bill promoted by the London and Home Counties Joint Electricity Authority (the main purpose of which is to obtain power to acquire a site for a large generating station at Duke's Meadows, Chiswick, on the Thames), concluded its consideration of the Bill last week. Among the witnesses called was Mr. J. S. Highfield, past-president of the I.E.E. In the course of his evidence Mr. HIGHFIELD referred to the proposal of the London Power Co., which is now before the Electricity Commissioners, for the erection of another large station at Battersea, and expressed the view that if that station were sanctioned there would be no need for a station at Chiswick. The CHAIRMAN pointed out that the Electricity Commissioners had intimated that there ought to be two stations.

Mr. F. J. WROTTESLEY, K.C. (for the Barnes U.D.C., which was opposing), suggested that the Committee should adjourn until it had learned what decision the Electricity Commissioners had reached with regard to the proposed station at Battersea. The CHAIRMAN said that the Committee wished to proceed with the Bill.

The Committee, at the conclusion of the evidence, found that the preamble of the Bill was proved, subject to the Electricity Commissioners determining that the new station at Chiswick should be a "selected station" under the Central Electricity Board, and subject to the Board's adopting the scheme.

Mr. H. P. MACMILLAN, K.C. (for the London Power Co.), said that the company had to appear before the Commissioners on June 21st, to seek sanction for the erection of the Battersea station. There were many opponents, and he did not want to be prejudiced by any decision of the Committee in this case. He asked for the insertion of a clause in the Bill which would have that effect. The attitude of the Joint Electricity Authority was that the station at Battersea would not be competitive with Chiswick, and, indeed, that both stations were necessary. All he asked was that the *status quo* should be preserved.

The CHAIRMAN said that the Committee had not considered the Battersea station in any way, and did not see why it should attempt to deal with it. They had left the Commissioners to say what stations they wanted, and where they should be erected, having regard to all the circumstances.

The Department of Overseas Trade.

Replying on June 20th to a question by Mr. Hore Belisha, Mr. BALDWIN said that the matter of the abolition or retention of the Department of Overseas Trade was engaging the close attention of the Government, but he was not yet in a position to make a statement on the subject.

County of London Electric Supply Co. Bill.

The County Councils of Surrey and Hertfordshire have announced their intention of opposing this Bill in the House of Lords.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

E.h.p. Transmission with 33,000-Volt Cable.

The article by Mr. G. W. Preston in your issue of June 10th is interesting; such articles are very useful in drawing attention to the present delicate nature of 33,000-volt cables. These cables must apparently be handled with such care that only the manufacturers should be allowed to touch them; if they must be run in iron pipes their current rating must be reduced; if they climb a hill, reservoirs of oil to prime them may be necessary, and possibly diaphragm boxes will be required in addition. Where the cables are exposed to the air they must have sunshades. In general it would therefore appear that they require very careful nursing from the time of their manufacture to their being put into service, and results obtained would tend to show that they require this nursing to be continued during their period of service. The types of breakdowns that have occurred on such cables are numerous, and faults have occurred under all conditions of loading. To users of cables and those supplied by them, the nature of the fault and the reason of the breakdown are entirely immaterial, and the frequent breakdowns only show that the cable is not good enough, and is not able to meet the conditions under which it operates.

Possibly they are too cheap (or too inexpensive); certainly their working factor of safety after one or two years is too low. It costs very little more to lay a 33,000-volt than an 11,000-volt cable, yet for the same section, three times the load may be carried more efficiently. On the other hand, a view has been expressed in these columns that a 33,000-volt overhead line is more reliable than the present-day 33,000-volt cables. If this is so, one can only say that these cables are dear at any price.

It is too soon to speak of the performance of the "H" and "S.L." types in this country; an improvement in performance is confidently expected, but the question is, will these cables be as reliable as the old original 6,600-volt cables which have been worked for many years at 11,000 volts?

A. T. Scott.

London, *June 14th*, 1927.

Cheaper Wiring.

I have read the article by "H.W.C." with interest and some misgiving. "H.W.C." is perfectly right in his remarks relative to the home-made laws of certain supply company officials, who in many cases insist on having things done to suit their particular whims and fancies. All contractors will have come up against this kind of thing, and if they have sufficient knowledge of the Acts of Parliament relating to the supply of electricity they will be in a position to put the "know-alls" in their proper place. I, however, will not advocate cheaper wiring, as this cheapness is at present to the detriment of the contracting industry. I certainly would never dream of fitting four or five heating sockets, looping them together with 3/.036 or 7/.029 cable, and connecting them to one circuit. This arrangement may be all right for an electrical engineer's own house, as this gentleman would know the carrying capacity of his cable and how to use his apparatus. For anyone else, however, the job would (in my opinion) be indeed a shoddy one. Far too much cheap wiring is being done and seems even to be encouraged by some supply authorities, who should deprecate such work. It is not our policy as respectable contractors to encourage cheaper wiring; rather let us say better wiring, and uphold the status of the contracting industry. If anyone can suggest a method of attaining this object I shall be pleased to give any help that lies in my power. I will anticipate anyone suggesting the E.C.A. as a possible solution and would state that in this area (in my opinion) this body is more a hindrance than a help to really good contractors.

A. Milne.

Glasgow, *June 16th*, 1927.

Metal-clad Draw-out Switchgear.

Mr. Davies, in his letter on the above subject in your last issue, infers that the advocates of vertical metal-clad switchgear have had no opportunity of witnessing circuit-breaker interrupting-capacity tests. I would like to inform him that they have not only witnessed tests on their own breakers with equivalent plant to that which he refers to, but have also seen kinematograph films showing the performance of various sizes of horizontal metal-clad units when the breakers are tested to destruction. These have in no way modified their view as to the superiority of the vertical principle, and have given the lie to the speculation that the busbars on horizontal gear are immune from trouble in the event of a breaker failure. The breaker referred to in his letter can scarcely be called "reasonably flameproof" when such a cloud of flame resulted, and either horizontal or vertical bars would have been enveloped in such a case. The performance, however, indicates the necessity for revision in that particular design. That circuit breakers can be con-

structed without such an emission is evidenced by the fact that the latest A.I.E.E. rules state: "The breaker shall perform at or within its own interrupting rating without emitting flame." It is a matter of design, location, and type of venting, and there is no reason why one type should not be as immune from trouble from this cause as another. It is significant that the largest switchgear manufacturers in the world, who were the first to have experience with a large plant for interrupting-capacity tests, have already supplied vertical drop-down gear for a power station designed for a half-million kW of plant.

Mr. Davies also criticises the double-breaker system of busbar selection as incorporated so simply in the vertical type of gear. I wish to point out that this system has not only stood the test of several years' operating duty on all pressures up to 33 kV, but has successfully withstood severe tests designed to prove its efficiency. A standard double breaker in one tank had its busbar terminals connected to two independent 33-kV supplies, and one breaker was put through rupturing-capacity tests whilst the other remained open. Before the tests the engineers, who had had long experience with the testing plant, predicted that there would be no danger of the trouble spreading from the breaker undergoing tests to the auxiliary busbar terminals. Their prediction was fully confirmed by the tests. Furthermore, the contacts of the breaker which had not been in service were not in any way damaged, and the second breaker was thoroughly fit for service.

It is not for one moment claimed that the double breaker in one tank is as good as two breakers each in separate tanks; this would, of course, be more costly, and take up more space. It is, however, contended that the arrangement provides a safe and convenient method of bus selection, enabling the facilities which duplicate bars afford to be taken advantage of, whilst at the same time providing a spare breaker which can be used in case there is not enough time to inspect the contacts after operation on a fault.

The "novel ideas" Mr. Davies refers to were introduced by my company to eliminate the weaknesses of the old designs and to provide the facilities which modern requirements demand. Happily these are now backed up not only by service experience, but also by special tests designed to prove their efficiency. In view of this controversy I have obtained permission to publish the enclosed letter from the Manchester Corporation Electricity Department which was received in 1925, and the letter may be of interest to your readers.

S. Ferguson.

Manchester, *June 18th*, 1927.

[Enclosure.]

Manchester Corporation Electricity Department,
Dickinson Street, Manchester,
November 6th, 1925.

Subject: 33 and 6.6-kV Switchgear—Dickinson Street Sub-Station.

Messrs. Ferguson, Pailin, Ltd.,
Higher Openshaw, Manchester.

Dear Sirs.—In reply to Mr. Ferguson's inquiry concerning our experience with the operation of the double switch unit type of switchgear installed at the Dickinson Street substation, I am pleased to say that, so far, it has proved highly satisfactory, and provides the degree of flexibility necessary at that station.

Both sets of busbars are in operation, and two separate ring main systems pass through the 33-kV bars, whilst on the 6.6-kV side one bus-bar is connected with the Barton supply, and the other to Bloom Street or Stuart Street, as the case may be.

Work has been carried out on one set of bars on the 33-kV system, with the other set in service, but, of course, every precaution was taken to prevent any mistake in operation during the time the work was in progress.

Yours faithfully,

H. C. Lamb,
Chief Engineer and Manager.

Legal.

Le Breton Engineering Co. v. Norton Wireless Co., Ltd.

In the Shoreditch County Court, on June 14th, before Judge Cluer, Mr. W. Le Breton, trading as the Le Breton Engineering Co., St. John's Wood, N.W., sued the Norton Wireless Co., Ltd., to recover £72 18s., the price of 7½ gross of variable gridleaks which the defendants were said to have ordered and refused to take.

For the plaintiff it was stated that the order was a verbal one given to an agent. It was for 15 gross, and half had been delivered and accepted. Mr. Kelly, for the defendants, admitted giving an order for 7½ gross, but said that he had never seen the agent which it had been alleged took the order for 15 gross.

Judge Cluer said that the alleged order should have been confirmed by the plaintiff. He accepted the defendants' version and gave judgment for them with costs.

Reviews.

The Atomic Theory. By Prof. Arthur Haas; translated by T. Verschoyle. Pp. xiv + 222; figs. 56. London: Constable & Co., Ltd. Price, 10s. 6d. net.

The author of this book is professor of physics in the University of Vienna, and the work here translated, which is practically identical with Part III (of Volume II) of his "Introduction to Theoretical Physics," grew up out of the lectures which he delivered at the University of Vienna in the exercise of his profession. Two years having elapsed since the appearance of the German book, it has been necessary for Professor Haas to make sundry corrections and to supply some further additions, in order that the English edition may be well up to date. The rate of progress in the advance of this branch of science is at present so great, that a book begins to become obsolete from the very date of its publication; and readers interested in the subject, and wishing to keep themselves well informed, have constantly to be buying new books if they are not to fall behind in their knowledge. It is therefore particularly needful, in noticing books on this subject, to indicate clearly the nature and scope of its contents, so that readers may not find themselves purchasers of too many books that they find to be of little service to them.

The object of the work before us is to explain fully the fundamental ideas involved in modern atomic theory and set out the most important consequences that ensue therefrom, so far as this can be done without introducing the higher mathematics, or presuming any deeper knowledge of the science of physics than is comprised in the ordinary school curriculum. The book is therefore designed to be of assistance to all persons of scientific education, and the author believes all workers in allied branches of science, such as chemistry, will find it adapted to their needs. Professor Haas has a clear mind himself and a gift for making things clear to his readers. It would be difficult to name a work of this size in which the material dealt with was better handled. The first chapter deals with the elementary quanta: here the facts on which the present theory was built up are concisely and admirably marshalled. In the next chapter the theory of the hydrogen atom is set out with the same lucidity. Chapter III is devoted to röntgen rays, and Chapter IV to the theory of the elements. On this foundation, the general theory of spectra and of atomic structure can then be firmly established, and this is done in the fifth and last chapter. The valuable contents of the book however do not end here, many useful pages follow by way of an appendix. First a summary of the contents of each chapter is very helpful in gaining a comprehensive view of the several departments of the subject. Then a synopsis of the symbols most frequently used. This feature might with advantage be imitated by all writers, as it saves one who consults the book hurriedly, much turning over of pages. The same might be said of the table of the universal constants in atomic physics which follows. Finally there is an historical summary valuable for rapid reference, which serves to impress—indeed, it almost stuns—the mind with a sense of the prodigious rate at which knowledge is now being accumulated. A well designed index concludes a work which, in 220 pages, ably covers the whole range of the subject. In spite of the necessity for so much compression the book is eminently readable, thanks to wise selection of material and the excellence of its arrangement.

Rotary Convertors: Their Principles, Construction and Operation. By E. P. Hill. Pp. xiii+329; figs. 247. London: Chapman & Hall, Ltd. Price, 25s. net.

Although the "British Standard Glossary of Terms used in Electrical Engineering" (B.E.S.A. Report No. 205) enjoins us to adopt the American name "Synchronous Convertor"—a point with which we do not quarrel—we still like to think that this type of machine, at least for 50-cycle frequency, was developed and perfected by British designers. It has always appeared to us that the 25-cycle compromise, with its costly consequences under the new Electricity Act, was one of the least desirable engineering developments ever imported into this country.

The future of the rotary convertor furnishes matter for interesting speculation. With the rather rapid conversion from direct to alternating current for distribution it would seem that the relative importance of this type of machine is likely to diminish.

A feature that has doubtless proved attractive to many writers—though perhaps unconsciously—is the remarkable ease of deducing many facts concerning the action of the rotary convertor by the aid of elementary mathematics, and also the simplicity of the results thus obtained.

Though written by a designer, the book before us is not intended for designers, but for engineers responsible for purchasing, operating, or testing rotary convertor machinery. This fact largely explains the character of the book, but to our mind does not justify the use of so many general arrangements and photographic reproductions throughout the text. The book is beautifully got up, and the illustrations as a whole are excellent; but we think that money and space could have been saved with advantage by the omission of numerous photographs and other material. Fortunately, the book has not

been spoiled in this way, for there is much solid material which will achieve the intended purpose.

Turning now to the contents of the book, the reader will appreciate information on many points associated with the working of rotary convertors, in addition to much of what might be classed as standard information. In considering armature heating, it is satisfactory to note that the maximum conductor heating is discussed. Though this does not enable the maximum temperature rise to be accurately predicted, owing to the flow of heat, it does provide a means of estimating the output obtainable under given conditions. Among the constructional features dealt with, the question of the brush angle is argued at length. In view of the fact that the rotary convertor is the chief culprit in the interference with communication circuits, we should have preferred a much more detailed treatment of this discussion. Also the effect of saturated iron in transformers employed in connection with reactance control of the voltage might well have been dealt with at greater length.

There is a useful chapter on transformers and auxiliary apparatus. An interesting section on the origin of the triple harmonic is included. In the general treatment of this subject much yet remains to be done. The starting of convertors then follows, and many important details in this connection are emphasised. Though the author is on the staff of Messrs. Metropolitan-Vickers Electrical Co., justice is done to the methods used by other firms.

The remaining chapters deal with operation, control, specifications, and testing, but we think enough has been said to show that the book will be of great service to those requiring a good general knowledge of rotary convertor practice. The book concludes with a four-page bibliography and an index.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1926.

1,961. "Electrical control gear for the starting of electric converting apparatus." M. W. Woods, M. G. Woods, J. P. Keith, J. Cruwys, G. Richardson and Power Equipment Co., Ltd. January 22nd, 1926. (Cognate application 9,931/26.) (271,534.)

2,178. "Ignition magnetos." E. C. R. Marks (Wico Electric Co.). January 25th, 1926. (271,536.)

4,459. "Electric selective distant control systems." Standard Telephones and Cables. Ltd. (Western Electric Co. Inc.). February 16th, 1926. (271,544.)

4,766. "Electric switches." H. D. Jackson Buckle Co., Ltd., H. D. Jackson, and F. White. February 19th, 1926. (271,547.)

5,286. "Vacuum electric tube devices." T. W. Lowden. February 24th, 1926. (271,558.)

5,318. "Electric organ action." J. Swinburne. February 25th, 1926. (271,560.)

5,390. "Antenna systems." British Thomson-Houston Co., Ltd. May 9th, 1925. (251,946.)

5,591. "Telephone systems." Standard Telephones & Cables, Ltd. (Western Electric Co. Inc.). February 27th, 1926. (271,576.)

5,593. "Wireless receiving aerial systems and circuits therefor." G. A. Mathieu. February 27th, 1926. (271,577.)

5,618. "Impulse transmitters for use in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd. June 1st, 1925. (252,674.)

6,133. "Electric generator or gas battery." C. H. Kendall (legal representative of J. A. Kendall, deceased) and R. E. Gore. March 4th, 1926 (271,581.)

6,381. "Terminal binding-posts for electric conductors." Oliver Pell Control, Ltd., and C. Oliver. March 8th, 1926. (271,583.)

6,483. "Vacuum electric tube devices." E. Y. Robinson, E. J. E. Hubbard and Metropolitan-Vickers Electrical Co., Ltd. March 8th, 1926. (271,584.)

7,146. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. March 15th, 1926. (271,592.)

7,354. "Construction of electric transformers." English Electric Co., Ltd., and A. T. Chadwick. March 17th, 1926. (271,594.)

7,431. "Means for the electrodeposition of chromium and its alloys." Clausson & Co. Aktiebolag. January 14th, 1926. (264,442.)

7,840. "Electrical resistance heaters for low temperatures." J. G. A Rhodin and E. B. Westman, Ltd. March 22nd, 1926. (271,600.)

8,450. "Electric discharge tubes." M-O Valve Co., Ltd., and C. W. Cosgrove. March 29th, 1926. (271,603.)

8,877. "Telephonic instruments." W. J. Rickets. April 1st, 1926 (271,604.)

9,728. "Cone-type loud speaker." Hopkins Corporation. June 1st, 1925 252,685.)

9,733. "Loud speakers." Hopkins Corporation. December 22nd, 1925. 263,478.)

10,128. "Cable grips." Callender's Cable & Construction Co., Ltd., and T. T. Wood. April 17th, 1926. (271,613.)

10,895. "Thermal-relay or time-lag device for use with electrical circuits." S. Brotherton. April 26th, 1926. (271,618.)

11,069. "Violet-ray high frequency apparatus." G. H. L. Beagley. April 27th, 1926. (271,620.)

11,203. "Means for maintaining constant the speed of electrical motors." C. E. Tasker. April 28th, 1926. (271,622.)

11,672. "Contact-breakers for magneto-electric ignition apparatus for internal-combustion motors." A. Lindberg. May 3rd, 1926. (271,627.)

13,477. "Dynamo-electric machines." Maschinenfabrik Esslingen. May 8th, 1925. (252,731.)

13,865. "Dynamo-electric machines." Maschinenfabrik Esslingen. June 2nd, 1925. (Addition to 252.731.) (253,115.)

15,294. "Automatic lighting device for quartz mercury-vapour lamps." H. Brettmon. June 17th, 1925. (253,927.)

16,524. "Electric and gas lamp shades." G. F. Green. July 1st, 1926. (271,665.)

19,265. "Electrolytic apparatus and electrodes therefor." W. G. Allan August 4th, 1926. (271.685.)

20,054. "Process of and apparatus for joining cables." Siemens-Schuckert Werke Ges. and F. Hanff. August 13th. 1926. (271,688.)

22,679. "Franking machines." U. Kohler and Hasler Akt. Ges. vorm. Telegraphen-Werkstatte Von. G. Hasler. September 14th, 1925. (258,300)

22,784 "Electrical connection and method of forming the same." National Carbon Co. Inc. March 3rd, 1926. (267,081.)

24,197 "Electric machines with slot winding." Siemens-Schuckertwerke Ges. October 1st, 1925. (Addition to 234,821.) (259,228.)

24,296. "Draw-out trucks for electric switchboards." Johnson & Phillips, Ltd., and P. M. Wood. October 1st, 1926. (271,705.)

24,354. "Method and means for converting mechanical vibrations into acoustical vibrations." Gramophone Co., Ltd. May 1st, 1926. (270,238.)

24,689. "Electrical accessories for the internal-combustion engines of motor vehicles." Soc. de Paris et du Rhone. November 4th, 1925. (260,963.)

24,717. "Wireless receiving apparatus for the elimination of atmospheric disturbances." E. Geles. October 5th, 1925. (259,255.)

25,067. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd February 26th, 1926. (266,668.)

25,934. "Rotary distributors for electric machines." J. G. Daloz. October 20th, 1925. (260,255.)

26,398. "Electric condenser terminal arrangements." Dubilier Condenser Co. (1925), Ltd. April 29th, 1926. (270,241.)

26,646. "Process of electrolytically sterilising water and apparatus therefor." P. M. R. Salles. October 25th. 1926. (271,721.)

26,869. "Means for producing high vacuum." British Thomson-Houston Co., Ltd. November 27th, 1925. (262,069.)

26,895. "Electrolytic apparatus and electrodes therefor." J. P. Scott. October 27th, 1926. (271,726.)

27,366. "Connections for electric circuits." G. F. Judd and E. A. Millington. November 1st, 1926. (271,730.)

27,474. "Carbon slip-pieces for current bow collectors." E. Conradty and O. Conradty. November 23rd, 1925. (261,730.)

27,581. "Electrical direction indicator for vehicles." G. Bruckner. November 3rd, 1926. (271,731.)

28,557. "Electric furnaces." Sir W. G. Armstrong, Whitworth & Co., Ltd., and E. Windle. November 12th, 1926. (271,739.)

28,768. "Gaseous electric conduction apparatus." Ratheon Manufacturing Co. December 21st, 1925. (263,108.)

28,904. "Starters for engines." M. B. Jackson. March 17th, 1926 (267,884.)

30,156. "Ships' telegraphs." J. M. Rutherford. November 29th, 1926. (271,750.)

30,242. "Means for packing electric and like bulbs." J. Brownlie and G. M. Woodhouse. November 30th, 1926. (271,753.)

30,336. "Magnetisable material." E. Gumlich. November 30th, 1925 (262,153.)

30,437. "Time-switching control apparatus for electric current-consuming apparatus." Siemens-Schuckertwerke Ges. December 2nd, 1925. (262,435.)

1927.

1,701. "Electric furnaces for heating gases to high temperatures." Akt. Ges. Brown, Boveri et Cie. January 22nd, 1926. (264,849.)

1,881. "Electric arc lamps." L. Korsten. February 25th, 1926. (266,685.)

3,348. "Ventilation of electrical machines." Allgemeine Elektricitats-Ges. February 6th, 1926. (265,619.)

3,988. "Electric welding torches." British Thomson-Houston Co., Ltd. February 20th, 1926. (266,336.)

5,627. "Commutator motors or generators with switching arrangements for the rotor winding." C. Lotte. March 12th, 1926. (Addition to 242,602.) (267,492.)

5,790. "Artificial lighting system combined with lamp reflectors or lamp shades for artificially lighting public streets or thoroughfares" J. Dollard. March 2nd, 1927. (271,789.)

6,430. "Electrode holders for arc lamps." J. R. Quain. January 25th, 1926. (Divided application on 266,872.) (271.791.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from the dates given :—

June 8th.

Welradco. No. 479,021. Class 8. Instruments and apparatus for use in wireless telegraphy and telephony.—Wooldridge Radio Co., Ltd., 39, Lisle Street, W.1.

Brunet. No. 479,214. Class 8. Electric transformers, loud speakers, and headphones.—Pettigrew & Merriman (1925), Ltd., 2 & 4, Bucknall Street, W.C.2.

Aurion. No. 480,162. Class 11. Apparatus for the use of deaf persons.—Lawrence & Mayo, Ltd., 19, New Oxford Street, W.C.1.

Electrolux. No. 469,787. Class 50. Refrigerating chests, safes, and goods of a like kind.—Electrolux, Ltd., 153 & 155, Regent Street, W.1.

Glypanite. No. 479,395. Class 50. Electrical insulating material.—Micanite and Insulators Co., Ltd., Empire Works, Blackhorse Lane, Walthamstow, E.17.

Himegite. No. 480,463. Class 50. Insulating substances (electrical).—T. De la Rue & Co., Ltd., 110, Bunhill Row, E.C.1.

June 15th.

Touchtone. No. 472,904. Class 8. Wireless telephonic receivers, but not including accumulators or any goods of a like kind.—Gent & Co., Ltd., Faraday Works, St. Saviour's Road East, Leicester.

Liontron. No. 479,444. Class 8. Crystal detectors.—S. Lyons, 119, Clerkenwell Road, E.C.1.

Walbro, W.B. (lettering and design). No. 479,739. Class 8. Wireless telephonic apparatus and instruments.—Walker Bros., St. Joseph's Works, High Street, Bramley, Guildford.

Synchronola. No. 479,893. Class 8. Wireless telephonic apparatus and parts.—Synchronola Radio Co., Ltd., 150, Brownlow Road, Horwich, Lancs.

Davent. No. 480,759. Class 8. Electric batteries.—M. Wright (Midland Electrical Co.), 113, Coleshill Street, Birmingham.

Stella Electric Lamps (lettering and design). No. 479,034. Class 13. Electric lamps of ordinary metal made in Great Britain.—Stella Lamp Co., Ltd.

Mainten. No. 479,588. Class 8. Philosophical instruments, scientific instruments, and apparatus for useful purposes; instruments and apparatus for teaching, but not including thermostats or any goods of a like kind.—H. R. Malby (Radio & Electrical Installations), 126, Portland Road, Hove.

Medicoil, No. 479,542, and Sunviray, No. 479,543. Class 11. Instruments, apparatus and contrivances for surgical or curative purposes.—Ajax, Ltd., 117, Central Street, E.C.1.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALFRETON (Derbyshire).—Primitive Methodist church, school, &c. (£30,000); R. Watchorn (donor).

ASHFORD (Kent).—Nurses' home, for East Ashford Board of Guardians; E. A. Jackson, architect, 13, North Street.

BARNSLEY.—School, Ardsley, for the borough E.C.; Dyson, Cawthorne & Coles, architects, 10, Regent Street.

BRADFORD.—Seven-storey block, offices and shops (£230,000); city architect, Town Hall. Mental hospital, Westwood estate (£260,000); city architect. Filter pressure house, Bingley; Thos. Obank & Son. Police headquarters; city architect.

BRISTOL.—Reconstruction of Palace Picture Theatre; G. H. Blackburn, manager; F. Verity, architect, London. Cinema on site of St. George's Hall, for J. Pugsley; W. H. Watkins, architect, Clare Street. Institution for mental defectives, for the T.C.; borough engineer. Doubling railway at Avonmouth Docks; city engineer.

CARLISLE.—Additional 300 houses, for the T.C.; borough surveyor. Warehouse, Caldergate; J. Leslie, architect. Stores, James Street; Hodson, Scott & Sons, Ltd.

CARNARVON.—Conversion of Sportsmen's Hall into town hall and municipal offices, for the T.C.; Arthur Hewitt, architect, Llandudno.

CHIPPENHAM.—Rectifier shop, for the Westinghouse Brake Co., Ltd.

CHISLET (Kent).—Additional 100 houses, for the Chislet Colliery, Ltd.

CLECKHEATON.—Works, Moorend, for the Killgerm Co., Ltd., chemical manufacturers, and Messrs. John Sharp, wire manufacturers (£16,000).

COATBRIDGE.—Shops for Clarkston Co-operative Society, Ltd.; Mr. Moffat, manager.

CREDITON (Devon).—Housing scheme (25), for the U.D.C.; surveyor.

DOUGLAS (I.O.M.).—Stores, Fort Street; Todhunter and Elliot, Ltd. Church, Hilary Street; Christian Science Society.

DUDLEY.—Extensions, mattress factory, Stourbridge Road; F. Flanagan. Additions, Grammar School; governors. Isolation hospital, for the T.C.; borough engineer.

EPSOM.—Housing scheme (38), for the R.D.C.; F. A. Pratley, surveyor, Ashley House.

FURNESS DISTRICT.—Alterations to Leven Valley Co-operative Stores; J. A. Wilson, The Glen, Backbarrow.

GOLDTHORPE (Doncaster).—Church hall, to seat 500, for the Wesleyan trustees; Sir Alfred Gelder, architect, Hull.

GOSPORT.—School (£18,000) at Brockhurst; secretary, Education Committee.

GUISBOROUGH.—Central schools, for North Riding E.C.; director of education, Northallerton.

HAMILTON.—Coachbuilding and repair works for Messrs. Metcalfe, coachbuilders, of London and Romford; local representative, 26, Bothwell Street, Glasgow.

HAMPTON.—96 houses, Priory Road; U.D.C. surveyor.

HASTINGS.—Additions, Fairlight Sanatorium, Old London Road; Eigood and Hastie, architects. Concert pavilion, Central Cricket Ground; A. Wallis.

HAYWARDS HEATH.—Proposed installation of electric lighting in St. Wilfred's Church; Parochial Council.

HULL.—Central public library extension (£14,000); city architect.

KESWICK.—Town hall, Main Street, for the U.D.C.; surveyor.

KIRKCALDY.—Bakery for Kirkcaldy Co-operative Association, Ltd.; the manager.

LANARKSHIRE.—Picture house at Carluke; M. Burns, manager. Church building at Allanton (£2,200); Rev. J. Cromarty Smith, Coatdyke.

LEITH.—Town hall and library; Bradshaw, Gass & Hope, architects, Silverwell Street, Bolton.

LONDON (East Ham, E.).—Additions, East Ham shopping hall, Myrtle Road; East Ham Shopping Hall, Ltd. Alterations, 255-9, Katherine Road; H. Blackman.

(Ilford, E.).—Distributing depôt, High Street; United Dairies, Ltd.

(Islington, N.).—Extension, municipal buildings (£48,000); Borough Council architect.

(St. Pancras, N.W.).—Buildings, Pratt Mews, Bayham Street; W. A. Rutter, architect.

LINCOLN.—Church, Addison Drive, for the Wesleyan trustees.

LOWESTOFT.—Electric car house, London Road South; E. J. Ford.

LYMINGTON.—34 houses (£15,099); C. T. Webb, Beaulieu, New Forest, contractor.

MANSELTON.—50 houses, G.W.R. Garden Village Society, Ltd., Swansea.

MERTHYR.—Pavilion, Aberfan; Miners' Welfare Fund.

MUIRKIRK.—Remodelling and extending Furnace Road Higher Grade School, with electrical work, for Ayrshire E.C.; William Reid, master of works, Education Offices, Ayr.

NEWARTHILL (Holytown, Lanarkshire).—Re-erection of 'bus garage, for Messrs. Brown (£5,000).

NEWTOWN.—Smallpox hospital; Worcestershire C.C.

NORTHAMPTON.—46 houses, Weedon Road site; A. Glenn and Sons.

OLDBURY (Birmingham).—Public baths with public hall (£16,000), for the U.D.C.; surveyor.

OTLEY.—30 houses, Bradford Road; O'Brien & Richmond.

OXFORD.—New kitchens, Oriel College, Magpie Lane; trustees. Students' rooms and extension of kitchen, St. Margaret's Road; St. Hugh's College trustees. Library, St. Aldate's site; Library Committee of Corporation. Two secondary schools; Education Committee. Additions, warehouse, Red Lion Square; Elliston and Cavell, Ltd.

OXFORD.—Two secondary schools, for the City E.C.; Director of Education. Additional housing scheme, for the T.C.; city surveyor.

RICHMOND (Yorks.).—Church, Catterick Camp (£15,000), for the Wesleyan trustees; Arthur Kellett, architect, Barnard Castle.

ROCHFORD (Essex). Additional housing schemes (92), for the R.D.C.; surveyor.

SANDWICH.—Additional 30 houses, for the T.C.; borough surveyor.

SCARBOROUGH.—Picture house, Westborough, for the Londesborough Theatre and Picture House (Scarborough), Ltd.

SLOUGH.—Station extensions (£20,000); Great Western Railway Co. Church, Bath Road, for the Wesleyan trustees.

STANDISH (Wigan).—Cinema and shops, High Street, for E. Bentham. Cinema, Preston Road, for J. R. Horrocks.

STIRLING.—Conversion of infirmary into headquarters' offices and meeting place for Stirlingshire Education Authority; the clerk.

STOCKTON-ON-TEES.—Extensions, Globe elevator works, for Pickering, Ltd.

STROUD (Glos.).—Nurses' home, General Hospital; A. Linton Iredale, architect, Park Road.

SWANSEA.—100 houses; borough architect.

SWINDON (Wilts.).—Church, Hurst housing estate; Rev. E. R. Knapp, vicar of Redbourne Cheney.

THORNABY-ON-TEES.—School (£10,000), Westbury Street, for St. Patrick's Catholic church; Rev. Canon D'Hooghe.

TROON.—Masonic temple, hall and shops, Portland Street (£4,000); J. R. Johnstone, architect.

TRURO.—Additions, Truro College; trustees. Oil depôt, Newham; Russian Oil Products, Bristol.

WALSALL.—Additional housing scheme (500), for the T.C.; borough surveyor. School, Blakenhall (£9,570), for the borough E.C.; borough surveyor.

WARRINGTON.—Housing scheme (30), Reynolds Street estate, for the T.C.; A. M. Ker, borough engineer. St. Oswald's Church, Padgate Lane (£4,000), for Rev. Father Hind; Wright & Hamlyn, architects; John Dolan, builder. Extensions, Palatine Works, Causeway Avenue; Fletcher, Russell & Co., Ltd. Pavilion, Causeway Avenue; Regals, Ltd. Pavilion, Greenalls Avenue; Greenall, Whitley & Co., Ltd.

WATFORD.—50 houses, Leggatts Rise Estate; Kempster and Williams. Joiners' shop, sawmill, garage and offices, Beachwood Rise; Kempster & Williams.

WEYMOUTH.—Electric light installation, borough sanatorium (£400), for the T.C.; town clerk.

WINCHESTER.—Drainage scheme with pumping stations, for the T.C.; John Taylor & Sons, engineers, Caxton House, Westminster, London, S.W.

WINDSOR.—Bazaar premises, Peascod Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.

YORK.—Extensions, Secondary School, Nunthorpe; Education Committee.

INDEX.

List of sub-headings:

Authors.
Bankruptcy Proceedings.
City Notes.
Contracts Closed and Open.
Correspondence.
Institution Notes.
Legal.
Lighting and Power Notes.
Liquidations.
New Companies.
New Electrical Devices, Fittings and Plant.
Obituary.
Official Returns.
Parliamentary Notes.
Radio Notes.
Railway Notes.
Reviews.
Selected Radio-Telephone Apparatus.
Telegraph Notes.
Telephone Notes.
Tramway Notes.

ERDEEN sawmills, Electrification of, 848
measuring instruments, by Lt.-ol. K. Edgcumbe and F. E. J. ckenden, 232, 276
ystems, The stability of, by F. H. lough, 322
ent prevention, 65, 543
ents, 24, 65, 686
ents caused by vehicles, Street, 65
ents, Mining, 265
ulator Makers' Association, 177, 8, 339
ulator separators, New, 182
A gas company and the Electri-ty, 257
Electrification and the Electricity, 83
The Electricity (Supply), 36, 43, 3, 85, 352
explosion, Inquiry into, 1024
Merchandise Marks, 758
as an electrical market, 297
tising Competition, Our, 285
tising electric cooker hire, 17
tising, Electrical, 137
tising electricity by films, 223
tising, Humour in, 430
tising van, An effective, 173
claim, A successful, 882
strike, Threatened, 838
navigation lights, 374, 394
in markets, Minor, 69
y, The Foreign, by A. J. Smith, 7
ed Clause," The, 123
ltural electrical machinery, by B. Matthews, 331, 377
lture, Electricity in, 546, 982
lture, Rural electrification and, Major A. McDowell, 209
ft, Leader cable for, 307
p, Electrical equipment for an, 5
hot, Extensions at, 725
bra theatre lighting, 375
earthed " house, The, by H. W. othier, 424
electric " day, The, 556
ctric house, An, 13
bet-itis, 524
nium in America, 757
nium in Canada, The manufac-re of, 936
amated Engineering Union An-ual Conference, The, 881
ca, Aluminium in, 757
ca and the British market, 343
ca, British industrialists to visit, 6
ca, Foreign electrical loans in, 257
ca, Powdered lignite in, 780
can activity in Brazil, 428
can capital for Brazil, 59
can distribution practice, 440
can drawn tungsten patent held valid, 306
can electric refrigerator trade tivity, 296
can electrical vehicle exports, 176
can engines, Australian ratepayers ainst, 489
can enterprise in Poland, 94
can exports to New Zealand, 680
can meters, European *v.*, 716
can radio apparatus licences, 559
can refrigerator industry, The, 8
can toaster banned, A cheap, 848
pers for community singing, 184
tion " on the Continent, 926
American telephone appointment, 1, 885
-Australian wireless telegraphy, 546
French discussions: F.B.I. statement, 94
French Industrial Conference, 343
German industrial discussions, 3, 972
Italian conference, An, 560, 599
Spanish commercial convention, e, 678
s, The effect of high voltages on ntalum, 982
Apology, An, 65
Appliances on an L.C.C. estate, Electrical, 757
Arbitration law reform, by " Legal Contributor," 595
Arc welding aided by hydrogen, by P. L. Roberts, 10
Argentina, British goods in, 774
Argentina, British trade with, 15, 597
Argentina, The importance of, 972
Artificial light as an aid to aerial navigation, 374, 394
Artificial-light treatment for children, 646
Artificial silk company, New, 680
Artificial silk openings, Further, 123
Artificial silk-spinning machines, Electrically-driven, 222
Artificial sunlight, 726
Ashford, Electricity supply at, 587
Association of Supervising Electrical Engineers, 686, 765
Association of Teachers in Technical Institutions, 892
Astoria Theatre lighting, 133, 298
Australia and German contracts, 974
Australia, British exports to, 14
Australia, Engineering wages in, 972
Australia, German locomotives for, 489
Australia, Radio apparatus for, 15
Australia, Radio patents in, 1014
Australia, Radio royalties in, 133
Australia, Storage batteries in, 758
Australian companies, New, 177, 516, 556, 799, 973
Australian company's change of name, 716
Australian copper consumption, Increased, 58
Australian demand for increased duty on batteries, 1014
Australian duty on valves deferred, 556
Australian electrical imports, 514, 639
Australian preference for British goods, 16
Australian radio action, 433, 680
Australian ratepayers against American engines, 489
Australian standard voltages, 647
Australian tariff decisions, 14, 176, 346
Australian tariffs, The demand for higher, 972
Austria, Electricity works in, 439
Austrian cable sales combine, 513
Austrian duty on insulators, Increased, 1014
Austrian electrical industry, 716
Austrian tariff changes, Proposed, 515

Authors—

Allen, S. T., Electricity supply in the West Midlands, 1038
Ashfield, Rt. Hon. Lord, The co-ordination of urban transport, 35
Balbi, C. M. R., Electrical aids for the deaf, 789
Barber, N. E., Domestic refrigeration, 195
Bentley, F. E., " Creeping " cables, 806
Berry, H. H., The electric market-place of the future, 9; Electrified homes, 989
Bexon, W. C., Disribution over an extensive area, 900, 944
Braendle, E. W., A radio-telephone loud-speaker, 876
Brockbank, R. A., The measurement of sheath losses in cables, 751
Campbell, A., A capacitance bridge and new inductometer, 31
Campbell, D. F., Electric furnaces in non-ferrous metallurgy, 537
Carter, T., A radio crystal detector circuit, 249; Metal clad draw-out switchgear, 857
Chapman, F. T., Standard performances for electrical machinery, 250, 292
Clothier, H. W., The " All-earthed " house, 424
Clough, F. H. The stability of a.c. systems, 322
Cooper, A. R., Electric railway track equipment, 74, 111

Authors—*continued.*

Coursey, P. R., and H. Andrews, Radio battery eliminators, 1033
Cramp, Prof. W., Electricity supply tariffs, 126, 165
Crawley, Lt.-Col. C., Wireless telegraph communication, 592, 675, 749
Dunsheath, P., High-voltage " S.L." type cables, 153, 189
Eckersley, T. L., Short-wave wireless telegraphy, 996
Edgar, J., Metal patterns and electricity, 509
Edgcumbe, Lt.-Col. K., and F. E. J. Ockenden, A.c. measuring instruments, 232, 276
Ekström, A., Electricity tariffs, 859
" Essaye," Tests for resultant economy, 167
Finch, G. I., Electrothermics, 817
Fowler, T. B., The centenary of Volta, 336
G.F.J., The power supply of wireless sets, 921
Goodrich, W. F., The use of low-grade fuels, 116
Guy, H. L., Economic value of increased steam pressure, 697, 738
Hall, J., Electrical measurement of temperature, 1036
Hamar, E. E., Publicity for supply undertakings, 747
Harrison, Lt.-Com. H. T., Public lighting, 450
Horsley, J. A. B., Electrical installations in mines, 235
H.W.C., Cheaper wiring, 923
Jackson, W. E., The charges for packages, 425; Easy payments and the law, 466; The Trade Unions Bill, 633; The Landlord and Tenant Bill, 672; The Shops Hours Bill, 922
Jones, W. J., H. Lingard and T. Catten, Electric floodlighting, 197
Kapp, R. O., Generating station costs, 124
Kennedy, W. S., The Electricity (Supply) Act, 1926, 52, 85
" Legal Contributor," Arbitration law reform, 595
Lipman, C. L., Modern electrical measuring instruments, 163
Marsden, R., Quality *versus* price, 208; What is it to drive?, 333; Hand-operated or automatic?, 510
Matthews, R. B., Agricultural electrical machinery, 331, 377; Electro-farming, 549, 787, 827
McDowall, Major A., Rural electrification and agriculture, 209
McJannet, D. W., Power transformer operation, 589
McLelland, W., Electricity in warships, 575, 616
Meares, J. W., Electric water heating, 635
Monkhouse, S. E., Industrial electric heating, 194
Morcom, Lt.-Col. R. K., The electrical industry in 1926, 467
Nixon, E. B., The design of extra-high-pressure cables, 5
" One of Them," The trials and humours of an estimating department, 207
Paterson, C. C., Electric lamps and valves, 494
" P.B.E.," The ordinary engineer and his remuneration, 634
Phillips, R. W. L., Presidential address to the I.M.E.A., 899
Pinkney, W. F. T., Assisted wiring schemes, 365
Preston, G. W., E.h.p. transmission, 919
Purse, F.W., Ascertainment of " kilowatt maximum demand," 752
" Quondam Apprentice," Some reminiscences, 551
Rawll, R. H., The earthing of portable domestic appliances, 206

Authors—*continued.*

Rich, T., Over the Loetschberg on a 4,500-h.p. locomotive, 287
Riddle, A., Japan and the electrical industry, 1010
Roberts, P. L., Arc welding aided by hydrogen, 10
Roles, T., Recent developments in power plant design, 944
Ross, E. G., The domestic load, 630
Sayers, D. P., Mains engineers' problems, 829
Schuler, H. W., Swiss railway electrification, 1007
Scott, A. T., Extra-high-pressure transmission, 128
Scott, E. K., Pulverised-fuel firing, 538
Seton, A., Electrical insulation, 90
Simons, E. N., The lay-out of the contractor's shop, 968
Smith, A. J., The factor's catalogue, 337; Reducing selling costs, 674; The foreign agency, 967
Spencer, D., Imperial development and co-ordinated investigation, 714
Stansfield, J. J. H., Unemployment insurance, 294
" Supply-station Engineer," Ironclad switching systems, 1009
Taunton, H. R., The ideal wiring system, 670, 709
Taylor, C. H., Mixed-pressure colliery turbines, 1035
Taylor, W. T., Sag calculations for power transmission lines, 290, 334, 379
Thornton, Prof. W. M., What is electricity?, 493
Tupholme, C. H. S., An electric welding job, 510
Tyers, P. D., Portable radio receivers, 963; Wireless batteries, 1012
Waite, J. N., River water—or cooling towers?, 46
Walsh, J. W. T., Illuminating engineering, 409
Wedmore, E. B., W. B. Whitney, and C. E. R. Bruce, Oil-immersed circuit breakers, 660
Wharton, C. J., The electrical production of steam, 452
White, H. R., H.p. transmission, 778
Wilkinson, G., Ideal electricity supply, 966
Wilkinson, J. R., Metal-clad draw-out switchgear, 970
Windred, G., Single-phase induction motor starting devices, 874

Automatic?, Hand-operated or, by R. Marsden, 510
Automatic telephony in Sheffield, 464
Automobile lamps, Shockproof, 514, 641
Ayrshire, Electricity supply in, 890

BALL-ROOM Lighting, 513
Ballot, Results of the " W.O.B.," 870, 879

Bankruptcy Proceedings—

Albion Electric Co., 256, 431
Archer, J. E. W., 345, 515
Armitage, F. H., 557
Atkins, J., 718, 756, 798, 841
Atkinson, H. H., 17, 256
Bardwell, S. H., 515
Barker, J. R., 640
Barker, W. A., and F. G. H. Barker, 1016
Barnes, G. C., 256, 557
Batt, E. G., 756, 928
Baylis, H. W., 840
Bebbington, H., 135, 798
Bell, L., 719, 756, 841, 928
Benson, J., 640
Bosher, J. A., 883
Brock, R. L., 56
Brookes, C. J., 756
Broome, W. J., 599, 679, 756

Bankruptcy Proceedings—*cont.*
Burnell, R. A., 472
Busfield, H., and J. J. Whittaker, 679
Challener, A. E. S., 387, 718
Charnock, J. R., 17, 345
Cheshire, P., 599, 798
Chisholm, J. D., 640
Collier, T. F., 472, 515, 598, 679, 1016
Comton Wireless Manufacturing Co. (A. P. Pacifico, J. P. Pacifico, and R. Feitelson), 96, 344
Cowley, E., 256, 472, 640
Coxon, W. K., 96, 718, 928
Cullum, A. J., 17, 135
Davenport, J. N., and L. A. Hackett, 214, 387
Davies, D. E., 883
Dickson, W. H., and A. J. Solomon, 17, 174
Donovan, D. T., and H. A. Langlois, 17, 96, 387, 598
Dollittle, J. H., 214
Duffin, A. H., and G. Kershaw, 719, 883
Figgins, J. V., 256, 472
Ford, P., 472, 718
Garrod, A. J., 431, 472, 557, 598
Glenn, H. A. S., 841
Goss, F. C., 515
Grainger, G. E., 387, 472
Gregory, F. F., 599
Grigsby, W. R., 841
Gross, F. C., 883
Hall, G. S., 1016
Hartley, F. A., 472
Hartley, F. A., and R. Hartley, 136, 472
Henstock, E. O., 299
Hereford-Lavey, J. R., and V. de Frece, 96
Hofman, C. G. (L. J. Chambers and Co.), 214
Holmes, S., 798
Horne, P. W., 174
Horsfall, W. M., 841
Hosken, S. T., 174, 345
Hubbard, C., 798, 1016
Hughes, A. H., 640
Humphreys, J., 345
Husband, F., 798, 928
Jensen, J. L. R., 798
Jones, M. C., 557
Joyce, J. O., 256
Kirk, E. W., 299, 345, 515
Kitching, C. H., 883
Lancaster, The Younger, E. M., 883, 928
Lazenby, G. C., 928, 1016
Leng, F., 883, 928
Lyons, J. F., 928
Mackintosh, E., 928
Marshall, S. B., 973
Martin, J. R., 557, 599
Mason, G., 798
Mason, G., and G. E. Tinsley, 472, 798
Mellor, G., 96
Mills, H. A., 17, 135, 256
Milnes, H., 174, 841
Moir, A. T. K., 640
Moody, C. P., 515, 718
Munday, E. D. S., 96, 299
Nichols, C. J., 345, 798, 973
Nichols, J. T., 1016
Nutter, H., 719, 798
Owen, W. E., 883
Pacifico, A. P., 756
Pacifico, Barney, 840
Parker, C. E. F., 136, 256
Parris, H. E., 96
Payne, N. H., 17, 96
Peet, J. R., 17
Pegrum, A. W., 256
Purcell, S., 515
Reed, V., 640
Reeves, R. P., 174, 472, 514
Refoy, J., 299
Rennie, J. G. F., 883
Rhodes, W. C., 136
Richardson, A. H., 345, 387, 598
Robinson, H., 841
Sandell, J. G., 136, 174, 344
Sanders, H. A., 557, 1016
Scott, J. G., 174
Segal, J., 756
Sims, G. R., 214, 256, 387
Smart, W. N., 883
Smethurst, A. A., 718, 756, 841
Smith, H. L., 928
Smith, W. T., 1016
Snook, F. C., 299
Spaven, J., 1016
Spencer, Mrs. H., 599, 718, 883
Squire, W. R., 214
Stephenson, I., 883, 1016
Stock, A., 472, 557
Strode, D. M., 1016
Tempest, G. W., 96, 345
Temple, E., and Mrs. J. E. Burkett, 515, 598, 718, 719
Thomas, F. H., 214
Thomas, T. W., 1016
Thompkins, B. G., 928
Thorne, G. J. C., and A. H. Thorne, 1016
Tidswell, H., 798
Tizzard, F. J. and N. Tizzard, 599
Turner, G., 56, 387
Turner, J., 719, 756, 841, 1016
Uttley, B., 798
Walker, O., 431, 639
Wardell, S. A., 515
Watmough, A. A., 56
Watson, C. W., 299, 515
Webb, A. F., 174
Weekes, A. L., 756, 798, 841, 928
White, P. J., 640, 882
Wickham, T. A., 718
Williams, A. A., 96
Wilson, H., 136
Wintle, L., 557, 756
Wood, H. L., 96
Woodgate, E. F., 214, 798
Youll, G., and A. Fraser, 798

Basingstoke, Extensions at, 481
Basle Fair, The, 265, 432
Baslow Hall, The electrical equipment of, 988
Batteries, Australian demand for increased duty on, 1014
Batteries for radio purposes, Dry, 3
Batteries in Australia, Storage, 758
Batteries, Wireless, by P. D. Tyers, 1012
Battery chargers, Indian duties on, 994
Battery-charging chart, A, 94
Battery electric rail cars, 353
Battery eliminators, Radio, by P. R. Coursey and H. Andrews, 1033
Battery locomotive, A large, 65
Battery organisation, Chinese dry, 756
Battery traction in Belgium, 646
Battery works strike, 717
Batti-Wallah's Society, The, 144, 306, 522, 581, 606, 686
Bauxite, 185
"Beam" communication, Wireless, 627
Beckenham and electrical contractors, 257
Belgian activity in Poland, 257
Belgian companies, New, 297, 677, 839, 884
Belgian Congo, Machinery imports of the, 271
Belgian duty on electric irons, 255
Belgian telephone reorganisation, The, 175
Belgian telephone system, The, 17
Belgian telephone works extension, 597
Belgium, Battery traction in, 646
Belgium, Electrical development in, 39
Belgium, Lamp manufacture in, 58
Belgium, The situation in, 666, 694
Bermondsey, Strike at, 257, 298, 346
Berry's Electric, Ltd., and the McClary cooker, 839
Bill, Irish contractors and the Government Electricity, 557
Bill, Irish Free State Electricity, 440
Bill, Proposed Whitley Councils, 717
Bill, The Landlord and Tenant, by W. E. Jackson, 672
Bill, The Shops Hours, by W. E. Jackson, 922
Bill, The Trade Unions, 555, 778
Bill, The Trade Unions, by W. E. Jackson, 633
Birmingham and electricity development, 396
Birmingham carnival, Electricity in a, 1015
Birmingham, Credenda apparatus at, 513
Birmingham Electric Club, 103, 459
Birmingham fittings factory, A, 1015
Birmingham frequency problem, The, 374
Birmingham power station contract, Important, 17, 57
Birmingham, Research at, 223
Birthday honours, The, 914
Blackpool, Hopkinson's display at, 639
Boiler explosion reports, 480, 606, 766
Boiler systems, Two-fluid, 222
Bolt heads, A conference on dimensions of nuts and, 481
Book factory, Lighting a, 513
Bradford exhibition, A, 213
Bradford, Extra-high-pressure steam plant at, 43, 104
Bradford Technical College, Gift to, 432
Brazil, American activity in, 428
Brazil, American capital for, 59
Brazil, British representative in, 346
Brazil, Conditions in, 177
Brazilian development, A, 439
Brazilian market, The, 383
Brazilian radio market, The, 58, 598
Brazil's electrical imports, 314
Bridge, A large electrically-controlled, 222
Britain's foreign electrical trade, 149
British Association, The, 764
British companies underquote Continental competitors, 134
British Electrical and Allied Industries Research Association — Annual luncheon, and report of the Council for 1925-26, 252
British Electrical and Allied Industries Research Association, Liverpool to join the, 57
British Electrical and Allied Manufacturers' Association, The—Annual meeting, 432, 462, 467
British Electrical and Allied Manufacturers' Association survey, The, 653
British electrical equipment in Canada, 134
British electrical industry, The progress of, 98
British Empire Chambers of Commerce, 14
British Empire electrical research, 243, 981
British Engineering Standards Association publications, 24, 65, 265, 439, 481, 646, 725, 890, 980
British Engineers' Association, The, 972
British Engineers' Association and railway rates, The, 132
British Export Society, 926
British exports to Australia, 14
British goods, Australian preference for, 16
British Goods in Argentina, 774
British goods in New Zealand, 94
British goods in South America, 678
British goods, New Zealand preference for, 386
British industrialists to visit America, 676
British Industries Fair, The, 72, 98, 134, 136, 173, 272, 286, 316, 359, 403, 448, 512
British Industries Fair, 1928, The, 842
British Industries Fair, the growth of the, 1003
British Insulated Cables, Ltd., secures big contract for Indian railway electrification, 352
British Legion, The, 352
British Malaya, Electrical imports of, 559
British manufacturers' representatives in Leningrad, 217
British market, A French view of the, 213
British market, America and the, 343
British orders, Russia and, 973
British participation in International Steel Trust, 59
British Science Guild, 565
British Thomson-Houston factory, New, 298
British Thomson-Houston lighting scheme, A, 795
British Thomson-Houston magnetos in speed record, 265
British trade in Canada, Bigger, 552
British trade with Argentina, 15
Broadcast radio coverage of city areas, 935
Broadcasting station, The Cork, 712
Brush co-partnership scheme, 559
Budget, The, 606
Budget, The F.B.I. and the, 93
Buenos Aires, Business opportunity in, 842
Buenos Aires subway, Proposed, 58
Building Trades Exhibition, Midland, 882
Bulgaria, Electricity in, 176
Bulgaria, Water power *versus* Diesel engines in, 223
Burmese companies, New, 257
'Bus operation, Trolley, 818
Business Efficiency Exhibition, 255
Buying, "Hand-to-mouth," 432

CABLE armouring machine, A large, 190
Cable carton, A new, 929
Cable companies, New, 134, 300
Cable company deal, Big, 346
Cable discharges, E.h.p., 441
Cable industry, The Czecho-Slovakian, 473
Cable industry, The German, 93
Cable insulation, A new, 265
Cable practice, High-pressure, 271
Cable railway, The Raxalp, 892
Cable sales combine, Austrian, 513
Cable tenders, Rugby and, 838
Cable tests, High-pressure, 202
Cables, "Creeping," by F. E. Bentley, 806
Cables for Durham, German, 16
Cables, High-pressure, 122
Cables, High-voltage "S.L."-type, by P. Dunsheath, 153, 189
Cables in mines, 687
Cables, Mansfield and foreign, 839
Cables, Municipalities and foreign, 925
Cables, The design of extra-high-pressure, by E. B. Nixon, 5
Cables, The measurement of sheath losses in, by R. A. Brockbank, 751
Calculator charts, Electrical, 950
Callender's at Leipzig, 298
Callender's hospital fund, 215
Canada and Chicago, 545, 552
Canada, Bigger British trade in, 552
Canada, British electrical equipment in, 134
Canada, Electrical notes from, 192
Canada, The manufacture of aluminium in, 936
Canadian and United States electrical trade, 507
Canadian market, The, 366, 432
Canadian order for Sweden, 882
Canadian power industry, The, 516
Canadian project, A large, 560
Canadian radio production in 1926, 1036
Canary Islands trade, 516
Canning's new works, 758
Capacitance bridge and new inductometer, A, by A. Campbell, 31
Capital issues in 1926, 57
Car, The "Otley" rail, 264
Carbonisation, Low-temperature, 441
Carlisle, Electricity supply in, 831, 893
Carnegie awards for gallantry, 822
Carnegie grant for X-ray martyr, 766
Cars, Battery electric rail, 353
Catalogue, The factor's, by A. J. Smith, 337
Cathedral lighting scheme, A, 230
Ceiling fans, 524
Census of industry, The, 175
Census of Production, The, 345
Centenary lecture, 1024
Centenary of Volta, The, by T. B. Fowler, 336
Central Electricity Board, The, 2, 82, 87, 202, 244, 265
Central Electricity Board, The chairman of the, 123
Central Scotland electricity scheme, 1927, The, 746, 754, 786
Ceylon, The electrical imports of, 655
Chambers of Commerce, British Empire, 14
Chancellor and overseas trade, The 625
Charges for packages, The, by W. E. Jackson, 425
Cheap electricity, 605
Cheap electricity for farming, 826
Chemical and Colour Exhibition, The Oil, 1018
Chicago, Canada and, 545, 552
Chief Technical Assistants' Association, 766, 982
Children, Artificial-light treatment for, 646
Chile, Wire manufacture in, 884
Chilean company, New, 514
China, The import trade of, 229, 678
Chinese company's reorganisation, 432
Chinese dry battery organisation, 756
Chinese electrical machinery import 58
Chinese notes, 18, 58, 173, 213, 641, 9
Chiswick power station, The, 847
Christmas showroom window, A, 15
Chromium plating, Practical resul with, 469
Church, A flood-lighted, 55
Church lighting, Modern, 16, 555
Circuit, A radio crystal detector, by Carter, 249
Circuit breakers, Oil-immersed, E. B. Wedmore, W. B. Whitn and C. E. R. Bruce, 660

City Notes—
Aberdeen Suburban Tramways Co 313
Adelaide Electric Supply Co., 67,
A.E.G., The, 187
Alley & McLellan, 487
Altrincham Electric Supply, 985
American loan for Italy, 67
American Telephone & Telegra Co., 357, 444, 897
Anderston Foundry Co., 941
Anglo-American Telegraph Co., 10 651, 729
Anglo-Argentine Tramways Co., 102
Anglo-Portuguese Telephone Co., 48 528, 570, 851
Arbroath Electric Light & Power Co 485
Argentine company, 811
Armstrong (Sir W. G.), Whitwort and Co., 67, 896, 941, 984
Armstrong-Whitworth scheme sanc tioned, 269
Aron Electricity Meter, 941, 1028
Ascot Gas & Electricity Co., 187
Associated Gas and Electric Syster 691
Associated Telephone & Telegrap Co., 529
Atlas Light & Power Co., 357
Auckland electricity loan, 853
Australian company, 313
Austrian companies, 731
Automatic Telephone Manufacturin Co., 445, 609
Babcock & Wilcox, 571, 608
Baird Television Development Co 689
Barcelona Traction, Light & Powe Co., 690, 810, 985
Bath Electric Tramways, 528
Belgian companies, 357, 571, 611, 731 771, 811, 897
Bengal Telephone Corporation, 811
Birmingham District Power & Trac tion Co., 811
Bogota Telephone Co., 445
Bolton, Thomas, & Sons, 852
Bombay Electric Supply & Tramway Co., 651
Bournemouth and Poole Electricit Supply Co., 401, 528, 610
Brazilian Traction, Light & Powe Co., 107, 401, 651
Bristol Tramways & Carriage Co. 444
British Aluminium Co., 486, 570
British Columbia Electric Railway Co., 67, 897
British Electric Traction Co., 730 811, 852, 940, 1028
British Electric Transformer Co., 485 569
British Empire Trust, 1028
British Engine, Boiler & Electrica Insurance Co., 529
British Insulated Cables, 401, 444, 48
British Thomson-Houston Co., 809 853, 897
Bromley (Kent) Electric Light and Power Co., 941
Brompton and Kensington Electricity Supply Co., 487, 651, 729
Bruce Peebles & Co., 313, 444
Brush Electrical Engineering Co., 771, 810, 851
Buenos Aires Lacroze Light & Power Co., 770
Burma Electric Supply Co., 811
Cable, Telephone & General Trust, 187
Calcutta Electric Supply Corporation, 691, 730, 769
Calcutta Tramways Co., 691, 770
Callender's Cable & Construction Co., 941, 1027
Cambridge Electric Supply Co., 401
Cammell Laird & Co., 445
Canadian General Electric Co., 357, 651, 985
Canadian Light & Power Co., 529
Canning (W.) & Co., 401, 445
Cape Asbestos, 1028
Cape Electric Tramways, 985
Castner-Kellner Alkali Co., 67
Cawnpore Electric Supply Corporation, 852, 940
Ceará Tramway, Light & Power Co., 357, 444
Charing Cross Electricity Supply Co., 401, 485, 570
Chatham and District Light Railways Co., 227
Chelsea Electricity Supply Co., 487, 651, 729
Chili Telephone Co., 896, 1029
Chinese companies, New, 107
Chiswick Electric Supply Corporation, 269, 985
Chloride Electrical Storage Co., 852
Cia. de Electricidad de la Provincia de Buenos Aires, 67
City Electric Light Co., Ltd. (Brisbane), 690
City of Buenos Ayres Tramways Co. 1904), 187, 269, 731
City of London Electric Lighting Co., 445, 527, 610
Clarke, Chapman & Co., 401

Notes—*continued.*
lifford, Chas., & Sons, 313
yde Valley Electrical Power Co., 313, 486, 569
atbridge and Airdrie Electric Supply Co., 401
olombo Electric Tramways & Lighting Co., 357, 445, 897
olumbia Gas & Electric Corporation, 147, 731
ompanies struck off the register, 147, 187, 690, 730, 811
ompanies to be struck off the register, 107, 187, 269, 313, 690
onsolidated Gas, Electric Light and Power of Baltimore, 691
ork Electric Tramways & Lighting Co., 611, 730
ornwall Power Co., 770
osta Rica Electric Light & Traction Co., 528
ounty of Durham Electrical Power Distribution Co., 445
ounty of London Electric Supply Co., 147, 313, 443, 569, 731, 770
oventry Chain Co., 771
aigpark Electric Cable Co., 731, 770
rossley Bros., 227, 313
uba Submarine Telegraph Co., 984
anish company, 401
avis & Timmins, 445
elhi Electric Tramways & Lighting Co., 1028
irect Spanish Telegraph Co., 529, 651
irect West India Cable Co., 357
irman, Long & Co., 1029
ulton & Co., 853
ublin United (Electric) Tramways Co., 147
reIco, 528
utch companies, 651, 731
astern Extension, Australasia and China Telegraph Co., 487, 811, 896
astern Telegraph Co., 810, 895
dison Swan Electric Co., 27
dmundson's Electricity Corporation, 67
ham and Staines Electricity Co., 528
ectric Construction Co., 896, 941, 984
ectric Supply Corporation, 651, 728
ectrical and Industrial Investment Co., 269
ectrical Distribution of Yorkshire, 312, 400, 651
ectrical Finance & Securities Co., 691, 770
ectrolytic Zinc Co. of Australasia, 107
gin Electric Supply Co., 357
field Cable Works, 147
glish Electric Co., 445, 487, 568
glish Electric Co. of Canada, 852
icsson Telephones, 444, 486, 570
inoid, 651
er-Ready Co. (Great Britain), 730, 770, 941
irbairn Lawson Combe Barbour, 771
lkirk Iron Co., 1029
llows Magneto Co., 941, 1028
le Tramway, Light & Power Co., 187, 227
lkestone Electricity Supply Co., 486
undation Co., 651
anco-Swiss investment bank, A 187
ench companies, 27, 313, 529, 731, 771, 810, 853, 897, 985, 1029
lashiels and District Electric Supply Co., 401
teshead and District Tramways Co., 570
neral Electric Co., 897
rman electrical companies, 227, 268, 313, 356, 443, 529, 571, 611, 731, 811, 853, 897, 985, 1029
nfield & Kennedy, 771, 897
obe Telegraph & Trust Co., 401, 985
eat Northern Telegraph Co., Ltd., of Denmark, 651, 810
eenock and Port Glasgow Tramways Co., 811
eenwood & Batley, 27, 1027
est, Keen & Nettlefolds, 941, 1029
idfields, 445
lifax and Bermudas Cable Co., 357
wkes, O. C., 313, 941
ndon Electric Supply Co., 444
nley's, W. T., Telegraph Works Co., 984, 1027
pkinsons, 691
ward & Bullough, 691
perial Tramways Co., 444
dia-Rubber, Gutta-Percha & Telegraph Works Co., 984
lo-European Telegraph Co., 611, 690, 729
ternational Automatic Telephone Co., 445, 485, 609, 730
ternational General Electric Co., 691
ternational Light & Power Co., 1029
n Trades Employers' Insurance Association, 852
e of Thanet Electric Supply Co., 400
lian loan in New York, 107
panese Electric Bond & Share Co., 27
row and District Electric Traction Co., 571
nson & Phillips, 691, 769
nson, Richard, Clapham & Morris, 985
lgoorlie Electric Power and Lighting Corporation, 940, 984
lith, James, & Blackman Co., 1029

City Notes—*continued.*
Kensington and Knightsbridge Electric Lighting Co., 487, 528, 570
Keswick Electric Light Co., 528
Kidderminster and District Electric Lighting & Traction Co., 1029
Lanarkshire Tramways Co., 730
Lancashire Dynamo & Motor Co., 570, 1029
Lancashire Electric Light & Power Co., 810, 896, 1028
Lancashire United Transport and Power Co., 356
La Plata Electric Tramways Co., 611
Launceston and District Electric Supply Co., 357
Laurentide Power Co., 269
Lewes and District Electric Supply Co., 853
Lima Light, Power & Tramways Co., 941
Lisbon Electric Tramways, 651, 984, 1029
Liverpool Overhead Railway Co., 400, 443
Llandudno and Colwyn Bay Electric Railway, 690
Llanelly and District Electric Supply Co., 401, 486
London and Suburban Traction Co., 269, 399
London Electric Supply Corporation, 444, 528, 569
London Electric Wire Co. & Smiths, 571, 611
London tramway companies' reports, 356
Low Temperature Carbonisation, 27
Lucas, Joseph, 651
Mackay Companies, The, 401, 730, 985
Maclellan, P. & W., 529
Madras Electric Supply Corporation, 852, 940
Madras Electric Tramways (1904), 651
Major & Co., 611
Mansfield and District Tramways, 400
Marconi interests in Argentina, 107
Marconi International Marine Communication Co., 651, 690, 770
Marconi's Wireless Telegraph Co., 147, 227, 313, 398, 444, 484, 610
Mather & Platt, 313, 400
Melbourne Electric Supply Co., 187, 771, 811,
Mersey Power Co., 527
Mersey Railway Co., 312, 357
Merthyr Electric Traction & Lighting Co., 852
Metropolitan District Railway Co., 852
Metropolitan Electric Supply Co., 444, 528, 610
Metropolitan Railway Co., 187, 268, 311
Metropolitan-Vickers Electrical Co., 487, 527, 571, 608
Mexborough and Swinton Tramways Co., 691
Mexican Light & Power Co., 227, 729, 771, 896, 984
Mid-Cheshire Electricity Supply Co., 487
Midland Counties Electric Supply Co., 313, 356, 399
Midland Electric Corporation for Power Distribution, 444, 527
Midland Electric Manufacturing Co., 571
Mirrlees, Bickerton & Day, 941
Montevideo Telephone Co., 650, 691
Montreal Light, Heat & Power Consolidated, 269, 357, 529
Morris, Herbert, 651
National Electric Construction Co., 690
National Gas Engine Co., 357
Newcastle and District Electric Lighting Co., 401, 445, 485
Newcastle-upon-Tyne Electric Supply Co., 486, 610, 985

New Issues.—Cia. de Electricidad de la Provincia de Buenos Aires, 67; Ascot Gas & Electricity Co., 187; County of London Electric Supply Co., 731, 770; Bolton, Thomas, & Sons, 852; Buenos Aires Lacroze Light & Power Co., 770; Electrical Finance and Securities Co., 770; Metropolitan District Railway Co., 852; Lancashire Electric Light & Power Co., 1028
Newmarket Electric Light Co., 730
Nigerian Power & Tin Fields, 611
Northampton Electric Light & Power Co., 312
North British Aluminium Co., 52
Northern General Transport Co., 650, 690
Northern Mexico Power & Development Co., 401, 941
North Metropolitan Electric Power Supply Co., 27, 269, 356, 400, 771
North Metropolitan Power Station Co., 227
North of Scotland Electric Light and Power Co., 940
Norwegian company, 771
Notting Hill Electric Lighting Co., 729, 810
Oliver Pell Control, 896
Oriental Telephone & Electric Co., 811, 896, 940
Oxford Electric Supply Co., 486
Para Electric Railways & Lighting Co., 528, 610
Parker, Winder & Achurch, 529
Penarth Electric Lighting Co., 896
Pennsylvania Water & Power Co., 269, 357

City Notes—*continued.*
Perak River Hydro-Electric Power Co., 67
Pernambuco Tramways & Power Co., 771, 852
Peterborough Electric Traction Co., 571
Peters, G. D., & Co., 529
Philips Lamps, 691
Pinchin, Johnson & Co., 445, 487, 897
Potteries Electric Traction Co., 810
Power Securities Corporation, 269, 312
Prospectuses, 227, 689
Provincial Tramways Co., 730
Quebec Power Co., 269, 357, 941
Quebec Railway, Light, Heat & Power Co., 27
Radio Corporation of America, 445, 771
Rangoon Electric Tramway & Supply Co., 487, 691, 940
Ransomes, Sims & Jefferies, 1028
Reading Electric Supply Co., 730
Reductions of capital, 401, 571, 898, 941
Reyrolle, A., & Co., 570
Rhondda Tramways Co., 651
Richmond (Surrey) Electric Light and Power Co., 401, 528, 611
River Plate Electricity Co., 571
Robey & Co., 529
Ross Electric Light & Power Co., 771
Rothesay Tramways Co., 811
Rushden and District Electric Supply Co., 313, 731
Ruston & Hornsby, 941
St. James' and Pall Mall Electric Light Co., 444, 486, 609
St. Maurice Power Co., 401
Salisbury Electric Light & Supply Co., 486
Scottish General Transport Co., 771
Scottish Power Co., 313, 399
Seaton (Devon) and District Electric Light Co., 985
Sevenoaks and District Electricity Co., 810
Shanghai Electric Construction Co., 147, 811, 852, 940
Shawinigan Water & Power Co., 227, 313, 941
Shropshire, Worcestershire and Staffordshire Electric Power Co., 147, 611, 690, 769
Siemens Bros. & Co., 771, 810, 851
Simms Motor Units, 27, 651
Singapore Traction Co., 187, 269
Slough and Datchet Electric Supply Co., 486
Smith, S., & Sons (Motor Accessories), 147
Smithfield Markets Electric Supply Co., 312
South London Electric Supply Corporation, 313, 528, 610
South Metropolitan Electric Light and Power Co., 313, 528
South Wales Electrical Power Distribution Co., 650
South Wales Power Co., 729
Spanish-Argentine company, 811
Sphere Investment Trust, 1028
Stanton Ironworks Co., 941
Stewarts & Lloyds, 445, 529
Stock Exchange Notices, 27, 67, 107, 147, 187, 227, 268, 313, 357, 400, 444, 487, 528, 571, 611, 691, 730, 770, 811, 852, 897, 941, 1028
Stratford-on-Avon Electricity Co., 771
Submarine Cables Trust, 269
Swansea Improvements & Tramways Co., 730
Swedish companies, 313, 529, 771, 853, 985
Swedish-Mexican company, 1029
Swiss companies, 444, 529, 853, 985
Tees Power Station Co., 445
Telegraph Construction & Maintenance Co., 357, 445, 484
Telephone Co. of Pernambuco, 27
Telephone Manufacturing Co., 941, 1028
Thames Valley Electric Traction Co., 691
Tilling-Stevens Motors, 529
Torquay Tramways Co., 312, 400
Tottenham District Light, Heat and Power Co., 187
Traction & Power Securities, 107, 147, 227
Tynemouth and District Electric Traction Co., 571
Tyneside Electrical Development Co., 487
Tyneside Tramways & Tramroads Co., 269
Underground Electric Railways Co. of London, 400, 485
"Underground" Group, The, 269, 311, 356
United Alkali Co., 187
United River Plate Telephone Co., 985
United Water Softeners, 1028
Urban Electric Supply Co., 731, 809
Uxbridge and District Electric Supply Co., 269
Verity's, 853
Vickers, 401, 690, 729
Victoria Falls & Transvaal Power Co., 529
Ward, T. W., 487
Waste Heat & Gas Electrical Generating Stations, 486, 570
Waygood-Otis, 444, 486
Wellington Electric Supply Co., 313
West Gloucestershire Power Co., 731, 853
West London & Provincial Electric and General Trust, 730
West Midland Joint Electricity Authority, 985
Western Telegraph Co., 401, 897
Western Union Telegraph Co. (Inc.), 187, 651, 691

City Notes—*continued.*
Westinghouse Brake & Saxby Signal Co., 187, 269
Westinghouse Electric & Manufacturing Co., 984
Westminster Electric Supply Corporation, 401, 444, 485
Weston-super-Mare and District Electric Supply Co., 852
Whitehall Electric Investments, 985, 1028
Windermere and District Electric Supply Co., 528
Windsor Electrical Installation Co., 486
Woking Electric Supply Co., 486
Wood & Cairns, 611
Wycombe (Borough) Electric Light and Power Co., 651
Yorkshire Electric Power Co., 27, 226, 312
Yorkshire (West Riding) Electric Tramways Co., 487, 528, 985
Yorkshire (Woollen District) Electric Tramways Co., 852
Yorktown & Blackwater Gas & Electricity Co., 227

Civic week at Fulham, 174, 216
Civil Service Commission, 606
Clinometer, The electrical, 279
Clock, A large electric, 993
Clock, A new public, 55
Coal bunker after subsidence, The raising of a, 395
Coal-handling plant in India, 620
Coal mines: Certificates of competency, 223
Coal resources survey, National, 480
Colchester joins Joint Board, 98
Colliery electrification, French, 251
Colliery turbines, Mixed-pressure, by C. H. Naylor, 1035
Colonial conference, A, 758
Colonial Premier's visit to Standard works, 15
Colour Exhibition, The Oil, Chemical and, 1018
Colour-lighting demonstrations, 184, 892
Colour photo-telegraphy, 702
Commercial electrical travellers, 176, 242, 255, 430
Commercial travellers' club, A, 433
Commissioners' report, Reflections on the, 161
Committee appointed, An important, 890
Committee on industry and trade, 254
Community singing, Amplifiers for, 184
Company law amendment, 16, 216
Competition, A window-dressing, 908
Concrete, Reinforced, 606
Conductors, Hollow electrical, 114
Conference on large e.h.p. systems, Fourth, 24, 565, 807
Continental competitors, British companies underquote, 134
Continental electrical agreement, Rumoured, 135
Continental wire trust, 300
Contract, Important Birmingham, power station, 17, 57
Contract regulations, South African, 134
Contract, The Southern Railway, 665, 686, 701
Contracting industry, Wages in the, 176, 925
Contractors, A lecture to, 104
Contractors, Beckenham and electrical, 257
Contractors' conference at Scarborough, The Electrical, 134, 176, 516, 972, 1002
Contractors' dinner, Sussex, 758
Contractors, Registered Electrical, 98, 254, 389, 502, 542, 641, 797, 974
Contractors, Scottish electrical, 1025
Contractor's shop, The lay-out of the, by E. N. Simons, 968

Contracts Closed—
Aberdeen, 350, 889
Auckland, 521
Australia, 63, 181, 520, 564, 684, 762, 889
Ayrshire, 763
Bangor, 304
Barking Town, 221, 350, 645, 889
Barnes, 102, 804
Barnsley, 684
Basingstoke, 1022
Battersea, 181, 479, 724, 890
Bedford, 724
Belgium, 102, 437, 763, 846
Bermondsey, 804
Bexhill, 350, 521, 846
Birkenhead, 63, 221, 393, 564, 604, 804, 933
Birmingham, 22, 350, 889, 1022
Blackpool, 142
Bolton, 645, 933
Bradford, 63, 304, 351, 393, 604, 979, 1022
Brecon, 604
Brentwood, 22
Brighton, 142, 521, 564, 724
Brisbane, 521
Bromley (Kent), 889
Burton-on-Trent, 478, 645, 804, 933
Bury, 393
Bury St. Edmunds, 684, 804
Buxton, 979
Camberwell, 479
Canterbury, 393, 604, 763
Cape Town, 181, 263, 479, 521, 605, 763
Chelmsford, 351, 393
Cheltenham, 393, 604, 724
Chester, 521
Chesterfield, 262, 304, 684, 979
Clacton, 304
Clydebank, 304
Colchester, 393
Coventry, 262

Contracts Closed—*continued.*
Cranbrook, 478
Croydon, 102, 304, 645, 804
Czecho-Slovakia, 724
Dartford, 102, 763, 804, 979
Dewsbury, 478, 979
Doncaster, 221, 763, 933
Douglas (I. of M.), 142, 804, 979
Dover, 604
Dublin, 143, 181, 304, 889
Dumfries, 221, 393, 645, 979
Dundee, 221, 351, 521, 564, 804
Durban, 1023
Durham, 304
Eastbourne, 221, 437, 564
East Ham, 103, 263, 437, 645, 804
Elvington (nr. Dover), 393
Epsom, 521
Erith, 22, 889
Evesham, 63, 304
Finchley, 63
Germany-Sweden, 181
Glasgow, 63, 142, 221, 304, 393, 478, 564, 645, 724, 846, 889, 979
Gloucester, 724
Government contracts, 142, 304, 478, 684, 846, 889, 1022
Gravesend, 263, 804
Grays, 889
Grimsby, 685, 933
Guildford, 181, 351, 889
Hackney, 64, 305, 847
Hamilton, 143, 479, 847
Hammersmith, 479, 1023
Hatton (near Warwick), 604
Hebden Bridge, 22
Heckmondwike, 221
Hitchin, 393, 763
Hornsey, 181, 305, 521
Hull, 64, 181, 351, 437, 564, 604, 724, 763, 804, 889
Hythe (Kent), 143
Ilford, 181, 351, 724, 804, 889
India, 437, 804, 933, 979
Irish Free State, 521, 685, 804, 889, 1022
Islington, 305, 393, 437, 479
Japan, 564
Johannesburg, 394, 479, 1023
Kendal, 890
Kettering, 685
King's Lynn, 685
Kiveton Park, 847
Lamp contracts, 604, 645, 724, 804
Leeds, 64, 181, 351, 437, 604, 804, 933
Letchworth, 351
Lichfield, 604
Liverpool, 63, 221, 305, 604, 763, 979
Llanfairfechan, 1023
London, 22, 64, 103, 143, 181, 221, 262, 351, 393, 437, 479, 521, 564, 604, 645, 685, 724, 763, 804, 846, 890, 980, 1023
Macclesfield, 305
Maidenhead, 763
Maidstone, 933
Manchester, 64, 181, 394, 479, 604, 645, 763, 804, 890, 1023
Mansfield, 685
Marlborough, 103
Melbourne, 521, 564, 762
Mold, 64
Newcastle, 305
New Zealand, 221, 521
Northampton, 394
Oldham, 64, 351, 604, 763, 933
Padiham, 351
Plymouth, 221, 564, 934
Poplar, 724
Portrush, 980
Portsmouth, 262, 685, 724
Preston, 143, 604
Prestwich, 804
Prestwick, 394
Reigate, 64, 564, 685
Rochdale, 103
Ross-shire, 763
Rotherham, 305, 605
St. Pancras, 103, 262, 804
Salford, 23, 181, 351, 564, 890
Seaham Harbour, 890, 980
Selkirk, 934
Sheffield, 143, 181, 351, 564, 645, 724, 934
Shoreditch, 103, 143, 438, 645, 1023
South Africa, 181, 263, 394, 479, 521, 564, 605, 763, 1023
Southend on-Sea, 23, 143, 305, 685
Southport, 980
South Shields, 394, 645
Southwark, 64, 564, 763
Smethwick, 724
Spalding, 479
Stepney, 143, 305, 521, 685, 847
Stevenage, 980
Stoke, 64, 221, 351, 521, 890
Stretford, 1023
Swansea, 804, 980
Swinton and Pendlebury, 479, 685
Sydney, 63, 520, 684, 763
Tain, 479
Tenterden, 263
Thanet, 980
Tilbury, 438
Torquay, 221, 394, 645, 804, 980
Tring, 263
Tynemouth, 143, 521, 685, 847
Uxbridge, 181
Wakefield, 645, 804, 1023
Wallasey, 605
Wallsall, 763
Warrington, 724
Watford, 763
West Ham, 351
Westminster, 305, 804
Weymouth, 263, 438, 685
Wimbledon, 394, 605, 763
Windermere, 23, 221
Woodford, 1023
Worcester, 23
Wrexham, 804
York, 23, 724

Contracts, More big, 82

Contracts Open—
Aberdare, 762, 803, 845
Aberdeen, 303, 350, 933
Adwick-le-Street, 350, 392, 437, 933, 979
Ampthill, 22
Argentina, 22, 63, 102, 141, 180
Armagh, 762, 803, 845
Armthorpe, 141, 180
Army contracts, 22
Ashford, 350, 392
Askern (near Doncaster), 22, 63
Auckland (N.Z.) 102, 142, 181, 724, 762, 804
Australia, 22, 63, 102, 141, 180, 220, 262, 303, 350, 392, 437, 478, 520, 563, 603, 644, 683, 723, 762, 803, 845, 889, 933, 979, 1021
Ayr, 102, 392, 437
Ayrshire, 520
Barking Town, 22, 520, 563, 603, 644, 683, 723
Barnes, 22, 63, 102, 520, 563
Barton-on-Irwell 889
Basingstoke, 762, 803, 845
Beckenham, 63, 437, 478, 520
Bedford, 220, 262, 303
Belfast, 102, 141, 180, 220, 520
Belgium, 22, 102, 220, 262, 303, 563, 644, 683, 723, 762
Bermondsey, 350, 393
Bexley, 180, 220
Bolsover, 520, 563, 603
Bootle, 22, 63
Bradford, 22
Brecon, 303, 350, 392
Bridlington, 303, 350
Brisbane, 220, 262, 303, 683, 723, 762
Bristol, 141, 180, 220, 262, 437, 478, 520, 563
Burnley, 22, 63
Bury, 63
Canada, 22, 63
Canterbury, 180, 220, 262
Cape Town, 262, 304, 603, 645, 684, 804, 846, 889, 933, 979, 1022
Cardiff, 180, 220, 262
Carlisle, 102
Castleford, 845
Cheadle and Gatley, 262, 303, 933, 979, 1021
Cheltenham, 102
Chile, 723, 762, 803, 845
Clacton, 63, 102, 141
Clayton, 520, 563, 603
Colombia, 478, 520, 563, 603, 644
Colwyn Bay, 303, 350
Croydon, 180, 220, 262
Darlington, 723, 762, 803
Dartford, 603, 683, 762
Darton, 723, 762
Dewsbury, 723
Doneraile (Co. Cork), 22
Douglas, 102, 141, 180
Dover, 350
Dublin, 262, 303, 603, 644, 724, 762, 803, 889
Dumfries, 392
Dundee, 63, 141, 180, 220, 262, 303, 437, 603, 724, 762, 803, 933, 979
Dunedin, 22, 63
Durban (Natal), 437
Durham County, 304, 350
Durrington (Wilts.), 683
Eastbourne, 141, 180, 220
East Ham, 350, 1021
Eccles, 180, 220
Ecuador, 22, 63
Edenburg (O.F.S.), 846, 889, 933
Edinburgh, 63, 102, 142, 304, 350, 392, 437, 478, 520, 563, 603, 645, 683, 724, 762, 803, 1021
Egypt, 102, 180, 220, 262, 304, 645, 683, 724, 762, 803, 933, 979
Elliott (C. P.), 846, 889, 933
Epsom, 724, 762, 803
Erith, 392, 437
Falcarragh (Co. Donegal), 22
Flint and Hope, 1021
Glasgow, 563, 603, 724, 762, 804, 933
Glentanar (Aberdeenshire), 762
Greenock, 63, 142, 889, 933
Grimsby, 478, 520, 603, 645, 683, 762, 804, 845
Guildford, 762
Halifax, 437, 979, 1021
Hamilton, 220, 392
Hammersmith, 102, 142, 181, 804, 845
Harrogate, 180, 220, 262, 979, 1021
Haverfordwest, 22
Hazel Grove and Bramhall, 350, 392, 437, 979, 1021
Holborn, 437, 478, 520, 563
Holmfirth, 350
Huddersfield, 102, 142, 180, 220, 1021
Hull, 180, 220, 804, 845, 889, 933
Ilford, 102, 142, 304, 350, 392, 437, 563, 603, 645, 845
India, 22, 63, 102, 220, 262, 304, 350, 393, 437, 478, 520, 563, 603, 645, 762, 804, 845, 1021
Invercargill (N.Z.), 520, 564, 603, 645, 684, 724
Inverlochy, 181
Inverness, 979
Islington, 393, 645, 683
Johannesburg, 22, 63, 102, 142, 220, 262, 304, 350, 437, 603, 645
Kendal, 645
Kettering, 350, 393, 437
Kilmarnock, 437, 478, 520
Kirkcaldy, 933, 979, 1021
Lanark, 933
Leamington Spa, 1021
Leeds, 142, 181, 220, 262, 304, 520
Lewisham, 979, 1021
Lithuania, 350
Littlehampton, 262, 304, 350
Liverpool, 22, 63, 102, 478
London, 22, 63, 102, 142, 181, 220, 262, 304, 350, 393, 437, 478, 520, 563, 603, 645, 724, 762, 804, 845, 889, 933, 979, 1021
Long Eaton, 181, 220, 262

Contracts Open—*continued.*
Lurgan, 1021
Lyttleton (N.Z.), 645, 684, 724
Macclesfield, 102, 142
Manchester, 22, 63, 102, 142, 181, 350, 393, 437, 645, 683, 724, 762, 804, 845, 889, 933, 979
Marlborough, 845, 889, 933
Melbourne, 22, 63, 102, 141, 180, 220, 262, 303, 350, 392, 437, 478, 520, 563, 603, 644, 683, 723, 762, 803, 845, 933, 979, 1021
Middlesbrough, 478, 520
Middleton, 804
Morley (Yorks.), 220
Newark-upon-Trent, 220, 262
Newcastle-under-Lyme, 1022
Newport (Mon.), 22, 63, 102
New Zealand, 22, 63, 102, 142, 181, 220, 262, 393, 437, 478, 520, 563, 603, 645, 684, 724, 762, 804, 845, 889, 933, 979, 1022
Nottingham, 889, 933, 979
Oldham, 220, 304, 350, 393, 437, 603, 645, 845, 889, 933
Peterborough, 142, 181, 220
Pietermaritzburg (S.A.), 1022
Plymouth, 520, 564, 603, 645, 1022
Plympton St. Mary, 393, 437, 478
Portsmouth, 142, 181, 220, 845, 889, 933
Prestwich, 645
Pretoria, 22, 63
Pudsey, 804, 845, 889, 933, 1022
Rathmines and Rathgar, 437
Rhondda, 304, 350, 393, 437
Richmond-on-Thames, 762, 804
Rochdale, 437
Romford, 22
Roxburgh, 304
Rumania, 393, 437, 478
St. Marylebone, 603, 645, 683, 724, 762
Salford, 22, 63, 142, 393, 724
Scarborough, 684, 724, 762, 804, 845
Sheffield, 437, 845, 889, 933
Shitlington, 1022
Shoreditch, 142, 181, 220, 437
Singapore, 1022
Sleaford, 63, 102, 684, 724, 762
Smethwick, 979, 1022
South Africa, 22, 63, 102, 142, 220, 262, 304, 350, 437, 564, 603, 645, 684, 804, 846, 889, 933, 979, 1022
South Elmsall, 262, 304, 350, 393
Southend-on-Sea, 393, 437, 478, 520, 564, 603, 645, 889, 933, 979, 1022
Spain, 564, 603
Spalding, 142, 181, 220, 262
Stafford, 564, 604, 645
Stepney, 22, 63, 262, 304, 889, 933, 979, 1021
Stirling, 762, 804
Stoke-on-Trent, 22, 63, 102, 142, 181, 262, 304, 350
Switzerland, 846
Sydney, 102, 141, 180, 220, 262, 437, 478, 520, 603, 644, 683, 723, 762, 803, 845, 933, 979, 1021
Thorne, 684, 724, 762
Tilbury, 142, 181, 220
Torquay, 22, 102, 142, 181, 262, 304, 350, 393
Tynemouth, 181, 350, 393, 762, 804, 846
Uruguay, 22, 63, 102, 142, 181, 520, 564, 604, 645, 684, 724
Walthamstow, 393, 437
Warrington, 304, 350, 393
Wellington (N.Z.), 142, 181, 220, 262, 393, 437, 478, 520, 563, 603, 645, 684, 724, 762, 933, 979, 1022
Whitehaven, 979, 1022
Whitley, 724, 762, 804, 846
Wrexham, 520, 564, 604

Contracts, Recent, 57, 98, 136, 174, 257, 298, 346, 386, 433, 471, 516, 559, 600, 678, 720, 758, 839, 882, 925, 975, 1017
Contracts, Some recent "Metrovick," 658
Controllers and motors, New drum-type, 656
Cooker, Berry's Electric, Ltd., and the McClary, 839
Cooker contracts, Jackson, 58
Cooker hire, Advertising electric, 17
Cookery Exhibition, Food and, 974
Cooking and domestic economy teaching, Electric, 293
Cooking appliances, "Creda" heating and, 44
Cooking equipment, Industrial electric, 386
Cooking equipment, "Magnet" industrial, 556
Cooking, The truth about electric, 374
Cooling towers?, River water—or, 764
Cooling towers?, River water—or, by J. N. Waite, 46
Co-operative Exhibition, The G.E.C. at a, 556
Co-ordinated investigation, Imperial development and, by D. Spencer, 714
Co-ordination of Government contracts, The, 387
Co-ordination of urban transport, The, by Lord Ashfield, 35
Copper consumption, Increased Australian, 58
Copper, Hardening, 469
Copper, lead and rubber prices, 49
Copper sales agreement, European, 58
Cork broadcasting station, The, 712

Correspondence—
Adequate distribution of electricity, The, by R. B. Matthews, 866
Bad business methods, by Jacob, White & Co., 782

Correspondence—*continued.*
Balancing loads on three-phase s vices, by E. A. Pinto, 867
Bogey of 40, The, by "Live and L Live," 821
Boiler-house efficiency, by "A.W 13
Charges for packages, The, by Jackson Harris, 541; by W. Jackson, 542
Cheap electricity, by R. B. Matthew 676, 953; by W. Cramp, 742; W. C. Mountain, 822; by Rust and Hornsby, 866; by G. Moore, 910
Cheaper wiring, by A. Milne, 1041
Commutation problem, A, by A. Griffiths, 743, 997; by the Mi land Electric Power Installati Co., 782; by P. Oaks, 866
"Do it with electricity," by A. Long, 370
Domestic load diagram, A, by Stevens, 742
Earthing of portable domestic app ances, The, by "A.M.I.E.E. 325; by The Midland Electr Power Installation Co., 326; J. Rose, 369; by R. H. Raw 413; by A. Reyrolle & Co., 457
E.h.p. transmission with 33,000- cable, by A. T. Scott, 1041
Electric cookers in housing scheme by H. A. Woods, 497
Electric flood-lighting, by Hall's sy tem of controlled illuminatio 237
Electric market place of the futur The, by G. F. Moreland, 129; F. W. Purse, 130
Electric ovens, by "Oven," 79; E. L. Joseph, 119; by W. Parke Butler, 130; by Artofex Enginee ing Works, 131
Electric power in agriculture, E. A. Mitchell, 866
Electric power on the farm, by McDowall, 368
Electric water heating, by J. W Meares, 677; by E. E. Shar 677; by E. G. Ross, 742
Electrical engineers in the Navy, "Anxious," 582
Electrical refrigeration, by "R frigerator," 119
Electricity supply tariffs, by J. R. Lunn, 281; by J. T. H. Legg 281; by R. A. S. Thwaites, 28 by W. Cramp, 326; by E. Sharp, 369
Electroculture, by "Paisley," 67 822; by R. B. Matthews, 781
Electromobiles, by the Electromobil Association, 910
Employment for unemployed powe station engineers, by "Unem ployed," 238
Energy consumption in small houses by "A.M.I.E.E.," 952
Extra-high-pressure cable discharges by D. P. Sayers, 370
Extra-high-pressure transmission, b W. Fennell, 237, 413; by A. T Scott, 327
Faults in flexibles, by W. A. Moore 457; by S. A. Laird, 496; b J. W. Meares, 541; by Ward an Goldstone, 583
Ferranti and Edison, by H. South 458
Great Britain's power resources i truer perspective, by T. Stevens 119
"H" type of cable, The, by C. G Watson, 12, 118; by Standar Telephones & Cables, Ltd., 12 by F. Richardson, 13; by th Macintosh Cable Co., 78; by C. Vernier, 78; by Cablon, Ltd., 79; by British Insulated Cables, Ltd. 79; by A. M. Taylor, 118; by T. N. Riley, 118; by D. D. Wat son, 119; by E. B. Nixon, 131; by D. M. Simons, 412; by E. Bowden, 456
Handicap to electrical progress, A, by I. Fawsett, 282, 458; by "F. Curius Dentatus," 370; by T. A. Kerr, 495
Hiding the light, by "Electrician," 742
Ideal wiring system, The, by J. J. Foggo, 781; by "C.T.," 781; by Johnson & Phillips, Ltd., 781; by "C.T.S.," 782; by St. Helens Cable & Rubber Co., Ltd., 822; by J. C. White, 822; by H. H. Leage, 865; by W. Paterson & Co., 865; by J. Dean, 910; by W. Garrett, 952; by L. B. Atkinson. 997
Irish Free State Electricity Supply Bill, The, by P. T. White, 583
Kiosk - type sub - stations, by "P.M.W.," 326; by P. Wardle, 369; by H. J. Coates, 369; by W. H. Holding, 414; by P. Nutter, 414
Knotty problem, A, by "Perplexed," 281; by H. H. Atkinson, 326
Local exhibitions and the public, by F. Rostron, 282
Machine tools in the power plant, by "W.S.," 662
Magneto repairs, by "Magneto," 910
Maximum potential gradients, by A. M. Taylor, 129
Memorial to Faraday, A, by H. Hewitt, 325
Metal-clad draw-out switchgear, by H. Whitehead, 952; by D. R. Davies, 953; by "W.B.," 998; by S. Ferguson, 1042

rrespondence—*continued.*
Metering problem, A, by "E.H.K.P.," 370, 542; by F. Rostron, 414; by D. M. Duncan, 414; by Aron Electricity Meter, Ltd., 457; by P. Oaks, 542
Motor-generator snag, A, by "Motor Generator," 119
Municipal and foreign traders, by "Salesman," 621
Mysterious occurrence, A, by W. H. M., 866, 953; by J. F. Hinsley, 910
Necessity for higher voltages, The, by A. M Taylor 79
Off-peak supplies, by "J.W.B.," 782
Ordinary engineer and the Beama, The, by "P.B.E.," 821
Permissible current-carrying capacities of high-pressure cables, The, by J. A Morton, 118
Power supply for wireless sets, by P. K. Turner, 13, 170, 282, 415; by A. O. Griffiths, 118, 237; by "Interested," 131, 237, 369, 457; by E. Rowbottom, 170; by R. S. Stanley, 170, 415; by E. Fowler Clarke, 457; by "F.B.," 998
Power transformer operation, by G. L. Porter, 676
Preservation of historical electrical plant, The, by E. F. Smith, 953
Price of electricity for home use, The, by C. J. Crawshaw, 456
Purchase of coal to specification, by Maxwell, 238
Radio-telephone loud-speaker, A, by P. D. Tyers, 997
River water—or cooling towers?, by R. J. Kaula, 131, 281; by J. N. Waite, 170, 456; by E. Fawssett, 370; by E. Burhorn Co., 621
Safety first: Earthing transmission-line towers, by T. Stevens, 865
Salaries of engineers, The, by "Another Poor Blighter," 326; by "Yet Another Poor Blighter," 369; by "And Yet Another Poor Blighter," 415; by Society of Technical Engineers, 458; by "Transmission," 458; by "Delta Star," 458; by "Yet Another," 496; by "P.W.," 496; by "M.Sc.," 496; by "Embryo," 540; by "Sociologist and Engineer," 542; by "Hopeful," 582; by "Satisfied E.P.E.A., &c.," 621; by "S.W.G.," 677; by E. T. Williams, 743
Sheath losses in cables, by P. Dunsheath, 822; by R. A. Brockbank, 865
Signs of trade revival, The, by L. E. Wilson, 130
Single-phase induction-motor starting devices, by W. S. Daniels, 953; by G. Windred, 997
Small British motors, by "Coldair," 13
Supply undertakers' regulations, by "C. and F.," 458
Testing three-wire a.c. networks, by "Faults," 621
Tricity Restaurant, The, by "M.I.E.E.," 282
Two-part prepayment meters, by H. W. Watts, 457
Wattmeter calculations, by D. Robertson, 119; by M. G. Scroggie, 170
What is it to drive?, by the Lancashire Dynamo & Motor Co., 415
Wireless receiver as a load, The, by E. J. Baty, 495

"Osmos" fan display, A, 838
"Osmos" valve display, A, 756
Ac sheet, Standard transport, 441
Ats, Generating station, by R. O. Kapp, 124
Acplings, Electro-magnetic, 1039
Arses for teachers in technical schools, 480
Acentry's new electricity works, 523
Areda" heating and cooking appliances, 44
Aredenda" apparatus at Birmingham, 513
Areeping" cables, by F. E. Bentley, 806
Acstal detector circuit, A radio, by T. Carter, 249
Arrent limiter, A new, 696
Ach-German co-operation, 217, 298
Acho-Slovakian cable industry, The, 473
Acho-Slovakian tariff reductions, 678

AMS, State inspection of, 451
Aish electrical industry, The, 954
Af, Electrical aids for the, by C. M. R. Balbi, 789
Aal of arrangement, 680
Aals of assignment, 346, 431, 599, 1017
Amark, Marking vacuum cleaners for, 1037
Amark, The foreign electrical trade of, 29
Aartment of Overseas Trade, The, 638, 680, 706, 717, 755, 838, 1015
Aartment of Overseas Trade, The F.B.I., and the abolition of the, 734
Aford (East) re-visited, 871
Agn of extra-high-pressure cables, The, by E. B. Nixon, 5
Ael-electric ships, 438, 605
Ael Engine Users' Association, 279
Ael engines in Bulgaria, Water power *versus*, 223
Aect-current meter, A new, 1037
Afecting fluid, Electrolytic, 980
Dissolutions of partnership, 18, 97, 215, 256, 299, 345, 388, 431, 558, 641, 680, 756, 799, 841, 884, 929, 974, 1016
Distribution mains, Inadequate, 783
Distribution over an extensive area, by W. C. Bexon, 900, 944
Distribution practice, American, 440
Distribution, The importance of, 826
Divers, A helium-oxygen atmosphere for, 440
Domestic advance, The time for, 2
Domestic appliance venture, New, 215
Domestic appliances, The earthing of portable, 848
Domestic appliances, The earthing of portable, by R. H. Rawll, 206
Domestic economy teaching, Electric cooking and, 293
Domestic load, The, by E. G. Ross, 630
Domestic refrigeration, by N. E. Barber, 195
Drawing-office lighting, Efficient, 968
Draw-out switchgear, Metal-clad, by J. R. Wilkinson, 970
Draw out switchgear, Metal-clad, by T. Carter, 857
Drum-type controllers and motors, New, 656
Dry batteries for radio purposes, 3
Ductile tungsten in the United States, 286
Durham, German cables for, 16
Dust clouds, The electricity of, 480
Dust, Flies and 936
Dutch association, A new, 439
Dutch cable tender, Salford and a, 59, 175, 212
Dutch East Indies, Voltage standardisation in the, 935

EALING, Electricity supply at, 504
Earthenware pipe works, New, 839
Earthing of portable domestic appliances, The, 848
Earthing of portable domestic appliances, The, by R. H. Rawll, 206
Earthquake, The Japanese, 471
Eclipse of the sun, The, 806
Economic survey, An, 638
Economic value of increased steam pressure, by H. L. Guy, 697, 738
Economics and organisation, Engineering finance, 1002
Economics of the electrical industry, The, 300
Economy, Tests for resultant, by "Essaye," 167
Edison's 80th birthday, 201, 418
Educational, 144, 185, 222, 395, 606, 647, 686, 725, 765, 892
Egypt, The electrical imports of, 856
Electric Lamp Manufacturers' Association at Teachers' Conference, 982
Electric Lamp Manufacturers' Association campaign, The E.D.A.—14, 54, 93, 132, 172, 212, 254, 297, 330, 343, 385, 429, 470, 512, 555, 579, 596
Electrical Association for Women, 105, 144, 185, 224, 309, 352, 394, 480, 565, 605, 648, 766, 806, 848, 981, 1025
Electrical Association for Women—Annual luncheon, 814
Electrical Contractors' Association, The, 716
Electrical Contractors' Association, The —Annual dinner, 98, 156
Electrical Development Association activities, 461
Electrical Development Association annual dinner, The, 177, 490
Electrical Development Association annual report, The, 490, 512
Electrical Development Association—E.L.M.A. campaign, The, 14, 54, 93, 132, 172, 212, 254, 297, 330, 343, 385, 429, 470, 512, 555, 579, 596
Electrical Development Association film display, An, 638
Electrical development in South Wales, 707
Electrical engineers' ball, The, 263, 805
Electrical industry and market, The, 653
Electrical industry in 1926, The, by Lt.-Col. R. K. Morcom, 467
Electrical industry, The, 329
Electrical industry, The economics of the, 300
Electrical installations in mines, by J. A. B. Horsley, 235
Electrical outlook, The, 1
Electrical Power Engineers' Association —Annual dinner of the London Western Section, 481
Electrical Power Engineers' Association —Annual dinner of the Northern Division, 511
Electrical Power Engineers' Association —Annual dinner of the North-West Midland Section, 307
Electrical Power Engineers' Association —Annual dinner of the Portsmouth Branch, 353
Electrical Power Engineers' Association —Annual dinner of the Scottish Division, 223
Electrical Power Engineers' Association visit, 847
Electrical Trades Benevolent Institution, The, 646, 725, 1025
Electrical Wholesalers' Federation, The —Annual dinner, 213, 363
Electricity and gas at Retford, 418
Electricity 4, Cheapen, 286
Electricity Commissioners, The work of the, 38
Electricity in agriculture, 546
Electricity in gasworks, 224, 251
Electricity (Supply) Act, 1926, The, 36, 43, 76, 85, 352, 395
Electricity (Supply) Act, 1926, The, by W. S. Kennedy, 52
Electricity supply, Ideal, by G. Wilkinson, 966
Electricity supply tariffs, 64, 785
Electricity supply tariffs, by Prof. W. Cramp, 126, 165
Electricity undertakings, Rating, 765
Electricity used dangerously, 870
Electricity?, What is, by Prof. W. M. Thornton, 493
Electricity works in Austria, 439
Electrification and the Electricity Act, 183
Electrode steam generators, H.P., 764
Electrodeposition for rust protection, 892
Electrodeposition of rubber, The, 155, 481, 766
Electro-farming, 378
Electro-farming, by R. B. Matthews, 549, 787, 827
Electro-farming discussed in Paris, 766
Electrolytic disinfecting fluid, 980
"Electrolux" refrigerator, The, 862
Electro-magnetic couplings, 1039
Electro-medical department at Glasgow, An, 806
Electromobile Association, The, 184, 279
Electron, The spinning, 82
Electrons and protons, Spinning, 306
Electrothermics, by Capt. G. I. Finch, 817
Empire research, 243, 981
Employment during December, 1926, 133; during January, 1927, 294; during February, 471; during March, 680; during April, 839; during May, 1014
Engineer and his remuneration, The ordinary, by "P.B.E.," 634
Engineer, The salaries of, 746
Engineering conference, A week-end, 605
Engineering finance, economics and organisation, 1002
Engineering industry, Improvement in the, 677
Engineering industry, The future of the, 513
Engineering industry, Wages in the, 258, 514, 639, 755, 795, 840, 925, 972, 1015
Engineering wages in Australia, 972
Engineers' Club (London), The, 184, 353, 565
Engineers, Registration of, 182
Engineers, The salaries of, 746
Esthonia, A report upon, 881
Esthonia, Patents in, 217
Estimating department, The trials and humours of an, by "One of them," 207
European *v.* American meters, 716
European copper sales agreement, 58
European 380-kV transmission line, The first, 765, 805
Ex-British Westinghouse Association, 264, 440
Exhibition, A Bradford, 213
Exhibition, A French electrical, 926
Exhibition, A Manchester power efficiency, 134, 430
Exhibition, A travelling, 1014
Exhibition, An international rubber, 94
Exhibition at Melbourne, British Trade, 513
Exhibition at Norwich, Ideal Homes, 173
Exhibition, Business Efficiency, 255
Exhibition, Food and Cookery, 974
Exhibition, French Radio, 881
Exhibition, Institution of Civil Engineers', 1024
Exhibition, Midland Building Trades, 882
Exhibition, Proposed Scottish Textile Machinery, 58
Exhibition scheme rejected, Islington, 716
Exhibition, The G.E.C. at a Co-operative, 556
Exhibition, The Hampstead Electrical, 133
Exhibition, The Ideal Home, 135, 352, 408, 454, 492
Exhibition, The I.M.E.A., 904
Exhibition, 1927, The National Radio, 471, 756
Exhibition, The Oil, Chemical and Colour, 1018
Exhibition, The Physical Society's, 32, 70, 109, 151, 191
Exhibition, The Shipping, Engineering and Machinery, 215
Exhibition, Volta Centenary, 892
Exhibitions and the public, Local, 202
Exhibitions, General Electric Co., 93, 257
Exhibitions, Local, 16, 133, 258, 298, 386, 432, 471, 516, 558, 596, 638, 679, 717, 757, 799, 838, 927, 973, 1014
Exhibitions, United States, 299
Exhibitors, Railway concession for, 257
Explosion, Inquiry into Acton, 1024
Export organisation, A large electrical, 156
Export selling, 254
Exports and imports during December, 1926, Electrical, 149; during January, 1927, 315; during February, 489; during March, 693; during April, 813; during May, 1031
Extra-high pressure cable discharges, 441
Extra-high-pressure cables, The design of, by E. B. Nixon, 5
Extra-high-pressure steam plant at Bradford, 43, 104
Extra-high pressure systems, Fourth conference on large, 24, 565, 807, 1023
Extra-high-pressure transmission, by A. T. Scott, 128
Extra-high-pressure transmission, by G. W. Preston, 919

FACTORIES, 298
Factories, Power in, 471
Factor's catalogue, The, by A. J. Smith, 337
Factory processes, Heat for, 695
Failures in 1926, 17
Fair, The future of the, 502
Fans, Ceiling, 524
Faraday, A memorial to, 352
Faraday House Old Students' Association, 352, 522
Farming, Cheap electricity for, 826
Farms, Electricity on Japanese, 223
Farms, Electricity on poultry, 197
Fatalities, 24, 144, 184, 223, 353, 439, 481, 805, 890, 935, 980
Faults in flexibles, 374
Federation of British Industries and the abolition of the D.O.T., The, 735
Federation of British Industries and the next Budget, The, 93
Federation of British Industries President's address, The, 559
Federation of British Industries statement: Anglo-French discussions, 94
Ferranti, F.R.S., Dr. S. Z. de, 330
Films, Advertising electricity by, 223
Finance, economics and organisation, Engineering, 1002
Fire alarms at Lytham, 222
Fire escape, A novel, 515
Fire fighting, Electrical aids in, 438
Fires, 177, 255, 686, 927
Fires and electric shocks, 224
Fires on electrical installations, 231
Fittings factory, A Birmingham, 1015
Flex, A new way of packing, 433
Flexibles, Faults in, 374
Flies and dust, 936
Flood-lighted church, A, 55
Floodlighting, Electric, by W. J. Jones, H. Lingard, and T. Catten, 197
Floodlighting for night work, 212, 257
Floodlighting handbook, 891
Floodlighting, Modern, 796
Floodlighting of quarries, The, 298
Floodlighting, Sign, 893
Fluid, Electrolytic disinfecting, 980
Food and Cookery Exhibition, 974
Foreign agency, The, by A. J. Smith, 967
Foreign cables, Municipalities and, 925
Foreign competition, 596
Foreign electrical loans in America, 257
Foreign electrical trade, Britain's, 149, 315
Foreign electrical trade, French, 855
Foreign electrical trade of Denmark, The, 29
Foreign trade development, 596
Foreign trade, Our, 95, 255, 489, 641, 693, 813, 1031
France, Electric ploughing in, 855
France, Industrial, 586
France, Standardisation in, 936
France, The Thury d.c. system in, 766
France, Unemployment in, 19
Franklin's rod, 265
French-Belgian-Polish undertaking, A, 556
French colliery electrification, 251
French companies, New, 60, 386, 473, 597, 678, 718, 797, 842, 885
French company's centenary, A, 133
French Customs tariff, Proposed new, 471
French electrical exhibition, A, 926
French electrical industry, The, 926
French electrification halt, 814
French electrification programme, The, 308
French foreign electrical trade, 855
French industrial progress, 613
French lighting service bureau, A, 60
French mines, Electricity in, 208
French Radio Exhibition, 881
French railways, The electrification of, 352
French science meeting, A, 441
French tariff revision, Proposed, 881
French telephone company, New, 134
French view of the British market, A, 213
French view of the South African market, A, 556
Frequency problem, The Birmingham, 374
Frozen time switches still work, 558
Fuel and power, National, 93
Fuel research, 81
Fuel, Smokeless, 1024
Fuels, The use of low grade, by W. F Goodrich, 116
Fulham, Civic week at, 174, 216
Furnace in industry, The electric, 711
Furnaces, High-frequency electric, 949
Furnaces in non-ferrous metallurgy, Electric, by D. F. Campbell, 537
Furnaces, Internally-heated, 748

GALVANISED steel as neutral conductor, 524
Gas at Retford, Electricity and, 418
Gas company and the Electricity Act, A, 257
Gasworks, Electricity in, 224, 251
Gear-tooth grinding, 565
General Electric Co., at a Co-operative Exhibition, 556
General Electric Co. exhibitions, 93, 257
General Electric Co. fan campaign, 836
General Electric Co. lighting in South Africa, 677
General utility machine, A, 176

Generating station costs, by R. O. Kapp, 124
Generating stations, Oil-driven, 586
Generation of electricity statistics, The, 826
Generators, H.p. electrode steam, 764
German amalgamation, A, 974
German cable industry, The, 93, 343
German cables for Durham, 16
German contracts, Australia and, 974
German electrical industry, The, 600
German engineering workers' wages demand, 138
German export selling concern, A, 94
German exports to New South Wales, 213, 596
German holdings in Russia, 298
German industrial revival, 597
German instrument companies amalgamate, 15
German lamp production, 795
German locomotives for Australia, 489
German manufacturers' combine, 531
German materials for Victoria, 842
German rectifier order, Large, 531
German rubber-selling combine, 58
German trade in India, 213
German turbine syndicate, 559
Germans to construct Moscow "Tube," 14
Germany, Electrical development in, 891
Germany, Russian orders for, 132
Germany, The electrical exports of, 531
Germany, Unemployment in, 59, 93, 176, 716, 927, 1018
Gift to Bradford Technical College, 432
Gifts with vacuum cleaners, Free, 57
Glasgow, An electro-medical department at, 806
Glasgow Corporation tramway supply account, 157, 306
Glassware, The brightness of illuminating, 43
Gold, Electrical precipitation of, 565
Government contracts, The co-ordination of, 387
Gramophone reproducer, The Marconi, 641
Great Britain, Electricity supply in, 856
Great Britain's radio exports, 430, 641, 972
Great Yarmouth, Electrical developments at, 203, 247, 264
Greek telephone concessions, 433

HACKNEY, The Prince visits, 298
Hampstead electrical exhibition, The, 133
Hand-operated or automatic?, by R. Marsden, 510
"Hand-to-mouth" buying, 432
Harbours, Electrical power in ports and, 439
Harcourt lighting fittings, 678
Heat for factory processes, 695
Heating and cooking appliances, "Creda," 44
Heating in an operating theatre, Electric, 934
Heating, Industrial electric, by S. E. Monkhouse, 194
Heating with Thermit welding, Electric, 353
Heaviside layer, The, 981
Heavy-oil-engine working costs, 34
Helium-oxygen atmosphere for divers, A, 440
High-frequency electric furnaces, 949
High-pressure cable practice, 271
High-pressure cable tests, 202
High-pressure cables, 122
High-pressure networks, International conference on, 183, 686
High-pressure steam turbine in operation, A, 222
High-pressure steam turbines, 523
High-pressure testing laboratory, A, 183
High-pressure transmission, by H. R. White, 778
High-voltage "S.L."-type cables, by P. Dunsheath, 153, 189
High voltages on tantalum anodes, The effect of, 982
Hoarding illumination, 881
Holland adopts trolley 'buses, 981
Holland, The electrical trade of, 774
Hollow electrical conductors, 114
Home, The electrified, 957
Homes, Electrified, by H. H. Berry, 989
Honduras, Catalogues for, 556
Honduras radio market, The, 343
Honours, The Birthday, 914
Hopkinson's display at Blackpool, 639
Hospitals, Electrical employés help, 58
House, An all-electric, 13
House, The "all-earthed," by H. W. Clothier, 424
Housing enterprise, 661
Housing scheme, Electricity in a, 716
Hudson tunnel, Supervisory traffic control for, 338
Humour in advertising, 430
Hundredth volume, Our, 1001
Hungarian electrical contracts, 55
Hungarian electrical exports, 343
Hungarian radio import regulations, 758
Hungary's foreign electrical trade, 58, 175
Hurricanes, Static and, 423
Hydro-electric contract, A Peruvian, 213
Hydro-electric development, Swiss, 906
Hydro-electric installation, A low-fall, 935
Hydro-electric schemes, Small, 461, 536, 647
Hydrogen, Arc welding aided by, by P. L. Roberts, 10

IDEAL electricity supply, by G. Wilkinson, 966
Ideal Home Exhibition, The, 135, 408, 454, 492
Ideal Home Exhibition at Norwich, 173, 352
Ilford, Electrical development at, 547
Illuminant, A new electrical, 352
Illuminated road signs, 522
Illuminated tramcar, An, 134
Illuminating engineering, 409, 450
Illuminating engineering, by J. W. T. Walsh, 409
Illuminating Engineering Society, U.S.A., 676
Illuminating engineering, Some problems in, 522
Illuminating glassware, The brightness of, 43
Illumination, Hoarding, 881
Imperial development and co-ordinated investigation, by D. Spencer, 714
Imports during December, 1926, Electrical exports and, 149; during January, 1927, 315; during February, 489; during March, 693; during April, 813; during May, 1031
Incorporated Municipal Electrical Association Exhibition, The, 904, 948, 991, 1024
Incorporated Municipal Electrical Association, The—Annual Convention at Buxton, 825, 833, 899, 914, 943, 987
India, Coal-handling plant in, 620
India, Electric steel works in, 936
India, Electrical goods for, 974
India, German trade in, 213
Indian cable sports, 215
Indian companies, New, 300, 432, 720
Indian contract, An important, 926
Indian duties on battery chargers, 994
Indian electrical imports, 58, 386, 447, 638, 773, 929, 994
Indian electrical notes, 295, 573, 619
Indian railway electrification, British Insulated Cables, Ltd., secures big contract for, 352
Indian tariff revisions, 255, 796
Induction motor starting devices, Single-phase, by G. Windred, 874
Inductometer, A capacitance bridge and new, by A. Campbell, 31
Industrial conference, Anglo French, 343
Industrial electric cooking equipment, 386
Industrial electric heating, by S. E. Monkhouse, 194
Industrial electric vehicles, 847
Industrial France, 586
Industrial psychology, 373
Industrial welfare, 255
Industrialists to visit America, British, 676
Industry, Electric power in, 430, 471, 516, 597, 678, 720, 755, 796, 839, 881, 972, 1015
Industry, The Census of, 175
Institute of Fuel, The, 706

Institution Notes—

American Röntgen Ray Society, 849
Association of Consulting Engineers (Incorporated), 354, 935
Association of Mining Electrical Engineers, 687, 937
Diesel Engine Users' Association, 441, 982
Faraday Society, 105, 566, 607
Incorporated Municipal Electrical Association, 24
Institute of Fuel, 726
Institute of Metals, 65, 309, 441, 525, 607
Institute of Transport 266, 727, 849
Institute of Wireless Technology, 396, 982
Institution of Chemical Engineers, 309, 482
Institution of Civil Engineers, 807
Institution of Electrical Engineers, 65, 105, 144, 185, 225, 266, 309, 354, 441, 482, 525, 566, 606, 648, 687, 726, 767, 849, 937
East Midland Sub-Centre, 687
Mersey and North Wales (Liverpool) Centre, 566, 726, 849
North-Eastern Centre, 726
North-Midland Centre, 482, 525
North-Western Centre, 606, 937
Scottish Centre, 105, 726
South-Midland Centre, 482, 525
Western Centre, 482, 566, 767, 849
Institution of Heating and Ventilating Engineers, 937
Institution of Mechanical Engineers, 309
Institution of Public Lighting Engineers, 185, 266
Iron and Steel Institute, 648
Junior Institution of Engineers, 105, 185, 266, 354, 648, 726
North-East Coast Institution of Engineers and Shipbuilders, 937
Physical Society, 225, 309
Röntgen Society, 309
Royal Institution, 65, 396, 767, 807
Royal Society of Arts, 687
Institution of Civil Engineers' Exhibition, 1024
Institution of Electrical Engineers, The—Annual dinner and reunion in London, 242, 280
Institution of Electrical Engineers, The—Annual dinner of the Mersey and North Wales (Liverpool) Centre, 236
Institution of Electrical Engineers—Annual dinner of the North Western Centre, 157
Institution of Electrical Engineers—Annual dinner of the Western Centre, 103
Institution of Electrical Engineers, The—Annual report and accounts for 1926-27, 777, 805
Institution of Electrical Engineers Students' dinner, 481
Institution of Electrical Engineers, The—Summer meeting at the North-Eastern Centre, 969, 1004
Institution of Electrical Engineers wiring regulations, The, 606, 1002, 1023
Institution of Engineers-in-Charge, The—Annual dinner, 565
Institution of Railway Signal Engineers, 767
Insulation, A new cable, 265
Insulation, A new mica, 224
Insulation, Electrical, by A. Seton, 90
Insulators, Increased Austrian duty on, 1014
Insurance, Telephone, 522
Insurance, Unemployment, by J. J. H. Stansfield, 294
Internally-heated furnaces, 748
International conference on high-pressure networks, 183, 686
International Electrotechnical Commission, The, 648
International trust rumours, 795
Inventions in 1926,
Irish contractors and the Government Electricity Bill, 557
Irish Free State electrical imports, 98, 213, 385, 555, 757, 926, 975
Irish Free State Electricity Bill, 440
Irish Free State, State electricity in the, 462, 606, 646, 686, 726, 764, 786, 848
Irish radio import duty, The, 134, 516, 555, 680, 795
Iron and steel trades development, 263
Ironclad switching systems, 1009
Irons, Belgian duty on electric, 255
Irons, Portuguese duty on, 885
Islington exhibition scheme rejected, 716
Italian companies, New, 98, 300, 343, 512, 556, 639, 796, 839
Italian electrical associations, 440
Italian radio market, The, 639
Italian tariff increases, 16
Italy, Electric vehicles in, 764

JACKSON cooker contracts, 58
"J. & P." wiring system, The, 344
Japan and the electrical industry, by A. Riddle, 1010
Japanese earthquake, The, 471
Japanese electrical industry, The, 16
Japanese engineers, State aid for, 298
Japanese farms, Electricity on, 223
Junior Institution of Engineers—Annual dinner, 737

KENT electrical retailer's enterprise, A, 796
"Kilowatt, maximum demand," Ascertainment of, by F. W. Purse, 752
Kiosk-type sub-stations, 231, 699
Kipling society, A, 144
Kitchen in a shop, Electric, 385

LABORATORY, High-pressure testing, 183
Lake Lugano as a reservoir, 352
Lamp business in Switzerland, 213
Lamp manufacture in Belgium, 58
Lamp manufacture in Russia, 471
Lamp production, German, 795
Lamp-renewal complaint, A, 298
Lamp syndicate developments, 298
Lamp test, A severe, 735
Lamps and valves, Electric, by C. C. Paterson, 494
Lamps by the million, 217
Lamps for old, New, 255
Lamps order, Safety, 718
Lamps, Shockproof automobile, 514, 641
Lamps wanted, Cheaper electric, 471
Lancashire electricity scheme, A, 870, 880
Landlord and Tenant Bill, The, by W. E. Jackson, 672
Law amendment, Company, 16, 216
Law, Easy payments and the, by W. E. Jackson, 466
Law reform, Arbitration, by "Legal Contributor," 595
Lay-out of the contractor's shop, The, by E. N. Simons, 968
Lead and rubber prices, Copper, 49
Lead mines reopened, Yorkshire, 257
Leader cable for aircraft, 307
League of Nations, Electrical questions at the, 1023
Lecture to contractors, A, 104
Leeds, Electrical exhibits at, 93
Leeds, Opposition to municipal trading at, 177
Leeds, Proposed electricity showrooms at, 57

Legal—

Aberdeen Suburban Tramways Co. *v.* Aberdeen Town Council, 954
Automatic Telephone Manufacturing Co.'s patent application, 742
Birkenhead electrician fined, 622
Birmingham District Power & Traction Co., 340
Bosville *v.* Wood, 783
British Thomson-Houston Co. litigation, 169, 238
British Thomson-Houston Co., Ltd., *v.* G. Clynes & Co., 283
British Thomson-Houston Co., Ltd., *v.* Fox, 622

Legal—*continued.*

British Thomson-Houston Co., Ltd. *v.* Metropolitan-Vickers Electrical Co., 384, 426, 480
British Thomson-Houston Co., Ltd., *v.* Mullard Radio Valve Co., Ltd., 339, 426
British Thomson-Houston Co., Ltd., *v.* Star Electric Lamp Co., 911
British Thomson-Houston Co., Ltd., *v.* West Yorkshire Electric Co. Ltd., 129, 169
British Thomson-Houston patents in the Irish Free State, 384
Claim for electricity consumed, 782
Claim for meters destroyed by fire, 266
Carlton Main Colliery Co., 283
Colassi *v.* Smith, 53
Compensation for Marconi Company, 283
Conspiracy to defraud, Alleged, 1025
Costs of opposition to Dublin Electricity Bills, 340
Damages awarded against the Cork Tramways Company, 169
Dublin and Lucan Electric Railway Co., The, 911
Dublin workmen's compensation case, 384
Esders *v.* Porn, 837
"Electric hare" dispute, 662
Electric Light and Power Contracts Finance Corporation, Ltd., 266
Electric light plant dispute, 582, 741
Electric sign erection dispute, 92
Electricity Finance and Distribution Corporation, 837
Electricity theft charge dismissed, 283
False pretences charge, 582
Fraudulent conversion charge, 662, 742
Fraudulent use of electricity, Alleged, 169
General Electric Co., Ltd., *v.* Currys Motor Accessories, Ltd., 621
General Engineering Development Trust, Ltd., 129, 238, 582
Handcock *v.* Routledge, 238
Hart Accumulator Co., Ltd., *v.* Berton & Onions, 954
Heren *v.* Babcock & Wilcox, 53
H.M. Inspector of Factories *v.* Barr and Stroud, 384
Impex Electrical, Ltd., *v.* Norton Wireless Co., Ltd., 782, 823, 837
Imprisonment for Faraday House secretary, 582
Indictment of Cory Bros., Ltd., quashed, 384
Infringement of grid leak patent, 384
La Radiotechnique *v.* Norton Wireless Co., 662
Lazenby *v.* Gardiner, 92
Le Breton Engineering Co. *v.* Norton Wireless Co., Ltd., 1042
Lord & Shand *v.* Webb, 621
Manslaughter charge against a colliery company, 53, 384
Marconi's Wireless Telegraph Co., Ltd., 980
Montreal Tramways & Power Co., 339
Neutron, Ltd., 266
Rating appeal by Aberdeen Corporation, 53, 92
Reid *v.* Dalrymple, 954
St. Austell Electric Light & Power Co. *v.* Beavis, 296
Sale of batteries on closing day, The, 53
Scarborough Electricity Supply Co., 296
Sentence, 53
Shocks from an electric drill, 741
Soame, Bt., Sir Charles, and co directors charged, 764
Southern Counties Electric Light and Power Supply, Ltd., 497, 511
Stepney Borough Council, Action against, 92, 837
Stonebridge Electrical Co. *v.* Magneta Time Co., 296
Swedish General Electric, Ltd.'s, patent application, 383
Taunton *v.* Tomlinson Lee, 823
Theft of a vacuum cleaner, The, 129
Thefts of electricity, 53, 497, 823, 837
Transporter Co., The *v.* Johnson, 53
Triumph Trust, Ltd., *v.* Frahm, 911
Triumph Trust, Ltd., *v.* Smith, 426
Unlicensed transmitter, An, 340
Wareham Electric Supply Co., Ltd., 299, 339, 394, 511, 621, 686
Wiring contract dispute, A, 169
Workmen's compensation case, 837
X-Rays, Ltd., 511

Leipzig Fair, The, 93
Leningrad, British manufacturers' representatives in, 217
Libraries and information bureaux, 242, 265
Lighting a book factory, 517
Lighting, Alhambra Theatre, 375

Lighting and Power Notes—

Aberdeen, 642
Accrington, 600, 642
Aire and Calder District, 60
Alderley Edge, 800
Aldershot, 217, 389, 759, 975
Algeria, 758
Alloa, 300
Alsager, 389
Amesbury, 19
Andorra, 301
Arbroath, 1018
Argentina, 433, 800
Ashford (Kent), 642
Asia Minor, 346
Auckland (N.Z.), 601
Audenshaw, 217

ghting and Power Notes—*cont.*
ughton (Lancs.), 19
ustralia, 19, 99, 177, 217, 258, 346, 433, 642, 758, 800, 930
ustria 138, 177 843
ylesbury, 347, 518
yrshire, 217, 720
allycastle (Co. Antrim), 843, 976
angor, 681
arking, 681
armouth, 433
arnes, 389
arnsley, 99, 258, 681, 800
arnstaple, 258, 975
arrhead (Renfrewshire), 60
arrow, 60, 99, 258, 434, 720, 930
asingstoke, 389
ath, 60, 217, 600
atley, 977
attersea, 259, 517, 601, 721
eckenham, 60, 217, 885
edford, 138, 300, 561, 720, 800, 1020
elfast, 976
elgian Congo, 1018
elgium, 99, 259, 389, 681, 721, 843, 885, 930
ermondsey, 301, 601, 976
ethesda (North Wales), 1018
exhill, 217, 517
icester, 389
irkenhead, 390, 560, 600, 681, 930
irmingham, 347, 885
lackburn, 721, 842, 885, 930
lackpool, 602
loemfontein (S.A.), 682
olton, 19
rackley, 517
radford, 99, 475, 517, 800, 1018
raintree, 177
razil, 19, 434
rentwood, 600, 800
ridge of Allan, 99, 258, 681
ridgnorth, 842
ridlington, 721
ridport, 389
rigg, 517
rightlingsea, 177, 347
righton, 177, 347, 475, 560
risbane (Q.), 930
ristol, 60, 138, 258, 800
romley, 475, 600
rownhills, 258
uckingham, 681
ugle (Cornwall), 258
ulgaria, 930
urnley, 217, 389, 930
urton-on-Trent, 800, 975, 1019
ury, 60, 434, 602, 722
ury St. Edmunds, 138, 475
uxton, 975
airns (Q.), 177, 758
alcutta, 975
anada, 60, 99, 217, 434, 475, 560, 600, 642, 681, 759, 800, 842, 930, 975
annock, 560
anvey Island, 258
ape Town, 518, 642, 760, 931
ardiff, 434, 560, 721
arlisle, 258, 721, 801
armarthen, 435
aterham, 258
hapel-en-le-Frith, 20
hatburn, 642
helmsford, 60, 560
heltenham, 217, 601
hesterfield, 19, 347, 842, 975
hichester, 759
hile, 301, 517
hina, 885
hirk (Yorks.), 681
heethorpes, 475
hitheroe, 301, 389, 434, 885
hockermouth, 99
holchester, 217, 435
hollie (W.A.), 433
holne, 801, 1019
hunway, 435
hurnwall, 759
hwentry, 177
claven (Yorks.), 801
clediton, 60, 217, 434
clewkerne, 601
cookhill, 561
cowborough, 434
coydon, 177, 681
cumberland, 1019
czecho-Slovakia, 19
darlington, 301, 561
dartford, 976
dartmouth, 885
derwen, 517, 885
derby, 389
devonport (Tasmania), 347
dewsbury, 99, 259, 977
doncaster, 930
dorchester, 1019
dorking, 346
douglas (I. of M.), 99, 435, 601, 681
dover, 347, 435, 642, 976
dublin, 99, 759, 976
dumfries, 642
dundee, 19, 347, 1019
dunfermline, 177
duntocher (Dumbartonshire), 517
durban (S.A.), 348
east Anglia, 19, 259
eastbourne, 19, 60, 99, 177, 561, 721, 930
east Dereham, 99, 517
east Elloe, 1019
east Grinstead, 301
east Ham, 259, 601, 1019
east Kent, 1019
edstry, 99
edinburgh, 99, 389, 722
edham and Staines, 977
El Salvador, 843
enniscorthy (Co. Waterford), 99, 259
epsom, 178, 517, 759, 930
erith, 561
esher, 518
evesham, 681
exland, 517

Lighting and Power Notes—*cont.*
Fishguard, 885
Fleetwood, 138
Folkestone, 259
Forbes (N.S.W.), 800
Formby, 642
France, 99, 347, 389, 517, 759, 801, 843
Frickley (Yorks.), 178
Fulham, 259, 434, 601
Gainsborough, 259, 801
Germany, 301, 347, 434, 475, 517, 801
Gillingham, 259
Glasgow, 138, 178, 301, 475, 721, 885, 1019
Grampian electricity scheme, 930
Grangemouth, 759
Grantham, 390
Grantown-on-Spey, 681
Gravesend, 301, 475, 681, 976
Grays, 178
Greenock, 885
Grimsby, 475
Guildford, 60, 347, 601, 721, 843, 930
Hackney, 139, 301, 347, 759
Halifax-Huddersfield, 259, 681
Hamilton, 20, 217
Hammersmith, 301, 642
Hampstead, 390
Hants, 60
Harrogate, 390, 681, 976
Harwich, 561
Haslingden, 218, 930
Hastings, 99, 434, 475, 642, 681, 843, 1019
Hatton (near Warwick), 99
Hawarden, 138, 217, 475
Haworth, 218
Hazelgrove and Bramhall, 259, 801
Helensburgh, 843
Hemsworth, 218
Hendon, 642
Hereford, 99
Heywood, 931
Hornsey, 178, 347, 518, 721, 885
Horsham, 178, 347, 390
Hove, 434, 976
Huddersfield, 347
Hull, 218, 475, 681, 759
Huntingdon, 99
Huntly (Aberdeenshire), 1019
Iceland, 601, 759
Ilford, 178, 301, 517, 885
India, 138, 178, 301, 475, 517, 642, 721, 885
Inverness 301, 1019
Ipswich, 259
Irish Free State, 99, 138, 178, 259, 301, 517, 721, 759, 976
Isle of Wight, 475, 930
Islington, 301, 347, 475, 682, 1019
Italy, 347, 475, 560, 642, 681, 759, 885, 976, 1019
Japan, 19, 390, 475, 721, 843, 885, 1019
Johannesburg, 178
Keighley, 99, 259, 976
Kendal, 801, 976
Kensington, 930
Kingussie, 139, 259
Kirkcaldy, 801
Kirkham, 259, 390
Knaresborough, 601
Lancaster, 347, 885
Latvia, 976
Launceston (Tasmania), 217
Leamington, 218
Leatherhead, 843
Leeds, 139, 390, 601, 642, 759, 930
Leek, 517
Leicester, 435, 759, 801
Lewisham, 930
Lexden and Winstree, 178
Leyton, 602, 976
Lichfield, 301
Limerick, 138, 178, 976
Lincoln, 178, 259, 801
Littleborough, 886
Liverpool, 60, 178, 218, 347, 390, 434, 601, 759, 886
Llandrindod Wells, 886
Llandudno, 390, 721
Llanfairfechan, 259, 475
Llansilin, 886
London, 60, 139, 218, 259, 301, 347, 434, 475, 517, 601, 642, 682, 721, 759, 801, 843, 930, 1019
London and Home Counties Bill, 434, 517
Long Eaton, 259, 843
Loughborough, 99
Louth, 302
Lowestoft, 139, 475, 721, 843, 1019
Luddenden Foot, 218
Lurgan (Armagh), 886, 976
Luton, 99, 682
Luxemburg, 60, 930
Lyme Regis, 19
Lymington, 1020
Lytham St. Annes, 390, 561, 759
Macclesfield, 20, 347, 642
Maidenhead, 435
Maidstone, 178, 601, 602, 886
Maldens and Coombe, 218
Maldon, 601
Malvern, 801
Manchester, 60, 218, 347, 390, 601, 721, 722, 861, 930 1020
Mansfield, 178
Marlborough, 259
Maryport, 886
Maybole, 642
Mexico, 259, 759, 886
Middlesbrough, 302, 475
Mid-Lancashire, 886
Milnrow, 302
Milton, 682
Monks Kirby, 60
Montgomery, 218
Morecambe, 722
Newark-on-Trent, 19, 931
Newbury, 347
Newcastle-on-Tyne, 178
Newhaven, 99, 259
Newmarket, 802

Lighting and Power Notes—*cont.*
Newport (I. of W.), 682
Newry (Co. Down), 302
New Zealand, 601, 642, 931
Northampton, 218
Northern Ireland, 20, 259, 302, 475, 682, 759, 843, 886, 976, 1020
North-West Midlands Electricity District, 99
Norway, 177
Norwich, 139
Nottingham, 259, 759
Oldbury, 518
Oldham, 931
Ollerton, 178
Ossett, 61
Oswestry, 722
Oxford, 1020
Paarl (Cape Province), 6
Padiham, 139
Paignton, 517
Paisley, 1020
Palestine, 139, 259, 682
Pembroke (Dublin), 721, 802
Pembrokeshire, 178
Persia, 218
Peterborough, 61, 435, 801
Peterhead, 759
Plymouth, 517, 601, 722
Plympton St. Mary, 802
Poland, 721, 801
Pontypridd, 642
Poplar, 347, 517
Portadown (Co. Armagh), 259, 302, 682
Port Bannatyne, 178
Portland, 347, 642
Portsmouth, 99, 347, 435, 722, 802
Portstewart (Co. Derry), 843
Portugal, 681, 801, 885
Preesall, 139, 390
Prestatyn, 561, 722, 843
Preston, 61, 139, 302, 561, 601, 642, 722, 759, 843
Prestwich 722
Price reductions, 390, 435, 475, 561, 602, 682, 759, 802 931, 977, 1020
Pwllheli, 100
Radcliffe, 20, 682
Rawtenstall, 20, 139
Reigate, 260, 390, 561
Retford, 218
Rhyl, 347
Richmond (Surrey), 1020
Ripon, 642
Rochdale, 218, 561
Rothesay, 642, 722
Rugby, 20
Rugeley, 100
Russia, 258, 434
St. Austell (Cornwall), 100
St. Helens (I. of W.), 20
St. Marylebone, 139, 301, 601, 721, 930
St. Pancras, 139, 642
Sandbach, 390
Sao Paulo, 19
Scarborough, 218, 561
Scunthorpe, 178, 642
Seaham Harbour, 178, 561
Shaldon, 760
Sheffield, 100, 390, 760, 843, 931
Sheffield-Rotherham, 218
Shipley, 178, 518, 931, 1020
Shoreditch, 475, 802
Shrewsbury, 302, 561, 843
Sidmouth, 390
Simonstown, 802
Skegness, 139
Skipton, 886
Slaithwaite (Yorks.), 100, 475
Smethwick, 518
South Africa, 61, 178, 348, 435, 518, 642, 682, 760, 802, 931
Southampton, 390, 561
South Durham, 100
South-East Lancs. Electricity Advisory Board, 20, 602, 682, 931
Southend-on Sea, 139, 390, 518, 682
Southport, 178, 435, 602, 759
South Shields, 390, 518
Southwark, 218, 301, 759, 976
Spain, 560
Spalding, 100, 260, 977
Special Orders, 61, 178, 260, 302, 390, 435, 475, 518, 602, 642, 682, 722, 760, 802, 886, 931, 977, 1020
Staveley, 20, 931
Stepney, 843
Stirling, 20, 518
Stockport, 643, 931
Stockton-on-Tees, 435
Stoke Newington, 642
Stoke-on-Trent, 100, 218, 390, 435, 518, 722, 843, 931, 977
Stourport, 61, 178, 802, 843, 931
Stretford, 802
Stroud (Glos.), 802
Sudbury, 886
Sunderland, 139, 977
Swansea, 139, 302, 348, 518, 682, 844, 977, 1020
Sweden, 19, 138, 258, 560
Swinton and Pendlebury, 348
Switzerland, 60, 217, 301, 347, 389, 434, 475, 681, 721, 1019
Taf Fechan, 561
Tain, 218
Tarvin, 476
Tasmania, 99, 217
Taunton, 722
Tendring, 179
Thame, 260
Tilbury, 977
Tiverton, 302
Torpoint, 390, 435, 602
Torquay, 61, 218, 435, 643, 802, 977
Tring, 20
Truro, 302
Tunbridge Wells, 435, 802
Tynemouth, 179, 302, 886
Uckfield, 561
United States, 139, 260, 348, 476, 561, 643, 844, 886
Uttoxeter, 1020

Lighting and Power Notes—*cont.*
Wakefield, 61, 802
Wallasey, 390, 391
Walsall, 100, 561, 643
Walthamstow, 218
Walton-le-Dale, 260
Walton-on-Naze, 561
Walton-on-Thames, 435
Warrenpoint (Co. Down), 475
Watford, 435, 760, 1020
Wellington (Somerset), 476
Wessex, 61
West Cornwall, 476
West Ham, 348, 561, 760
West Midlands, 348, 518, 561
West Penwith, 977
West Riding, 139
Wetherby (Yorks.), 218
Weymouth, 100. 435, 844
Whitburn (Durham), 722
Whitby, 435, 476
Whitchurch (Hants.), 844
Whitehaven, 682
Wigan, 20, 977
Wigton (Cumberland), 218
Wimbledon. 61, 218, 759, 977
Winchester, 61, 561
Wirksworth, 391
Wirral, 61, 348, 561
Wolverton, 20, 518
Woolwich, 434, 976
Worcestershire, 260
Worthing, 218, 391
Wrexham, 561
Wrotham (Kent), 139
Yarmouth, 61, 643
York, 20, 476, 561, 602, 760
Yorktown and Blackwater, 931

Lighting, Better, 646
Lighting business in Portugal, 69
Lighting, Colour, 892
Lighting, High-power street, 222
Lighting in schools, 638
Lighting installation, A "Mazda," 133
Lighting installations, Recent, 964
Lighting, Modern church, 16, 555
Lighting, Modern stage, 735, 793
Lighting scheme, A B.T.-H., 795
Lighting scheme, A cathedral, 230
Lighting scheme, A remote-control public, 816
Lighting service bureau, A French, 60
Lighting Service Bureau, The Manchester, 157
Lighting, Shop and store, 16
Lighting unit tests, 439
Lignite in America, Powdered, 780

Liquidations—
Alkluri Electrics, 1017
Aster Engineering Co. (1913), 515
Autochrome Signs (1926), 557
Automatic Company (Bristol), 97
Automobile Electrical Repairers, 599
Autoveyors, 388, 473
B.D.S. Wireless, 756
Bell, J., & Croyden, 515
Booth, Joseph, & Bros., 473
British Broadcasting Co., 215
British Electrolytic Zinc Co. (Isherwood Process), 215, 883
British Wireless Supply Co. (1924), 299, 431
Bucks. Electric Wire and Engineering Co., 97
Carpax Co., 473, 515, 599
Castle, J. P., & Co., 345
Cinema Apparatus Co., 388
City Fuseboard Co., 599
Claremont, Johnson & Co., 256, 345, 557
Clear Hooters, 18
Cleartron Radio, 136, 174
Cleveland Electrical Engineering Co., 599
Clough, H., & Co., 557
Compression Starter & Switchgear Co., 97
Conradi & Braun, 928
Correcta Light Co., 929
Coughlan & Tyrrell, 841
Deansgate Electro Radio (Manchester), 473
De Leeuw & Co., 1016
District Lighting Supply, 841, 883
Domestic & General Electrical Co., 97
Electric Light & Power Contracts Finance Corporation, 215, 719
Electrical & Radio Distributors, 799, 883
Electrical Cabinet Works, 719
Electrical Engineering & Equipment Co., 1017
Electrical Stores (Nottingham), 473, 558
Electrical Wholesale Supplies (Leicester), 929, 1016
Electricity Finance & Distribution Corporation, 756
Evalasio Distributing Agency, 472
Farringdon Electrical Co., 18
Fladbury Electric Light & Power Co., 256
Foolprufe Patent Accumulator Co., 431, 557, 640
Gil-Ray Trading Corporation, 472
Goswell Engineering Co., 558
Gwynnes Engineering Co., 18
High Salvington Electric Supply Co., 884
Holbrook's Electric Service Co., 883, 973
Interchangeable Electric Signs, 841
Jones, F. J., & Sons, 557
Kenyon & Torrance, 56
Kingsway Radio, 558, 640
Knight, A. W., 883
Knivetown Electric Wire Co., 56, 96, 431
Llandrindod Wells Electric Light and Power Co., 599
Magnetic Signs & Carriers, 799
Manda Motors, 1017

Liquidations—*continued.*
Marine & Mechanical Electric Welding Co., 558
Measurement (Australia), 884
Mining Requirements Co., 56
Montreal Tramways & Power Co., 599
Nadin & Dell Electric, 799
National Wireless Corporation, 18, 136, 215, 719
Neutron, 215, 299, 345, 387, 1017
Orling's Telegraph Instruments Syndicate, 345
Paragon Electric Welding Co., 388
Presland Electric Supplies, 345
Radi-Arc Electrical Co., 640, 719
Radio Cabinets, 215, 299
Radio (Hove), 175, 299
Radio Phonopore & Electricals, 215
Radio Productions (Leeds), 599
Radio Valves, 841
Re-echo Radio Co., 558
R.M.P., 884
Robins Wholesale Electrical & Wireless Co., 719
St. Helens Electric Lighting Co., 345
Samuel, L., 515
Selling Wireless, 431
Service Radio, 599, 679
Sherborne Trust, 679
Slogasigns, 97
S.M.F. Electrical Supplies, 928
Southern Counties Electric Light and Power Supply, 299, 515, 756, 798
Spanish & General Wireless Trust, 175
Springfield Electric Motors, 928
Sterling Accessories, 388
Tele Dis Services (Founders Co.), 18
Unique Wireless Co., 215
United Electric Car Co., Ltd., and Dick, Kerr & Co., 884
Universal Radio Syndicate, 215
Vee Cee Dry Cell Co., 884
Wareham Electric Supply Co., 256
Watson, Jones, 214
Wireless Services, 841
Wireless Valves, 431
Woodstock Electric Light Co., 431
Yates & Thom, 883, 929, 1017

Lister's jubilee, Messrs., 94
Liverpool to join the B.E.A.I.R.A., 57
Load factor, Improving the, 626
Local exhibitions, 16, 133, 258, 298, 386, 432, 471, 516, 558, 596, 638, 678, 717, 757, 799, 838, 927, 973, 1014
Local societies, 848
Location of power stations, The, 42
Locomotive, A large battery, 65
Locomotive, Over the Loetschberg on a 4,500 h.p., 287
Locomotives, Electric mine, 791
Locomotives for Australia, German, 489
Locomotives for Spain, Electrical, 98
Locomotives in Switzerland, Electric, 307
Loetschberg on a 4,500 h.p. locomotive, Over the, 287
London Chamber of Commerce, 560
London County Council estate, Electrical appliances on a, 757
London County Council tramways, The, 805
London electricity supply changes, 58
London sign, A new, 884
London transport, 383, 626
London's electricity supply, 503, 745
London's electricity supply in 1924-25—The L.C.C. annual report, 532
London's tramways, 847
Loud-speaker, A radio-telephone, by E. W. Braendle, 876
Low-grade fuels, The use of, by W. F. Goodrich, 116
Low-temperature carbonisation, 441
Lugano as a reservoir, Lake, 352
Luxemburg concession, The, 556, 599
Lytham, Fire alarms at, 222

MACHINE, A general utility, 176
Machinery, Agricultural electrical, by R. B. Matthews, 331, 377
Machinery exports, Our electrical, 796
Machinery imports of the Belgian Congo, 271
Machinery markets, Our electrical, 345
Machinery, Standard performances for electrical, by F. T. Chapman, 250, 292
McClary cooker, Berry's Electric, Ltd., and the, 839
"Magnet" industrial cooking equipment, 556
Magnetic testing of wire rope, 155
Magnetos in speed record, B.T.-H., 265
Mains engineers' problems, by D. P. Sayers, 829
Mains, Inadequate distribution, 783
Man power, Sales and, 296
Manchester Lighting Service Bureau, The, 157
Manchester Power Efficiency Exhibition, A, 134, 430
Manchester retailers and municipal selling powers, 257
Manchester, Selling appliances at, 60
Manchester Steam Users' Association, 481, 648
Mansfield and foreign cables, 839
Mansfield electricity investigation, 308
Manufacturers' Agents' Association, The, 512
Manufacturing concession, A Russian electrical, 924
Maps, Midland Bank, 16
Marconi gramophone reproducer, The, 641
Marconi radio apparatus, 395
Market-place lighting, 647
Market-place of the future, The electric, by H. H. Berry, 9
Materials for the electrical industry, 41
"Mazda" lighting installation, A, 133
Measurement of sheath losses in cables, The, by R. A. Brockbank, 751
Measurement of temperature, Electrical, by J. Hall, 1036
Measuring instruments, A.c., by Lt.-Col. K. Edgcumbe and F. E. J. Ockenden, 232, 276
Measuring instruments, Modern electrical, by C. L. Lipman, 163
Melbourne, British trade exhibition at, 513
Merchandise Marks Acts, 758
Merchandise Marks applications, 926
Mercury-contact motor starters, 657
Metal-clad draw-out switchgear, by J. R. Wilkinson, 970
Metal-clad draw-out switchgear, by J. Carter, 857
Metal industries, Research and the, 481
Metal patterns and electricity, by J. Edgar, 503
Metallurgy, Electric furnaces in non-ferrous, by D. F. Campbell, 537
Meter, A new direct-current, 1037
Meter Engineers' Technical Association, 144, 307, 525
Meters approved, 97, 678
Meters, European *v.* American, 716
Metropolitan-Vickers in Russia, 471
Metro-Vick carnival, The, 579
"Metro-Vick" contracts, Some recent, 658
Mexico, Electrical plant for, 173
Mica insulation, A new, 224
Midland Bank maps, 16
Midland Building Trades Exhibition, 882
Midland students' ball, 65
Mine locomotives, Electric, 791
Minerals, Electrical prospecting for, 981
Mines, Cables in, 687
Mines, Coal: Certificates of competency, 223
Mines, Electrical installations in, by J. A. B. Horsley, 235
Mines, Electricity in, 565
Mines, Electricity in French, 208
Mines electrification, Sulphur, 197
Mines reopened, Yorkshire lead, 257
Mines, Storage batteries in gassy, 223
Mining accidents, 265
Mining gear, Testing, 438
Molybdenite as a photoelectric material, 353
Montefiore prize, The George, 439
Moscow radio station, The, 647
Moscow "Tube," Germans to construct, 14
Motor-generators, Special, 741
Motor starters, Mercury-contact, 657
Motor starting devices, Single-phase induction, by G. Windred, 874
Motors, New drum-type controllers and, 656
Moving pictures, "Wireless," 103
Mullard window displays, 134
Municipal selling powers, Manchester retailers and, 257
Municipal showrooms and offices, New, 257, 343, 388, 431, 515, 717, 797, 882
Municipal showrooms, Southend traders and, 1015
Municipal trading at Leeds, Opposition to, 177
Municipalities and foreign cables, 925

NASH on the electrical industry, Sir P., 171
National Association of Supervising Electricians, 65, 185, 264, 340, 525
National coal resources survey, 480
National fuel and power, 93
National Illumination Committee of Great Britain, 849
National Industrial Alliance, 1025
National Institute of Industrial Psychology, 396
National Physical Laboratory, The—Annual report, 580
National Physical Laboratory, The Photometric Department of the, 806
National Union of Scientific Workers, 308
Navigation lights, Aerial, 374, 394
Neon electric signs, 865

New Companies—
A. & C. Receivers, 226
Abbey Cables, 894
Airships Electric Advertising Co., 983
Alpha Electric Welding Co., 442
Accurate Recording Instrument Co., 67
Alldays & Onions, 186
Amalgamated Brake & Signal Co., 310
Amalgamated Lamp Companies (Great Britain), 398
Anderson & Stuart, 398
Artandia, 938
Ashworth & Smith (Electrical Supplies), 608
Auto-Electric Advertising Co., 894
Baird Television Development Co., 568
Ball, A. E., & Co., 267
Baron, W., & Co. (London), 850
Bartlett, H. J. (Hove), 397
Baynton, Gordon, 527
Berkeley Electrical Engineering Co., 607
Bond, C. D., & Son, 850
Boynton & Co., 106
Briggs, J., Electrical Contractors, 443
British Curtis Radio, 938
British Electric Meters, 355
Brockbank & Powell, 1026
Bryce, Archibald & Co., 186

New Companies—*continued.*
Bryterlite Electrical Co., 808
Buell Combustion Co., 768
Bussell, S. W., 850
Canadian Porcelain Co. (British), 689
Carnegie & Watson, 267
Carrington & Button, 808
Catton & Coates, 850
C.C.A. (Vacuum Cleaners), 650
Century Cables, 311
Charnock & Walker, 226
Chromium Plating & Development Co., 186
Clear Hooters, 355
Cleartron (1927), 607
Cleethorpes Radio Supply, 808
Continental Hydro-Electric Co., 26
Dale, E. A., 186
D.A.R., 727
Dental & General Radiography, 608
Devereaux, 1026
Dionoid Battery Co., 607
Dormer & Wadsworth, 226
D.X. Coils, 727
Dyson, J., & Co., 66
East Suffolk Electricity Distribution Co., 483
Electric Agencies, 649
Electric Bulk, 808
Electric Fans, 186
Electric Repairs (Glasgow), 938
Electrical Agencies (London), 808
Electrical Coils, 66
Electrical Manufacturing & Plating Co., 808
Electrical Refrigerators & Appliances, 146
Electrical Units, 808
Electro Trust, 443
Elektromekano Co. (London), 649
Elliott's Electrical Construction Co., 26
Evalasio Distributing Agency, 267
Express Magneto (Repairs) & Electrical Co., 398
Finnell System, 808
Flexible Electric Cords, 398
Foster-Boynton & Co., 26
Frigidaire, 567
Gillan Radio-Electric, 398
Gorford Bros., 688
Gottlieb, J. L., & Co., 355
Graver, Cousins & Co., 608
Gray, W. L., 146
Griffin Harding & Bryant, 526
Halle, M. A., & Co., 310
Hammerl, W., & Co., 567
Herne Bay and District Electricity Supply Co., 938
Hertfordshire Rubber Co., 397
Hodgson, W. G., & Co., 355
Holbrook, J., & Tattersall, 808
Howarth, Green & Co., 226
Hungerford and District Electric Supply Co., 146
Husbands, Hart & Warburton, 26
Index Lamp Co., 66
Indian & Colonial Supply Association, 310
Irish Radio Stockists, 938
J. & C. Manufacturing Co., 1026
Jennens, J. R., 26
Johnson & Tanner, 688
Johnson, Ross & Co., 106
Jones, Ernest, & Co., 107
Jays & Co. (Engineers), 568
Junit Manufacturing Co., 483
Kasha, I., & Son, 267
Kemp, J. T., 268
King, Stringer & Co., 267
Lamb & Co. (Westcliff), 106
Langs (Wimbledon), 689
Lectro Linx, 689
Leeds Sunlight & Electrical Clinic, 850
Lewis, H., 26
Light-o'-Day Electric Lamp Co. (1927), 397
Lincoln Radio Supplies, 355
Lisburn Electric Supply Co., 186
Liverpool Engineering and Condenser Co., 808
Lockett, Lloyd & Statham, 146
Loewe Radio Co., 608
Logan Electric Supplies, 608
London & Midland Manufacturing Co., 526
Luminad, 808
Macilafone Co., 443
MacLean & Robb, 267
Maitland & Co. (Manchester), 26
Martin's, Electricians, 527
Maughan, J. L., & Co., 226
Mercury Electrical Appliances, 1026
Mickleburgh, Charles, 267
Microfuses, 850
Midways Electric, 398
Millerphones, 66
Miller's Radio Products, 983
Mouldings & Insulators, 310
Natural Power, 106
Neutron (1927), 1026
Nigerian Power & Tinfields, 443
Northern Radio & Electrical Factors, 483
North-Western Wireless Company and Wallasey Motor Exchange, 398
N.S. Accumulators, 650
Partridge & Mee, 567
Perring-Thoms Wireless Syndicate, 850
Peters & Co., 768
Phone Conversion, 355
Poole, R. A. (London), 894
Porn & Dunwoody, 638
Porter, W. H., & Co., 808
Power Holdings, 526
Power Lines Construction Co., 650
Premier Producers (1927), 310
Radi-Arc Electrical Co. (1927), 1027
Radio Electric Co. (Bournemouth), 938
Radio Investigations, 567

New Companies—*continued.*
Radio Service (London), 850
Raworth, Frank, 983
Red 'Phone Book (Newcastle), 355
Regent Electrical Co., 894
Reid Power Development Co., 1026
Reid Process, 983
Reliance Trading Co. (Liverpool), 26
R.I. & Varley, 649
Ribton, C. P., 568
Roberts, J., Sons & Eccles, 727
Russell, N., & Co., 267
Rund Manufacturing Co., 186
Sherrion-Goodridge Patents, 768
Ship Carbon Co. of Great Britain, 310
Siderman Electrical Supplies, 649
Sifam Electrical Instrument Co., 938
Signs of the Times, 526
Sinclair, R. J., & Co. (Glasgow), 938
S.L. Electrical Co., 607
Solidite & Synthetic Mouldings, 26
South American Public Utilities Trust, 1026
Southern Industries, 310
Stelmar Projection Lighting, 267
Strouds (Bellingham), 442
Synchronola Radio Co., 442
Takato & Co., 398
Thacker, W. F., 146
Transporting Machinery & Engineering Co., 397
Triotron Radio Co., 895
Tully Gas Plants (1927), 1026
Vacuum Lamp Co., 397
Vacuum Power, 310
Victor X-Ray Corporation, 895
Wand & Mitchell, 483
Warner (Control), 526
Warner Trust, 526
Weenen Goddard & Co., 895
Welwyn Wireless, 268
Western Wireless & Electrical Co. (Salisbury), 146
Willson, W. D., 895
Wilrose Co. (Birmingham), 808
Wilson, L. E., & Co., 808
Winfield & Reeves, 442
Wireless Piano Players, 483
Wireless Pictures, 106
Woolldridge, M. (Wireless), 808
Young Accumulator Co., 526

New Electrical Devices, Fittings and Plant—
Automobile lamps, Two special, 427
Battery maintenance outfit, 491
Bedwarmer, An electric, 193
Bell system, A new electric, 615
'Bus lighting lamp, A, 193
Cable gland, A novel, 775
Cable-haulage equipment, A, 654
Cable vehicle, A heavy, 73
Carpet washer, An electric, 210
Change-over switch, A new, 775
Cleaner, A small electric, 995
Control pillars, Improved, 427
C.T.S. trailing cables, 1040
Earthing clip, A new, 427
Egg-cleaning machine, An, 736
Empson emulsifier, The, 995
"Emvee" cord-grip, The, 211
Fan, A new electric, 815
Feed-water impurity indicator, A, 491
Feeder pillar, A unit-type, 536
Fire, A new electric, 73
Floor machine, A heavy-duty, 73
Geyser, A new electric, 194
Hair dryer, An improved electric, 491
Illuminated flowers, 736
Iron safety stand, An electric, 193
Ironclad switch, An improved, 535
Ironclad switch-fuse, A new, 815
Junction box, A simple, 491
Kettle, An electric, 615
Kettle protective device, A, 775
Lamp, Another internally frosted, 536
Lawn mower, An electric, 615
Lead headed nails, 995
Light shielding fitting, A, 73
Machinery fault-detecting apparatus, 536
Mining switchgear, New, 30
"Morganite" heaters, 194
Motorless refrigerator, A, 30
Motor-operated rheostats, 995
Non-pitting control apparatus, 1040
Outdoor circuit breaker, A new, 73
Oven, A small electric, 535
Pitman water turbine regulator, The, 211
Pole-type condenser, A, 654
Radio valve testing machine, A, 654
Rectifier for ultra-violet apparatus, A, 736
Rope drive, A short, 30
Street-lighting fitting, A new, 427
Suspended globe fitting, A, 654
Switch, An improved, 615
Switchgear, Electrically-operated, 907
Switch-timing attachment, An automatic, 995
Temperature control, Apparatus for automatic, 815
Three-light automobile lamp, A, 210
Treble-scale miniature instrument, A, 736
Tropical-climate fan, A, 907
V-chain drive, A, 1040
Vulcanising bath, An electric, 736
Washer combination, An electric, 211
Wax baths, Electric, 210
Weatherproof bell, A, 775
Welding plant, An electric, 907

New South Wales, German exports to, 213, 596
Newton's bicentenary, 482
New York, Electric vehicles in, 523
New Zealand, American exports to, 680

:w Zealand, British goods in, 94
:w Zealand, Electric vehicles in, 673
:w Zealand, Electrical progress in, 428
:w Zealand's preference for British goods, 386
)n-ferrous metallurgy, Electric furnaces in, by D. F. Campbell, 537
)n-ferrous Metals Research Association, 934
)rthern Europe, Trade marks in, 517
)rth Metropolitan progress, 472
)rway, Radio apparatus trade in, 93
)rwegian cable industry, The, 974
)rwegian electrical market, The, 300
)rwich, Ideal Homes Exhibition at, 173
)ttingham contractors' dinner, 559
)ts and bolt heads, A conference on dimensions of, 481

)BITUARY.

Alderton, G. H., 310
Aspen, S., 567
Auld, W., 310
Banker, S. M., 106
Beer, W. E., 768
Bemrose, W. S., 226
Berkeley, A., 310
Blurton, W. H., 310
Broadbent, T. W., 267
Brooker, C., 226
Burchard, A. W., 146
Burnham, G. F., 807
Burtonshaw, A. V., 768
Calli, M. J. L., 483
Campbell, A., 727
Canham, C., 688
Carson, E. F., 483
Casale, Dr. L., 355
Chadburn, W., 567
Childs, H., 983
Clay, G., 526
Colclough, J. W., 310
Cookson, M., 1026
Copsey, W. J., 483
Cotterell, A. E., 397
Cowdray, Viscount, 727
Crawshaw, J. C., 983
Crush, R., 567
Cushing, J. W., 106
D'Alton, Lt.-Col., P. W., 607, 649
Davies, C. E., 355
Davies, T. F., 267
Davies, W. H., 267
Dickson, A. N., 688
Dobson, Eng.-Com. W., 567
Dudley, A. A., 483
Elder, C. E., 185
Erskine-Murray, Dr. J. R., 267, 309
Fawcus, G. H., 226
Forshaw, A. C., 442
Fowler, H. T., 66
Fox, Sir F., 66
Fay, A., 649
Green, Sir F., 310
Guy, W. H., 185
Hankinson, A., 267
Hardie, A. R., 607
Hardy, W. E., 850
Harlow, J. M., 807
Harmood-Banner, Sir J., 354
Hartnell, H., 768
Heilbron, Dr. E., 106
Henderson, Ald. J. W., 355
Hills, A. F., 397
Hoadley, Mrs., 894
Hogarth, R. W., 355
Kemnal, Sir J., 226, 266
Kilpin, S. L., 66
Koechlin-Hoffmann, Herr R. A., 267
Leaf, W., 397
Lehmann, C., 894
Lilley, L., 894
Lockwood, T. D., 688
Loxley, A. C., 66
MacLaren, J. J. S., 894
MacLeod, M., 649
Malpas, J. B., 850
Micklewright, W. R., 526, 567
Morris-Airey, H., 1025
Newbigin, W. J., 983
Newman, F., 807
Quaney, K., 807
Ramsay, J. T., 185
Rogerson, W. M., 1025
Roothaan, J. C., 66
Rothwell, A., 807
Santano, Senor M. P., 397
Schanschieff, G. A., 567
Sciama, G., 25
Scott, G. L., 146
Smith, Ald. E. B., 442
Smith, J., 310
Stokes, Sir W., 226
Taylor, G. M., 983
Thomson, J., 483
Tripp, G. E., 1025
Turney, Sir John, 483
Vallency, C. G., 185
Varley, G. P., 66
Walker, Ald. W., 688
Wallis-Jones, Capt. R. J., 649, 687
Watts, W., 146
Wellington, H. U., 310
Wenman, H. O. H., 355
Wilkins, A. J., 185
Wimhurst, W. E., 727
Woodward, J. H., 894

fficial Returns—

berayron and District Electricity Supply & Power Co., 850
bies Battery Co., 939
ccumulators (Birmingham), 1027
ccumulators of Woking 356
ckroyd & Best, 67
cme Electric Lamp Co., 1027
cme Production Co., 769
cton Burnell, A. E., 186

Official Returns—*continued.*

Adelaide Electric Supply Co., 939
Airedale Electrical and Manufacturing Co., 939
Ajax Production Engineers, 311
Allen West & Co., 568
Allerton Electrical Supplies, 728
Almondsbury and District Electric Supply Co., 355
Alpha Electric Welding Co., 728
Anderton Brothers, 809
Anglo-Portuguese Telephone Co., 311
Armstrong, John, & Co. (Manchester), 983
Arrigoni, C. & J., & Co., 356
Artic Fuse & Electrical Manufacturing Co., 939
Atkins & Wallis, 268
Atlas Light & Power Co., 186
Atmos Electrical Co., 1027
Attaix, 398, 728, 851
Automatic Coil Winder & Electrical Equipment Co., 895
Auto Mechanical Rectifiers, 355
Automobile Electrical Repairers, 895
Auto Welding & Engineering Co., 728
B.A. Manufacturing Co., 568
Badman, V., 26
Bann Syndicate, 1027
Barbados Electric Supply Corporation, 268
Barnes Brothers (Radiex), 107, 311
Bastian Electric Co., 26
Baynton's Wholesale Wireless, 769
Bedale and District Electric Supply Co., 895
Beko Lamp Co., 443
Belshaw & Co., 689
Bestolamps, 939
Blackwell, Robert W., & Co., 107, 689
B.N.B. Wireless, 728
Bordesley Electrical Accessories Co., 1027
Boulding, Geoffrey, 650
Brecknell, Munro & Rogers, 689
Brent, J., & Co., 939
Brighton Lighting & Electrical Engineering Co., 850
British Brown, Boveri, 484
British Di-Electric Co., 67, 268
British Electric & General Insulators, 186
British Radio Corporation, 650
British Resistor Co., 939
Bromley (Kent) Electric Light and Power Co., 650
Brookhirst Switchgear, 484
Brown, F. C. (Electricity), 895
Brundall and District Service Co., 226
Buenos Aires Town and Docks Tramways, 186
Bullers, 484
Bury Lighting & Heating Co., 527
Bussell, Sydney W., 939
C.A.C. Valve Distributing Co., 768
Callington and District Electric Supply Co., 851
Cann, J. Churley, 728
Cannon, W. G., & Sons, 484
Cark and District Electricity Co., 398
Carlisle and District Transport Co., 895
Carmichael & Partners, 895
Castle Fuse & Engineering Co., 268
Central Electric Development Co., 689
Century Cables, 527, 895
Chislehurst Electric Supply Co., 850, 895
City of Oxford Motor Services (formerly City of Oxford Electric Tramways), 226
Claremont, Johnson & Co., 311, 895
Clear Hooters, 809, 895
Cleartron Radio, 67
Cleveland and Durham Electric Power, 398
Coley & Swinnerton, 728
Correcta Light Co., 689
County of London Electric Supply Co., 809, 938
Craft, Frank (Castleford), 1026
Credenda Conduits Co., 608
Crossley (Liverpool), 809
Curtis, Peter, 809
Cymbal, 1027
Darimont Electric Batteries, 939
Dartmoor Electric Supply Co., 147
Davies, Kent & Stewart, 484
Davis Electrical Co., 484
Davis, H. E., 67
Deane, Edward, & Beal, 483
Deansgate Electro-Radio (Manchester), 186, 355
Delagoa Bay Development Corporation, 484
District Lighting Supply, 1027
Duff Bros., 1027
Dulverton Electric Lighting Co., 983
Dutton, H. W., & Co., 939
East India Tramways Co., 483
East Lancashire Electrical Co. (Accrington), 355
Ebonite Container Co., 26
Eddystone Components, 809
Ejecta Valve Co., 268
Electracts, 527
Electric Advertising Clocks, 568
Electric Cables, 939
Electric Construction Co., 650
Electric Fans, 483
Electric Light Insurance & Maintenance Co., 769
Electric Supply Co. of Victoria, 608
Electrical & Allied Instrument Manufacturing Co., 769
Electrical & Chemical Ebonite Co., 147
Electrical Contracts & Maintenance Co. (1925), 939
Electrical Devices, 107, 895
Electrical Importers (Hull), 728
Electricity Distribution of North Wales and District, 355
Electro-Mechanical Brake Co., 26

Official Returns—*continued.*

Electro-Mechanical Supplies, 1027
Electron Co., 809, 895
Electro-Plant, 1027
Elwell, C. F., 650, 689
Embleton & Barker, 728
English Cable Supplies, 226
English Electric Co., 608
English Freeholds & Industrial Undertakings, 608
Eunice Wireless Cabinet Works, 398
Evalasio Distributing Agency, 311
Evans, Joseph, & Sons (Wolverhampton), 443
Express Cable Engineering Co., 67
Farndons Electric, 483
Finston Manufacturing Co., 26
Fitz-Hugh, Charles, 67
Forest City Electric Co., 939
Frinton-on-Sea and District Electric Lighting Corporation, 26
Galliers (Wholesale), 650
Gas & Electricity Development Co., 939
Gauntletts, 895
General Cable Manufacturing Co., 568
General Radio Co., 26, 1027
Gent & Co., 939
Gilfillan Brothers, 311
Gillespie Valve Manufacturing Co., 728
G.L. Electrical Supply Co., 650
Goswell Engineering Co., 26, 650
Gray, W. L., 443
Grierson, 26
Gwynedd Trust, 851
Hall Telephone Accessories, 186, 483
Hambling, Clapp & Co., 895
Hammersley Bros., 527
Harrison Brothers (Electrical Engineers), 939
Hawker, G. S., 1027
Hazeltine Neutrodyne Radio Sets, 983
H.E.C. Electric Co., 728
Hellyar & Sons, 608, 728
Highfield Electrical Co., 67
High Salvington Electric Supply Co., 850
Hodges, Cecil, & Co. (Overseas), 728
Hodson, A. C., 527
Hook, William J., & Co., 650
Horley and District Electricity Supply Co., 268, 689, 728
Howarth, Green & Co., 650
H.T.C. Electrical Co., 809
Hulett, D., & Co., 483
Ilfracombe Electric Light & Power Co., 147
Illuminated Advertising Co., 1027
Implitico, 484
India Rubber, Gutta Percha & Telegraph Works Co., 769
Interchangeable Electric Signs, 851
International Electrolytic Plant Co., 728, 850
International Hydro-Electric Development Syndicate, 851
Jersey Electric Lighting & Power Co., 939
Johnson, Ross & Co., 939
Jones, Burton & Co., 311
Kalgoorlie Electric Power & Lighting Corporation, 26
Kalisky, S. (Aldgate), 398
Kaplan, H., 527
Keith, James, & Blackman Co., 939
Kent Bros. Electric Wire Co., and E. H. Phillips, 983
K.H.E., Ignition Co., 67
Kinetic Elutriators, 939
Kingsmill Art Metal & Electrical Co., 689
Korting Brothers (1917), 809
Kye, 728
Lacy Induction Coil Co., 983
Lacy Patents Holding Co., 895
Lancashire Telephone Systems, 895
Ledger, Taylor & Co., 728
Leeds Radio Services, 146
Lewis, H., 268
Lewis, John (Wireless), 769
Lewis, Thomas & Sons, 147
Liskeard Gas & Electricity Co., 1027
Lissen, 728
Lithanode Co., 850
Liverpool Electric Cable Co., 356
London Electric Stores, 608
London Power Co., 67
Love, W. P., & Sons, 608
L.P.S. Electrical Co., 809
Luminograph Co., 1027
Macintosh Cable Co., 147
Mackallen Heating Co., 851
Maisner, E. H., & Co., 728
Mann, Egerton & Co., 768
Marse, J., & Co., 650
Martlets, 1027
Mawdesleys, 689
Mexican Hydro-Electric Development Syndicate, 939
Mickleburgh, Charles, 768
Middleton, V. G., & Co., 268
Midget Lamp Co. (1924), 527
Milldale, 939
Morison, I. D., 939
Morris Electrical Co., 650
Morser, Harry, & Co. (Wireless), 484
Moy, Ernest F., 689
M.S.L., 809
Nalder Bros. & Thompson, 608
National Electric Lamp Co., 728
Nefa Co., 850
Neon Lights (1923), 895
Neutron, 186, 356, 398, 983
Newcastle-upon-Tyne Electric Supply Co., 768
New Phonopore Telephone Co., 186
Newton Brothers (Derby), 355, 398
North Metropolitan Power Station Co., 443
North-Western Wireless Company and Wallasey Motor Exchange, 769
Norton Wireless Co., 689, 983
Nott, J. H., & Sons, 26

Official Returns—*continued.*

Nox Electric Lamp Co., 398, 527, 983
Oriental Telephone & Electric Co., 107
Palmer, C. F. (London), 650
Patent Conveyor Co., 107
Peacehaven Electric Light & Power Co., 484
Permac, 689
Philips Lamps, 1027
Pickvance, 186, 268, 484
Pinnacle Switchgear, 443
Plessey Co., 650
Powell, E., 146
Power & Traction Finance Co., 608
Power Securities Corporation, 1027
Poynter, Griffiths & Co., 769
Presteign Electric Co., 147
Prince's Electrical Clocks, 728
Pulford Brothers, 809
Pyramid Products, 268
Quality Radio, 939
Racon Electrical Co., 1026
Radio Accessories, 398
Radio Communication Co., 226, 728
Radio Experts, 527
Radio (Hove), 146
Radio Supply Co., 728
Radiolicity, 809
Radions, 568
Rangoon Electric Tramway & Supply Co., 146, 608
Rapinet, 850
Reed & Morris, 1027
Re-Echo Radio Co., 398
Reed, Evans & Co., 268
Refty Electrical Appliances, 186
Rhayader Electric Light & Power Co., 146, 728, 769
Rhondda Tramways Co., 226
Richards, John, & Co. (Electrical Engineers), 608
Robson, Paling & Co., 728
Roddis Electric, 527
Rose Bros. Electrical Co., 895, 1027
Rubon, 728
Runbaken, J. H., 809
Salmon, Godfrey, 67
Samestophone, 728
Santon, 226
Schall & Sons, 1027
Seear, Scott & Co., 527
Shardlow, C., & Co., 728
Sheffield Wireless Depôt (1926), 809
Shenton & Co., 186
Sherborne Electric Supply Co., 1027
Shipton, E., & Co., 728
Siderman Electrical Supplies, 939
Siemens Bros. & Co., 311
Simmonds & Stokes, 608, 1026
Skegness Electricity Supply Co., 728
Skewes, W., & Co., 939
Small Electric Motors, 608
Smith, J. & W. B., 527
Smithfield Markets Electric Supply Co., 939
South Metropolitan Electric Tramways & Lighting Co., 769
Southern Electric Free Wiring Co., 484
Spa Radio Co., 895
Stella Conduit Co., 850
Stensigns, 186
Stevenage Electric Light & Power Co., 728
Strange & Sons Electrical Engineering Co., 689
Sussex Electricity Supply Co., 608
Tabbush, Joseph, & Co., 311
Teignmouth Electric Lighting Co., 67, 107, 147
Telephone Manufacturing Co., 311
Temple Cox Research Co., 443
Thermionics, 650
Thompson Manufacturing Co., 67
Thursfield, C. J., & Co., 147, 939
Townlea Electrical Co., 608, 983
Townson & Chadwick, 26
Trent Electric Wire Works, 650
Tribe, A. E., & Co., 568
Tungsram Electric Lamp Works (Great Britain), 1027
Tungstalite, 728
Tungstone Accumulator Co., 895
Turner, Atherton & Co., 939
Uneeda Supplies Co., 895
Unity Lamp & Accessories, 650
Vaca Falls Co., 608
Valco, 939
Vee Cee Dry Cell Co., 809, 939
Venezuela Telephone & Electrical Appliance Co., 484
Ventimotors, 895
Wakelins Wireless Co., 1027
Walker, MacEwen & Co., 355, 398
Wallingford and District Electric Supply Co., 809
Waltham Radio, 728
Wardle Engineering Co., 689
Weald Electricity Supply Co., 147, 895
Wellingborough Electric Supply Co. 939
Western Telegraph Co., 484
Western Wireless & Electrical Co (Salisbury), 226
Westminster Engineering Co., 527
West Wilts. Electric Light & Power Co., 689
Wheatley, Smith & Co., 939
White, Charles, Electrical Co., 689
Whitfield Electrical Co., 809
Whittaker Bros., 1027
Wholesale Electric Lamp Co., 769
Wickford and District Electricity Supply Co., 939
Willet & Robinson, 1027
Windsor Electrical Installation Co. 568
Win-Sum Electric Diffusers, 107
Wireless Experts, 186
Wireless Lights Syndicate, 689
Woking Electric Supply Co., 650, 689
Wood, H. L., & Son, 107, 186

Official Returns—*continued.*
Woodstock Power Syndicate, 107
Wye Lighting, Heating & Power Co., 107
Yale Electric Power Co., 527
Yarmouth (I.W.) Electricity Supply Co., 939
Yorkshire Electric Transformer Co., 650

Oil, Chemical & Colour Exhibition, The, 1018
Oil-driven generating stations, 586
Oil-immersed circuit breakers, by E. B. Wedmore, W. B. Whitney, and C. E. R. Bruce, 660
"Old Cromptonians," The, 910
Ontario Hydro-Electric Power Commission, The, 891
Ontario, Rural electrification in, 114
Operating theatre, Electric heating in an, 934
Ore fields, Electrical prospecting in, 246
Organisation, Engineering finance, economics and, 1002
"Otley" rail car, The, 264
Ovens, The truth about electric, 582
Overseas electrical markets, Our, 88, 918
Overseas trade, Fostering, 586
Overseas trade, The Chancellor and, 625
Overspeed test-house, An, 647

PACKAGES, The charges for, by W. E. Jackson, 425
Paint industry amalgamation, 213
Pamphlet, Another polyglot, 343
Paris, Electro-farming discussed in, 766
Paris Fair, The, 757

Parliamentary Notes—
Adjournment, 909
Agriculture and electricity, 295, 578
Beam communication with South Africa, 1041
Beam service to Australia, 661
Beam wireless tests, 295, 541, 909
Bognor Gas and Electricity Bill, 540
Breaking-up of streets, 954
Broadcasting, 295, 340, 429, 497, 578, 715
Broadcasting on trains, 715
Budget, The, 661
Call boxes in post offices, 429
Coal research, 864
Colchester Corporation Bill, 541
Compasses for the fleet, 429
County of London Electric Supply Co. Bill, 819, 863, 1041
Department of Overseas Trade, The, 954, 1041
Duty on bakelised paper, 661
East Anglian Electricity Bill, 820, 864
Easter recess, The, 578
Electric railways, 909
Electrical artificers, 620
Electrical surveys, 295
Electricity Board, The, 340
Electricity charges at Pontefract, 620
Electricity in mines, 715
Electricity loan periods, 821
Electricity schemes, 715, 821, 864
Explosion, A fatal, 429
General interconnection, 909
Hastings Electricity Order, 497
Hastings Tramways Bill, 541
High-power broadcasting, 384
Hydro-electric works at Snowdon, 864
Imperial broadcasting, 909
Interference with broadcasting, 661
Key industry duties, 954
London and Home Counties Bill, 620, 863, 908, 954, 1041
Mexborough case, The, 821
North Metropolitan Electric Supply Bill, 864
Oil from coal, 781
Overhead transmission lines, 541
Pacific Cable Bill, 619
Private Bills, 384, 429, 497, 578, 620, 781
Radio for aircraft, 384
Railway electrification, 541, 780
Rugby wireless station, 497
Rural telephones, 429, 579
Southern Railway contract, The, 780
Special Orders, 579, 909
Trade Disputes Bill, The, 780
Trade Facilities Act guarantees, 864
Trans-Atlantic telephony, 295, 429
Ultra-violet ray treatment, 497
Washington radio conference, 909
Wayleaves, 541
Wessex Electricity Bill, 619
Whitsun recess, The, 956
Winding gear in collieries, 541
Wireless calls to America, 715
Wireless operators, 541
World copper syndicate, 1041
Yorkshire Electric Power Bill, 619, 909, 954

Patent application, 927
Patent Office report, The, 958
Patent restoration, 1015
Patent specifications, Published, 239, 283, 327, 371, 415, 459, 499, 543, 583, 623, 663, 703, 743, 783, 823, 867, 911, 955, 999, 1043
Patents in Australia, Radio, 1014
Patents in Esthonia, 217
Patents in the United States, Electrical, 842
Patterns and electricity, Metal, by J. Edgar, 509
Payments and the law, Easy, by W. E. Jackson, 466
Performances for electrical machinery, Standard, by F. T. Chapman, 250, 292
Peru, The electrical imports of, 271
Peruvian duty increased, 59
Peruvian hydro-electric contract, A, 213
Peruvian market, The, 432
Petters' Indian award, A, 98
Phase displacement, Transformer ratio and, 935
Philips lamps at the "Astoria" kinema, 133
"Phonoscope," The, 183
Photo-electric cells in photometry, The use of, 1023
Photo-electric material, Molybdenite as a, 353
Photometric Department of the N.P.L., The, 806
Photometry, The use of photo-electric cells in, 1023
Photo-telegraphy, 223, 892
Photo-telegraphy, Colour, 702
Physical Society's Exhibition, The, 32, 70, 109, 151, 191
Piezo-electric effect in Rochelle salt crystals, 523
Pipe works, New earthenware, 839
Plant for Mexico, Electrical, 173
Plant, Remotely-controlled and automatic, 1031
Platinum in the Transvaal, 716
Ploughing, Electric, 113
Ploughing in France, Electric, 855
Points from two speeches, 585
Poland, American enterprise in, 94
Poland, Belgian activity in, 257
Poland, Conditions in, 813
Poland, Radio business in, 133
Polish foreign electrical trade, 315
Polish offer, A, 926
Polish tariff reduction, 176
Polyglot wireless pamphlet, A, 177
Poplar electricity undertaking, The, 667, 686
Poplar, Threatened strike averted at, 59
Porcelain, A heat-resisting, 525
Portable domestic appliances, The earthing of, by R. H. Rawll, 206
Portable radio receivers, by P. D. Tyers, 963
Ports and harbours, Electrical power in, 439
Portugal, Lighting business in, 69
Portuguese duty on irons, 885
Poster competition, Radio Exhibition, 597
Poultry farms, Electricity on, 197
Powdered lignite in America, 780
Power company's plant, A receiver and a, 95
Power efficiency exhibition, A Manchester, 134, 430
Power in factories, 471
Power in industry, Electric, 430, 471, 516, 597, 678, 720, 755, 796, 839, 881, 972, 1015
Power, National fuel and, 93
Power plant design, Recent developments in, by T. Roles, 944
Power station contract, The Birmingham, 17, 57
Power stations, The location of, 42
Power supply of wireless sets, The, by "G.F.J.," 921
Power transmission by radio, 934
Preserving the amenities, 1003
"Press" radio receiver, A, 574
Price, Quality *versus*, by R. Marsden, 208
Prince visits Hackney, The, 298
Private arrangements, 18, 97, 136, 214, 388, 431, 558, 599, 640, 719, 799, 841, 929, 973, 1017
Production management, 15
Profit-sharing scheme, A, 882
Propaganda, Results from, 795
Prospecting in ore fields, Electrical, 246, 981
Protons, Spinning electrons and, 306
Psychology, Industrial, 373
Public lighting, by Lt.-Com. H. T. Harrison, 450
Public lighting conference, 565
Public lighting scheme, A remote-control, 816
Public, Local exhibitions and the, 262
Publicity for supply undertakings, by E. E. Hamar, 747
Pulverised-fuel firing, by E. K. Scott, 538
Purse, Frederick Walter, 959
"Putting Price in its Place," 927

QUALITY *versus* price, by R. Marsden, 208
Quarries, The floodlighting of, 298

RADIATION, 766
Radio action, Australian, 432, 680
Radio apparatus for Australia, 15
Radio apparatus licences, American, 559
Radio apparatus, Marconi, 395
Radio apparatus trade in Norway, 93
Radio battery eliminators, by P. R. Coursey and H. Andrews, 1033
Radio business in Poland, 133
Radio coverage of city areas, Broadcast, 935
Radio crystal detector-circuit, A, by T. Carter, 249
Radio exhibition, French, 881
Radio Exhibition poster competition, 597
Radio Exhibition, 1927, The National, 471, 756
Radio exports, Great Britain's, 430, 641, 972
Radio import duty, The Irish, 134, 516, 555, 680, 795
Radio import regulations, Hungarian, 758
Radio industry, Improvements in the, 254
Radio Manufacturers' Association, The, 133, 882
Radio market, The Brazilian, 58, 598
Radio market, The Honduras, 343
Radio market, The Italian, 639

Radio Notes—
Amateur broadcasting 392
Argentina, 21
Atmospherics, 761
Australia, 62, 101, 141, 180, 477, 519, 723, 1021
Austria, 141, 477, 887
B.B.C. Advisory Committee, 101
Belgium, 261, 978
Bulgaria, 219, 644
Canada, 101, 392, 844, 887, 978
China, 219, 392
Colombia, 644, 978
Continental relays, 519
Continental stations, New, 603, 644
Daventry station, New, 180
Denmark, 62, 261, 303, 519
Dominican Republic, 436
Eclipse of the sun, The, 978
Empire broadcasting, 844
Finland, 180
France, 21, 62, 519, 563
Germany, 141, 261, 349
Greece, 519, 1021
Haiti, 180
High-power stations, 21, 219, 563
Holland, 477
Hungary, 62, 180, 803
India, 21, 644, 932
Irish Free State, 519, 683, 723
Italy, 303
Japan, 21, 180, 563
Licences, 21, 141, 261, 436, 563, 723
Lithuania, 603, 761
Long-wave stations, 683
Loud-speakers, 21, 563
Malaya, 303
New Zealand, 219, 644
North Wales, 436
Paraguay, 392
Peru, 349
Philippine Islands, 303
Poland, 141, 261, 644
Reality in reception, 62, 261
Regional broadcasting, 932
Rhodesia, 723
Rumania, 392
Russia, 349
Santo Domingo, 141
Short-wave experiments, 978
South Africa, 141, 180, 261, 349, 436, 519, 563, 1021
Spain, 519
Station, Suggested new, 303
Sweden, 21, 477
Teaching by wireless, 978
Turkey, 436, 978
Union Internationale de Radiophonic, 845
United States, 21, 219, 261, 349, 436, 519, 683, 761, 803, 887, 1021
Wave-lengths, 141, 180, 978
Wave propagation, 519
"Wireless Exchange," Another, 803
Wireless Organisations Committee, 261

Radio patent litigation, United States, 795
Radio patents in Australia, 1014
Radio, Power transmission by, 934
Radio production in 1926, Canadian, 1036
Radio purposes, Dry batteries for, 3
Radio receiver, A "Press," 574
Radio receivers, Portable, by P. D. Tyers, 963
Radio royalties in Australia, 133
Radio station, The Moscow, 647
Radio-telephone loud-speaker, A, by E. W. Braendle, 876
Radio-telephony, Transatlantic, 51
Radio trade, Swedish, 175
Radio-waves, New method of studying, 525
Rail car, The "Otley," 264
Rail cars, Battery electric, 353
Railway concession for exhibitors, 257
Railway electrification, British Insulated Cables, Ltd., secures big contract for Indian, 352
Railway electrification economies, Swiss, 24, 666
Railway electrification, Further Swiss, 224
Railway electrification scheme, A, 7
Railway electrification, South African, 324
Railway electrification, Swiss, by H. W. Schuler, 1007
Railway material in South Africa, Defective, 344

Railway Notes—
Argentina, 682
Australia, 100, 435, 760
Austria, 219, 391, 602, 682, 760
Belgian Congo, 61
Belgium, 391, 844
Brazil, 435, 682
Czecho-Slovakia, 348, 643
Egypt, 602
France, 100, 435, 760
Germany, 100, 302, 348, 391, 476, 844
Holland, 602
Hungary, 348, 602, 722
India, 61, 140, 302, 802, 1020
Irish Free State, 760
Italy, 20, 140, 179, 643, 802
Japan, 20, 179, 260, 391, 476, 518, 602, 760, 802, 844, 977
London, 20, 61, 140, 179, 219, 302, 436, 518, 562
Poland, 844, 1020
South Africa 932

Railway Notes—*continued.*
Southern Railway, 436, 886
Spain, 260, 348
Switzerland, 100, 140, 179, 219, 34
391, 435, 602, 682, 932, 977
Sydney, 100
United States, 61, 100, 140, 643, 76
844
Wharfedale, 20

Railway rates increase, 59, 97
Railway rates, The B.E.A., and, 13
Railway signalling school, A, 614
Railway, The Raxalp cable, 892
Railway track equipment, Electric, b
A. R. Cooper, 74, 111
Railways, The electrification of Frenc
352
Rat, Tale of a, 849
Rating electricity undertakings, 765
"Rawlplug" competition, A, 471
"Rawlplug" handbook, A, 641
Raxalp cable railway, The, 892
Receiver and a power company's plan
A, 95
Receivers appointed, 299, 838
Rectifier order, Large German, 531
Reduction of capital, 256
Refrigeration, Domestic, by N. E
Barber, 195
Refrigeration, Electrical, 523
Refrigerator industry, The American
758
Refrigerator, The "Electrolux," 862
Refrigerator trade activity, America
electric, 296
Register, The National, 473
Registered Electrical Contractors, 9
254, 389, 502, 542, 641, 797, 974
Registration of engineers, 182
Reinforced concrete, 606
Relay, An electrical, 848
Reminiscences, Some, by "Quondan
Apprentice," 551
Remote-control public lighting scheme
A, 816
Remotely-controlled and automati
plant, 1031
Remuneration, The ordinary enginee
and his, by "P.B.E.," 634
Research and the metal industries, 48
Research at Birmingham, 223
Research, British Empire electrical, 243
981
Research in the United States, 264
Research, Scientific and Industrial—Re
port of the Department for the yea
1925-6, 502, 539
Restaurant lighting, Modern, 213
Restaurant, The new Tricity, 55, 83
Retail electrical trade, The, 462
Retailer's enterprise, A Kent electrical
796
Retailers, Our supplement for, 241, 666
826
Retford, Electricity and gas at, 418
Retford electricity supply, 419, 480

Reviews—
Alternating current rectification, by
L. B. W. Jolley, 342
Anglo-American Year Book, The, 47
Atomic theory, The, by Prof. A.
Haas, 1042
Central station voltages and charges
throughout the United Kingdom
842
Colliery Managers' Pocket Book
1927, The, 18
Colliery Year Book and Coal Trades
Directory, 1927, The, 600
Condensing plant, by R. J. Kaula and
I. V. Robinson, 341
Deafness explained, by C. M. R.
Balbi, 600
Department of Scientific Research:
Technical papers on illumination
research, 342
Director system of automatic tele-
phony, The, by W. E. Hudson,
888
Données numériques d'electricité
magnetisme et electrochimie, 888
Electric lighting and power distribu-
tion, by W. P. Maycock, 91
Electric switch and controlling gear,
by C. C. Garrard, 888
Electrical condensers, by P. R.
Coursey, 998
Electrical Engineers' Year Book,
1927, The, 19
Electrical technology, by H. Cotton,
253
Electrical Trades Directory and
Handbook, 1927, The (Blue
Book), 216
Electrician annual tables of electricity
undertakings, 1927, The, 719
Electricity Act, The new, by W. S.
Kennedy, 498
Electricity (Supply) Act, 1926, The, by
E. J. Rimmer, 498
Electricity (Supply) Act, 1926, The, by
J. C. Dalton, 498
Electricity (Supply) Act, 1926, The, by
T. J. Sophian, 498
Electro-organic chemistry, by C. J.
Brockman, 887
Elements of radio communication, by
O. F. Brown, 622
Engineering factory supplies, by
W. J. Hiscox, 341
Four-place mathematical tables with
forced decimals, by F. S. Carey
and S. F. Frace, 1018
Heat-power engineering. Part I,
Thermodynamics and prime
movers, by W. N. Barnard, F. O.
Ellenwood, and C. F. Hirshfeld.
662

:views—*continued.*
High vacua, by G. W. C. Kaye, 622
History of radio-telegraphy and telephony, by G. G. Blake, 949
Kelly's Directory of the Merchants, Manufacturers and Shippers of the World, 884
Makers of science: Electricity and magnetism, by D. M. Turner, 498
Marconi short-wave "Beam" system, The, 884
Marconi's International Register of Telegraphic and Trade Addresses, 1926-27, 18
Mechanical World Electrical Pocket Book, 1927, The, 300
Municipal Year Book, 1927, 516
Notes on electricity as applied to 1926 artillery, 999
Notes on the induction motor, by H. E. Dance, 92
Optical Convention, Proceedings of the, 19
Optical instrument catalogue, 19
Overhead electrical transmission lines: Wade's tables, 198
Polyphase induction motors, by R. D. Archibald, 498
Practical Electrician's Pocket Book, 1927, The, 216
Practical telephone handbook, The, by J. Poole and others, 998
Principles of electric power transmission and distribution, by L. F. Woodruff, 198
Rotary and motor convertors, by E. F. Smith, 498
Rotary convertors: Their principles, construction and operation, by E. P. Hill, 1042
South African Municipal Year Book, 1926-27, Official, 216
Successful crystal and one-valve circuits, by J. H. Watkins, 253
Tait's Electrical Directory of Australia and New Zealand, 975
Television, by A. Dinsdale, 999
Theory of electricity, The, by G. H. Livens, 253
Towards industrial recovery, by H. Quigley, 799
Wireless Trader Year Book and Diary, 1927, The, 19
Year Book and Directory of the *South African Mining and Engineering Journal*, 1927, 600
X-Rays, past and present, by V. E. Pullin and W. J. Wiltshire, 949

...ver water—or cooling towers?, 764
...ver water—or cooling towers?, by J. N. Waite, 46
...ad signs, Illuminated, 522
...ichelle salt crystals, Piezo-electric effect in, 523
...id, Franklin's, 265
...ipe, Magnetic testing of wire, 155
...yal Air Force display, 980
...yal and Whitworth scholarships, 347
...yal Arms, Tradesmen using the, 58
...yal Society's soirée, The, 792, 836
...bber Exhibition, An International, 94
...bber prices, Copper, lead and, 49
...bber-selling combine, German, 58
...bber, The electrodeposition of, 155, 481, 766
...gby and cable tenders, 838
...ral development in Warwickshire, 935
...ral electrification and agriculture, by Major A. McDowall, 209
...ral electrification in Ontario, 114
...ral electrification scheme, A, 891
...ral supply deputation, 647
...ssia and British orders, 973
...ssia, Electrical manufacturing in, 878
...ssia, German holdings in, 298
...ssia, Lamp manufacture in, 471
...ssia, Metropolitan-Vickers in, 471
...ssia pays for machinery, 55
...ssia, Swedish activity in, 716
...ssia, Turbo-generator construction in, 655
...ssian electrical manufacturing concession, A, 924
...ssian electrical notes, 573
...ssian order canard, A, 926
...ssian orders for Germany, 132
...st protection, Electrodeposition for, 892

SAFETY device, A remote, 265
...ety Lamps Order, 718
...ety measures, Proposed compulsory, 799
...s calculations for power transmission lines, by W. T. Taylor, 290, 334, 379
...aries of engineers, The, 746
...es and man power, 296
...esmanship, Public service, 513
...esmanship, Schools of, 720
...ford and a Dutch cable tender, 59, 175, 212
...ymills, Electrification of Aberdeen, 848
...rborough, The Electrical Contractors' Conference at, 134, 176, 516
Scholarships and free studentships, Royal, 23
School, A railway, 614
Schools, Lighting in, 638
Schools of salesmanship, 720
Science meeting, A French, 441
Scientific and Industrial Research—Report of the Department for the year 1925-6, 502, 539
Scientific production, 680
Scotland electricity scheme, 1927, The Central, 746, 754, 786
Scottish electrical contractors, 1025
Scottish electrical traders, 176
Scottish electricians' wages, 842
Scottish Lighting Service Bureau, The, 297
Scottish Power Consumers' Association, A, 725
Scottish textile machinery exhibition, Proposed, 59
Seagrave's record, Major, 558

Selected Radio Telephone Apparatus—
"Amplion" cone speaker, An, 952
Battery charger, A, 279
Battery eliminator, A d.c., 861
Battery eliminator components, 115
Baty condenser, The, 279
B.T.-H. valves, New, 578, 776
Condenser telephone, The, 115
"Cosmos" valves, 278
Crystal set achievement, A, 158
"DE" valves, New 6-V, 115
Filament transformers for "K" valves, 578
"Gecophone" battery eliminator, The, 952
Hospital equipment, 577, 861
"Hunt" specialities, 861
"Individual-Gang" condenser, An, 561
"KL.1" valve, The novel, 158
"Layerbilt" batteries, 578
"Mandem" dial, The, 577
"Marconiphone" products, New, 776
"M.I." wireless generators, 700
Mullard valves, New, 578
"Pin Jack" voltmeter, A, 278
"PM" valve, A new, 115
Portable receiver, A new, 951
"R. C. Twosome" amplifier, The, 578
Resistance amplification, 776
"R.I." battery eliminator, The, 700
Siemens batteries, New, 776
"Steep-Slope" valves, New, 776
Thermo-electric generator, A, 861

Selling appliances at Manchester, 60
Selling costs, Reducing, by A. J. Smith, 674
Sequestration, 884
Service Department, Our, 1003
Service notes, 184, 309, 522, 565, 767
Shannon power scheme, The, 242, 522, 934
Sheath losses in cables, The measurement of, by R. A. Brockbank, 751
Sheffield, Automatic telephony in, 464
Ship, Electricity on board, 453
Shipping Engineering and Machinery Exhibition, The, 216
Ships, Diesel-electric, 438, 605, 764
Shockproof automobile lamps, 514
Shocks, Fires and electric, 224
Shop and store lighting, 16
Shop, Electric kitchen in a, 385
Shop-window lighting, 297, 556
Shops Hours Bill, The, by W. E. Jackson, 922
Short-circuit fuse tests, 1024
Short-wave wireless telegraphy, by T. L. Eckersley, 996
Showroom window, A Christmas, 15
Showroom window, Valve-making in a, 95
Showrooms at Leeds, Proposed electricity, 57
Shropshire Power Co. at the Fair, The, 558
Siam, The import trade of, 223, 315
Siemens Schuckert acquisitions, 19, 757
Sign, A new London, 884
Sign controller, A large electric, 581
Sign floodlighting, 893
Sign paradise, An electric, 438
Signalling school, A railway, 614
Signs, Neon electric, 865
Silk openings, Further artificial, 123
Silk-spinning machines, Electrically-driven artificial, 222
Singapore, Electrical development in, 53
Single-phase induction motor starting devices, by G. Windred, 874
Skysign rhapsody, A, 439
"S.L."-type cables, High-voltage, by P. Dunsheath, 153, 189
Smelting in Sweden, Electric, 892
Smoke abatement, 6, 122
Smokeless fuel, 1024
Societies, Local, 848
South Africa, Defective railway material in, 344
South Africa, G. E. C. lighting in, 677
South African contract regulations, 134
South African electrical trade, 1032
South African market, A French view of the, 556
South African railway electrification, 324
South African tube company, New, 16
South America, British goods in, 678
South America the battleground: A Berlin report, 795
South American scheme, Big, 213
Southend traders and municipal showrooms, 1015
Southern Railway contract, The, 665, 686, 701
Southport development booklet, A, 386
South Wales, Electrical development in, 707, 805
Spain, Electrical development in, 618
Spain, Electrical imports of, 905
Spain, Electrical locomotives for, 98
Spain, Telephone manufacturing in, 55
Spanish tariff decision, 15
Span-wire suspension, 884
Speeches, Points from two, 585
Stability of a.c. systems, The, by F. H. Clough, 322
Stage lighting, Modern, 735, 793
Standard performances for electrical machinery, by F. T. Chapman, 250, 292
Standard works, Colonial Premier's visit to, 15
Standardisation in France, 936
Standardisation in the United States, 418
State electricity in the Irish Free State, 462
State inspection of dams, 451
Static and hurricanes, 423
Statistics, The generation of electricity, 826
Steam generators, H.p. electrode, 764
Steam plant at Bradford, Extra-high-pressure, 43, 104
Steam pressure, The economic value of increased, by H. L. Guy, 697, 738
Steam pressure, Increasing, 705
Steam, The electrical production of, by C. J. Wharton, 452
Steam turbine in operation, A high-pressure, 222
Steam turbines, High-pressure, 523
Steel trades development, Iron and, 263
Steel Trust, British participation in International, 59
Steel works in India, Electric, 936
Storage batteries in Australia, 758
Storage batteries in gassy mines, 223
Stourport electric power station, 915, 960
Street accidents caused by vehicles, 765
Street lighting, Electric, 417
Street lighting, High-power, 222
Street-lighting tower wagon, A, 523
Strike at Bermondsey, 257, 298, 346
Strike averted at Poplar, Threatened, 59
Strike, Battery works, 717
Strike, Threatened A.E.G., 838
Studentships, Royal scholarships and free, 23
Sub-stations, Kiosk-type, 231, 699
Subway, Proposed Buenos Aires, 58
Sulphur mines electrification, 197
Sun, The eclipse of the, 806
Sunlight, Artificial, 726
Supplement for retailers, Our, 241, 666, 826
Supply undertakings, Publicity for, by E. E. Hamar, 747
Survey costs, Electrical, 263
Sussex contractors' dinner, 758
Sweden, Canadian order for, 882
Sweden, Electric smelting in, 892
Swedish activity in Russia, 716
Swedish electrical exports, 513
Swedish electrical industry, The, 93, 176
Swedish Ericsson company, The, 927
Swedish radio trade, 175
Swiss-Bulgarian company, New, 176
Swiss companies, New, 432, 717, 885, 927
Swiss electrical industry, 597
Swiss electricity exporters' union, 184
Swiss foreign electrical trade, 733
Swiss hydro-electric development, 906
Swiss industries, Electricity in, 981
Swiss railway electrification economies, 24, 666
Swiss railway electrification, by H. W. Schuler, 1007
Swiss railway electrification, Further, 224
Switch, An automatic telephone, 637
Switch display, A Tucker, 1014
Switchgear in the United States, 367
Switchgear, Metal-clad draw-out, by J. R. Wilkinson, 970
Switchgear, Metal-clad draw-out, by T. Carter, 857
Switching systems, Ironclad, 1009
Switzerland, Conditions in, 906
Switzerland, Electric locomotives in, 307
Switzerland, Lamp business in, 213
Switzerland, New uses for electricity in, 131
Sydney contract dispute, The, 15, 176
Syrian tariff modification, 597

TANTALUM anodes, The effect of high voltages on, 982
Tariffs and wayleaves, 869
Tariffs, Electricity, by A. Ekström, 859
Tariffs, Electricity supply, 785
Tariffs, Electricity supply, by Prof. W. Cramp, 126, 165
Teachers' conference, E.L.M.A. at, 982
Technical institutions, Teachers in, 523
Technical schools, Courses for teachers in, 480

Telegraph Notes—
Aircraft navigation, 562
Argentina, 1021
Australia, 179, 348, 519
Austria, 62
"Beam" radio-telegraphy, 391, 436, 562
Belgium, 62, 179, 260
Bolivia, 219, 391, 723
Bulgaria, 436, 932
Cable communication between Canada and Australia, 978
Canada, 260
Cape Verde Islands, 436
Central America, 21
Communication with aircraft, 100
France, 602, 723
Germany, 391
Guatemala, 261, 761
India, 100, 643, 887, 932
Irish Free State, 261
Italy, 761
Japan, 477
League of Nations, 391
Long-distance radio communication, 477
Mexico, 62

Telegraph Notes—*continued.*
New Zealand, 436
Pacific cable board, 477
Persia, 179
Poland, 219
Portugal, 101, 303, 723
Radio at sea, 140
Radio-telegraphy, 62, 101, 844
San Marino, 643
Santo Domingo, 643
Siam, 477
South Africa, 887
Spain, 477, 519
Submarine telegraphy, 101, 603
Telegraph service, The, 219
Transatlantic cables, 644, 723
Turkey, 723
United States, 803, 887, 978
Venezuela, 141
West Indian Islands, 477
Wireless at sea, 761

Telegraphy, Voice-frequency, 421
Telephone concessions, Greek, 433
Telephone development, 597, 638
Telephone Development Association, The, 177
Telephone insurance, 522
Telephone manufacturing in Spain, 55

Telephone Notes—
Australia, 978
Austria, 21
Belgium, 179, 802
Borneo, 62
Canada, 476
Continental telephony, 643, 761
Ecuador, 562
France, 302, 348, 391
Germany, 260, 723, 761
Gibraltar, 261, 602
Glasgow, 978
Greece, 349
Guatemala, 261
Guernsey, 603
Hull, 62, 723
Hungary, 476
Iceland, 101
India, 100, 219, 683, 887
Irish Free State, 219, 302
Italy, 140
Japan, 477
Jersey, 219
New Zealand, 436, 683, 802
Portugal, 101, 303
Radio-telephony, 62
Russia, 391, 803
South America, 391
Spain, 21, 349
Sweden, 21, 1021
Switzerland, 844
Telephone service, The, 21, 62, 101, 179, 261, 349, 391, 436, 477, 562, 761, 803, 1021
Transatlantic radio-telephony, 101, 261, 303, 349, 392, 436, 562, 603, 803, 844
Turkey, 141, 519
United States, 519, 644, 1021

Telephone reorganisation, The Belgian, 175
Telephone service, The, 196, 533
Telephone switch, An automatic, 637
Telephone system, The Belgian, 17,
Telephony in Sheffield, Automatic, 464
Telephony, Transatlantic, 2
Television, 307, 594
Telpherage, Electric, 24
Temperature, Electrical measurement of, by J. Hall, 1036
Tenant Bill, The Landlord and, by W. E. Jackson, 672
Tennis-court lighting, 440
Test-house, An overspeed, 647
Testing laboratory, High-pressure, 183
Tests for resultant economy, by "Essaye," 167
Textile Machinery Exhibition, Proposed Scottish, 58
Theatre lighting, Alhambra, 375
Theatre lighting, Astoria, 298
Thefts of electricity, Alleged, 501
Thermit welding, Electric heating with, 353
Threshing demonstrations, Electric, 764, 848
Thury d.c. system in France, The, 766
Timber trade reports, 59, 385, 639, 797, 1015
Time switches still work, Frozen, 558
Toaster banned, A cheap American, 848
Torquay, Electrical treatment at, 717
Tower wagon, A street-lighting, 523
Track equipment, Electric railway, by A. R. Cooper, 74, 111
Trade discount abuse, 926
Trade expansion, The importance of, 121
Trade Facilities guarantees, 343
Trade marks in Northern Europe, 517
Trade names supplement, Our, 429, 1014
Trade revival, The signs of, 50, 98
Trade Unions Bill, The, 555, 779
Trade Unions Bill, The, by W. E. Jackson, 633
Tradesmen using the Royal Arms, 58
Trading clause, The, 913
Traffic control for Hudson Tunnel, Supervisory, 338
Trafford Park, Electrical activity at, 171
Train accident reports, 65, 223, 306, 909
Tramcar, An illuminated, 134
Tramcars, Improved electric, 381
Tramway controller, A new type of, 534

Tramway Notes—
Aberdare, 260
Adelaide, 20
Argentina, 218, 682
Auckland, 844

Tramway Notes—*continued.*
Australia, 20, 219, 722
Belgium, 519, 562
Blackburn, 602, 643, 886, 932
Bournemouth, 802
Bradford, 61, 100, 140, 179, 219, 260, 302, 476, 562, 602, 1020
Brighouse, 722
Brighton, 844
Burnley, 61, 260, 476, 682, 722
Canary Islands, 643
Cardiff, 886
Colne, 1020
Cork, 844
Croydon, 140, 435, 562
Darlington, 302
Dearne Valley, 476, 562
Dublin, 476, 643
East Ham, 802
Edinburgh, 179
France, 302, 348, 435
Germany, 476
Glasgow, 20, 435, 562, 682, 722, 932, 977
Gravesend, 476, 643, 932
Halifax, 219, 348, 391
Heywood and Middleton, 562, 722
Holland, 682
Huddersfield, 1020
Hull, 602, 844
Increase of charges, 140, 179, 722
Ipswich, 260
Irish Free State, 476, 844
Japan, 476, 519, 602, 886
Jugo-Slavia, 100
Launceston (Tasmania), 219
Leeds, 61, 932
Lincoln, 977
Liverpool, 391, 802, 1020
London, 219, 435, 562, 602, 760, 886, 1020
Manchester, 20, 760, 886, 932
Middlesbrough, 61, 722
Middlesex, 61
Newcastle-on-Tyne, 391
New Zealand, 844
Nottingham, 643, 760
Oldham, 219
Perth, 562
Poland, 562
Pontypridd, 682
Preston, 682
Salford, 932
Sheffield, 643, 683
Southend-on-Sea, 844
Spain, 391
Stretford, 761
Sunderland, 260
Swansea, 140, 302
Walsall, 219, 977
West Hartlepool, 562
Wolverhampton, 802
Worcester, 179, 476

Tramway supply account, Glasgow Corporation, 157, 306
Tramways and Light Railways Association, 848, 1013
Tramways, London's, 847
Transatlantic radio-telephony, 51
Transatlantic telephony, 2
Transformer operation, Power, by D. W. McJannet, 589
Transformer ratio and phase displacement, 935
Transmission, Extra-high-pressure, by A. T. Scott, 128
Transmission, E.h.p., by G. W. Preston, 919
Transmission, H.p., by H. R. White, 778
Transmission line regulations, 438
Transmission line, The first European, 380-kV, 765, 805
Transmission lines, Sag calculations for power, by W. T. Taylor, 290, 334, 379
Transport cost sheet, Standard, 441
Transport, London, 383
Transport, The co-ordination of urban, by Lord Ashfield, 35
Transvaal, Platinum in the, 716
Travellers, A notice to, 925
Travelling exhibition, A, 1014
Trials and humours of an estimating department, The, by "One of Them," 207
Tricity Restaurant, New, 55, 83
Trolley 'bus operation, 818
Trolley 'buses, Holland adopts, 981
Tube production, Improved, 560
Tucker switch display, A, 1014
Tungsten in the United States, Ductile, 286
Tungsten patent held invalid, American drawn, 306
Turbine in operation, A high-pressure steam, 222
Turbine syndicate, German, 559
Turbines, High-pressure steam, 523
Turbines, Mixed-pressure colliery, by C. H. Naylor, 1035
Turbo-generator construction in Russia, 655
Two-fluid boiler systems, 222

ULTRA-violet rays, 330, 981
Unemployment during 1926, 168
Unemployment in France, 19
Unemployment in Germany, 59, 93, 176, 716, 1018
Unemployment insurance, by J. J. H. Stansfield, 294
Union cable works, The, 716, 755
United States, Ductile tungsten in the, 286
United States, Electric vehicles in the, 439
United States electrical exports, 59, 257, 447, 693, 839
United States, Electrical patents in the, 842
United States electrical production, 814
United States, Electrical progress in the, 162
United States electrical trade, Canadian and, 507
United States exhibitions, 299
United States radio patent litigation, 795
United States, Research in the, 264
United States, Standardisation in the, 418
United States, Switchgear in the, 367
University of London, 24, 727
Urban transport, The co-ordination of, by Lord Ashfield, 35
Uruguayan electrical import duties, 799

VACUUM cleaners for Denmark, Marking, 1037
Vacuum cleaners, Free gifts with, 57
Valve display, A "Cosmos," 756
Valve-making at Whiteley's, 881
Valve-making in a showroom window, 95
Valves, Electric lamps and, by C. C. Paterson, 494
Van, An effective advertising, 173
Vehicle exports, American electrical, 176
Vehicle parade, Electric, 481
Vehicle records, Electric, 103
Vehicle, The electric, 243
Vehicles in Italy, Electric, 764
Vehicles in New York, Electric, 523
Vehicles in New Zealand, Electric, 673
Vehicles in the United States, Electric, 439
Vehicles, Industrial electric, 847
Vehicles, Low-loading electric, 659
Vehicles, Novel electric, 891
Vehicles, Street accidents caused by, 765
Victoria, German materials for, 842
Voice-frequency telegraphy, 421
Volta Centenary Exhibition, 892
Volta, The centenary of, by T. B. Fowler, 336
Voltage standardisation in the Dutch East Indies, 935
Voltages, Australian standard, 647
Volume, Our hundredth, 1001

WAGE agreements, The enforcement of, 841, 926
Wages demand, German engineering workers, 138
Wages in Australia, Engineering, 972
Wages in the contracting industry, 176, 925
Wages in the engineering industry, 258, 385, 514, 639, 755, 795, 840, 925, 972, 1015
Wages, Scottish electricians', 842
Warships, Electricity in, by W. McLelland, 575, 616
Warwickshire, Rural development in, 935
Waste-heat recovery, 646
Waste, The elimination of, 655
Water heating, Electric, by J. W. Meares, 635
Water-power site, A redeveloped, 830
Water power *versus* Diesel engines in Bulgaria, 223
Wattmeter calculations, 23
Wayleaves, Tariffs and, 869
Welding aided by hydrogen, Arc, P. L. Roberts, 10
Welding job, An electric, by C. H. Tupholme, 510
West Midlands, Electricity supply the, by S. T. Allen, 1038
West Midlands Industrial Council, 1
What is electricity?, by Prof. W. Thornton, 493
What is it to drive?, by R. Marsden 333
Whiteley's, Valve-making at, 881
Whitley Councils Bill, Proposed, 717
Whitworth Scholarships, Royal an 307
Wills, 106, 267, 310, 355, 483, 526, 64 768, 807, 850, 938, 983, 1026
Wimbledon's electricity service, 757
Window, A new idea for the, 881
Window displays, Mullard, 134
Window-dressing competition, A, 908
Wire manufacture in Chile, 884
Wire rope, Magnetic testing of, 155
Wire trust, Continental, 300
Wireless batteries, by P. D. Tyers, 10
Wireless "beam" communicatio 627
Wireless export trade, 246
"Wireless" moving pictures, 103
Wireless pamphlet, A polyglot, 177
Wireless Retailers' Association—Annu meeting, 715
Wireless sets, The power supply of, b "G. F. J.," 921
Wireless telegraph communication, b Lt.-Col. C. Crawley, 592, 675, 74
Wireless telegraphy, Anglo-Australia 546
Wireless Telegraphy Commission, 24
Wireless telegraphy, Short-wave, b T. L. Eckersley, 996
Wiring, Cheaper, by H. W. C., 923
Wiring regulations, The I.E.E., 60 1002, 1023
Wiring schemes, Assisted, by W. F. T Pinkney, 365
Wiring system, The ideal, by H. R Taunton, 670, 709
Wiring system, The "J. & P.," 344
Wiring, The necessity for adequat 958
Witnesses, Expert, 162
"W.O.B." ballot, Results of the, 87 879
Woodworkers' shops, The electric driv in, 123
Working costs, Heavy-oil-engine, 34
Works visits, 95, 726, 884, 972
World Economic Conference, The, 972

X-RAY martyr, Carnegie grant for 766
X-ray martyrs, 295, 438
X-ray warning notice, An, 597

YORKSHIRE lead mines re-opened 257

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Notes and Comments.

trical Retail Trade.

hile it is true that a very large proportion of the ical material used by the domestic consumer es him through the medium of the electrical con- or, it is equally certain that some millions of ds' worth of such products are passed to the public the counter of the ical retailer who lays laim to being a "con- or."

at do we mean by an ical Retailer? The word iler" has essentially a keeping meaning in the f every-day commodities, n the electrical trade it eceived official recogni- In case the shopkeeper is selling electric lamps ittings and shades, fires acuum cleaners, wireless atus and valves, as well trical toys of manifold asks how it has hap- that this official recog- has been given, we may for his information the in which the organised tion of electrical contractors recently described

* * *

Electrical Retailer" Defined.

activities of the association referred to (The cal Contractors' Association, Incorporated) are own as well as they might be among the smaller al contractors and dealers, so we may pardonably state that when that body drew up a trading policy a few years ago it started a new section to provide for Electrical Retailers, who, through their membership of the section, should participate in such retailers' trading advantages as were already secured by the Electrical Contractors' Association for their full Contractor members. More may be said respecting those advantages at a later date. An "Electrical Retailer" was defined in the following terms:—

"A person, firm or company with shop or showroom premises and equivalent, suitable for a Retail Trade, or equivalent facilities for resale, who carries a substantial and varied stock of electrical goods and sells the same to the user."

It was added:—

"Although the two businesses are very commonly combined they are not really identical; and while it is generally desirable that an electrical contractor should also be an Electrical Retailer, there are, and always will be, a large number of Electrical Retailers who are not Electrical Contractors and would gain no advantage by combining that business with their own."

* * *

Ourselves and the Retailer.

In addition to this, usage in the electrical trade has caused the term "Electrical Retailer" to be thoroughly established amongst us, and it is because we recognise the great value of this class of electrical trader as a

CONTENTS.

Notes and Comments ... ...
Electrical Retail Trade; An Electrical Retailer Defined; Ourselves and the Retailer; The Great Electrical Campaign; Two Important Events; What do you want to know? Something for Nothing! Trade Literature; Books for the Electrical Contractor; Electro-medical Apparatus.

A Campaign Message to the Retailer, by J. W. Beauchamp ... ...

Market Development, by W. E. Bush ...

Electro-medical Appliances for the Home (illustrated) ... ...

Selling Lines for Retailers (illustrated) ...

medium through whom vast supplies of electrical goods must be passed on during the coming years, that we have decided to devote this Supplement to the matters with which he is particularly concerned. The widest possible meaning will be given to the word retailer in preparing the matter that is to appear in these pages, for electrical, including wireless, goods to-day form a considerable line of trade for ironmongers, hardwaremen, stores, and various shopkeepers who do not lay claim to be primarily either electrical retailers or contractors. To such we hope to be able to give up-to-date information regarding articles in which a market can be made among the general public by anybody prepared to sell them. The public interest in electricity and all that can be done with it in the home has led to the electrical shop-keeper being bombarded with all sorts of inquiries. If he is alive and alert he has already recognised that he must gather together from some direction or other not already accessible to him, information which will qualify him for turning *all* inquiries to good account. It is our intention to render him assistance of this character periodically by means of this Special Supplement, and we invite suggestions regarding ways in which we can do so.

We cannot be sure that a horse taken to the water will drink, but we intend to fill the trough by bringing together notes and pictures describing electrical articles suitable for over-the-counter trade, and discussing some of the problems which are bound to arise in connection with a retail business. In our opinion it must be of untold value to the electrical dealer or trader to be brought into closer touch with others in the electrical industry and to be regularly informed of what they are doing. He will thus get to know what to buy, when to buy, how to buy, how to avail himself of facilities for securing the best terms and conditions from manufacturers and from the wholesalers in the trade, and many other things.

* * *

The Great Electrical Campaign.

One of the curious facts in the present situation is the remarkable lack of knowledge amongst electrical retailers of the great Electrical Campaign that has been in progress in most parts of the United Kingdom since last September. The electrical shopkeeper or the small contractor who has not joined in this effort does not know what he is losing. Some contractors and traders have reaped substantial orders because the public interest has brought new customers into their shops. During the next few months every retailer should try his best to further stimulate the public interest in the scheme not merely because he will thus be assisting the general electrical movement, but because he can add immediately and definitely to his own trade turnover. We print on a later page a message from Mr. J. W. Beauchamp inviting the full co-operation of retailers in the remaining stages of the campaign.

* * *

Two Important Events.

All who are interested in the sale of electrical goods of the smaller kinds, including domestic appliances, wireless devices, and so forth, must keep in mind two events which will afford them excellent opportunities for inspecting many examples of such products and at the same time enable them to discuss prices and business points regarding them with representatives of the manufacturers who desire to explain to buyers their features of interest. At Birmingham, from Monday, February 21st, until March 4th, a large number of such exhibits will be on view on the of some seventy or eighty makers, at the British tries Fair. This Electrical Section will be a market where live men will be found for the twelve days ready to receive electrical traders h small or large their requirements may be. The trical part of the Fair has grown in size and i in recent years, and this time it will contain a co power plant provided by 30 different manufac acting in co-operation. Electrical shopkeepers have not already received the Invitation Vouche was circulated with the Electrical Review on I ber 31st should apply to the Editor of the Elec Retailer and Dealer, 4, Ludgate Hill, London, at once, as it carries with it the right to r travelling rates, which we feel must be an inducement to electrical buyers to undertake the j to Birmingham. Then in London, there is brought together a large collection of wireless app and material, electric pocket lamps of all kinds trical glassware, instruments, and other things t not come within the Birmingham category. The event to which we wish to direct attenti the Ideal Home Exhibition, which takes pl Olympia, London, from March 1st to 28th. He usual, it will be possible to see many interestin trical articles employed in the illuminatio domestic equipment of the modern home. These bitions are annual fixtures, and there will be n else like them until 1928.

* * *

What Do You Want to Know?

For the convenience of anybody and eve in the electrical trade who wants to know thing about anything electrical, we have a S Department which is prepared to go to endless trouble—in reason, of course—to hel out of your difficulties. We think that if a can answer your questions we can do so. Your mers want a special brand or design of switch, fitting, oven, or some other member of the ele family, and you do not know off-hand that y obtain it for him. You don't know either the or the trade factor. Don't tell him that yo supply it, or try to put him off with something doesn't want—ask him to call again, and interim approach us. If we know it, we will gi a reply at once in your own stamped envelope. we can at least promise to find out, and w promise such a thing—well, in 90 per cent. of th we fulfil our promise. That the electrical tra cannot possibly keep in his mind, if it ever fo way there, the special name of every electrical accessory or other article introduced, is the most thing in the world. It has long been recognis there must be some central authoritative bureau all such information would be kept on file ready t out to the inquirer. Years ago we published section of a Directory, the discontinuance of wh came necessary under the stress of war condition day we publish the special Trade Names of number of electrical articles, by arrangement wit manufacturers or factors, as a Quarterly Supple the Electrical Review.

* * *

Something for Nothing!

It is not supposed that every busy retailer wi the time, even if he possess the ingenuity and to design a striking leaflet or advertisement. F

...e it to the printer who *may* know more about it ... produce something better than the majority of ...ers would do for themselves. But there are ...r courses open to the average man. The manu...rers who prepare lists by the half million or ...ion at a time, for circulation by the trader, can ...d to have a good man producing a good design ...n gets home straightaway and effectively. Let the ...ler write for a batch of these and he will receive ... with space for inserting his own name and address; ...bly even these will be printed in for him free of ...nse. Another practice which we strongly recommend ... study of the excellent and very varied publicity ...ts and advertisement designs prepared by the ...sh Electrical Development Association, of 15, Savoy ...t, Strand, London, W.C.2. This Association's ex... have prepared electrical publicity literature deal... with almost every conceivable domestic and other ...f electricity, and a close study of their work can ...y fail to stimulate the minds of retailers who are ...arch of ideas for making their own local efforts ...essive.

* * *

...le Literature.

...nufacturers and wholesalers of electrical products, ... as lamps and lighting fittings and accessories, ...ic fires, cooking apparatus, vacuum cleaners, ...ng machines, electric refrigerators, and a great ...ty of wireless apparatus and parts, have issued a ...of excellent catalogues and price lists which should ...ured by readers of these pages who are anxious to ... themselves abreast of the times. We suggest that ...ers write for copies at once after they have seen ... referred to here, as such literature is very helpful ...eal trade purposes. Among catalogues recently ...ed we may mention a comprehensive one from the ...sh Thomson-Houston Co., Ltd., covering a very ...range of its wiring supplies and domestic appli...; the company has since published a miniature ...n of this 150-page catalogue—it is for pocket ... measuring $6\frac{1}{4}$ in. × $4\frac{3}{4}$ in., and is an exact ...a. The General Electric Co., Ltd., which is ...ntly issuing trade catalogues and lists for the ...uctor relating to its varied electrical products, ...laced before us a pamphlet on electric appliances, ...r running costs thereof, and a catalogue of ...ophone" wireless receiving sets, components, and ...ories. A three-colour window poster of "Cosmos" ... has been prepared by Metro-Vick Supplies, Ltd., ... a booklet particularises and prices ten types of ... valves. The Sun Electrical Co., Ltd., has ... folders dealing with a number of domestic elec... appliances and electro-medical apparatus and a ... blue catalogue (472 pages) of "Everything ...ical." A full catalogue by Messrs. A. P. Lund... & Son regarding the "Lektrik" plug connectors, ...ors, and other accessories such as they have been ...ing to the trade for so many years, is also among ... productions.

* * *

...s for the Electrical Contractor.

... best recently published book for study by elec... tradesmen who contemplate branching out into ...al installation work is that written by Mr. ...res Purdie. Those already engaged in the ...ting business in a small way would also find it ... if they are making preparations for launching ... a larger scale. There is plenty of work avail... able and far more in prospect now that the electrical movement is spreading so rapidly. Mr. Purdie's book is described as "a guide and handbook specially designed to meet the needs of all those engaged in business as electrical contractors." It can be obtained from our "Book Department," 10s. 6d. net (plus 6d. postage). Another book which is being widely used and is constantly in demand is Mr. Donald S. Munro's well-known handbook on "The Practice of Electrical Wiring." This is a standard work by an expert, containing a great deal of information which is invaluable to contractors, wiremen, and all using installation material. In its enlarged edition form its price is 5s. 4d. post free. This can also be obtained from our "Book Department," which will likewise be pleased to forward any other electrical books on receipt of orders and remittances. The works mentioned we commend to the electrical retailer and contractor for his personal use, but there is a large variety of small popular booklets that he can stock for sale to his amateur wireless workers and electrical experimenters.

* * *

Electromedical Apparatus.

One of the most profitable lines to which retailers should devote attention is that of electromedical apparatus for home treatment; nevertheless, it appears that little has been done to develop this fertile field—whether because the retailer is unaware of its possibilities, or because he hesitates to plunge into the mysteries of therapeutics. That it *is* a fertile field we have demonstrated to our own satisfaction; there is a lively public demand for apparatus of this description, which is rapidly growing, and is being stimulated by the frequent references of writers on medical subjects to the virtues of ultra-violet rays and high-frequency currents. Moreover, the manufacturers of such apparatus have not been slow to meet the demand—a remarkable variety of appliances has been placed on the market. It only remains for the retailer to complete the chain between the manufacturer and the purchaser by stocking the apparatus and promoting sales.

Such an opportunity has rarely come his way: we strongly recommend him to seize it. For that purpose we have devoted much space in this issue to an account of the nature of ultra-violet rays and high-frequency currents, and a series of illustrations of the appliances that have been evolved, with a view to assisting the retailer to take advantage of this opening. In later issues we propose to deal on similar lines with radiant heat treatment, electrical vibrators, ozonisers, &c.

Those who are interested in this subject and wish to follow it up will be pleased to learn that a course of lectures will be commenced in March for the instruction of any members of the electrical trades who intend to handle "artificial sunlight" lamps commercially. These lectures will be delivered by Mr. J. W. Mason, F.B.O.A., F.I.O., the manager of the electrical department of one of our largest manufacturers of chemical and surgical apparatus and supplies, who conducts regular courses of lectures to members of the medical profession, masseurs, and nurses; they will relate especially to the nature, production, and effects of ultra-violet rays, and will include the demonstration in operation of all kinds of apparatus used in this connection. Thus the retailer will be afforded a unique opportunity of gaining that practical working knowledge of the subject which is essential if he is to make the best use of this new opening for trade.

A Campaign Message to the Retailer.

By J. W. BEAUCHAMP.

Director and Secretary of the British Electrical Development Association, Inc.

THE retailer of electrical service, whether his particular commodity is units or appliances, has no lack of reasons for approaching the householder to-day.

Sometimes, however, one wants something more than a reason, an excuse at least in making the first contact with strangers.

Using the term Retailer in its widest sense to cover those who sell power, wiring or appliances, the E.D.A. has, since October, offered the best excuse the retailer has ever had for approaching this particular field of business. No fewer than 2,500 have taken advantage of the E.D.A.-E.L.M.A. national scheme for the better lighting of the homes of Britain and already, through the activity of these retailers and in their shops and showrooms, half a million of the public have fallen for this advertising campaign, and learned from it a good deal they did not know before about the use of electric light in their homes, and the possibilities which electricity offers to them in every district for some greater or less convenience and comfort in household working.

The numerous reports sent in to E.D.A. offices, and raised at meetings up and down the country, reveal that the campaign is achieving its object, increasing sales, multiplying the rate of new connections, and offering the great advantage of bringing together people in all sections of the Industry in a way which will be more useful as the years go by, and for future campaigns of electrical work which may be decided upon.

If there is to-day any contractor, retailer or electricity supplier who does not know all about the present E.D.A. campaign, a postcard to the head office w bring him that information within a few hours, a in such form that he will find himself up to da four months late it is true, but yet with two mont in which to do something in connection with the ca paign, to the benefit of his own business and the gene betterment of the whole industry.

The writer would particularly ask all readers this paper, in the months of February and Marc to do their individual and collective best to use th campaign, known in the trade as W.O.B., a vigorc tree of national development from some bran of which everyone in this business can gather a harv of present work and future prospect.

A contractor, who had derived benefit from this wo remarked a few days ago at a local meeting "*t business impetus produced by this campaign is lik to continue for at least a couple of years ahead.*" the other hand, there can be no certainty that as t years go by, those who provide the national fun that are being spent by the Association will rema content to put forward campaigns which, by the nature, permit everybody in the industry to secu benefit at little trouble and irrespectively of wheth they are bearing their share in the cost of the prop ganda and industry protection work that is bei carried out by the Association.

Half-a-million people have already called at ret shops and showrooms, to secure their copies " Electric Lighting in the Home "—please assist E.D. and yourself, by a liberal distribution of this publi tion before the campaign ends on March 31st.

* * *

Market Development.

A "Four-Star" Plan for Retailers.

By W. E. BUSH.

IN the many articles which have appeared in the electrical Press, the subject of electrical retailing has been exhaustively dealt with from specific and specialised aspects such as shop window dressing, interior display, advertising and publicity methods of all kinds; in fact, every kind of advice that might be employed to assist a retailer in obtaining a larger share of the available electrical business has been freely given.

I propose therefore in this article to approach the subject from a somewhat wider angle than the consideration of the several factors that go to the making of a successful individual business, and to suggest a plan for stimulating development on a co-operative basis. The essentials for development in the domestic field can be divided under four main headings:—

1. Education of public.
2. Reasonable energy rates and simple tariffs.
3. Adequacy of wiring installations.
4. Moderate prices for electrical equipment.

Of these four headings the third is probably the m in need of immediate attention. The price-cutting w that has been in operation amongst the smaller co tractors in recent years has resulted in a very po standard of wiring, both in regard to quality a adequacy. The majority of houses are wired wi the fewest outlets possible. This automatically lim the market for the future retailing of electric appliances. To correct this handicap, and to stimula progress in the other avenues of development stat above, I suggest the following activity to be know as the "Four Star" Plan.

(*a*) In every district a committee representing t electrical contractors and the central stati authority, should be set up. (Such committe already exist in the many districts where W.O. circles have been formed.)

The committee shall decide the Star category in which the district shall be grouped, based on the economic advantages of using electricity for domestic purposes in that district.

"One Star" denotes Lighting only.

"Two Star" denotes Lighting and Appliances.

"Three Star" denotes Lighting, Appliances and Heating.

"Four Star" denotes Lighting, Appliances, Heating and Cooking.

The factor which will chiefly govern the grade of a district is the charging rate for electricity and the form of tariff, although special circumstances, such as over-loaded mains, should also be taken into consideration. A district in which the rate is say 10d. for lighting, and 4d. for power, could not be economically rated at higher than "Two Star," whereas 6d. and 2d. respectively would probably just come within the "Three Star" category. All two-part tariffs, with a reasonable fixed charge and unit rate of one penny downward, could well be classified as "Four Star" districts.

Having fixed the "bogey" for the district, the committee will proceed to draw up a specification of wiring outlets for various sizes of houses, according to Star classification, ensuring that a liberal number of wall plugs are provided and that the wires are of ample size for future development.

(*d*) The next step should be an endeavour to persuade all contractors to quote on the "STAR" specification when submitting estimates. This may at first be difficult but should become easier as the effect of paragraph (*e*) increases.

(*e*) The many advantages of living in a Two, Three or Four Star house, as the case may be, should be constantly brought to the public attention by advertising, exhibitions, demonstration houses, &c. Builders developing new estates should be made to see the advantages of featuring the electric Star programme, as a selling point. The competitive or envious spirit should be encouraged amongst the public so that Mrs. A would not be content with her "Two Star" installation, if Mrs. B's house was "One Star" higher.

It would probably be desirable that a standard poster of registered design should be available for advertising the scheme, and some control from a central headquarters would be advantageous. Such a plan, if put into operation, should serve as a stabilising force for quality and price of work which would tend to stimulate progress in the more backward districts, and would fix in the mind of the public a "hall mark" of household electrification.

* * *

Electromedical Appliances for Home Treatment.

HE curative properties of electricity have been known for many years—as long ago as 1755 they were lauded in a London magazine in con-on with "disorders of the rheumatic and paralytic "—and during the past quarter of a century very t progress has been made by way of experimental rch in the study of the most effective methods of sing them and of the results obtained. No hospital days can be regarded as fully equipped unless it ovided with an elaborate and costly installation of ical apparatus for the treatment of disease, for graphy, for special methods of illumination, and numerous minor purposes in which electricity is r an indispensable accessory than a principal . Many consultants also have provided themselves similar equipment for use in their private prac- with excellent results; but it is only within quite t times that electrical treatment in the ordinary hold has become comparatively common-place, and eased to bear the stigma that is attached to quack ines. Over 30 years ago a great deal of mischief done to medical electricity by the operations of n persons who foisted on the public "electric " which, in point of fact, produced no electricity , but which were extensively advertised as effect- xtraordinary cures, and were certainly sold at an rdinary profit; the Electrical Review, at the f several actions for libel (all of which it won), ainly instrumental in putting an end to this ture, but could not so readily remove the stains the fair fame of the science of electrotherapeutics, was then in its infancy.

However, by the efforts of the enthusiastic investigators who, undaunted, persevered in their endeavours to develop the use of electricity in the cure of disease and to establish this mode of treatment on a sound basis of ascertained fact, and by the convincing evidence of successful results, the lost ground has been far more than regained: as we have said, the merits of electrical treatment are now universally recognised in professional circles, and the general public is beginning to demand a share in its benefits, without the necessity of attending hospital or surgery.

1.—Ultra-Violet Radiation.

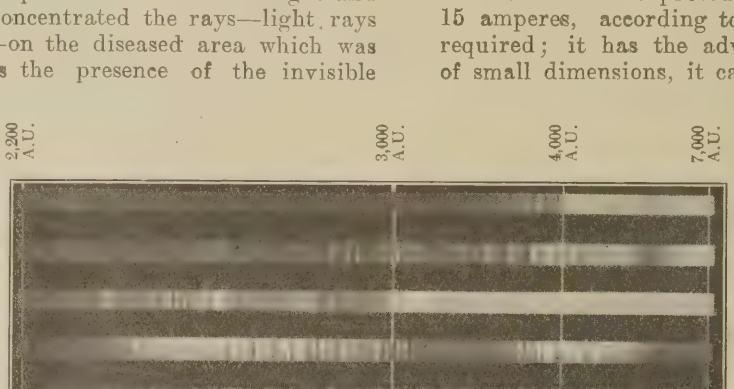
One of the most powerful factors in restoring the prestige of electrotherapeutics was the invention of the "Finsen light" treatment for lupus and similar skin diseases, and its adoption at the London Hospital in 1900, thanks to the interest of Queen Alexandra; another was the discovery of the X-rays by Röntgen in 1895. The circumstance that both of these factors depend entirely upon the use of ether waves or vibrations identical with light rays in all respects save that of wave-length is significant in more ways than one, as we shall show.

In the first place, all ethereal vibrations, which are electromagnetic waves, are identical in form and differ only in frequency, and therefore in wave-length. The vibrations which give rise to the sensations of light and colour occupy only a trifling proportion of the great scale which extends from the longest waves used in long-distance wireless-telegraphy—some 30,000 metres (about 19 miles) in length from crest to crest—to the infinit-

esimal waves which are known as the "gamma rays" of radium. Next to the latter come the X-rays, and between these and the shortest visible (violet) light rays come the "ultra-violet rays." Passing through the green, yellow, and red light rays we come to the "infra-red" or pure heat rays, which are followed by the Hertzian and wireless waves. Wave-lengths, shorter than those last named, are usually measured in terms of the "Angström unit" (A.U.), one ten-thousand-millionth of a metre in length; the softest (*i.e.*, longest) X-rays are one A.U. in wave-length, and the shortest visible violet-rays have a wave-length of 3,900 A.U. From 3,900 A.U. down to about 2,000 A.U. comprises the region of "ultra-violet" rays with which we are here especially concerned; shorter waves than these are so quickly absorbed by the atmosphere that they cannot be used in electrotherapeutics.

Ultra-violet rays are almost completely absorbed by glass of ordinary composition (recently a new glass known as "Vitaglass" has been invented, as the result of research, which permits a large proportion to pass through), but pass freely through transparent quartz. The essential features of the Finsen light apparatus were the use of a very powerful electric arc light and a quartz lens, which concentrated the rays—light rays and ultra-violet rays—on the diseased area which was to be treated. It was the presence of the invisible ultra-violet rays that brought about the cures of lupus for which the Finsen light became famous.

Natural sunlight contains ultra-violet radiations, but in the smoky atmosphere of towns little of this reaches the level of the streets. On high mountains, on the other hand, where the air is pure, dry, and free from dust, the U.V. rays are present in quantity, and long ago the curative properties of sunlight under such conditions were recognised. Finsen's great invention consisted in finding an artificial substitute for the natural ultra-violet radiation of the sun. But whereas sunlight was applied by exposing practically the whole body to the healing rays, the Finsen lamp concentrated the radiation upon a small area. It is now known that the curative action of ultra-violet rays is not confined to the area irradiated—in some way they act upon the blood itself, so that if part of the body is exposed to the rays, the whole organism derives benefit therefrom. This discovery has profoundly modified the methods of treatment. Whilst local application is highly efficient in skilled hands, employing powerful apparatus, it is not suitable for use except under expert supervision. General irradiation, however, can be practised with safety by anyone, provided that the ultra-violet rays employed are not too intense, that the subject is not too near the source of the rays and that the exposure is not unduly prolonged; and such treatment is capable of producing remarkable results, as will be seen. But first it is desirable to describe the apparatus by which the rays are produced.



Spectra by Dr. Judd Lewis; reproduced from "Ultra-Violet Therapy," by W. E. Schall, B.Sc.

One of the most fertile sources of ultra-violet r the mercury vapour arc, which has long been use lighting purposes—usually in glass tubes, which pr the emission of the U.V. rays; when the arc i closed in a quartz container, these rays are pro in abundance, over a wide range of wave-length. a device must be classed as somewhat dangero unskilled hands, though it is very efficient when ap by trained operators under professional supervi the mercury arc, therefore, is not likely to be w used in domestic circles.

Next in order is the tungsten arc—an arc s between tungsten electrodes, as in an ordinary arc l Whilst perhaps less powerful than the mercury the tungsten arc is an excellent source of U.V. ray spectrum containing wave-lengths down to 2,130 A.U. Both from practical considerations regard to construction and operation, and from point of view of therapeutic effectiveness, the tungsten lamp is probably the best and most conve appliance; but it has one important limitation—i burn only with direct current, and if the local tricity supply is alternating, rectifying apparat some sort must be provided. The arc takes from 15 amperes, according to the intensity of radi required; it has the advantage that, being a s of small dimensions, it can be accurately focused reflector, w if coated silicon, re 75 per cen the U.V. that fall up

A third s of ultra-v rays is an tric arc be carbon trodes. If bon only is the U.V. r tion is weak, but providing carbons special cores, containing salts of tungsten, ni or iron, it can be greatly intensified. This for arc lamp, which burns on either a.c. or d.c., ap to be by far the most suitable for the purpose of treatment; it is simple in construction and opera and moderate in price, and whilst it produces a amount of ultra-violet rays, it is not nearly so pow as the mercury and tungsten lamps—consequent may be regarded as free from danger to the pat Many patterns of U.V. lamp can be used alternat with either cored carbons or solid tungsten electro provided, of course, that direct current is availabl the latter—and they are accompanied by resist which enable them to be fed from public supply m at any voltage that is used for domestic purp Some of them are described and illustrated below.

It remains now to deal with the uses and effec ultra-violet rays—but briefly, for this raises phys gical questions which can only be fully treate medical experts. The first effect observed as the r of U.V. radiation of sufficient duration and inte is a reddening of the skin, styled "erythema": is the indicator by which the effect of the treatment be (roughly) measured. It shows that the capi

(*Continued on* p. vi.)

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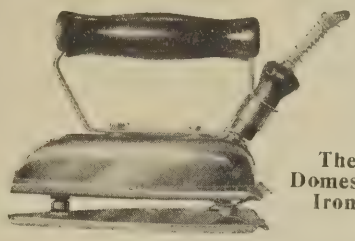
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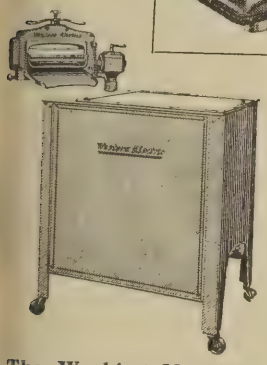
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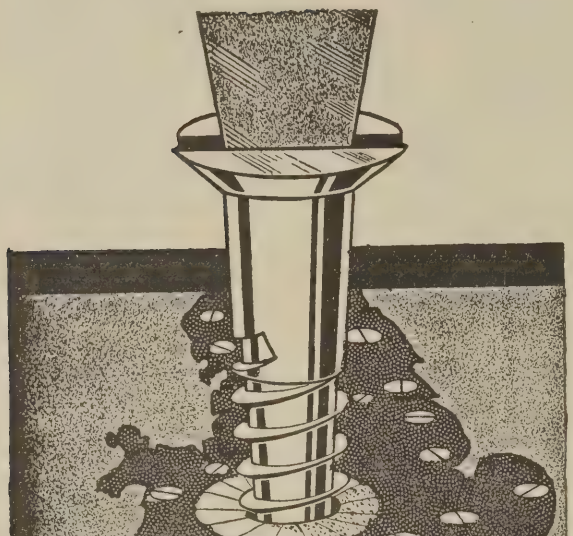
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(*Continued from p.* 6.)

circulation has been stimulated and that the rays taking effect. Too strong or too long a dose lead excessive erythema, which may be accompanied irritation of the skin, but is not necessarily harm As the erythema does not appear until some hours a the irradiation, it is wise to begin with small d and gradually increase them.

The next effect that is visible, after regularly repe doses in moderation—it may be daily, or two or t times a week—is "pigmentation," which is practic identical with sunburn; both pigmentation and str erythema are liable to be followed by peeling of skin (desquamation), but this is not a serious matt though it suggests a warning to diminish the dose future applications.

These are the external appearances, and are superficial; the real beneficial effects of ultra-v radiation are constitutional, and may not be sen until the treatment has continued for days or we As we have said above, we do not propose to enl upon a medical discussion which we are not compe to handle, but on the highest professional authority can confidently assert that the radiation has g curative power in connection with certain disease the skin, the healing of wounds, the loss of hair, it is of great value in the treatment of the var disorders commonly classed together as "rheumatis *e.g.*, lumbago, neuritis, and arthritis; it reli nervous depression and neurasthenia; and it is effe in pulmonary tuberculosis and catarrhal condition the respiratory organs, including bronchitis asthma. The cure of rickets is one of its most not claims; numerous clinics have been set up for the t ment of rickety children, with a large measure of cess. Even where no active disease is present, g benefit has been derived from the use of U.V. radia which appears to stimulate and refresh the w organism, both physically and mentally. Hence have no hesitation in urging the claims of apparatus to an honoured place in every electrical s the more so since we know that the public is eag possess it.

For the help of those who wish to pursue the s of the subject further than is possible in this sketch, we append a short bibliography of reliable up-to-date works. We also strongly commend to reader's attention the excellent bulletins which issued by some of the makers of electromedical app tus, particularly the following:—

"Ultra-Violet Therapy," by W. E. Schall, B F.Inst.P. (Schall & Son, Ltd., 75, New Caven Street, London, W.1.)

"Sunlight in the Home," by J. W. Mason, F.B.(F.I.O. (Arnold & Sons, 50-52, Wigmore Street, W

"Artificial Sunlight." (Watson & Sons (Ele Medical), Ltd., Sunic House, Parker Street, W.

We are much indebted to the firms above name well as to The Cox-Cavendish Electrical Co. (1 Ltd., 105, Great Portland Street, W.1; Messrs. I. vete, Ltd., 11, Little St. Andrew Street, W.C.2; Sterling Corporation (Great Britain), Ltd., 17, timer Street, W.1; Messrs. Bower Electric (1926), 27, Ridinghouse Street, W.1; The Medical Su Association, Ltd., of 167-185, Gray's Inn Road, W and many other firms, for the willing assistance they have given us in the preparation of these not

BIBLIOGRAPHY.

"Ultra-Violet Rays in the Treatment and Cu Disease," by Percy Hall, M.R.C.S. (Eng.), L.R

ond.). London: William Heinemann (Medical ooks), Ltd. Price 7s. 6d. net.

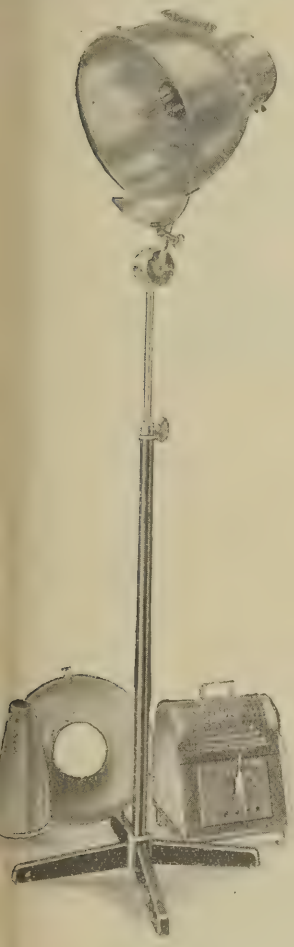
"Ultra-Violet Radiation and Actino-Therapy," by rs. W. K. & E. H. Russell. London: Stanley Phillips. evised edition in the press.

"Artificial Sunlight and its Therapeutic Uses," by r. F. H. Humphris, M.D., F.R.C.P. Price 8s. 6d. net.

* * *

he "Solart" U.V. Lamp.

The "Solart" lamp for ultra-violet radiation is of e automatic type, mounted with a parabolic hood flector on a floor stand; the automatic burner is adily removable from the hood, and the carbons, ich are of a special metallic-cored type, are easily ewed. An electromagnetic blow-out is provided



"Solart."



"Alpine Sun."

h ensures the extinction of the arc when the car- are too short. The hood is fitted with hooks, at it can, if desired, be suspended from a bracket rom the ceiling; and a front plate is provided h limits the area irradiated, and to which a ising tube can be attached. These features, with resistance and control board, are shown in the npanying illustration. (*I. Calvete, Ltd.*, 11, e St. Andrew Street, W.C.2.)

* * *

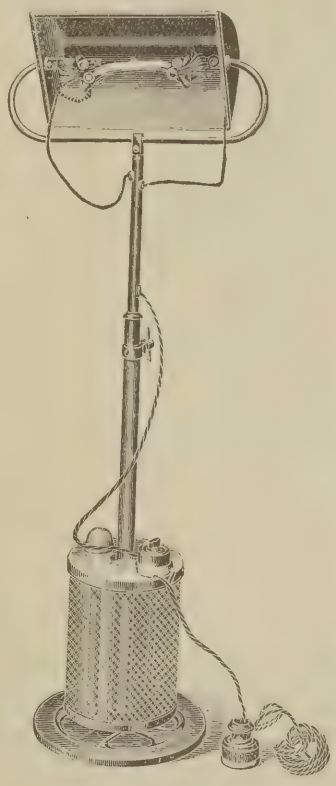
"Alpine Sun" Lamp.

e Arnold U.V. lamp for home use consists of a twin lamp, burning carbons cored with a special com- pound of rare earths and metals, which give a spectrum closely resembling that of the sun and rich in ultra-violet rays. The lamp is mounted on a white enamelled stand, with all bright parts nickel-plated; it takes 5 or 10 amperes, and is provided with a resistance and all necessary attachments. The use of two arcs diminishes the waste of energy in resistance and shortens the time of exposure. A simple trip control is fitted. (*Messrs. John Bell & Croyden, Ltd., incorporating Arnold and Sons*, 50-52, Wigmore Street, London, W.1.)

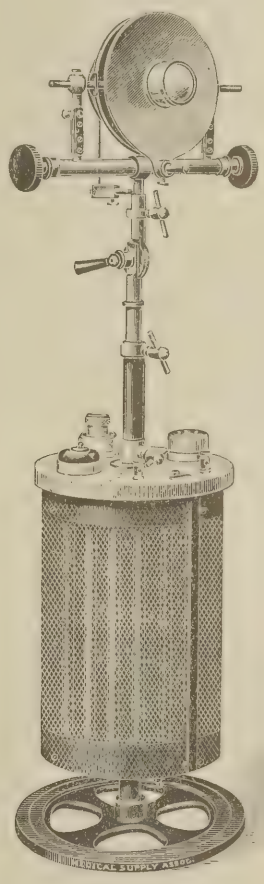
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The "Alps" Mercury Vapour Lamp.

The "Alps" quartz mercury-vapour lamp is a simple model, fitted with an adjustable reflector, and tilting gear for striking the arc in the quartz tube. The floor standard type is self-contained, the resistance being mounted on the base, with a control switch and safety fuse. With suitable modifications, this lamp can be used on a.c. as well as on d.c., at any usual voltage. A table model is also made. (*Medical Supply Association, Ltd.*, 167-185, Gray's Inn Road, W.C.1.)



"Alps."



"Grevillite."

* * *

The "Grevillite" Tungsten Lamp.

The "Grevillite" tungsten arc lamp burns either tungsten or cored carbons, on direct current only; the arc is controlled by hand, and adjustment in all directions is provided. The rheostat is mounted on the stand, with switch and fuse. As here illustrated, the apparatus is fitted with a quartz lens for local irradiation. (*Medical Supply Association, Ltd.*)

The "Schall" U.V. Lamp.

Messrs. Schall & Son, Ltd., make the ultra-violet ray lamp shown in the adjoining figure; the arc lamp is of the hand-feed type, mounted in a bowl reflector on a tripod stand, which is provided with universal adjustments. This lamp is especially suitable for use with tungsten electrodes, taking five amperes, a

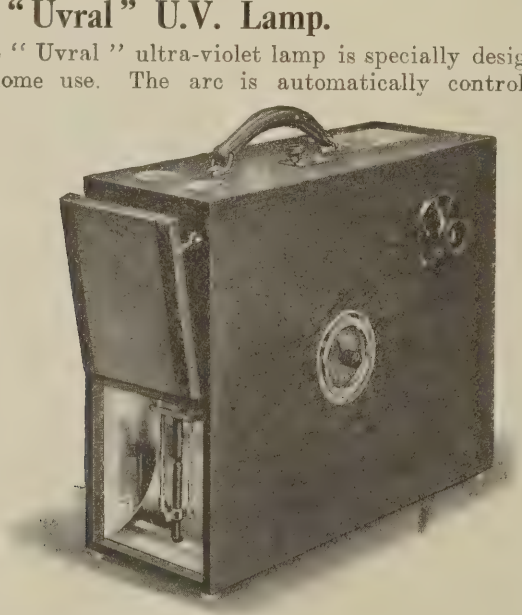


separate resistance and switchboard being provided. Automatic-feed lamps are also made. Where the supply current is a.c., special cored carbons are substituted for the tungsten electrodes. (*Schall & Son, Ltd.*, 75, New Cavendish Street, W.1.)

* * *

The "Uvral" U.V. Lamp.

The "Uvral" ultra-violet lamp is specially designed for home use. The arc is automatically controlled,



and burns tungsten electrodes or special cored carbons, consuming from 3.5 to 4.5 amperes; it operates on a.c. or d.c., at any usual voltage. A unique feature is incorporation of a patent time-switch control, "Expometer," which makes it impossible to use apparatus until it has been set for a predetermi dose of from one to fifteen minutes' exposure; at end of the specified time the apparatus is automatic switched off. The whole is contained in a neat t cabinet, and weighs 22 lb. (*Bower Electric* (19 *Ltd.*, 27, Ridinghouse Street, W.1.)

* * *

The "Sunbeam" U.V. Lamp.

An exceptionally attractive pattern of porta carbon or tungsten arc lamp is the "Sunbeam"; shown, it consists of a light metal case, containing resistance to enable the lamp to be operated on 100 200 volts, and surmounted by a focal reflector wh

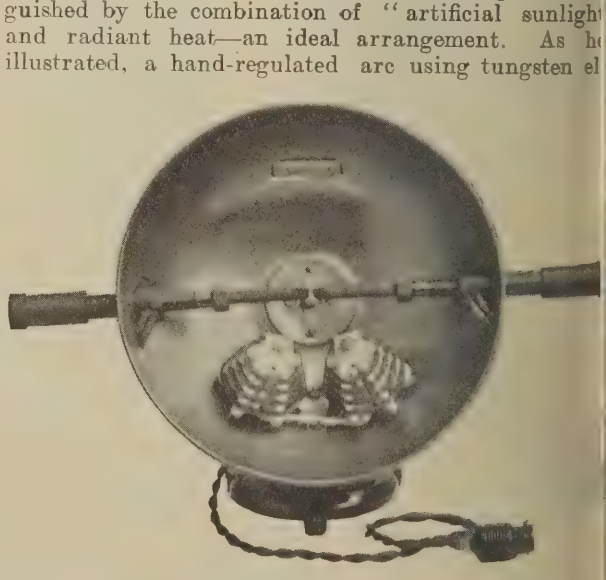


can be locked in any position. The arc needs adjustment during an exposure of ordinary duratic special cored and impregnated carbons are used d.c. and a.c., but tungsten electrodes can be used w d.c. (*The Cox-Cavendish Electrical Co.* (1924), *Lt* 105, Great Portland Street, W.1.)

* * *

The "Arc-Radiant" Lamp.

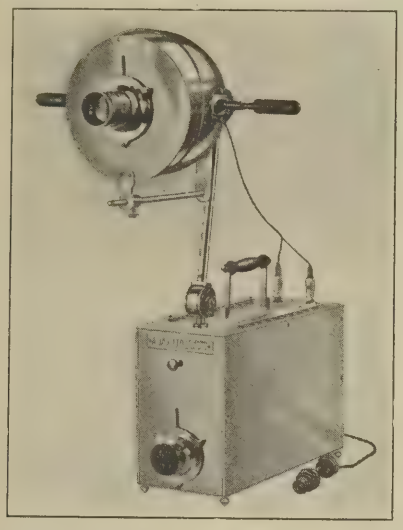
The Quain-Munro "Arc-Radiant" lamp is dist guished by the combination of "artificial sunligh and radiant heat—an ideal arrangement. As h illustrated, a hand-regulated arc using tungsten el



trodes or cored carbons is mounted in a portable bo radiator; the latter can be used for heating alon without the arc if desired. (*Quain Sunlight Lamp Ltd.*, 26, Victoria Street, S.W.1.)

e "Ajax" Tungsten and Carbon Lamp.

The accompanying illustration shows a hand-fed gsten arc lamp (above), and an automatic lamp ning "polymetallic" carbons (below); in the latter carbons are set at right angles, an exceptional angement which, we understand, is highly efficient.



diaphragms and quartz concentrators for local treatt are provided for both lamps, which can also be plied separately. The apparatus is portable (weigh- 14 lb.), and can be used on any lighting circuit. *x, Ltd.*, 117, Central Street, London, E.C.1.)

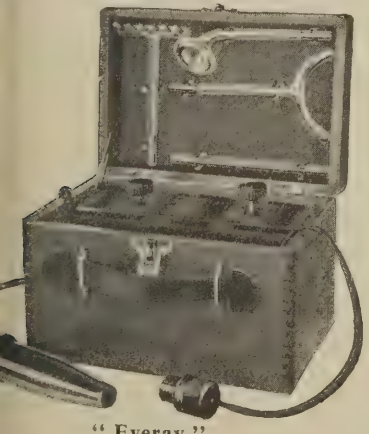
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2.—High-frequency Treatment.

ck of space compels us to hold over our article upon -frequency apparatus for electromedical treatment. are able, however, to illustrate four examples which ypical of this class of equipment.

"Everay" H.F. Apparatus, Type B.

e "Everay" set which is here illustrated is handly housed in a polished mahogany case, and is ided with a switch covering the usual ly voltages, a.c. or d.c. No metal parts exposed. Three glass electrodes and one llic electrode are clipped into the velvet-



"Everay."

lid, and a carrying handle is provided; the ted handle, adaptor, and flex are packed into a ate compartment. The set weighs 5¾lb. Several patterns are made. (*Messrs. I. Calvete, Ltd.*, 11, St. Andrew Street, W.C.2.)

The "Schall" H.F. Apparatus.

A small portable apparatus for d'Arsonval high-frequency currents is here illustrated, weighing 7 lb.; it is suitable for 100 or 200 volts, a.c. or d.c., and includes two electrodes, insulated handle, and flexible connections, the latter being heavily insulated. (*Messrs. Schall & Son, Ltd.*, 75, New Cavendish Street, W.1)

* * *

The Hotpoint "Shelton" H.F. Apparatus

We illustrate herewith a very compact set of high-frequency apparatus, packed in a flat silk-lined case; the whole of the generating equipment is contained in

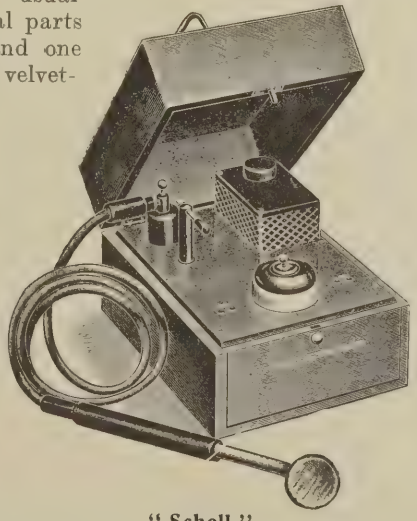


the cylinder which acts also as the handle into which the applicators are inserted. A set of six applicators is provided, and others can be supplied. (*Hotpoint Electric Appliance Co., Ltd.*, 24, Newman Street, London, W.1.)

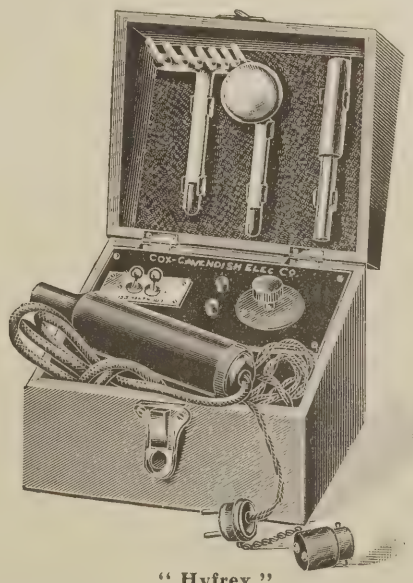
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The "Hyfrex" H.F. Apparatus.

The "Hyfrex" instrument for the production of high-frequency currents consists of a polished wood case containing the generator, regulator, and throw-over switches for different voltages, with a compart-



"Schall."



"Hyfrex."

ment to receive the insulated electrode handle, flexible cords, and a combined plug and adaptor fitting. Three electrodes are provided, and are held in clips in the hinged cover. (*The Cox-Cavendish Electrical Co.* (1924), *Ltd.*, 105, Great Portland Street, W.1.)

Selling Lines for Retailers.

Probably one of the advantages of electrical domestic apparatus which has a big appeal to the housewife is its portability. Of particular interest in this connection is an electric iron and travelling outfit which has recently been put on the market. This consists of an electric iron, which is suitable for use on any voltage, complete with a suitable nickel-plated stand, a special water boiler, and a curling-tong heater, the whole being contained in a neat plush-lined wooden box. This is one item of a range of domestic equipment made by the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, which is described and illustrated in an interesting and useful pamphlet, "Magnet Household Electrical Appliances." A feature of this publication is that while the necessary technical information required by the retailer is brought out, such as the loading of the apparatus and the pressure for which it is designed, an effort is made to get on the understanding level of the prospective purchaser or user regarding the cost of running the equipment. An approximate cost for a definite performance is given; for instance, an electric toaster which is suitable for operation on the breakfast or tea table is described as being capable of toasting between 60 and 70 slices of bread for one penny. Two items of perhaps unusual interest are an electric egg whisk and a drink mixer. Fig. 1 shows the former. In each case a small electric motor is mounted vertically on the top of the mixing apparatus. Various cooking apparatus is listed, from the small hot plate for table use to the complete cooking stove for a family of eight persons. One of the difficult problems nowadays for the occupier of the small flat or house, is to find a suitable appliance for the very limited space available. The electric griller shown in fig. 2 is the result of an attempt to meet the demand for such an apparatus. It will provide for frying, grilling, boiling, and toasting operations, and also serve as a hotplate. A meal for one or two people can be cooked rapidly and efficiently; a steak can be grilled for about one penny where the rate is 1d. per kWh.

Increased attention is being given to-day to the question of installing refrigerators in the home, and here, again, electricity is proving itself to be the most suitable medium for the operation of such apparatus. A refrigerator offered by this company provides 18.5 cu. ft. of storing space, although the overall dimensions are only 6 ft. 6 in. by 3 ft. by 2 ft. 9 in. The apparatus is safe, simple, and reliable, and its upkeep costs are very small.

* * *

The use of the domestic electric vacuum or suction cleaner has of recent years increased enormously, and manufacturers are giving the subject very close attention. The company dealing with this appliance is Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2, which treats of the value of the electric cleaner in the home in a well-produced and illustrated booklet, "The Home of Leisure." Fig. 4 shows the vacuum sweeper produced by the company, which, as will be seen, is of the bag-container type. Attention is drawn to the ease with which dirt and grit may be removed from almost inaccessible places, such as between the cushions and the padded sides of an arm-chair. Included in the accessories provided with this apparatus is what is per novel in this country, the "Vac Mop." means of this crumbs and dust can be removed the kitchen linoleum without the slightest risk of dar to polished surrounding walls and furniture. L of beautiful table furniture and decorations wil very interested in a dozen or so of electric table a ances which are illustrated in a small folder, "T Appliances of Distinctive Quality." The range cludes coffee percolator sets, coffee urns, a tea-pot, k and toasters, all electric, of course, of ornamental signs and finished in silver, aluminium, or nic plating.

The electric washing machine has been a much lected apparatus in this country, although its ad tages to all concerned are obvious. Fig. 7 shows a machine, which is obtainable from the above compa and by means of which, it is claimed, the average fa wash can be done at a cost of only 1½d. for electric a negligible amount when the great saving in time energy is considered. The apparatus is in the form a cabinet and includes a wringer which is driven by same motor as the washer. The motor and mechan are constructed so as to require very little atten and are very easily controlled.

As a companion to the above machine, the comp produces an ironer which, while useful in the ho should find an easier market in hotels, institutions, The effective parts of this are a roller and an e trically-heated shoe. The roller is 30 in. long and 6 in diameter; it is well padded and runs on ball be ings. The shoe has an area of contact of 147 sq. and the energy consumption of this and the driv motor is in the neighbourhood of 1,200 W.

* * *

Among the new lines which are available to the c tractor and retailer is the "Volta" vacuum clean which has only been on the British market for a v few weeks. There is a growing preference for the t of cleaner in which the dust bag or box is separate fr the nozzle portion, that is, connected only by a flexi hose. Such is the "Volta," as will be seen from our ill tration (fig. 5). The suction of the machine, which is p vided by a small motor in the rear compartment of body of the machine, is excellent. We recently w nessed a demonstration in which a ⅞-in. diameter st ball was picked up and hurried away to the dust b The latter occupies about half of the body, and is tained in position by the front cap, which is held tigh by two spring catches. A feature of the machine is absolutely flat end enabling it to be stood vertically the removal and replacement of the bag. A compl set of useful accessories is provided, including a sh nozzle, a nozzle mounted on about four feet of rigid tu a large wide brush and a small round one. Thus, ap from use upon the floor, the machine can be employ for cleaning all parts of a room—even the picture rail and the long-arm nozzle can be pushed under very l furniture. The cleaner is being handled by Vol Ltd., Kern House, Kingsway, W.C.2; Mr. J. Scriven who has had many years' experience of the vacu cleaner business, is managing director of the compar Volta, Ltd., deals exclusively with the trade; no sa are made direct to the public.



1.—A "Magnet" Egg Whisk.

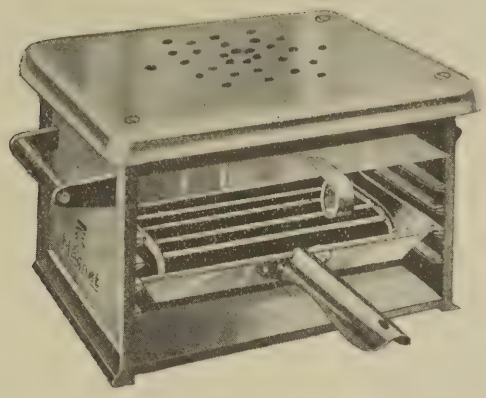


Fig. 2.—A "Magnet" Grill.



Fig. 3.—An Immersion Heater.



4.—The "Standard" Vacuum Cleaner.



Fig. 5.—The "Volta" Vacuum Cleaner.

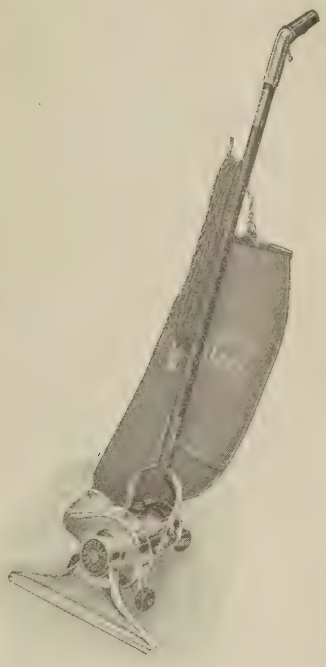
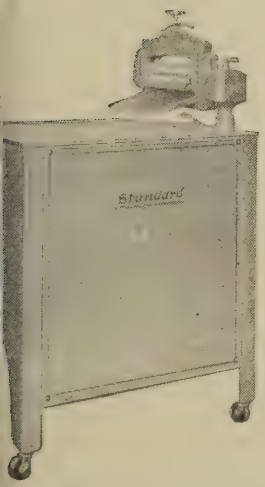


Fig. 6.—The "Cadillac" Vacuum Cleaner.



7.—The "Standard" Washing Machine.

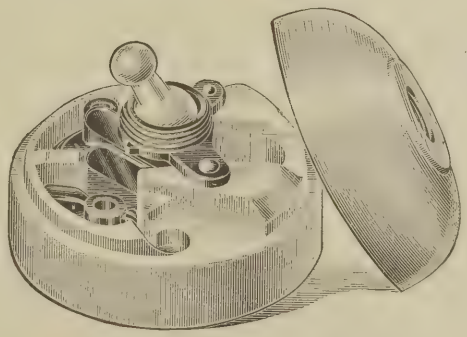


Fig. 8.—An "Efesca" Switch.



Fig. 9.—The "Turnover" Toaster.



Fig. 10.—The "Sunray" Torch.

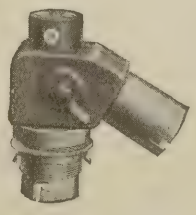


Fig. 11.—A Two-way Adaptor.

In addition to wiring supplies and domestic apparatus, Messrs. Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester, make many small novelties which are likely to attract customers to the retailer's shop and perhaps lead up to more important business. There is always a demand for pocket lamps from people who are not at the moment interested in larger electrical applications, and it is well for the retailer to attract these if he can. Messrs. Ward and Goldstone supply a wide range of such lamps; one of them, the "Sunray," a "fountain pen" torch, is illustrated in fig. 10. To deal next with the man who at present uses electricity for lighting only: it is a very difficult matter to sell him a cooker right away (quite apart from the necessity for extra wiring), and it is not always simple to induce him to buy a toaster or kettle. It should be far easier to introduce him to an immersion heater, which is inexpensive, a lampholder device, and very adaptable for a number of uses. The "Goltone" immersion heater depicted in fig. 3 is a typical example of this kind of appliance. It is provided with 5 ft. of flex and a lampholder adaptor, or, at a slightly higher cost, with a two-pin plug.

Messrs. Ward & Goldstone's Booklet N.50 contains illustrated details of these and numerous other small devices which should interest the retailer.

Messrs. Falk, Stadelmann & Co., Ltd., ringdon Road, E.C.1, are well known as viders of wiring materials of all kinds, as as a variety of lighting, domestic and radio ap ances. Among their recent productions is a tum switch designed to conform to Home Office requirem in the matter of insulation. For this purpose the c pany has commenced the manufacture of "Duroid," unbreakable, insulating and non-inflammable comp tion for tumbler-switch covers. The threaded m centre is retained in the design of the switch, but i effectively shut in by a flange in the cover. The c position is applied to both the "Efesca Snap" qui make-and-break switch and the ordinary "Efesc slow-make type. One point in both these patterns i special leaved contact. One of these switches is ill trated in fig. 8.

The latest publications of Messrs. Falk, Stadelma include a little booklet (Catalogue No. 546), contain illustrations and prices of "Ideal" domestic ap ances, including irons, water heaters, grills, toaste kettles, and percolators. The main value of the book lies in the very explicit instructions which are giv for the use of each appliance.

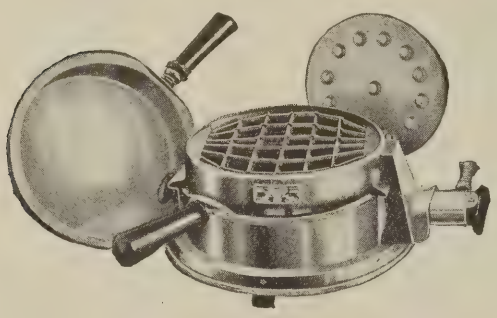


Fig. 12.—The "Utility" Table Cooker.



Fig. 13.—A "Fulray" Bowl Fire.

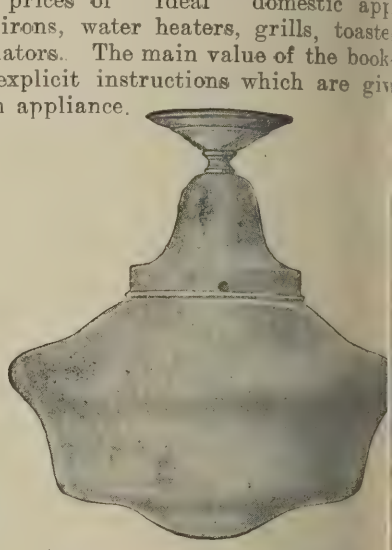


Fig. 14.—A "Silvaray" Fitting.

"Cosmos" appliances (Metro-Vick Supplies, Ltd., Trafford Park, Manchester) have benefited from the publicity accorded to "Cosmos" lamps and valves, and their name should have a familiar ring to the public. From such a large selection it is difficult to choose examples which will typify the whole. The "Turnover" toaster is a neat appliance which should commend itself to the electrical buyer. It is safe and convenient; the bread is turned over by simply twisting an insulated knob which is seen in the accompanying illustration, fig. 9. It has the ample loading of 550 watts. The "Cadillac" electric suction cleaner is a machine of handsome appearance and reasonable price, and in view of the approach of spring and its orgies of cleaning, is a seasonable article for display. The "Cadillac" weighs 12 lb., and is provided with 20 ft. of flexible cable. It is shown in fig. 6.

While the use of the lampholder for heavy current consuming devices should be frowned upon by the retailer, there are many small domestic appliances which can conveniently be connected to the mains in this way. This is easy in daylight, but troublesome when both the light and the appliance are wanted simultaneously. In such circumstances a device similar to the "Utility" adaptor illustrated in fig. 11 is undoubtedly useful. This particular Metro-Vick "gadget" has a small switch incorporated in it to enable the lamp to be switched off if desired.

Some mention should be made of lamps. One of t latest catalogues received deals with "Siemens lamps, which are typical of those made by members of the E.L.M.A. While clear-glass lam have still by far the largest sale, there is growing appreciation of diffusing bulbs and eve coloured ones for home lighting. "Silvalux" lam have a double glass bulb, the inner lining being of cle glass and the outer portion of opal glass. A somewh similar effect is obtained by "Purlite" lamps, but the are internally frosted. The colour-spraying process applied to both vacuum and gasfilled lamps, and t following colours are obtainable: red, blue, gree yellow, amber, ivory and flame. The Siemens an English Electric Lamp Co., Ltd., 38-39, Upper Tham Street, E.C.4, also produces beautiful lightin fittings; the one shown in fig. 14 is typic of the company's "Silvaray" glassware fittings. A other large section of the company's business is tha devoted to domestic appliances. The "Siemens-Xcel range includes fires, cookers, irons, kettles, toaster &c. Of the heating apparatus, the small bowl fire (th "Fulray") illustrated in fig 13 is likely to appeal t the public as being convenient for general purpose Another all-round "Siemens-Xcel" appliance (we refe to its qualities not its shape) is the "Utility" tabl cooker shown in fig. 12. It is claimed by the makers t be the only British made article of its kind.

THE

"ELECTRICAL REVIEW"

COMPETITION.

THE advertising competition was judged at the Hotel Cecil, on Thursday Morning, 17th February, 1927.

The Judges on this occasion were:

Mr. J. W. BEAUCHAMP, M.I.E.E., of the E.D.A;

Mr. W. F. T. PINKNEY, M.I.E.E., of the Newcastle-upon-Tyne Electric Supply Co., Ltd;

Mr. H. T. YOUNG, of Messrs. Troughton & Young, Electrical Contractors, Knightsbridge, London,

RESULTS.

FULL PAGE CLASS I.

(Generators, Motors, Turbines, Engines, Condensers, Compressors, Coolers, Heavy Switchgear, Batteries [Storage] and Heavy Machinery in General.)

£50 - The British Thomson-Houston Co., Ltd., Rugby. Advertisements prepared by Mr. A. L. M. AYERS.

FULL PAGE CLASS II.

(Fittings, Switches, Lamps, Valves, Insulators, Fans, Tools, Bearings, Heating and Cooking Apparatus and General Electric Accessories.)

£50 - The Ormond Engineering Co., Ltd.
Advertisements prepared by Messrs. BERTRAM DAY & CO., LTD.

A SPECIAL AWARD WAS GIVEN IN THIS CLASS TO

£25 - W. T. Henley's Telegraph Works Co., Ltd.
Advertisements prepared by Mr. JOHN S. SIMMONS.

FULL PAGE CLASS III.

(Instruments, Meters, Telephones, Wires and Cables, Conduit Wiring Systems, Radio Sets and Components, and Apparatus not covered by Classes I. and II.)

£50 - Stella Conduit Co., Ltd.
Advertisements prepared by Messrs. H. P. POPE, LTD., Birmingham.

HALF-PAGES.

As there were insufficient Entries in each of the Three Classes, they were all judged in one Class.

£25 - Varley Magnet Co. Advertisements prepared by E. WALTER GEORGE, LTD.

A SPECIAL AWARD WAS GIVEN TO

£15 - Midland Electric Manufacturing Co., Ltd.
Advertisements prepared by Mr. JOHN F. PRESTON, Birmingham.

On the following pages we give the Report of the Judges, and reproduce the successful Advertisements.

The Judges' Report.

IN the second Competition promoted by the ELECTRICAL REVIEW to stimulate interest in Advertising technique within the Electrical Industry, there were submitted 22 sets of six full-page displays and eight sets of half-page displays, the latter covering all classes of material advertised in the REVIEW, whilst the former or full-page series was divided into three classes: plant and machinery, accessories and appliances, material and sundries.

The general standard of the advertisements submitted was distinctly high with regard to all the leading requirements of publicity display of this class and for such a journal; in many cases, however, the treatment lacked uniformity in value throughout the whole of the displays offered; most of the sets presented one or more examples much to be commended and above the average or the worst of the set.

In judging modern technical advertising, one must consider the varying difficulty which confronts the advertiser or his expert according to the character of the material for which publicity is required. In some cases the magnitude of the article or its final environment assists the advertiser, and lends impressiveness to the display. In this respect some of the advertisers have already the advantages enjoyed by the transport companies, who are assisted in their modern advertising by the support of striking scenery or buildings with historical association.

Incidentally, advertising of this class has a prestige value for electrical service as a whole, in addition to its main object —selling the advertised material, or maintaining the reputation of the maker. It is important, however, that the imagination of the designer should not be too much occupied by the fortunate adjuncts of his task. Some of the examples expressed a nice balance between the dramatic significance of the material illustrated and the selling value of brief, if rather technical, information about its leading characteristics and correct method of use; others rather missed the opportunity of conveying some information about the product which would give point to the impression created by the illustration.

Advertisements of this class, apart from any particular information in diagram, graph or letterpress form, can be effective when merely constituting a record of good work done, but where that alone is relied upon the advertising needs to be frequent, extensive and varied, whereas the presentation by the manufacturer of some particular, if small, selling point or virtue in the appliance, can often best be advertised by the continuous repetition of some well-thought-out display.

Many examples can still be seen in the technical Press of to-day where machinery and appliances, sometimes even material of outstanding value, are advertised with little or no imaginative support. On the other hand, some very fine modern advertising appears to fail by the imaginative support being overdone when, if it does not completely overshadow the main issue in the reader's mind, it at least divides his attention, placing in his mind two distinct impressions where it should leave but one and that one riveted the more firmly by a not too strong supporting suggestion relating to the use of the material or to the advantages which its use brings either to the retailer of it or to the ultimate consumer.

It is very necessary in technical advertising that the people responsible for material, and familiar with its particular and technical appeal to the buyer, should work closely with those who may have been brought on to the scene because of their knowledge of advertising practice and ability to visualise an attractive treatment which might not occur to the more technical mind. This co-operation is needed to prevent the overshadowing above referred to, and particularly to avoid foolish technical errors which may otherwise creep into the letterpress and illustrations.

In advertising accessories, particularly perhaps those bought by retailers as part of their raw material and only finally bought by the user as a component in his finished installation, many points of real advertising interest arise: the quality and durability of the appliance; its price, appearance, and the influence which its use may have on the cost of erection or ultimate permanence of the installation; features connected with ease of wiring and fixing, reducing the call upon the skill or care of the workmen installing the appliance, or using it afterwards; foolproofness, &c.

In some of the advertisements in this competition the mo has been made of these points, and simple appliances hav been advertised strongly on some feature of construction i a clear manner, with generous spacing and calculated to appe to the practical man with little need to refer to the letterpres

In our trade papers it is desirable not to miss any technic "story" opportunity if it can be made clear at a glanc and not to rely exclusively upon a well-known name, a drama tic treatment or catchy headlines; all these can be valuab in the first test of an advertisement—"power to arrest atte tion," and to some extent the second—"power of retainin attention"; but they may fail through not giving some cle message of sufficient interest to remain in the reader's min There is a good deal of magic in names and short descriptiv Trade Words. Some of these have already grown into th language, but they generally have some happy accident abou them, some distinctive sound or rhythm, which remain readily in the mind. The number of such words which ca be found is necessarily limited, and attempts to produce Trad Names are not always successful. Combinations of initia letters or contractions of longer words require to be con sidered with care before being generally adopted; example can be found where a well-known name has been submerge in favour of an invented word with no greater merit, an requiring fresh mental effort by the reader.

Some of the really fine examples of imaginative supportin treatment and designs suffer from the serious fault that although striking, they are not related to the main subject, an rather suggest that the expert has become too muc enamoured of his own bright idea.

The ingenuity of the advertiser is rather taxed when makin a display on behalf of material which has been a commonplac in the business for years. It may not be of distinctive appear ance, nor can it even be put forward as having the virtue o invisibility in use; here refuge is often taken in an appea which illustrates the place or use behind which the advertise material is performing some function. A good advertisement can in such cases often be produced by inverting the procedure adopted with striking appliances or plant, allowing the sup porting design or idea to make the main picture, and being itself supported by some illustrative treatment of the actua material offered.

The plainest and simplest material can with a little thought be illustrated in a way which is impressive or, as one may say, harsh, so making a definite impression on the mind.

It seems desirable on behalf of the advertisers who pay, and the skilled people who draft, to enter a reminder that some material does present considerable difficulty in treatment. In such cases the expert starts handicapped and needs to give thought to the subject, and even then, perhaps, must rely to a large extent on inspiration or bright ideas, of which there may be no lack, but which are difficult to command just when wanted.

Generally the letterpress used in the advertisements reviewed was of high standard and employed with restraint. Efforts to arrest attention by playing tricks with type and letter arrangement are seldom successful; they cannot redeem bad copy, and they only distract attention from goods.

There were still some instances of false economy in using blocks of poor quality or much the worse for wear. In advertisements and catalogues the electrical trade is often too economical in this respect, as well as in using inferior photographs in the first instance.

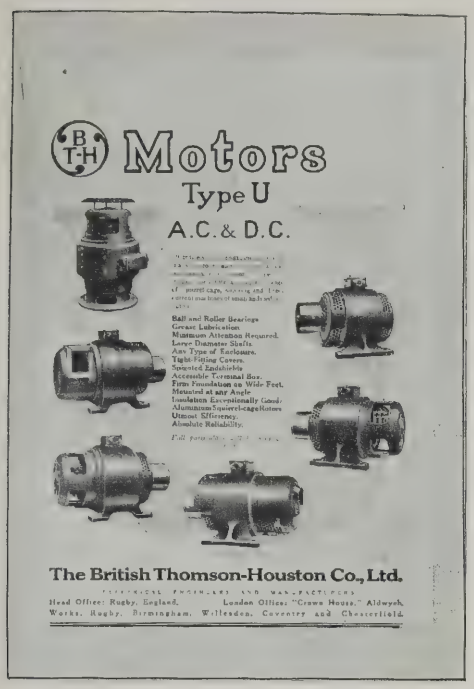
The writers of this Report would like to put on record their thanks to the ELECTRICAL REVIEW for the facilities offered for judging in this interesting competition. The task, not a light one, and lasting for a considerable time, was a liberal education in itself and much assisted by the method of classifying, mounting, and exhibiting the advertisements which the organisers of this competition had adopted.

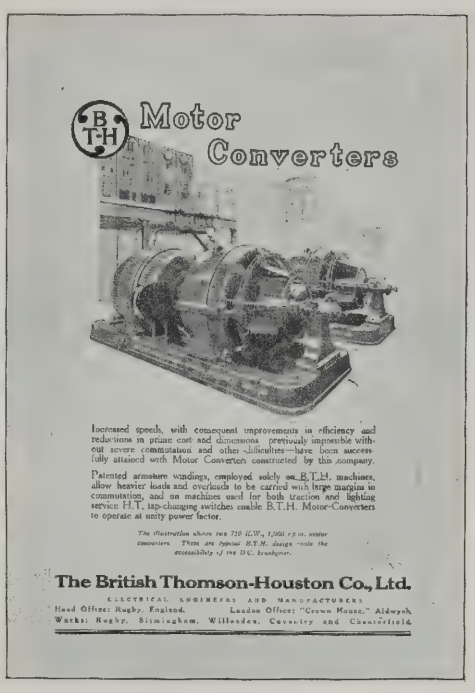
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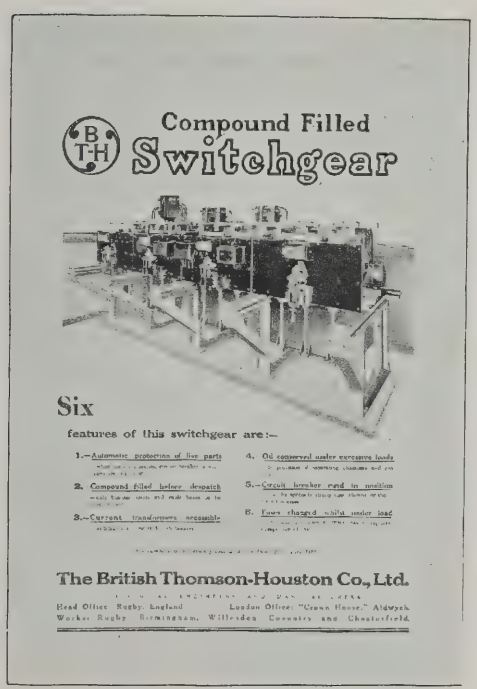
J. W. BEAUCHAMP,
W. F. T. PINKNEY,
H. T. YOUNG,
} *Judges.*

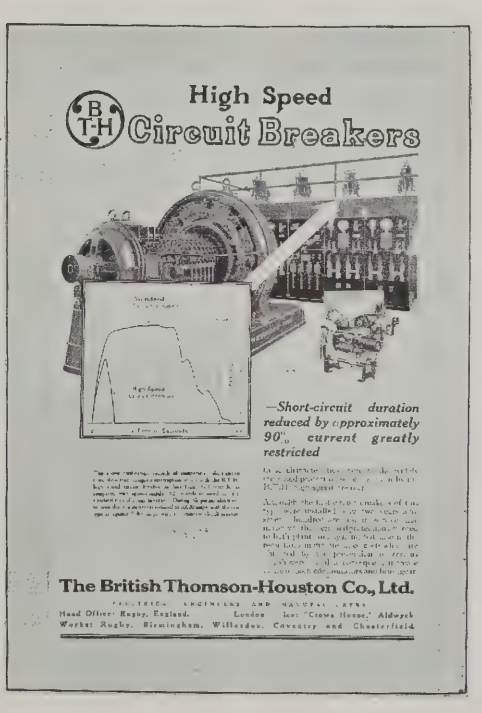
February 22nd, 1927.

CLASS I (FULL PAGE) WINNING DESIGNS.

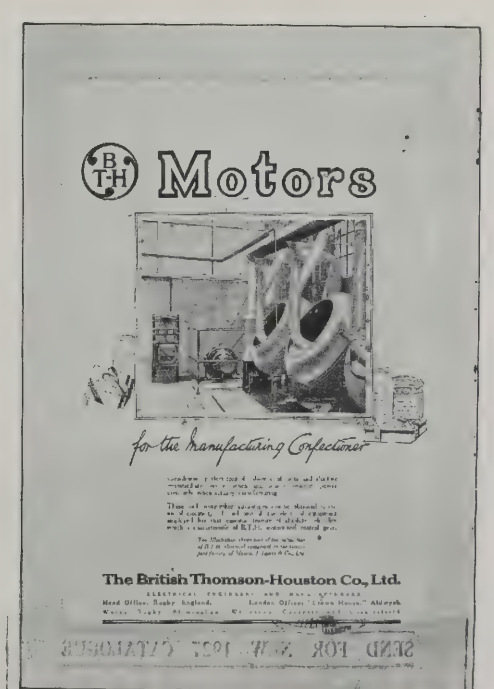




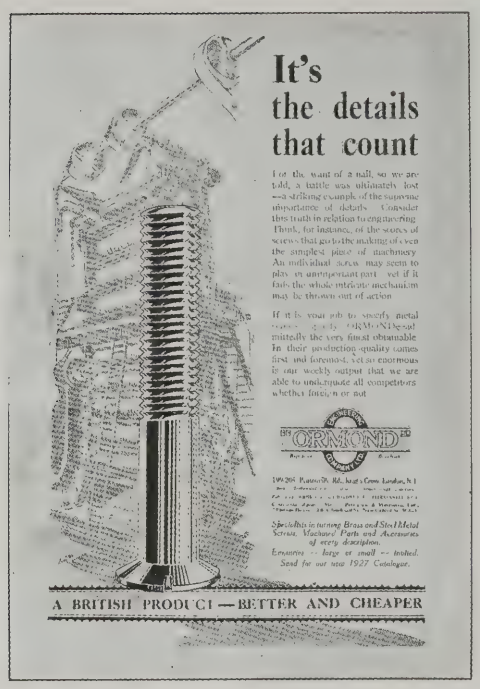








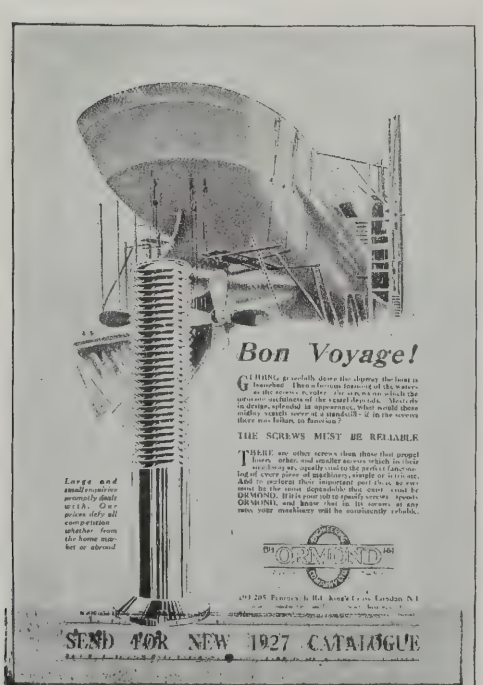
CLASS II (FULL PAGE) WINNING DESIGNS.





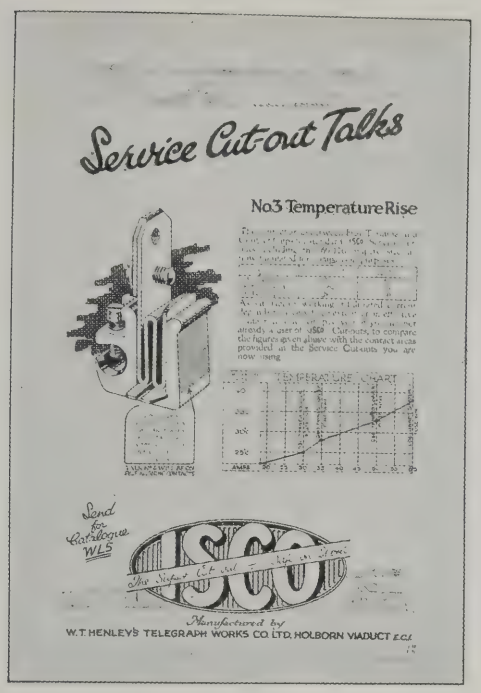






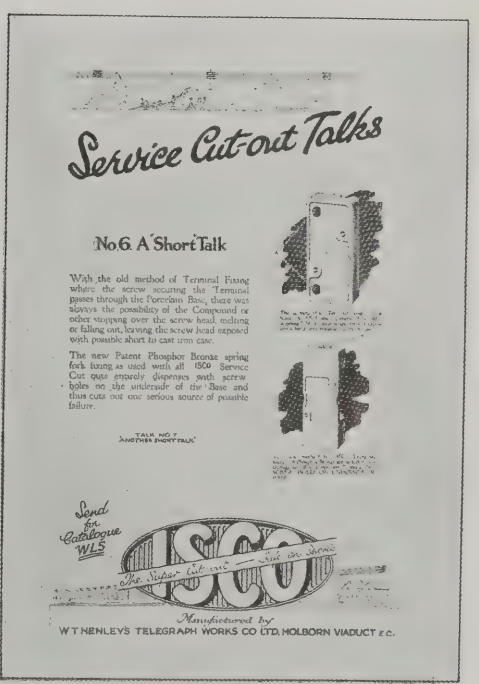


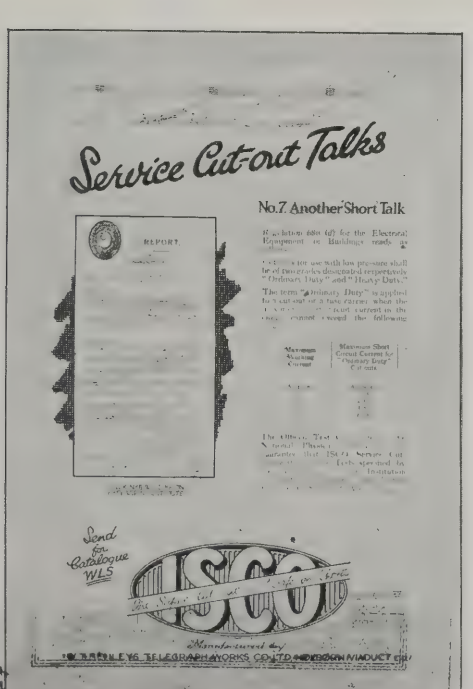
CLASS II (FULL PAGE) SPECIAL AWARD DESIGNS.

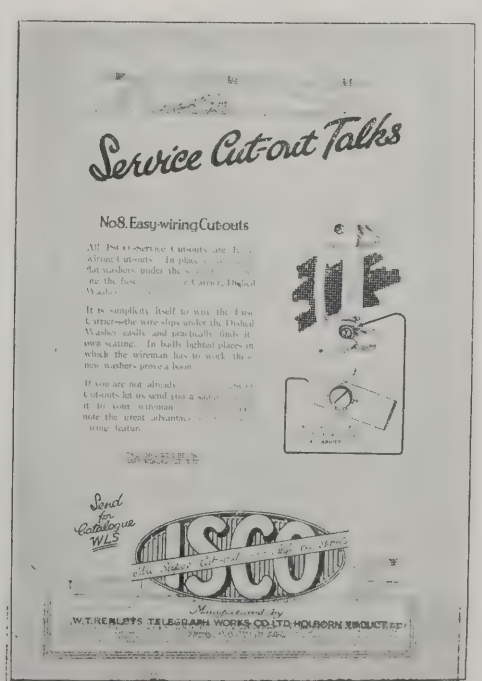












CLASS III (FULL PAGE) WINNING DESIGNS.



STELLA·CONDUIT

STELLA

QUALITY AND SERVICE



IN the wiring of individual houses, Model Villages, Garden Suburbs and housing schemes generally, a considerable amount of Stella Conduit is used. Architects appreciate the fact that Stella Conduit does not interfere with existing schemes of decoration. Contractors and Engineers know from experience of its sound construction and lasting serviceability. All round it is regarded as eminently suitable for this class of work.

STELLA·CONDUIT

STELLA

QUALITY AND SERVICE



IN Churches and such like buildings most parts ularly the wiring system must be unobtrusive. For this reason and in consideration of other such qualities as price and genuine excellence, Stella Conduit is very widely used. It is the first choice of many Architects and Electrical Contractors.

STELLA·CONDUIT

STELLA

QUALITY AND SERVICE

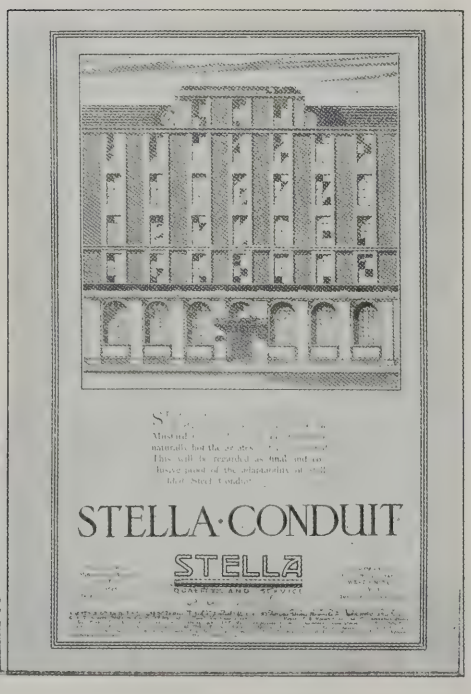


STELLA Conduit has been employed in the wiring of very many country residences. In whatever part of the country a client may live, he has to be carefully considered, Stella Conduit affords excellent and reliable protection. And such protection is not at the expense of lightness. Stella Conduit can be arranged to harmonise with all architectural schemes.

STELLA·CONDUIT

STELLA

QUALITY AND SERVICE



STELLA·CONDUIT

STELLA

QUALITY AND SERVICE

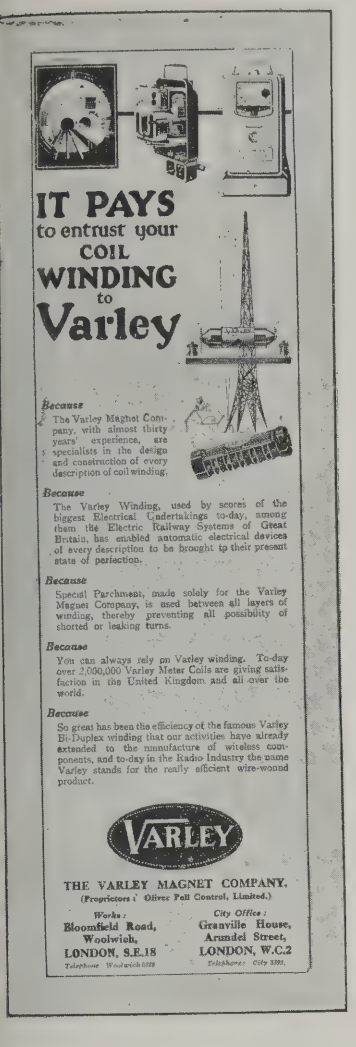


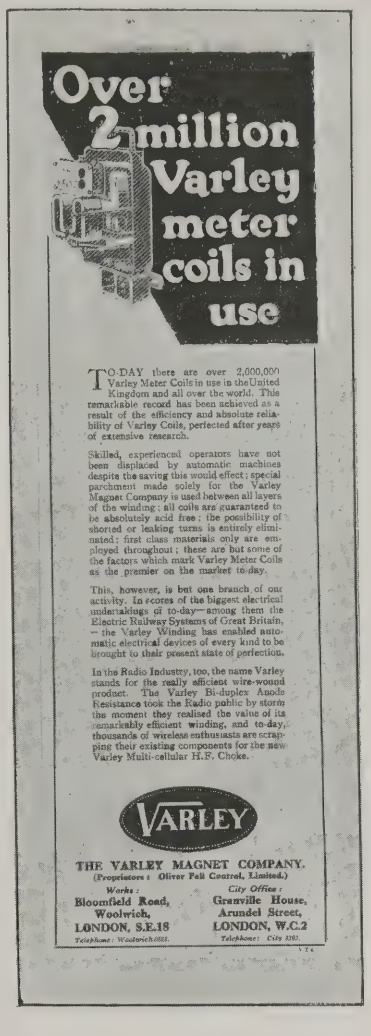
FOR Factories, Warehouses, Offices, etc., "Stella" Conduit is essentially the best that can be used and is to-day in demand throughout the country. Contractors and Engineers know from experience its quality, dependability and soundness of construction. More suitable material for all classes of work is unobtainable.

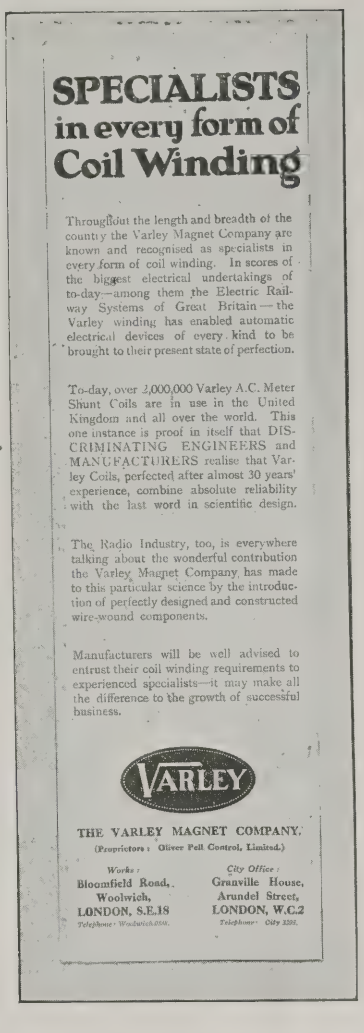
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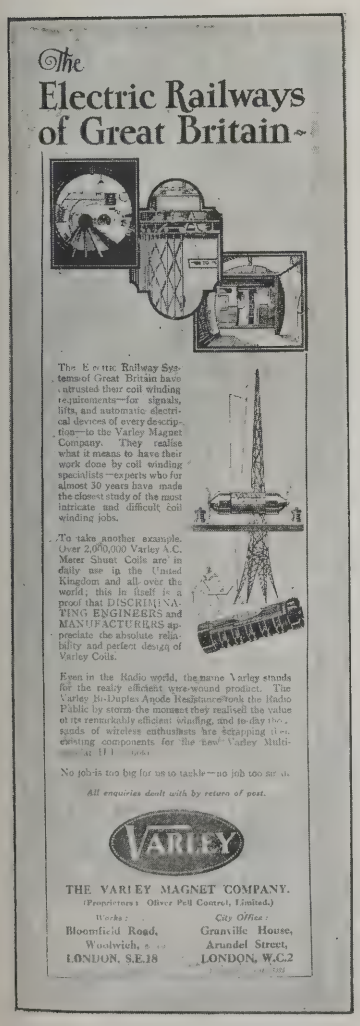
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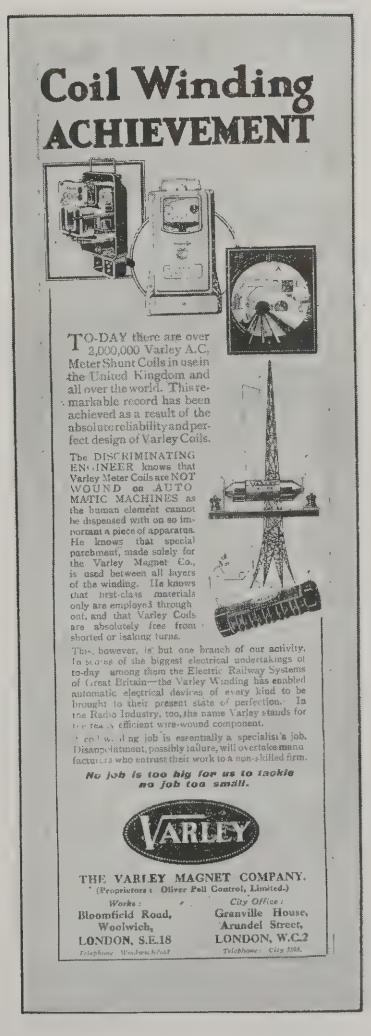
CLASSES I, II and III (HALF-PAGE) WINNING DESIGNS.

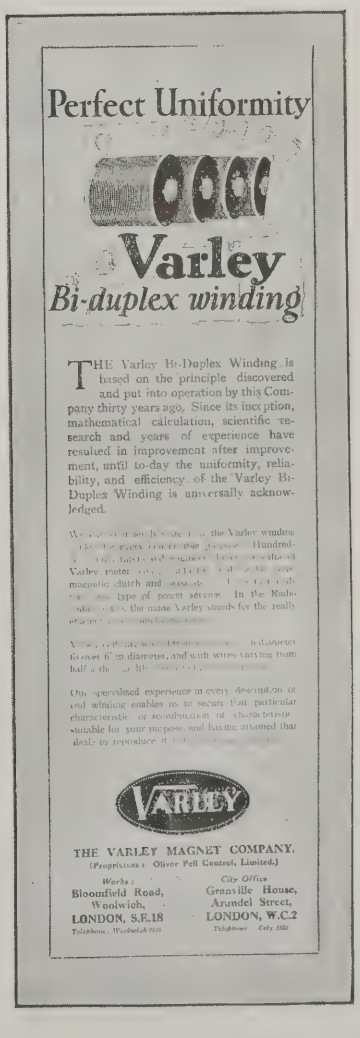












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M.E.M. in South Africa.

In all Mining and large engineering works in South Africa M.E.M. Gear is consistently used. This has come about through the widespread reputation for final superiority which this Gear enjoys. Stocks are carried by all electrical supply houses.

The M.E.M. range of Ironclad Gear comprises—The "GLASGOW-REX" Switch; the "MEMREX" and "MEMETTE" combined Switches and Fuses; the "KANTARK" Fuseboard. They are fully described and illustrated in publications Nos. 150, 155, 156 and 157. Any, or all, sent free on request.

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SPECIALISTS IN IRONCLAD SWITCH & FUSE GEAR

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SPECIALISTS IN IRONCLAD SWITCH & FUSE GEAR

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GOES ROUND M.E.M. THE WORLD



M·E·M

M.E.M. in Australasia.

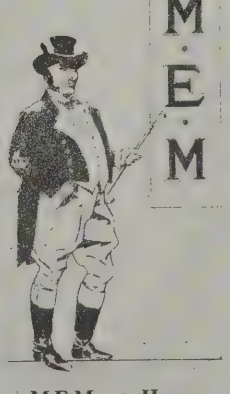
Throughout Australasia M.E.M. Ironclad Gear is approved by all Supply Authorities and Power Boards. It is recognised as the best in construction, the best in operation, and the best in price. M.E.M. Gear is without Peer.

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Factory Representatives:
Mr. JAMES THORNELL, Box No. 2073, G.P.O., SYDNEY, N.S.W
and all Electrical Wholesalers

MIDLAND ELECTRIC Manufacturing Co. Limited.
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SPECIALISTS IN IRONCLAD SWITCH & FUSE GEAR

GOES ROUND M.E.M. THE WORLD



M·E·M

M.E.M. at Home.

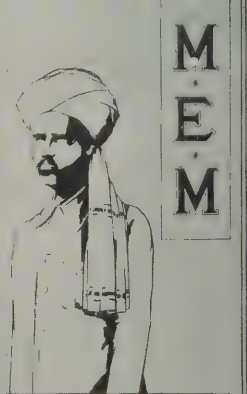
In England, Scotland and Ireland M.E.M. Ironclad Switch and Fuse Gear is popular for its advanced design, its unfailing accuracy in operation, and its moderate price. We are represented at home by the undermentioned and M.E.M. Gear is obtainable from all Electrical Wholesalers.

The M.E.M. range of Ironclad Gear comprises—The "GLASGOW-REX" Switch; the "MEMREX" and famous "MEMETTE" combined Switches and Fuses; the "KANTARK" Fuseboard. In the foregoing order they are fully described and illustrated in publications Nos. 155, 156, 157. Any, or all, sent free on request.

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LONDON: Hogan & Wardrop, 80, Golden Lane, London, E.C.1.
MANCHESTER: T. A. Nunwick
GLASGOW: R. W. S. Mackay.
NEWCASTLE-ON-TYNE: R. F. Sunderland, Milburn House.
BRISTOL & SOUTH WALES: A. M. Perks.
MIDLANDS: W. Lees.
YORKSHIRE: J. W. Waterhouse.
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AND ALL ELECTRICAL WHOLESALERS.

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M·E·M

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On the Indian Railways, and by all the large Industrial organisations M.E.M. is used. It is appreciated as the best Gear obtainable, and its performance at all times confirms this. Stocks are carried by all electrical supply houses.

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INDIA—*M. L. Hochat & Co., Navsari Buildings, Hornby Road, Bombay, & 133, Canning St., Calcutta.*

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All communications to be addressed to The Electrical Review, Limited.

Vol. I. No. 4. MAY, 1927.

Notes and Comments.

Coming Events.

During the next few weeks several conferences of some importance to the electrical industry will be held, principal amongst which are the Summer Meeting of the Institution of Electrical Engineers, the Annual Conference of the Electrical Contractors' Association Allied Associations, and the Annual Convention of the Incorporated Municipal Electrical Association. Although, of course, there will not be a great amount of effort devoted to the interests pure and simple of the electrical retailer, we feel sure that the retailer will be interested in the proceedings, and consequently a brief outline of these may not come amiss.

The annual convention of the Incorporated Municipal Electrical Association will be held at Buxton from May 30th to June 4th. It will be formally opened by the Mayor of Buxton on May 31st, on which date Mr. R. W. L. Phillips, M.I.E.E., will read his presidential address. The remainder of the period will be devoted to the reading of papers and discussions thereon, and visits, not the least important of which will be to the exhibition of electrical apparatus, which each year grows in importance.

The summer meeting of the I.E.E., which will be held from June 14th to 17th at Newcastle-upon-Tyne, is more of a social than a business event. A number of visits will be paid to various works in the district, including turbine and switchgear manufacturing concerns, and also to shipbuilding yards and coal mines. The social functions include a civic reception and a reception and dance at Armstrong College.

The annual conference of the E.C.A. Allied Associations is to be held at Scarborough from June 22nd to 25th inclusive, and some particulars of this appeared in our last issue. The most notable events will be the presidential address of Mr. H. J. Miles, several interesting papers and discussions, a short address by the new president, Mr. W. A. Shaw, of Stockport, and the annual general meeting, which will be held on June 23rd.

* * *

The Central Scotland Electricity Scheme.

One of the most pleasing events of the past month in the electrical industry has been the publication of the Central Scotland Electricity Scheme, 1927, which the Electricity Commissioners have prepared and submitted to the Central Electricity Board. This scheme, with the full particulars of which we are not concerned here, deals with an area of 4,980 square miles, including roughly the whole of the industrial, shipbuilding, and coalfield areas of Scotland. It looks forward to the area being supplied in ten years' time by eight capital stations, which will be interconnected by a series of high-pressure main transmission lines. The transmission system is designed to form a series of ring mains, so that there will be alternative routes to points of supply, and consequently greater security against breakdown.

CONTENTS.

NOTES AND COMMENTS: Coming Events. The Central Scotland Electricity Scheme. The Electrical Contractors' Association. The Right Attitude towards Complaints. Necessary Knowledge. Indirect Salesmanship. A Better Business Bureau. Why Customers do not Return. Shop Windows and Advertising.

SUMMER WINDOW DISPLAYS (illus.)

SOME DOMESTIC ELECTRIC FANS (illus.)

SELLING LINES FOR RETAILERS (illus.)

STOCK-KEEPING FOR THE ELECTRIC SHOP, by E. N. Simons.

LATEST TRADE LITERATURE AND CATALOGUES.

TRADE NOTES AND NEWS.

The scheme, of course, has been generally anticipated, but it is very cheering, and highly hopeful for the future, to note that the Central Electricity Board are not "letting the grass grow under their feet," and are quickly settling down to their task. The scheme is a big one, involving a huge sum of money and a tremendous amount of work, but we have every confidence that the responsible authorities will carry it through to a successful conclusion, the benefits of which are fairly obvious. Other schemes in course of preparation deal with Central England; Yorkshire, Lancashire and Cumberland; South-East England, including London and the Home Counties; South-West England; and South Wales, and it will be interesting to see whether the Commissioners and the Central Electricity Board will act as expeditiously as they have in the present case.

* * *

The Electrical Contractors' Association.

In our March issue, it will be remembered, we published a message to the trade from Mr. H. J. Miles, president of the Electrical Contractors' Association, Incorporated, in which he outlined the benefits membership of that Association had to offer. During the past week or two this information has been considerably augmented by a brochure issued by the Association, which can be obtained on application to 15, Savoy Street, Strand, W.C.2. This brochure outlines in a lucid manner the development of the Association, its present status, and in what manner it helps the electrical contractor in his work; it also deals with the allied associations: the N.E.C.T.A., Limited, and the National Federated Electrical Association.

Of particular interest is the fact that the E.C.A. has a section specially for electrical retailers, who are entitled to all the advantages that membership affords. Since this is, at any rate at present, the only organisation working on behalf of the electrical retailer, it is surely deserving of the support of this section of the industry. No one would deny that in the electrical development of this country the retailers will play an increasingly important part and that consequently they should work on an organised basis, such as an efficient trade association secures. Many problems have to be decided, such as price maintenance, price-cutting, "dabbling," discounts, and so on, and unless there is some recognised association representing the electrical retailers there can be little or no unanimity on these points. The ancient fallacy that the lone hand is best, that trade associations and trade unions are things to be avoided, has long been exposed, and unity is now the order of the day. The electrical manufacturers have their association, the electrical wholesalers theirs, and it can only be to the good of the industry that the electrical retailers also combine for the voicing of their opinions, for maintaining their true trade status, and for their own betterment generally.

* * *

The Right Attitude towards Complaints.

A factor that is almost inseparable from electrical retailing is the complaint. To avoid this is a wrong policy, for, trivial as the grounds for complaint may be, the customer making it is entitled to a hearing, and he will form a higher opinion of the retailer if and when a complaint has been settled to his satisfaction. This comes from the insight received into the dealer's side of the question, and the pains taken by the latter to trace the trouble, if any, to its source. In the matter of lamps, it has happened in the past that a customer who has some real trouble tries to strengthen the case by returning all the old lamps used, including some which have obviously had a good life. Care must then be taken to discriminate between normal failures and genuine "troubles." The person making a complaint may say something which gives a clue to the cause of the trouble, and so it is advisable for the dealer, even after first examination of the lamps, to say as little as possible himself until the full facts have been obtained. No complaint, whether it concerns lamps or other goods, should be treated lightly. The ideal to aim at is to turn every complaint into a purchase and to leave the complaining party eminently satisfied.

* * *

Necessary Knowledge.

The trader who enters into electrical retailing with little or no knowledge of electricity or of the goods he proposes to sell is running a very grave risk, a risk only a few degrees less than that run by the electrical expert who enters electrical retailing with only a vague idea of selling methods. The electrical retailer, in short, should not only have a rather more than working knowledge of electrical matters, but he should also be versed in the intricacies of retail selling. The one is a necessary complement of the other, and, speaking generally, it may be said that one is of little value by itself.

There are, however, several other points of some importance to be taken into consideration, most of them of a local character. Of these, the most important is the local electricity supply. The retailer ignorant on this point who attempts to sell electrical apparatus may be compared with the street hawker who tries to sell mechanical toys without knowing how they work. Guesswork will play a large part in any sales, and because of this many customers will be lost. The electrical retailer, therefore, must be thoroughly conversant with all details of the local electricity supply, such as voltage, periodicity, price, and so on, and he must also give careful attention to any changes that may take place. In this respect, any such changes are always reported in the Electrical Review, and there can be no excuse for ignorance on these points. But, in addition to this, the electrical retailer must be able to say in a moment what will be the running costs of a particular appliance. Running costs have a direct bearing on the purchase price, and both must be given to any prospective customer if deception—innocent though it may be—is to be avoided. The customer, too, will appreciate this information, and in this manner a new customer can easily be turned into a permanent and satisfied client. A little trouble taken in this direction will surely add greatly to the goodwill of the business, and every electrical retailer should make it a duty to see that he and his assistants are armed with this knowledge.

* * *

Indirect Salesmanship.

One of the finest forms of advertising that any retailer can have is the spoken recommendation of a satisfied customer. This form of indirect publicity can usually be productive of more sales than the most elaborate newspaper advertising, especially in the smaller communities, where most of the inhabitants are known to each other. This, of course, is well known to experienced retailers, but there are, nevertheless, many

retailers who regard a sale merely as the exchange of goods for money, and content themselves with treating it in that light, utterly disregarding the potentialities of the customer.

Not every retailer, however, appreciates another form of indirect publicity of almost equal value: the recommendation of the influential residents in the locality. Of these, the most important are the doctor and the parson, the former being the most promising agent from the electrical retailer's viewpoint. The doctor plays a leading part in the life of his community, being interested in preserving the health and well-being of those around him, and his word undoubtedly carries great weight in the homes which he enters either professionally or socially.

The electrical retailer should demonstrate to the doctors in his locality just what electricity can do to lighten labour and preserve the health of the community generally. The doctor should be shown how the electric washing machine eliminates the ailments due to too much unhealthy bending and strain on the back; how the electric refrigerator safeguards food during hot weather; how the electric iron lessens the housewife's labour; and how each of the other electrical domestic appliances has its own story to tell of health preservation, not excluding the purer air which results from the use of an electric fire. The arrangements for the demonstration must differ with varying circumstances. But the electrical retailer who takes pride in his work must surely give it sooner or later. Undoubtedly the doctor can be one of the best and most effective mediums for electrical propaganda, and the retailer should not hesitate to enlist his services.

* * *

A Better Business Bureau.

Speaking at a luncheon of the Incorporated Association of Retail Distributors recently, Mr. Louis E. Kirstein, a noted American business man, outlined the functions of the "National Better Business Bureau," a business society that has a large following in the land of dollars. The Better Business Bureau, it seems, is a movement for promoting fellowship amongst those engaged in industry, finance, and retail trading, and also to see that its members do not stray from the path of honest trading. It attempts to carry out the precepts of "truth in advertising," and if any of its members exceeds the bounds of truth, or even if non-members fail in this respect, strong steps are taken to put the matter right. In other words, the Bureau teaches its members to "play the game," and in this manner increase their business in a legitimate manner.

It seems to us that a trade society run on similar lines would be of genuine value in this country, for, frankly, much of the advertising that one sees to-day is by no means based on the maxim "fair play is a jewel, and truth a casket of jewels."

Truth in advertising may sound a bit cold to many, and it may seem difficult to write advertisement copy without making use of a number of laudatory adjectives which are apt to deceive, but both these policies are best in the long run. The public appreciates being told the whole truth and is not, as a rule, slow to express its appreciation in tangible form.

* * *

Why Customers Do Not Return.

It is the steady customer who enables the retailer to place his business on an established basis. The occasional customer who makes a purchase and then never returns to the shop, although adding to your net sales, is not helping to build up your trade on a sound foundation, as is the customer who always comes to you for his electrical requirements. These are your best customers, and it is to obtain and maintain these that the sales staff should direct its efforts. If you find that casual customers are not returning to your shop, you should make every effort to discover why, and particularly whether it is due to any fault of your own. Possibly a customer, urged by disappointment or vexation, perhaps because one of the sales staff has erred, may be the means of dissuading other people from coming to your shop. You owe it to yourself and to your business to find out why every customer does not follow up a first purchase.

When such a procedure is adopted, you may be sometimes surprised at the results. You may discover, through tactful probing, that one customer is discontented because a purchase has been forced upon him by an over-zealous salesman, or that a former patron discontinued further purchases because the articles failed to give satisfaction. It is valuable to find these out, because in the future you will be impelled to fight shy of the salesman who tries to palm off questionable goods. You may learn to your regret, but to your advantage, that a certain sales assistant in your shop is not giving satisfactory service. The successful retailer is the one who is giving his customers the best service; he is the one who is encouraging his patrons to come again, to buy again, to keep the business running—which is the course pursued by every progressive retailer to-day. People are naturally disposed to favour the shop that makes an effort to please them.

* * *

Shop Windows and Advertising.

In connection with the two words "sales production," there are two little questions our readers should ask themselves. Number one is: How often are shop windows backed up in Press advertising? Number two goes on another line of argument, namely: How often are Press announcements referred to in window displays?

These two points, taken side by side, may seem somewhat paradoxical, but actually there is a lot of sense in them. Take number one, for instance. It is an almost everyday occurrence to read an advertisement in any local paper which describes at length the goods offered by the advertiser, but never a word is there about watching the windows in which the goods are displayed. Then, with regard to point number two, a man may pass the window in a hurry and scarcely notice any of the goods displayed. If, however, a large window ticket was displayed, and it had something in large print about looking in the local paper for the firm's advertisement, it is quite probable that the passer-by would spend a few minutes of his spare time in turning up the announcement referred to. These are, perhaps, only small points, but they make a big difference to the sales turnover.

* * *

NOTE.

The Editors will be pleased to hear from readers on all subjects of electrical retail trading.

Summer Window Displays.

Taking Full Advantage of the Hot Weather.

DURING the hottest part of last year, an electrical retailer in a London suburb passed the remark: "I'm on the sunny side of the street, and during the hot weather I notice that not so many people stop to look in my windows." This was, of course, a natural reaction on the part of the public, for the shady side of the street is always the most comfortable in sunny weather, and it requires something really attractive to lure people out of the shade.

That is just where this retailer failed: he did nothing to attract the public to his shop windows. He just carried on in the same old style, and lamented the failing of the public, whereas it was his own lack of initiative that was the root cause of his wilting sales.

During hot weather, special summer window displays will greatly assist the sales of cooling apparatus for the home, such as fans and refrigerators. The "prospect" will be in the right mood, and will eagerly consider any devices for combating the hot weather and lightening domestic labour. But it must be a special display. The display that is neat and attractive along the usual conventional lines will not, as a rule, attain its objective. What may be termed "summer selling punch" is a very necessary element, and the more powerful the means employed, the more convincing will be the display. To the conservative-minded this may sound somewhat of an exaggeration, but its truth has been proved up to the hilt in the past, as the following examples will show. Perhaps, too, these examples will give retailers ideas for new and original displays which will prove equally effective.



Fig. 1.—An Excellently Conceived Display for Domestic Refrigerators. It comes from America.

FAN DISPLAYS.

That the display need not be directly illustrative of the function of the article that is being pushed, and that the unusual will attract as much as the standard, was aptly shown by a provincial retailer. In his window was a charmingly dressed wax model of a girl, whose hat was being swept off her head and her skirts blown above her knees. The wind, of course, was created by two electric fans, which were prominently displayed. This is not an event that any woman would relish, naturally, but the display attracted considerable attention, and as a result a large number of fans were sold.

A display worthy of mention was that of a suburb retailer, who was fortunate in having a large windo In the centre of the window was a red-haired girl seat at a piano, while a man standing behind her w demonstrating his lung power. On one side of t window, seated in an easy chair, was an elderly m reading the evening paper, and on the other side, al seated in an easy chair, was mother busily engag in darning socks. An appearance of a sultry nig was very cleverly created. An electric fan, wi coloured ribbons attached to show the power of t breeze, was on the piano, with a card saying "T this on the Piano. That was all, yet the di play sold more th thirty electric fans less than a fortnigh The reason was, course, that the displ had a homely appeal.

An appeal of rather different nature, the a peal to the senses, w that of a West End r tailer, who draped h window in lengths coloured velvet. T back cloth was of mi night blue, carefull hung so that each fol should be perfect, an with a *papier-mâch* column at each en ornamented in silver an blue. On the floor each centre side, at slanting angle, were tw oval leather mats, dye blue, on each of which a electric fan topped mahogany pedestal, wit several more fans on th mats beside the pedestal The sides of the window were also hung with midnigh blue velvet. The display was tasteful and attractive and undoubtedly sold a large number of fans.

Another display that for sheer simplicity an effectiveness would take a lot of beating was as follows The back and the sides of the window were drape with alternate lengths of blue and yellow cloth, an the floor was covered in the same style. In the centr of the window was a single pedestal on which was on fan from which white ribbons were blown in all direc tions. At the base of the pedestal was a card heade "Summer Breezes in Your Home," and giving the pric of the fan and its running costs in relation to the loca electricity supply.

MONDAY MORNING COOLNESS.

Other domestic appliances which have a direct summe appeal, and for which special displays can be made are refrigerators, vacuum cleaners and electric washin

machines. A very cleverly designed refrigerator display, an American one, is shown in fig. 1. Of the other two, the washing machine is the most difficult to show. The following display, however, arranged by a large Liverpool retailer may create some new ideas.

The background of the window, which was a large one, depicted the rear of a small house with a low verandah, on which a rambler rose made a brave display. Thanks to an electrical outlet, the washing machine on the verandah was gaily churning away. Apparently one batch of washing had just been completed, for the housewife, represented by a wax figure, was posed in the attitude of hanging clothes on the line across the lawn, over which artificial grass mats were laid. Her little boy was playing on the lawn with a bat and ball. Here again was the direct human appeal, and the results were very gratifying.



Fig. 2.—A General Electric Display of Fans.

THE HUMOROUS APPEAL.

As a final example we will study a humorous display of electric vacuum cleaners arranged by a Birmingham trader. A prize-fight ring was reproduced in the window, with a sprinkling of spectators in the novel form of vacuum cleaners with a face mask attached to each handle. These stood in a single line across the background, enveloped in black cloth draperies. Inside the ring, "Battling Vacuum Cleaner" had just succeeded in delivering the knock-out blow to "Kid Drudgery," a pitiful broom figure with two hand brushes for hands and a mask for his face. The referee, a very trim and smiling housewife, was counting time. A show-card in the front of the window bore the legend: "Battling Vacuum Cleaner knocks out Kid Drudgery," and underneath this, in smaller type, was an invitation to enter the shop and see the vacuum cleaners demonstrated.

In conclusion, there are one or two points that must always be borne in mind when arranging these displays. The first is that the price of the goods shown should always be part of the display, for this is invariably one of the factors that determines a sale. Even at the risk of a display losing some of its effectiveness, the price must be given. The second point is that the display should never be exaggerated—it should be as near to the truth as possible. Exaggeration only provokes distrust, and through this many a sale may be lost.

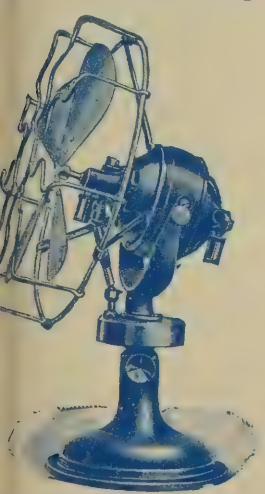
* * *

Some Domestic Electric Fans.

The present period is the proper time for pushing the sales of electric fans. In the preceding article we deal with special window displays of fans, and below we give particulars of some types of fans on the market which can be installed in the home, and for which a ready sale should be found.

THE "SUNCO" OSCILLATING TYPE.

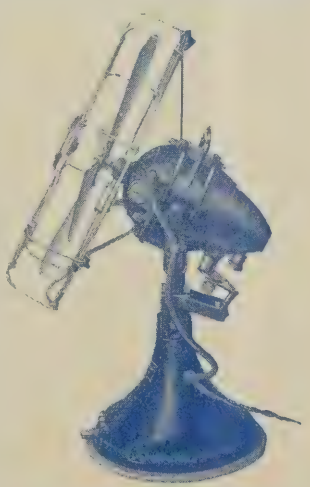
This fan oscillates in a horizontal plane through an angle of about 110 degrees, the motion being readily stopped by the simple setting of a lever. The moving parts are exceptionally strong, simple, and quite silent in operation, while the provision of a safety clutch obviates the danger of injury to the fan through its movement being obstructed. The safety clutch operates automatically in the event of the motion being impeded, and allows it to reverse and resume its oscillatory action in another direction. It is finished in black enamel with gold relief, oxidised mounts, and is fitted with a 2-speed regulator. A knuckle joint enables it to be used either as a pedestal or as a wall bracket fan. It is sold to the trade by the Sun Electrical Co., Ltd., London.



The "Sunco" Oscillating Fan.

"MAGNET" FAN—"GYRO" TYPE.

This is an entirely new pattern. It is so constructed that the body of the motor oscillates through a sweep of 105 degrees horizontally and 45 degrees in a vertical direction, thus completing an elliptical movement and giving a maximum air displacement for a minimum current consumption. A simple device is provided for reducing the sweeps as desired down to a minimum of 44 degrees horizontally and 30 degrees vertically. As a result of this wide oscillating range, the total area swept by the fan is considerably greater than that obtained by a fan oscillating on one axis only. It is fitted with 12- or 16-inch blades as desired, and can be obtained suitable for alternating or direct current of almost any voltage and periodicity. Should any obstruction prevent the operating of the oscillating



The "Magnet" "Gyro" Fan.

Reprinted from "The Lancet," March 26th, 1927.]

The "Ajax" Portable Arc Lamp.

THE lamp which has been submitted to us is designed as a portable source of ultra-violet radiation to be taken to the patient's house and used on the ordinary house mains. Such a lamp must obviously be of reasonable size and weight, simple to use, and capable of running on any voltages direct or alternating. The instrument submitted consists of a strong metallic case, about the size and shape of a large attaché case, heavily nickel-plated, which contains a small automatic arc and the necessary resistances. The arc itself is permanently mounted at one end of the case and is not intended to be removed when in use. This makes for safety in handling and for simplicity, as the minimum of fitting-up is required. The end facing the arc forms a sliding panel which can be completely withdrawn when a wide-angled beam, suitable for the irradiation of a large area, is required. For localised treatment, the sliding front carries a diaphragm and a water-cooled chamber fitted with rock crystal windows. The water cooling is effected by a glass reservoir on the top of the instrument, convection currents causing the water to circulate between the reservoir and the water chamber. This simple arrangement was found to be quite effective for the short period required—in ten minutes the temperature of the water had risen only 7 deg. C., whilst the quartz lens, though warm, was not uncomfortably hot.

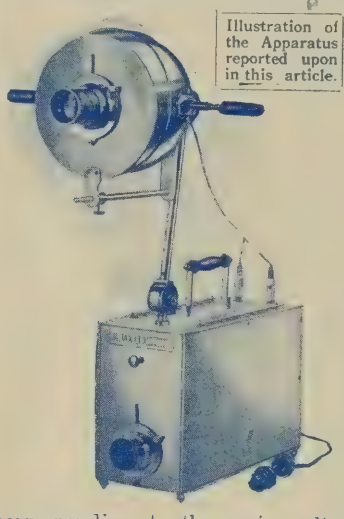


Illustration of the Apparatus reported upon in this article.

The arc is formed between cored carbons, either tungsten-cored or so-called polymetallic, the latter being cored with a mixture of metals designed to give intense radiation in the region of most therapeutic value. On the back of the instrument three knife switches are fitted. One is the main switch for the arc, the second has two positions corresponding to the main voltages of 220 and 110 respectively. The instrument is sufficiently flexible to allow of its use on other voltages varying within 10 per cent. of these values. The third switch allows the use of the magnetic blower which is fitted to the arc; this is an electro-magnet which forces the arc forward in the form of a flame when in use and thereby increases the output of radiation. The main switch has two contacts, one controlling the arc in the case and the second switching the current to a second arc which is mounted in a hood-shaped reflector carried at the end of an adjustable arm attached to the top of the case. This arc can be used with a rock crystal lens applicator as described above, but in this case, no cooling device is fitted, the heat not being so intense as for the internal type. The instrument takes about eight ampères of current, and was found on test to give a very steady output. The case tended to get hot during a prolonged run but, owing to the efficient ventilation of arc and resistances, no damage was detected. The radiation from the bare arc and also after it had passed through the applicators was examined with a Hilger quartz spectroscope. The spectra extended as far as 2,100 Angstrom units and the quartz lenses were found to be transparent over the whole range. The polymetallic carbons gave a spectrum of closely packed lines over practically the whole range. A few minor points of design—*e.g.*, the disposition of the switches on the case, call for slight modification, but they are by no means important and are already receiving the attention of the manufacturers.

In general, the "Ajax" lamp seems to be very well designed for its purpose—namely, to provide a portable source of ultra-violet rays which can be used over a wide range of varying conditions and for a number of different purposes.

Important Announcement.

A Rapidly Extending Development in the Trade.

We (AJAX Ltd.), *actual manufacturers of High-cla Electro-Medical Apparatus of all kinds, wish to draw t attention of retailers particularly to the new Artifici Sunlight Treatment Lamps.*

By the wide publicity given to the subject in the l press, everyone is aware to-day of the extraordina curative effects of the Ultra-Violet Rays and Apparat are being bought for all Hospitals and Clinics as we as Doctors in their private practices.

We consider that this trade should be done throug the usual trade channels: it is an electrician's job to f up electrical apparatus and we wish to co-operate in th closest manner possible with the trade for the supp of our Lamps.

We shall give all help possible for the establishmer of this trade: we have organised a system of speci one week demonstrations personally attended by a expert member of our staff and a system of circularisin and advertising that calls the attention of potential pu chasers to the fact that all these high-class Electr Medical apparatus can be obtained through their loc electrical supplier.

Certain tuition is necessary in the handling, use an fitting of these Lamps and this is given free either a out factory or on the traders' own premises by arrang ment.

There are no secrets for an electrician in the fitting u of these Apparatus, but certain precise indications ar necessary to facilitate the handling of them.

* * *

ULTRA-VIOLET RAY GENERATORS.

We supply three different types:—

(1) Mercury Vapour Quartz Burner Apparatus.
(2) Polimetallic and Tungsten Cored Carbon Arc
(3) Tungsten Arcs.

Various models of these apparatus serve for Collective Flood, Individual, Local and Spot Treatments: we hav suitable apparatus for all treatments.

Whilst our standard of manufacture is of the highes grade, our prices are strictly competitive and in fact lower than current market rates owing to our hug turnover.

Our Trade discounts are most liberal and we encourag trade purchasers in every way possible.

* * *

PROPAGANDA.

We advertise extensively in all the Medical papers, and we receiv enquiries from all parts; when agents are appointed, all enquirie from their districts are referred back to them and thus they acquir a certain amount of trade without expense or trouble to themselves.

When our distributing organisation is complete, with Agencies fixe in all various parts of the country, a list of the names of such Agent will be widely advertised.

The article in the preceding column is typically descriptive of ou Apparatus.

The small Tungsten-Cored Carbon Arc low-priced apparatus illus trated on the next page, "sells at sight." It is very handsomel finished and is efficient.

The Mercury Vapour type Apparatus, also illustrated on the nex page, is a standard model for Medical Practitioners.

We court immediate enquiries which will receive prompt attention.

We supply all types of Electro Medical Apparatus without exception

Our book entitled "Sunlight" Treatment, publishe at **4/6**, *Post Free* **5/-**, *gives full particulars concernin the Apparatus and the manner of treatment, and is mos useful to all purchasers of the apparatus.*

AJAX LTD. (Section E.R.D.) — *Inventors, Designers, Patentees & Manufacturers,* — *117, CENTRAL STREET, LONDON, E.C.1.*

'Phone: CLERKENWELL 6194. Telegrams: COOPENGEER, BARB LONDON. Cables: COOPENGEER, LONDON.

SELLS AT SIGHT - £5 10 0

(Subject).

The New Ajax "SUNVIRAY" Portable and Stand Model Tungsten Cored Carbon Arc Lamp.

Price complete for Alternating or Direct Current, **£5 10 0**
The Best British-made, Low Price U.V.R Lamp yet Invented.

TUNGSTEN Cored Carbons, giving particularly rich output of Ultra Violet Rays. Suitable for all voltages on either Alternating or Direct currents.

CAN be used on all House lighting circuits or Power currents. It is absolutely automatic in functioning and requires no attention when in use.



THE Front view of the Portable model is one-fifth the actual size and as a Stand model one-seventh the actual size.

THE centre rod is threaded at each end and is simply screwed on and off at will.
These Lamps can be safely recommended for Home Use.

This apparatus is made on our definite principle of high-class manufacture only, and whilst the price has been reduced to a strict minimum, a full guarantee for Five Years is given with every lamp.
Tungsten Cored Carbons are the most efficient for this class of apparatus and burn steadily and noiselessly under the automatic control.
A quick-break-knife switch is fitted to prevent arcing.
The current consumption is almost negligible, being about one unit per hour.
The Aluminium plate seen between the Lamp itself and the base is part of a cooling arrangement which completely prevents overheating.
There is no difficulty in manipulation and nothing to get out of order.

FULL PARTICULARS ARE SENT ON REQUEST.

Standard Model for Hospital and Doctors' Use.

The "AJAX"

U.V.R. APPARATUS

MERCURY VAPOUR
QUARTZ BURNERS

Greatest Efficiency. Lowest Cost

PUREST QUALITY QUARTZ

MAXIMUM WEALTH IN U-V. RAYS

Suspension Models from £18-18-0 (Subject).

APPARATUS INSTALLED IN ALL PARTS UNITED KINGDOM

For All Voltages.

DIRECT AND ALTERNATING CURRENTS

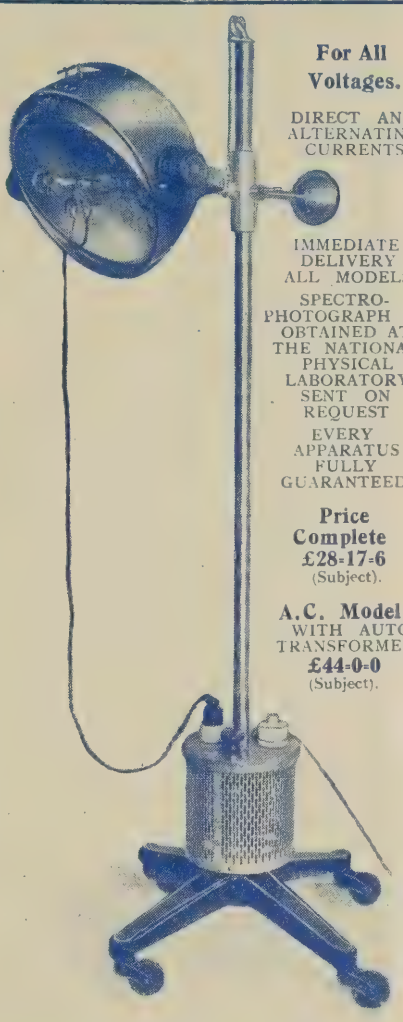
IMMEDIATE DELIVERY ALL MODELS

SPECTRO-PHOTOGRAPH AS OBTAINED AT THE NATIONAL PHYSICAL LABORATORY SENT ON REQUEST

EVERY APPARATUS FULLY GUARANTEED

Price Complete £28-17-6 (Subject).

A.C. Model WITH AUTO-TRANSFORMER **£44-0-0** (Subject).



D.C. MODEL.

There are two spherical-shaped hoods, both mobile, one inside the other—the inner one fitted with Iris Diaphragm for local or spot treatment. Having both hoods movable enables any angle of incidence desired to be obtained.

Uuique Offer. Guaranteed Maintenance.

To eliminate all question of doubt of the cost of Maintenance, Replacement of Burners, in fact, a "guarantee for ever" can be obtained on payment of a small quarterly charge. *Full particulars on request by which "upkeep" is placed on a definite guaranteed basis.* Burners supplied free when required, and in fact the whole apparatus replaced should occasion arise.

Also Hospital Type Automatic Carbon Arc Lamps for collective treatment from (subject)	£35 : 0 : 0
Sinusoidal and Surging current apparatus for Galvanism and Faradism (subject)	£31 : 10 : 0
High Frequency Sets with 3 electrodes in handsome carrying case (subject)	£4 : 4 : 0

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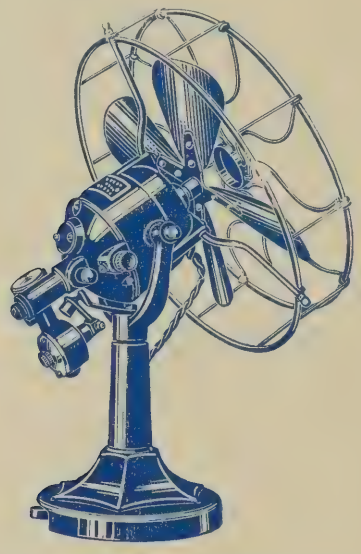
Phone: CLERKENWELL 6194. **Telegrams: COOPENGEER, BARB LONDON.** **Cables: COOPENGEER, LONDON.**

mechanism, a slipping clutch allows the fan blades to continue revolving. The motor is of the semi-enclosed series-commutator type, fitted with laminated body and poles. A regulator in the base of the fan gives three speed variations, and an "off" position, and is capable of reducing the speed of the fan by approximately 50 per cent. The resistance coils are wound on mica slabs and are liberally designed so as to enable the fan to be run continuously on any step of the regulator. It is manufactured by the General Electric Co., Ltd., London.

* * *

THE "ELLIPSO" OSCILLATING FAN.

The "Ellipso" oscillating fan, illustrated herewith, is the product of Messrs. Berkeley & Young, Ltd., Birmingham, who claim that its elliptical movement is obtained by the simplest gear yet evolved. This movement is secured through a simple traversing mechanism constituted by a single link which is connected to and rotates with a slow motion shaft. This link is anchored by a universal ball joint to a fulcrum fixed to the



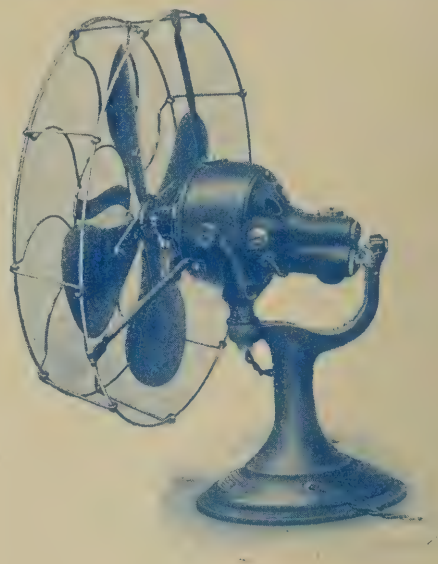
The "Ellipso" Oscillating Fan.

base. The reducing gear that transmits the drive from the motor shaft to the slow motion shaft is contained in a simple gear box integral with the motor end casing. One end of the slow motion shaft is located outside the gear box for the hinging and the single link, which is constructed to turn crankwise and is simultaneously capable of increasing or decreasing its angularity with respect to its slow motion shaft, thereby giving an elliptical traverse. A very simple and efficient friction clutch is also embodied. It is supplied with 12-in. blades for either a.c. or d.c. supply.

* * *

THE "ORBIT" ELECTRIC FAN.

Manufactured by Messrs. Veritys, Ltd., Birmingham, this fan is constructed along rather novel lines, and is distinctly pleasing in appearance. It is made for both a.c. and d.c. supply, and has a wide range of oscillating movement in all directions. An efficient and sensitive slipping clutch is provided, making it impossible to damage any part of the fan or gear should any obstruction be encountered during the oscillating action. The double worm reduction gear consists of hardened steel worm and phosphor bronze wheels, whil



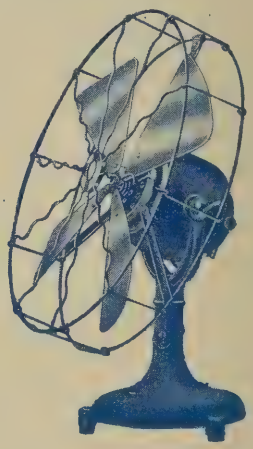
The "Orbit" Fan.

the gear box is totally enclosed and dustproof. No bal joints are used in the driving mechanism. The curren consumption is low, being only 30 watts for a 12-in size fan.

* * *

THE "EDISWAN" TYPE H.326/333 FAN.

Manufactured by the Edison Swan Electric Co., Ltd. London, this appliance is for working off direct cur rent, and it can be obtained mounted as either a tabl or a bracket fan. The motor is of the ventilated type with efficient lubrication, ensuring a low-tempera ture rise after prolonged runs. In this convertibl



An "Ediswan" Fan.

bracket pattern the complete motor is supported o trunnions, and the pedestal specially jointed to permi of wall mounting when desired. This conversion i easily accomplished by means of one screw, and in con junction with the trunnion bearing enables cool air t be delivered in any direction. A 3-speed regulator i fitted in the base. The motor and pedestal are finishe in black enamel, while the blades and guards are c polished and lacquered brass.

Selling Lines for Retailers.

THE "SUNVIRAY" U-V RAY LAMP.

Manufactured by Messrs. Ajax, Limited, London, this ultra-violet ray (artificial sunlight) lamp is intended for use in mild cases, and can be used in the home equally as well as the surgery. It is supplied with a quick-break switch, which prevents arcing, and separate plug holes are provided for the different voltages, 110 and 220, each of which gives a wide margin for other voltages. When switching on the current, the arc is



The "Sunviray" U-V Ray Lamp.

immediately struck, and the burner will function automatically until the carbons, which are tungsten-cored, are burned out. It is constructed to consume a current of 4 to 5 amps., and consequently can be used on any ordinary circuit. It does not overheat, and a special cooling device is arranged over the resistance unit by which there is free circulation of air for cooling purposes. The radiation is sufficient to cover the whole of the body at a distance of little more than 2 feet. Our illustration shows the portable model.

CASTLE TERMINALS.

There are still a considerable number of people who prefer making their wireless sets to purchasing the commercial article, and there are many who like to experiment in construction. Among the necessities of



(a) "Castle" Spade Terminal.

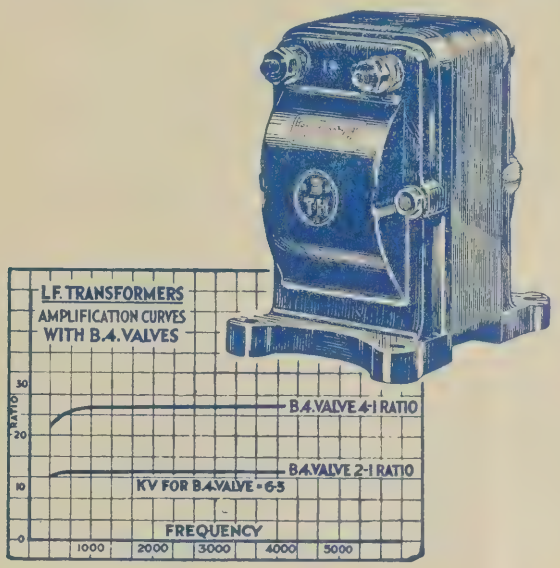


(b) "Castle" Wander-plug.

these people are terminals and other small gadgets, and there is usually a steady sale for these. The spade terminal and wander-plug illustrated herewith are the products of Messrs. T. L. Castle, London, who specialise in this class of work. They are made of standard brass, machined turned, and are designed with a view to saving both time and trouble.

"B.T.-H." L.F. TRANSFORMERS.

When the l.f. amplifying valves of a wireless set are transformer-coupled, it is important that the transformers should have no resonance peaks. This object is achieved when the windings of the transformers are correctly designed and their impedance is as near as



"B.T.-H." L.f. Transformer and Characteristic Curve.

possible to that of the valves used. "B.T.-H." l.f. transformers have been designed with this end in view. They are of the iron-cored, power type, and heavy gauge wire is used, this enabling large currents to be carried without fear of breakdown. The windings and core are correctly proportioned and are protected against atmospheric effects and mechanical damage by a casing of "Abrolite"—a high quality insulating compound. They are made by the British Thomson-Houston Co., Ltd., Rugby, in two ratios, 2 : 1 and 4 : 1, the lower ratio being recommended for use in the input stage and the higher ratio for use in the intermediate position.

THE BASTIAN HOT PLATE.

As may be seen from our illustration, this domestic apparatus is constructed much along the usual lines, al-



The "Bastian" Hot Plate.

though the interior arrangements differ and may be considered an improvement. The elements are of new pattern

Quartzalite, and water can be spilt over them with no likelihood of the apparatus being damaged. They are fitted to the cast-iron plate which forms the hotplate itself. They are easily removable and, if the quartz tube is undamaged, they can be rewired at a very low cost. It is made in three sizes by the Bastian Meter Co., Ltd., London.

THE "SWANLITE" GLASSWARE UNIT.

A series of tests have recently been carried out by the Edison Swan Electric Company, Ltd., London, to determine the distribution of light from their "Swanlite" enclosed glassware units. Two units, each equipped with 200-watt gasfilled lamps, were mounted at a height of nine feet above the working plane; the spacing between the units was twelve feet, and the intensity of light from each was checked at progressive distances of one foot from points immediately beneath them. In



"Swanlite" Glassware Unit.

each case the maximum intensity was 5-foot-candles, and the minimum intensity 1.25-foot-candles. The illumination was fairly even, the maximum variation being 0.5-foot-candles. As may be seen from the illustration, the unit is of the flat type, and the maximum intensity is therefore in a downward direction. It is specially suitable for the illumination of shops and stores where goods are displayed on counters, or on shelves with a height slightly less than the mounting height of the units.

"UNIVERSAL" TEST AND BATTERY CLIPS.

Manufactured by the L.P.S. Electrical Co., Ltd., London, the "Universal" test and battery clip is a stamped metal spring clip designed to facilitate the making of temporary electrical connections. It is non-corrodible, has a wide spread of jaw, and is fitted with a strong spiral spring which ensures a perfect electrical connection. It is made in two types: one for battery charging and one for small radio work. The battery-charging clips are heavily coated with lead to resist acid fumes, and are fitted with a copper shunt to prevent current passing through the spring. The small radio clips have strong springs and will grip accumulator pillars firmly. They may be used for accumulator or h.t. battery connections, tappings on transmitting inductances, and so on.

THE "UNIPIVOT" POINTER GALVANOMETER.

In this instrument, the movement is enclosed in an aluminium case, combining lightness with strength, and the compact design renders it easily portable, so making it very useful for laboratory work. Normally, the movement is insulated from the case but the instrument can be supplied with the case con



The "Unipivot" Pointer Galvanometer.

nected to the movement, thus enabling it to be used with a thermal junction as a wave-meter for wireless purposes; a zero adjustment and a coil-clamping device are fitted. It can also be adapted for use as an accumulator tester and as a cell-testing voltmeter. The scale, which has a length of about 75 millimetres, may be calibrated or uncalibrated as desired. Standard ranges vary from 0 to 24 microamperes to 0 to 1,200 millivolts. It is manufactured by the Cambridge Instrument Co., Ltd., London.

A NEW DESIGN OF CEILING SWITCH.

The single cord ceiling switch illustrated herewith has recently been produced by Messrs. J. A. Crabtree & Co., Ltd., Walsall. In this fitting a single cord performs both the function of switching on and switching off the

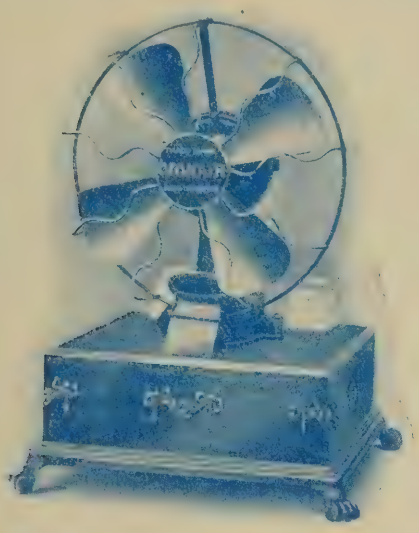


A Crabtree Ceiling Switch.

current, a single pull being all that is necessary. A cord of any desired length can be quite simply inserted in the switch acorn. The fitting is made in several finishes, and with either a flat base switch or a semi-recessed switch.

"OZONAIR" SEMI-PORTABLE FAN.

This type of electric fan, which also purifies and deodorises the air, has been specially designed for general use. It is solidly constructed, and is suitable for purifying the air in large rooms, offices, and so on, in addition to private houses. The apparatus consists of an ornamental metal base finished in oxidised copper. The generator, transformer, &c., are contained in the base. The air inlet is provided with a renewable metal



The "Ozonair" Semi-Portable Fan.

gauze air filter. Behind the fan pedestal are mounted two fuses, and between these a four-way revolving-action switch, which permits of regulating fan only, ozone strong, ozone weak, and off. It is manufactured by Ozonair, Limited, London.

THE "ADNIL" PRESS-BUTTON SWITCH.

Robustness and durability are the prominent features of this switch, which is manufactured by Messrs. S. G. Beach & Co., Ltd., London. It is constructed entirely of "Ebolite," a highly-polished insulating material of jet black colour, and its one spring is made of special phosphor-bronze; the press buttons are not screwed on, but are permanently fitted and cannot be detached

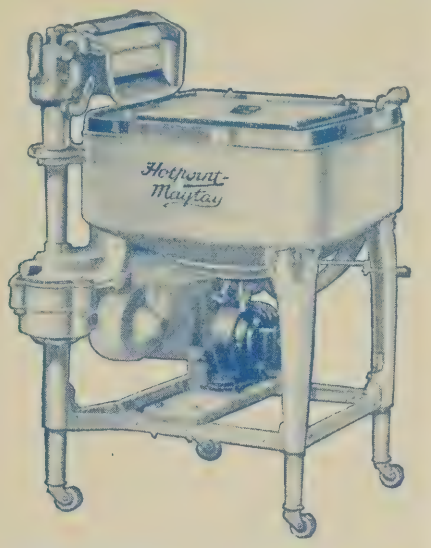


The "Adnil" Press-Button Switch.

and lost. To open and to close the switch, a slight push only is required, and no trouble is experienced on account of the switch or block working loose. To close the switch, the button marked with the white spot is pushed. Each switch is carefully tested for jigging, and is supplied complete with the necessary number of black-headed fixing screws.

THE "HOTPOINT-MAYTAG" WASHING MACHINE.

This electrically-driven machine has been constructed with a view to mechanical simplicity. The drive is situated beneath the tub and works the washer, placed in the bottom of the tub, by means of a crankshaft. It works on the "gyrafoam" principle, and has a capacity of 50 lb. of family washing per hour. The tub is of aluminium, and is easily adjustable to any height. Another feature is the metal, swinging wringer attached

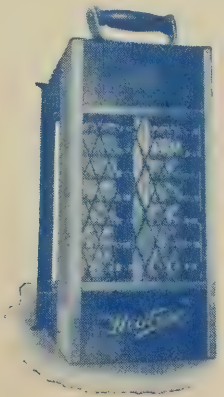


"Hotpoint-Maytag" Washing Machine.

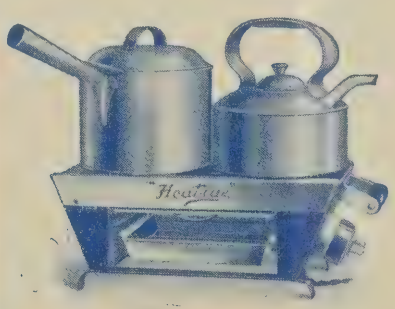
to the machine. This swings into seven positions, adjusts itself automatically for handkerchiefs or blankets, and has an automatic drainboard. The suppliers are the Hotpoint Electric Appliance Co., Ltd., London.

"HEATRAE" COMBINED COOKER AND HEATER.

This domestic apparatus should find a ready sale among residents of small houses or flats. As can be seen from our two illustrations, it can be used either as a breakfast cooker or as a radiator, the necessary change-over being slight. Grilling and toasting can be done simultaneously, and it can also be used for boiling and simmering. It is strongly made in steel and



(a), as Heater.



(b), as Cooker.

The "Heatrae" Combined Cooker and Heater.

aluminium, has no breakable cast parts, and is attractively finished in stove black enamel and polished aluminium, with a wood grip lifting handle. It is made by Electric Fires, Ltd., Norwich, with either two or three spiral elements.

Stock-Keeping for the Electric Shop.

By ERIC N. SIMONS (Author of "Successful Retailing", &c.)

IN keeping stock of electrical goods systematically, a proper storage classification scheme should be instituted. It is important to know at a glance: (1) exactly what the goods are; (2) what quality they are; (3) whose make they are; (4) where they are kept.

The only way in which this information can properly be given is by means of a recording system that embodies letters and numbers as symbols. Thus, a stack of shelving could be divided into vertical sections each vertical section being designated by a letter of the alphabet. In each of these vertical sections a certain class of goods would be kept, *e.g.*, wireless valves, and so forth. In each horizontal section—since each vertical section would be sub-divided into horizontal sections—would be kept a particular kind of wireless valve. Each of these horizontal compartments would be numbered. Thus, No. 1 section might carry bright valves, No. 2 dull emitters. In each horizontal section (where the class of goods made it desirable) there would be a number of drawers, boxes, or whatever kind of bin or receptacle might be employed, and in each of these would be kept the valves of a particular brand. These receptacles would also be lettered.

If, therefore, the stock-keeper wished to send down to the sales counters a dozen Mullard dull emitters, he would examine his stock record and find an entry something after this style: "A,2.c." He would at once go to vertical stack A of his shelves, and take out of horizontal section No 2 the drawer labelled "c," in which he would find the valves he wanted. It might be regarded as desirable to record the capacity or contents of each drawer, which could be done by adding a further numeral. Thus, A.2.c.36 would mean that drawer "c" either could contain or actually did contain 36 Mullard valves.

In storing goods, those likely to be most often withdrawn and replenished should, for preference, be kept near the entrance. Heavy articles should be stored on the floor, or on the lower shelves, so that the labour of lifting is minimized. Goods sold by measurement, *e.g.*, wire, should be stored where there is room to measure off the necessary lengths. The goods should travel progressively from stock to counter, which means that the goods which have been longest in stock should automatically be the first to go down to the sales counters on demand. For this reason, the shelves or compartments should, where possible, be so arranged that new consignments can be distinguished from existing stock. This enables the stock keeper to dispose of the old stock before drawing on the new.

Articles of fair length should for preference be stored in racks. Small oddments can be safely kept in bins which should be clearly labelled with contents and capacity. Goods likely to be damaged by dust or damp should be re-wrapped if the old wrapping has burst or worked loose. When cold, damp, dryness, or heat, are likely to affect articles, the latter should be carefully protected. Above all things, the stock room should be adaptable to the varying needs of the business. Stocks and their character change constantly, and if the stock system is too rigid in its arrangement the recording system will be thrown out of gear.

To indicate the prices at which they are to be sold goods should be marked in code. These codes consist of groups of ten different letters, each letter standing for a number. The group is easily remembered by stock-keeper and assistants if it makes up a simple word or phrase. For example, "the lazy fox" would serve excellently as a price code.

* * *

New Sales Literature and Catalogues.

MESSRS. L. McMICHAEL, LTD., Wexham Road, Slough, Bucks.—A circular letter dealing with the company's radio apparatus and a blotter and leaflet (priced) advertising the "Dimic Three" receiving set.

SADIA, LTD., 30, Ely Place, E.C.1.—List H, containing illustrated details of "Sadia" water heaters and auxiliary equipment, with prices and particulars of running costs. Also a folder upon the same subject.

MESSRS. YOUNG & WILDSMITH, LTD., 20, Bloomsbury Street, W.C.1.—A net trade price list of electrical materials, accessories, and appliances.

MESSRS. GARNETT, WHITELEY & CO., LTD., Lotus Works, Broadgreen Road, Liverpool.—A series of leaflets dealing with "Lotus" radio components, including a remote-control system. Illustrated and priced.

THE MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—Coloured showcards illustrating various types of "Sterling" variable and fixed condensers, and examples of transformers and chokes.

MESSRS. WARD & GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester.—List No. E.12, describing battery eliminators for radio work, including valve, electrolytic, and d.c. types. Priced and illustrated.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—May price sheet of electrical materials, appliances and accessories.

MESSRS. FREDERICK J. GORDON & CO., LTD., 92, Charlotte Street, W.1.—A priced and illustrated catalogue of the leading makes of accumulators and dry batteries and accessories.

THE HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, E.15.—A purse folder containing an attractive pamphlet giving prices and details of "Hart" radio batteries.

MESSRS. COURTNEY, RUSSELL & CO., 65a, Holborn Viaduct, E.C.1.—A leaflet illustrating five examples of crystal electric lighting fittings.

THE EDISON SWAN ELECTRIC CO., LTD., 123-125, Queen Victoria Street, E.C.4.—This company has sent us a complete set of its catalogue section in a tidy binder. The sections are well illustrated and priced, and cover lamps, lighting fittings, fans, heating and cooking apparatus, instruments and meters, batteries, accessories, d.c. and a.c. motors, and radio apparatus.

BERRY'S ELECTRIC, LTD., 85-86, Newman Street, Oxford Street, W.1.—Two pamphlets giving particulars and prices of the "Wilton" fire and the "Fleur-de-Lis" basket and dogs. The illustrations show these to be handsome additions to the "Magicoal" series.

MR. ALLAN WRIGHT, 124, Chancery Lane, W.C.2.—A booklet containing particulars and prices of "Inventum" electric water-heating appliances.

THE WESTON ELECTRICAL INSTRUMENT CO., LTD., 15, Great Saffron Hill, E.C.1.—A priced and illustrated booklet dealing with the company's voltmeters, milliameters, galvanometers and so on, for wireless purposes.

Trade Notes and News.

The Secretary of the Radio Manufacturers' Association has sent us particulars relating to the National Radio Exhibition, which is to be held from September 24th to October 1st. Full details will be published in a later issue, but in the meantime it is interesting to note that the stand positions will be allotted by ballot among firms whose applications are received by June 14th. The primary ballot will be for exhibitors at the 1926 exhibition.

* * *

From Messrs. Ajax, Limited, we have received a copy of a book published by them entitled "*Sunlight*" *Treatment*. This deals in a practical manner with the medical benefits of ultra-violet irradiation, and gives a list of the maladies that definitely yield to this treatment, and the correct method of treatment in each case. Authoritative articles deal with the benefits of treatment, skin effects, and so on, and the book concludes with a description of the various U-V ray apparatus manufactured by Messrs. Ajax, Ltd. The book is priced at 1s. 6d.

* * *

Mr. A. W. Saulter has granted a sole licence to Messrs. Hugh Stevenson & Co., Ltd., Manchester, for the manufacture of his patent coiling device.

* * *

The General Radio Co., Ltd., has purchased Radiobats, Ltd., and has thus secured control of an English high-tension radio battery factory producing 7,500 cells per week.

* * *

A company known as Lectro Linx, Ltd., has been formed with offices at 1, 2 and 3, Ashley Mansions, Vauxhall Bridge Road, S.W.1, to undertake the exploitation of the "Clix" specialities.

* * *

Two local exhibitions of electrical domestic appliances and radio goods, one at Dover and one at Deal, were recently held by Mr. C. O. Clark, a well-known electrical retailer in those towns. The two exhibitions were a great success, being visited



by more than 3,500 people in four days, and a large number of orders were taken for radio sets, electric lighting fittings, cooking apparatus, and vacuum cleaners. Our illustration shows one of the radio stands.

* * *

Messrs. Weight & Bradley, wireless engineers, have opened premises at 14, Cross Street, Reading.

* * *

The County Electrical and Wireless Stores, Ltd., Deal, has closed its premises at 7, South Street, and the business will now be carried on at 19, High Street.

* * *

Messrs. A. Emanuel & Sons, Ltd., have opened a new electrical fittings showroom at 9, George Street, Manchester Square, W.1. A very wide selection of lighting fittings is on view.

Messrs. Hough Bros., radio engineers, have opened premises in High Street, Huntingdon.

* * *

The Mullard Wireless Service Co., Ltd., has opened a new depôt at 13, Deansgate, Manchester. The depôt will carry large stocks, and is under the management of Mr. Y. W. P. Evans.

* * *

Mr. J. E. Dawson, radio engineer, has opened new showroom premises at the corner of High Street, Boston.

* * *

Messrs. Curry's, Ltd., dealers in wireless and electrical goods, have opened a new branch business at 61, Hallgate, Doncaster.

* * *

The Fulham Electricity Department is to make an immediate start on the erection of new showrooms on the Fulham Road site. The total cost is estimated at £13,000.

* * *

We learn that the Nantwich Electrical Co. has recently opened new premises at 4, Church Lane, Nantwich.

* * *

The Bristol Electricity Department has made arrangements to give demonstrations in electric cooking at its showrooms. Bristol electrical retailers should benefit from this.

* * *

The new works of ELECTROLUX, LTD., at Luton, were formally opened by Sir Robert Horne, K.C., M.P., on May 18th. A large and distinguished company, including many well-known electrical men, journeyed down from London to attend the ceremony. The various processes connected with the production of the "Electrolux" refrigerators and vacuum cleaners were inspected. The output of both of these specialities is already considerable, but it will be doubled in the course of a few weeks.

* * *

We are informed by the Midland Electric Manufacturing Co., Ltd., that the prices of "Memette" switches have been considerably revised.

* * *

Pritchett & Gold and E.P.S. Co., Ltd. (in which is incorporated Peto and Radford) have appointed Mr. F. H. Durrant as their district representative for Northants, Beds., Berks., Bucks., Herts., and Oxfordshire.

* * *

A "Brighter Homes" Exhibition is to be held in the Music Hall, Aberdeen, from September 30th to October 11th. The exhibits will embrace heating, cooking, lighting, and labour-saving appliances.

* * *

Mr. F. Sandler, wholesale electrical and wireless factor, has removed to larger premises at 2, Mayes Street, Shudehill, Manchester

* * *

Mr. Leonard J. Ive, electrical and wireless engineer, has opened new showroom premises at 11, The Parade.

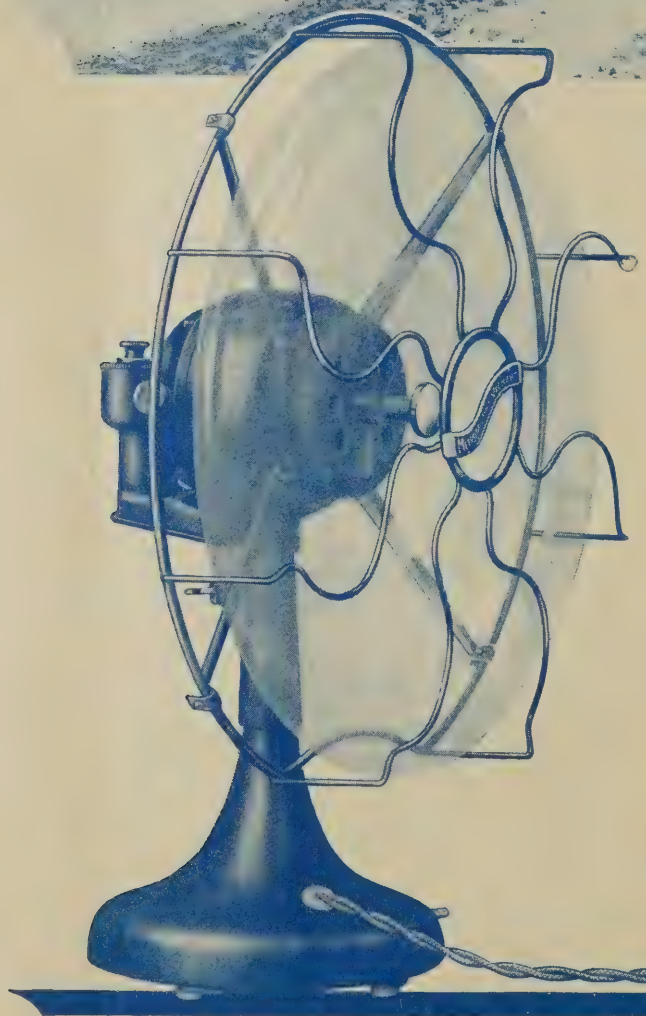
* * *

"One step won't take you very far,
You've got to keep on walking.
One word won't tell folks who you are
You've got to keep on talking.
One inch won't make you very tall,
You've got to keep on growing.
One little ad. won't do at all,
You've got to keep 'em going."

From "The Stamp Collector's Fortnightly."



LLANBEDROG MOUNTAIN, NR. PWLLHELI
Photograph by kind permission of L.M. & S. Railway



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When thoughts turn instinctively and without effort to holidays and holiday resorts, that is the time to think also about the selling of electric fans. Our summer is elusive and all too brief, but profitable business is done by those Electrical Retailers who are prepared with an adequate stock of :–

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"Cosmos" Fans are efficient and dependable

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155 Charing Cross Road, London, W.C.2

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THE ELECTRICAL REVIEW

TRADE NAMES SUPPLEMENT

. 5. JUNE, 1927.

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THE "ELECTRICAL REVIEW" TRADE NAMES SUPPLEMENT.

Name and Description.	Manufactured by or Obtainable from.
ABBOTT BRAND Empire cloths and tapes in silk and cambric, pressphan, leatheroid, &c.	Abbott, Anderson & Abbott, Ltd., 17, Fore St., E.C.2.
ACCIDENT PROOF Kettles	Premier Electric Heaters, Ltd., Keeley St., Watery Lane, Birmingham.
A.C.E.C. Cables, electrical machinery, transformers	A.C.E.C., 56, Victoria St., London, S.W.1.
ACID PROOF BLACK Acid-proof insulating black enamel	W. W. Hill, Son & Wallace, Ltd., Broughton, Manchester.
ACME Patent automatic time switches, lanterns for street lighting, "Acme," "Goliath," and "Edison" screw lamp-holders	The "Acme" Lighting & Engineering Co., Waverley Rd., St. Albans, Herts.
ACME Motor starting switches	Acme Electrical Mfg. Co., Tariff Rd., N.17.
A.D. Primary cells	Le Carbone, Coventry House, South Place, E.C.2.
ADANAC Switch with fuses	Berry's Electric, Ltd., 85-86, Newman St., Oxford St., W.1.
ADAPTABLE Earthing clip	Hann & Ingle, 13, Albert Place, Bridge St., Manchester.
ADJUSTABLE Adaptor (two pin to B.C.)	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
ADNIL Press-button switches of "ebolite"	S. G. Leach & Co., Ltd., 26-30, Artillery Lane, E.1.
ADVANCE Flush and semi-recessed plug connectors	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
AEROFLEX Rewirable cartridge fuses with high-rupturing capacity	Parmiter, Hope & Sugden, Ltd., Vernon St., Longsight, Manchester.
AIRMAX Inductance coils	J. Dyson & Co., Ltd., 5 & 7, Godwin St., Bradford.
AJAX Ultra-violet ray (artificial sunlight) lamps and all electro-medical and hairdressing trade apparatus	Ajax, Ltd., 117, Central St., E.C.1.
ALKLUM Batteries (nickel-steel type)	Worsnop & Co., Ltd., Carlton Works, Halifax.
ALTON Storage batteries	The Alton Battery Co., Ltd., Alton, Hants.
AMPLION Loud speakers	Graham Amplion, Ltd., 25-26, Savile Row, London, W.1.
ANCALITE Electric cable and public speech equipment	Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.
ANCHORA Wood poles for transmission lines ...	Armstrong, Addison & Co., 17, North Bridge St., Sunderland.
ANTI-BREAK Anti-vibration disc	Engineering & Lighting Equipment Co., Sphere Works, St. Albans, Herts.
ANTI-SULPHURIC Enamel	Griffiths Bros. & Co., London, Ltd., Macks Rd., S.E.16.
APEX Switchgear and fusegear	Foster Engineering Co., Ltd., Morden Works, Wimbledon, S.W.19.
ARCOVITE Arc shields, mouldings, sheets and tubes	Siluminite Insulator Co., Ltd., The Green, Southall, Middlesex
ARGENTA Lamps	Philips Lamps, Ltd., 145, Charing Cross Rd., W.C.2.
ARMACELL Insulating varnish	Griffiths Bros. & Co., London, Ltd., Macks Rd., S.E.16.
ARMORDUCT Vacuum cleaners, wires and cables	Armorduct Cable Co., Ltd., 159, Westminster Bdge. Rd., S.E.
ARORA Electric fires, electric kettles, electrical cooking apparatus, industrial electric heaters	Arora Co., Rosebery St., Loughborough.
ARROW The complete line of wiring devices, reciprocating heating switches, &c.	S. G. Leach & Co., Ltd., 26-30, Artillery Lane, E.1.
ARTIC Electric light fittings, switchboards, and ironclad distribution gear	Artic Fuse & Electrical Mfg. Co., Ltd., Birtley, Co. Durham.
H. E. ASHDOWN (BIRMINGHAM), LTD. "Bakelite" mouldings	H. E. Ashdown (Birmingham), Ltd., Perry Barr, Birmingham.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
A.T.E.A. Telephone, *e.g.*, apparatus, measuring instruments, electricity meters	W. F. Dennis & Co., 70, Queen Victoria St., London, E.C.4.
ATLAS Leclanché batteries	Atlas Carbon & Battery Co., Ltd., 56, Southwark Bridge Rd., S.E.1.
A.T.M. IN CIRCLE Telephone and telegraph equipment	Automatic Telephone Mfg. Co., Ltd., Strowger Works, Milton Rd., Edge Lane, Liverpool.
AUTO Thermal-type sign flashers ...	Attracta Electrical Co,. 2 & 3, Titchfield St., Dean St., W.1.
AUTO-COMBINATION Tumbler switch plugs	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
AUTONOFF Time switch	Venner Time Switches, Ltd., 45, Horseferry Rd., S.W.1.
AUTOREELITE Combined spot light, trouble light, and portable light for motor-cars	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
AVERY Boiler scales, totalisers and coal weighers	W. & T. Avery, Ltd., Soho Foundry, Birmingham.
AVERY Water weighers, weighing machines, coal meters	W. & T. Avery, Ltd., Soho Foundry, Birmingham.
AVOMETER Combined measuring instrument for amps, volts, and ohms	Automatic Coil Winder & Electrical Equipment Co., Wellington House, Buckingham Gate, S.W.1.
A.W.P. Electric welding supplies	Alloy Welding Processes, Ltd., 14-16, Church St., N.1.
BAA Accumulator acid	F. W. Berk & Co., Ltd., Abbey Mills Chemical Works, E.15.
BAKELAQUE Insulating material	Attwater & Sons, Hopwood St. Mills, Preston.
BAKELITE Insulating varnish	Attwater & Sons, Hopwood St. Mills, Preston.
BAKELITE Mouldings and insulating material	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
BAKELITE Laminated	Mouldensite, Ltd., Darley Dale, Derbyshire.
BAKELITE Moulding powder	The Damard Lacquer Co., Ltd., 82, Victoria St., S.W.1.
BAKELITE Moulding powder	Mouldensite, Ltd., Darley Dale, Derbyshire.
BAKELITE Moulding powder	Redmanol, Ltd., 82, Victoria Street, S.W.1.
BAKELITE Varnishes	The Damard Lacquer Co., Ltd., 82, Victoria St., S.W.1.
BAKELITE Varnishes	Mouldensite, Ltd., Darley Dale, Derbyshire.
BALLSOK Patent insulating beads	Lionel Robinson & Co., 3, Staple Inn, W.C.1.
BATTERSEA Carbon brushes	Morgan Crucible Co., Ltd., Battersea Works, Church Rd., S.W.11.
BATWIN Motors	Power Contracts, Ltd., 138-140, Southwark St., S.E.1.
B.C.M./A.T.M. Telephone and telegraph equipment	Automatic Telephone Mfg. Co., Ltd., Strowger Works, Milton Rd., Edge Lane, Liverpool.
B. & D. Electric drills	Gerrard & Co., Ltd., 15-19, Gt. Tichfield St., W.1.
BEANCO Switches	Baxendale & Co., Ltd., Miller St., Manchester.
BEANCO Dry cells	Baxendale & Co., Ltd., Miller St., Manchester.
BEANCO Lampholders	Baxendale & Co., Ltd., Miller St., Manchester.
BECOL Ebonite (made to Government specification)	British Ebonite Co., Ltd., Nightingale Rd., W.7.
BECOLATE High-temperature insulation material (made to Government specification)	British Ebonite Co., Ltd., Nightingale Rd., W.7.
B.E.L. Violet-ray high frequency and radiant heat apparatus	Bower Electric (1926), Ltd., 27, Ridinghouse St., Gt. Portland St., W.1.
B.E.L.L. Decorative and special lamps of all types, double-ended tubular lamps for reflector fittings, candelabra, &c.	British Electric Lamps, Ltd., Spencer Hill Rd., S.W.19.
BELLEROID Insulators	Barrett & Elers, Ltd., Dace Rd., E.3.
B.E.M. Motors	Brittain's Electric Motor Co., Eastdown Works, Dermody Rd., Lewisham, S.E.13.
BENCO Heavy duty B.C. & E.S. lampholders	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
BENCOLITE Ornamental glass lighting unit for commercial installations	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
BENGRIP B.C. adaptors with special cord grip features	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
BENJAMIN Reflectors, industrial signals, automobile accessories, wireless, &c.	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
BENJAMIN CLEARER TONE Anti-microphonic valve holders ...	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17
BERLINER Automatic and telephone apparatus	Shipton Automatic Telephone System, Ltd., 37, Tothill St., S.W.1.
BERRITE Insulations and varnishes, joint box and sealing compound	Berrite, Ltd., Yiewsley, Middlesex.
BERRY Transformers	British Electric Transformer Co., Ltd., Hayes, Middlesex.
BIBBY Couplings and air filters	Wellman Bibby & Co., Ltd., Victoria Station House, Victoria St., S.W.1.
BI-POLE Tumbler switches and switch plugs	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
BIFLECTOR Reflector fitting	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
B.K.B. All classes of motors for d.c. and a.c. battery chargers for garage and house use, a.c. and d.c. generator sets, &c.	B.K.B. Electric Motors, Ltd., 200, High Holborn, W.C.1
BLACKFRIARS Adhesive tape	Spicers, Ltd., 19, New Bridge St., E.C.4.
BLACKLEY Tape	Connolly's (Blackley), Ltd., Blackley, Manchester.
BLAKE Insulated staples	Mosses & Mitchell, Ltd., 122-124, Golden Lane, E.C.1.
BLUE LABEL Dry cell	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
BOTRADE Switches and distribution boards ...	S. Bill & Co., Ltd., Queen's Rd., Aston, Birmingham.
BOYCE MOTO-METER Radiator temperature indicator ...	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17
BRIGHTRAY Nickel-chrome resistance material ...	Henry Wiggin & Co., Ltd., Wiggin St., Birmingham.
BRITMAC Switches and lampholders	T. M. Johns & Co., Ltd., Station Rd., Plymouth (Distributors).
BRITMAC Tumbler switches and lampholders	C. H. Parsons, Ltd., Britannia Works, Tyseley, Birmingham
BRITTAIN Motors	Brittain's Electric Motor Co., Eastdown Works, Dermody Rd., Lewisham, S.E.13.
BROWN-BOVERI Automatic pressure regulators ...	British Brown Boveri, Ltd., Trafalgar House, Waterloo Place, S.W.1.
BRUSH Tramcars, tramcar trucks, motor-'bus bodies	The Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough.
BRUSH Transformers, motors and generators, liquid starters	The Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough.
BRUSH-LJUNGSTROM Steam turbo-generators	British Electrical Engineering Co., Ltd., Falcon Works, Loughborough.
BRUSTON Electric lighting plants, pumps, and refrigerators	G. C. Pillinger & Co., 53, Victoria St., S.W.1.
BULL Motors	E. R. & F. Turner, Ltd., Ipswich, England.
BUSY BEE Vacuum cleaner	Drake & Gorham Wholesale, Ltd., 67, Long Acre, W.C.2.
CABLEGRIP Cable boxes	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
CAB TYRE Cab tyre sheathed wires and cables	St. Helens Cable & Rubber Co., Ltd., Slough.
CAB TYRE Electric cables	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, London, E.C.1.
CABTYRIT Corrosion-resisting rubber	St. Helens Cable & Rubber Co., Ltd., Slough.
CADURO Cadmium copper wire for trolley and transmission purposes	Richard Johnson & Nephew, Ltd., Bradford Iron Works, Manchester.
CALLENDER Electric cables of all types	Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.
CAMBRIDGE Instruments	Cambridge Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
CASSIRER Cables and flexibles	Richards, Longstaff & Co., Ltd., 52, Gracechurch St., E.C.
C.A.V. Batteries and other electrical equipment, for cars and commercial vehicles, radio productions and l.t. and h.t. batteries	C. A. Vandervell & Co., Ltd., Acton Vale, W.3.
CECIL Resistances, fan regulators, dimmers	Mansell & Ogan, Ltd., 15-17, Cecil St., Charing Cross R. W.C.2.
CELEC Sliding resistances, dimmers, arc resistances, and charging boards	Curtis Mfg. Co., Ltd., Conduit Place, W.2.
CELERITY Rail grinders	Equipment & Engineering Co., 2 & 3, Norfolk St., W.C.
CENTRAL Electric vacuum cleaner with revolving brush	C.C.A. (Vacuum Cleaners), Ltd., "Swinton House," 322 Gray's Inn Rd., W.C.1.
CENTRALETTE Electric vacuum cleaner with fixed brush	C.C.A. (Vacuum Cleaners), Ltd., "Swinton House," 322 Gray's Inn Rd., W.C.1.
CENTURY D.C. volt ammeter test set	Elliott Bros. (London), Ltd., Century Works, Lewisha S.E.13.
C. & H. Electricity meters and instrument transformers	Chamberlain & Hookham, Ltd., Solar Works, New Barthc mew St., Birmingham.
C.H. Hand-operated and self-acting electric motor controlling apparatus and wireless components	Igranic Electric Co., Ltd., 149, Queen Victoria St., E.C.4
CHARPEEB Electric fans and irons	Charlesworth, Peebles & Co., 5, Eden St., Hampstead R N.W.1.
CHASLYN S.O.S. AND VENT TYPE Hydrometer with gravity balls ...	J. H. Collis & Co., 10, Canning Place, Liverpool.
CHLORIDE Storage batteries	The Chloride Electrical Storage Co., Ltd., Clifton Junctı near Manchester.
CIRSCALE Electrical measuring instruments ...	Record Electrical Co., Ltd., Broadheath, Altrincham, Cheshi
CITY Motors	City Electrical Co., 1, Emerald St., W.C.1.
CLARITONE Loudspeakers and headphones ...	Automatic Telephone Mfg. Co., Ltd., Milton Rd., Edge La Liverpool.
CLASSIC Pulpit, desk, piano and organ fittings	The Lodge Fittings Co., Ltd., 57, Albert Rd., Aston, I mingham.
CLEARER TONE Anti-microphonic valve holders ...	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.
COCUSITE Moulded bakelite material for accessories	A. P. Lundberg & Sons, Pioneer Electrical Works, Parac Passage, Sheringham Rd., N.7.
COLEC A system of heating combining central heating with electricity for topping up	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W
COMPACTUM 2-valve set	The Edison Swan Electric Co., Ltd., 123-5, Queen Victc St., E.C.4.
CORNWALL Regulators and dimmers	Donovan & Co., 47, Cornwall St., Birmingham.
COSMOS Cookers, domestic appliances, electric kitchen equipment, &c.	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.
COSMOS Lamps, fires, fans	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.
COSMOS Radiophones, radio valves and wireless apparatus	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.
COXPAR Voltage regulator	Cox-Walker & Partners, Darlington.
CRABTREE Accessories and switchgear	J. A. Crabtree & Co., Ltd., Lincoln Works, Walsall.
CRACORE Twin and three-core solid bitumen cables, cab tyre sheathed trailing cables	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
CRANE WITH ELECTRIC SYMBOL (DESIGN) Electric cranes, &c.	S. H. Heywood & Co., Ltd., Reddish, Stockport.
CREDA Domestic appliances	T. M. Johns & Co., Ltd., Station Rd., Plymouth.
CREDA Heating and cooking appliances ...	Credenda Conduits Co., Ltd., Oldbury, Birmingham.
CRESSALL Resistance nets, regulators, unit heaters	Cressall Mfg. Co., Eclipse Works, 31 & 32, Tower Str Birmingham.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
CROWN Cable, tape and wires	Foster Engineering Co., Ltd., Morden Works, Wimbledon, S.W.19.
CROYDON Searchlight projectors	London Electric Firm, Brighton Rd., South Croydon.
CRYPTO Generators and motors (a.c. and d.c.), constant potential equipments, commutating rectifiers, &c.	The Crypto Electrical Co., Ltd., Acton Lane, Willesden, London, N.W.10, associated with The Lancashire Dynamo and Motor Co., Ltd., Trafford Park, Manchester.
CRYSELCO Electric lamps	Cryselco, Ltd., Kempston Works, Bedford.
CRYSTALATE Insulated fittings	Crystalate Mfg. Co., Ltd., Tonbridge, Kent.
C.T.S. Electric cables	St. Helens Cable & Rubber Co., Ltd., Slough.
C.T.S. Cab tire sheathed electric cables ...	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
CUMULUS Electric water heaters	Nathan & Allen, Ltd., 25, Victoria St., London, S.W.1.
DANIA Dry cells	Atlas Carbon & Battery Co., Ltd., 56, Southwark Bridge Rd., S.E.1.
DECO Control devices for handling plants	Dalyte Electrical Co., Deco Engg. Works, West Row, N. Kensington, W.10.
DEFORNAX Dynamo and motor brushes	J. O. Williamson, 10, Bucknall St., New Oxford St., W.C.2.
DELCO-LIGHT Lighting plants and batteries ...	Frigidaire, Ltd., Chapter St. House, Vauxhall Bridge Rd., Westminster, S.W.
DELTA Bell batteries	Falk, Stadelmann & Co., Ltd., Efesca Electrical Works, 83-93, Farringdon Rd., E.C.1.
DERI Motors, single and multi-phase, variable speed	British Brown Boveri, Ltd., Trafalgar House, Waterloo Place, S.W.1.
DETERGIO Glass brushes for cleaning commutators	J. O. Williamson, 10, Bucknall St., New Oxford St., W.C.2.
DIALITE Electric cables	St. Helens Cable & Rubber Co., Ltd., Slough.
DIAMOND Seal padlocks for slot meters ...	The Tourtel Mfg. Co., 48, Uxbridge Rd., Ealing, W.5.
DIAMOND H Switches, all types, temperature control apparatus	Hart Manufacturing Co., 76-76b, Rochester Row, S.W.1.
DIATRINE Diatrine paper-insulated cable ...	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
DICTOGRAPH House and office telephones.	Dictograph Telephones, Ltd., Aurelia Road, Croydon.
DIM-A-LAMP Portable lamp with dimming device	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
DIM-A LITE Adaptor lampholder with dimming device	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
DISCUS Organ-blowing equipments	Watkins & Watson, 17, White Lion St., Islington, London, N.1.
DISPERSO Hand dust bellows for dispersing dust from machines	J. O. Williamson, 10, Bucknall St., New Oxford St., W.C.2.
DOT Two-pin plug connectors and switch plugs	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
DOWSING'S Electric heating and medical appliances	Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3, and 91-3, Baker St., W.1.
D.P. Storage batteries	The D.P. Battery Co., Ltd., Bakewell, Derbyshire.
DRAGON Loud speakers	Graham Amplion, Ltd., 25-26, Savile Row, London, W.1.
DRAKA Cables	Electric Cables, Ltd., 88, Golden Lane, E.C.1.
DUFLEX Control of the pendulums in existing turret clocks	Gent & Co., Ltd., Faraday Works, Leicester.
DUGDILL'S PATENTS Electric movable fittings	John Dugdill & Co., Hazelgrove, Stockport.
DULCIVOX Loud speaker	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
DUNDEE "A" Adhesive protecting tapes	W. Geipel & Co., Vulcan Works, St. Thomas St., S.E.1.
DUNDEE "B" Adhesive protecting tapes	W. Geipel & Co., Vulcan Works, St. Thomas St., S.E.1.
DUPLEX Two-way tumbler switch with "off" position	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
DUPLEX-A-LITE Scientific lighting unit	L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.
DUREX Electric wiring system for C.T.S. or L.C. cables	Simplex Conduits, Ltd., Garrison Lane, Birmingham.
E Control gear, &c.	Geo. Ellison, Perry Barr, Birmingham.
EBBINITA Mouldings (not fireproof), cheap grade	Siluminite Insulator Co., Ltd., The Green, Southall, Middlesex
EDISWAN Dry batteries	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
EDISWAN Valves	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
EDISWAN HYMEG H.T. accumulators	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
EDISWAN LOTEN L.T. accumulators	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
E. & E. Railway and tramway specialities ...	Equipment & Engineering Co., 2 & 3, Norfolk St., W.C.2
EELEX Small wireless and electrical components and accessories	J. J. Eastick & Sons, 118, Bunhill Row, E.C.1.
EFESCA Switches, batteries, lampholders ...	Falk, Stadelmann & Co., Ltd., Efesca Electrical Works, 83-93, Farringdon Rd., E.C.1.
ELASTRONG Mechanical rubber	St. Helens Cable & Rubber Co., Ltd., Slough.
ELASTUMEN Cable	Johnson & Phillips, Ltd., Charlton, S.E.
E.L.E.C. Industrial lighting fittings	Engineering & Lighting Equipment Co., Sphere Works, St. Albans, Herts.
ELECT Cooking and heating apparatus, ovens, irons, fires, &c.	Electric Heating Co., George St., Croydon.
ELECTRICOAL (HEATRAE) Imitation coal fires	Electric Fires, Ltd., Heatrae Works, Norwich.
ELEPHANTIDE Insulating pressboards	B. S. & W. Whiteley, Ltd., Pool, Nr. Leeds.
ELIMINAIR Feed water deaerator	Richardsons, Westgarth & Co., Ltd., Hartlepool.
ELIXUM Quick make and break switch and fuse, ironclad fuses	Sykes & Dyson, Ltd., Queen's Mill Rd., Huddersfield.
ELLIOTT Electrical measuring instruments of all kinds	Elliott Bros. (London), Ltd., Century Works, Lewisham, S.E.13.
ELLISON Circuit breakers, electric	Geo. Ellison, Perry Barr, Birmingham.
ELLMAR Moulded pressings in bakelite and similar materials, insulating parts, &c.	The Ellmar Mouldings Co., Thimble Mill Lane, Birmingham.
ELTRON Electric hollow immersion heater ...	United British, Foreign & Colonial Agencies, Ltd., Sentinel House, Southampton Row, W.C.1.
ELWELL-PARKER Electric truck	Gillespie Partners, Ltd., Cecil House, Holborn Viaduct, E.C.
EMACO Electric fans, lighting accessories, wireless components	Enterprise Mfg. Co., Ltd., Grape St., Shaftesbury Av., W.C.
EMB Electrical control gear, resistances unbreakable, jointless and rustless, tramways trucks and brakes	The Electro-Mechanical Brake Co., Ltd., West Bromwich.
E.M.C. Electric fans, lighting accessories, wireless components	Enterprise Mfg. Co., Ltd., Grape St., Shaftesbury Av., W.C.
EMPIRE Insulating cloth and tape	Attwater & Sons, Hopwood Street Mills, Preston.
EMVEE Lampholders, switches and general accessories	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.2.
ENA Electric fires, electric heating elements	Ena Electrical Appliances, Ltd., 62, Englefield Rd., N.1.
ENDURAL Special cables and compound ...	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
EQUATORIAL Cable	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
EQUILUXO A special type of glassware	The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.
ERICSSON Telephones and wireless apparatus...	Ericsson Telephones, Ltd., 67-73, Kingsway, W.C.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
ESLA Street lighting equipment	Electric Street Lighting Apparatus Co., The Foundry, Canterbury.
ESSELL Insulating varnished cloth, papers, tapes, &c.	Spicers, Ltd., 19, New Bridge St., E.C.4.
EVER READY Dry cells, batteries, and electric lamps (portable)	Ever Ready Co. (Gt. Britain), Ltd., Hercules Place, N.7.
EVERAY High frequency, violet ray apparatus	I. Calvete, Ltd., 11, Little Saint Andrew St., St. Martin's Lane, W.C.2.
EXAUTO Time switch	Venner Time Switches, Ltd., 45, Horseferry Rd., S.W.1.
EXIDE Storage batteries	The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.
EXIDE-IRONCLAD Storage batteries	Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.
EXPOMETER Exposure meters for automatically controlling ultra-violet ray apparatus	Bower Electric (1926), Ltd., 27, Ridinghouse St., Gt. Portland St., W.1.
EXPRESO Switches and accessories	The General Accessories Co., Ltd., 125, High Holborn, London, W.C.1.
FABROIL Non-metallic gears	British Thomson-Houston Co., Ltd., Rugby.
FAIRYLAND Lighting strip	Imperial Lighting Co. (Implitico), Ltd., 2-6, Pocock St., S.E.1.
FALCO Electrical cooking and heating appliances	The Falkirk Iron Co., Ltd., Falkirk, N.B.
FALCO INDUCER Electrical cooking by induced current, a.c. supply	The Falkirk Iron Co., Ltd., Falkirk, N.B.
FAMOS Vacuum cleaner	T. M. Johns & Co., Ltd., Station Rd., Plymouth.
FAMOUS Electric vacuum sweeper, electrical fittings, cycle accessories	Watson's Wholesale Wireless, 2, Bigg Market, Newcastle-on-Tyne.
F.A.P. Conduit and fittings and accessories	Fitter & Poulton, Ltd., Weston Lane, Greet, Birmingham.
FARRINGDON Bells	Falk, Stadelmann & Co., Ltd., Efesca Electrical Works, 83-93, Farringdon Rd., E.C.1.
FERRANTI Meters, transformers, instruments ...	Ferranti, Ltd., Hollinwood, Lancs.
FERROZOID Nickel-iron resistance material ...	Henry Wiggin & Co., Ltd., Wiggin St., Birmingham.
FERRY Copper-nickel resistance material ...	Henry Wiggin & Co., Ltd., Wiggin St., Birmingham.
FIBRE Insulating materials	Mosses & Mitchell, Ltd., 122-124, Golden Lane, E.C.1.
FIBRESTOS Fireproof sheets	Siluminite Insulator Co., Ltd., The Green, Southall, Middlesex.
F.I.L. High tension suspension insulators	W. Geipel & Co., Vulcan Works, St. Thomas St., S.E.1.
FIREFLY Flameproof white enamel for fuse boxes	W. W. Hill, Son & Wallace, Ltd., Broughton, Manchester.
FIRIMINE Fuse switches	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
FISH-SPINE Admiralty-pattern porcelain insulating beads	Taylor, Tunnicliff & Co., Ltd., 110, Cannon St., E.C.4.
FLAMINGO Electric fires	British Electric Transformer Co., Ltd., The Tricity House, 50, Oxford St., W.1.
FLEXOTUBE Insulated sleeving	John MacLennan & Co., 115, Newgate St., E.C.1.
FLEXTOL Power driven hand tools	S. H. Morden & Co., Ltd., Morden House, 18, Dartmouth St., S.W.1.
FLUVENT Distribution fuse boxes	Parmiter, Hope & Sugden, Ltd., Vernon St., Longsight, Manchester.
FLY Magicoal fire	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
FORMAPEX Insulating varnish, moulding mixtures, miocarta sheet and tubes	Ioco Rubber & Waterproofing Co., Ltd., Netherton Works, Anniesland, Glasgow.
FOSTER Transformers, tanks, sub-station equipment	Foster Engineering Co., Ltd., Morden Works, Wimbledon, S.W.19.
FOSTER Lamps, lanterns and electrical accessories	Foster Engineering Co., Ltd., Morden Works, Wimbledon, S.W.19.
F.R.—B'HAM Copper earth clips and other accessories	F. Ryman, 116, Livery St., Birmingham.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
FRANCIS Lamp lock	Francis Lamp Locks, Ltd., 83, Pall Mall, S.W.1.
FRIGIDAIRE Automatic electrical refrigerator ...	Frigidaire, Ltd., Chapter St. House, Vauxhall Bridge R Westminster, S.W.
FURSE Cinema electrical apparatus, curtain controllers, dimmers, &c.	W. J. Furse & Co., Ltd., Traffic St., Nottingham.
GAMEWELL Fire alarm systems	Standard Telephones and Cables, Ltd., Connaught Hou Aldwych, W.C.2.
GARDY Rotary switches and fuses	Thompson & Co., 1 & 3, Old Swan Lane, E.C.4.
GEAR SHIELD Gear-saving lubricant	Fred. J. Down, 90-93, Fenchurch St., E.C.3.
GECOFIX Electric light fittings of every description	The General Electric Co., Ltd., Magnet House, Kingsw London, W.C.2.
GECORAY Reflectors for shop-window lighting	The General Electric Co., Ltd., Magnet House, Kingsw London, W.C.2.
GEEKODUCT Conduits, fittings and accessories ...	The General Electric Co., Ltd., Magnet House, Kingsw London, W.C.2.
GENACCO Electric lighting accessories	The General Accessories Co., Ltd., 125, High Holborn, Lond W.C.1.
GENII Geysers, water heaters, stills, radiators, air heaters, &c.	Geo. Nobbs, Ltd., 89, Cleveland St., Fitzroy Sq., W.1.
GIANT POLIFLOR Electric floor polisher for institutions and dance halls	C.C.A. (Vacuum Cleaners), Ltd., "Swinton House," 32 Gray's Inn Rd., W.C.1.
GILSONITE Asphaltum	Ashby, Morris, Ltd., 17, Laurence Pountney Lane, E.C.4
GLASGOW-REX Ironclad switches	Midland Electric Mfg. Co., Ltd., Stafford Works, Barford Birmingham.
GLO-CLAD Watertight and gastight electric lighting system	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
GLOVERS Electric wires, cables and lead-covered house wiring systems	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
GLOWRAY Nickel-chrome resistance material ...	Henry Wiggin & Co., Ltd., Wiggin St., Birmingham.
GODWINEX Radio and electrical apparatus ...	J. Dyson & Co., Ltd., 5 & 7, Godwin St., Bradford.
GRAHAM Motor horns, dimmer switches, &c.	Graham Amplion, Ltd., 25-26, Savile Row, London, W.1
GRAHAM Naval telephones, band repeater and docking order equipment	Alfred Graham & Co., Ltd., St. Andrew's Works, Crof Park, S.E.4.
GRAND Electric ironer	L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.
GREENGATE Cables	Greengate & Irwell Rubber Co., Ltd., Greengate Works, ford, Manchester.
GRIPTITE Adhesive tape	Spicers, Ltd., 19, New Bridge St., E.C.4.
GUTTAROID Insulating tape	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
HÆTANIC Nickel chrome high resistance wire	L.P.S. Electrical Co., Ltd., Avenue Rd., Acton, W.3.
HAILGLASS Lighting glassware, clear, opal, coloured or decorated	Ackroyd & Best, Ltd., Beacon Works, Morley, near Lee
HAMILTON BEACH OR H. B. Vacuum cleaner, drink mixer, vibrator, &c.	S. G. Leach & Co., Ltd., 26-30, Artillery Lane, E.1.
HARCOURT Electric light fittings and door furniture	Metro-Vick Supplies, Ltd., 145, Charing Cross Rd., W.C
HARPOON Guy anchors for staying poles, &c. ...	Fred. J. Down, 90-93, Fenchurch St., E.C.3.
HART Electrical accumulators	Hart Accumulator Co., Ltd., Marshgate Lane, E.15.
HAZEMEYER Switchgear	Alan Wright, 124, Chancery Lane, W.C.2.
HEATRAE Electric heating apparatus	Electric Fires, Ltd., Heatrae Works, Norwich.
H.E.C. Static transformers	Hackbridge Electric Construction Co., Ltd., Hersh Walton-on-Thames.
HELENITE Electric cables	St. Helens Cable & Rubber Co., Ltd., Slough.
HELSBY Condensers for telephone, telegraph and power factor improvement	British Insulated Cables, Ltd., Helsby, near Warrington
HELSBY Cords (telephone and switchboard) ...	British Insulated Cables, Ltd., Helsby, near Warrington

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
HELSBY Rubber-insulated cables	British Insulated Cables, Ltd., Helsby, near Warrington.
HELSBY Telegraph and telephone line material	British Insulated Cables, Ltd., Helsby, near Warrington.
HELSBY Wiring systems	British Insulated Cables, Ltd., Helsby, near Warrington.
HENLEX Special compound insulation ...	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HENLEY Link disconnecting boxes	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HENLEY Distribution pillars	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HENLEY Tape	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HENLEY Cables of all types	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HENLEY WIRING SYSTEM Special wiring system and fittings ...	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HEXAPHASE System for working overhead or underground at 150,000 volts	Major A. M. Taylor, Slade Lodge, Erdington, Birmingham.
HINGELESS Fuseboard (non-corrodible detachable)	S. Bill & Co., Ltd., Queen's Rd., Aston, Birmingham.
HITEST Cables	Falk, Stadelmann & Co., Ltd., Efesca Electrical Works, 83-93, Farringdon Rd., E.C.1.
HIVOLTSIT Compressed bakelised varnish paper material, varnish insulating paper, moulded insulators to any design for any purpose	The Standard Insulator Co., Ltd., Winsley House, Wells St., Oxford St., W.1.
HOFFMANN Ball and roller bearings, steel balls and rollers	Hoffmann Mfg. Co., Ltd., Chelmsford, Essex.
HOLOPHANE Prismatic illuminating glassware ...	Holophane, Ltd., Elverton St., Vincent Sq., S.W.1.
HOMOGENEOUS Leadless non-hygroscopic cables for low and the highest tensions	Maatschappij Tot Vervaardiging Van Homogene Kabels. (Homogeneous Cables, Ltd.), 43, Stadhoudersplein, The Hague, Holland.
HOPKINSON OR H.I.M. Alternating-current motors	Hopkinson Induction Motors, Willesden Lane, North Acton, W.3.
HOT-POINT Electric irons, soldering irons and branders	Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3, and 91-3, Baker St., W.1.
HOT-POINT Domestic electric appliances	Hotpoint Electric Appliance Co., Ltd., 24, Newman St., Oxford St., W.1.
HOTPOINT-FALCO Electric cookers	Hotpoint Electric Appliance Co., Ltd., 24, Newman St., Oxford St., W.1.
H.W.S. Special wiring system and fittings ...	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
HYPER-SCALE Electrical measuring instruments ...	Nalder Bros. & Thompson, Ltd., 97a, Dalston Lane, E.8.
ICALL Hairdryers, vibro-massage, electro medical apparatus	I. Calvete, Ltd., 11, Little Saint Andrew St., St. Martin's Lane, W.C.2.
IDEAL Electrical measuring instruments of all types	Nalder Bros. & Thompson, Ltd., 97a, Dalston Lane, E.8.
I. & F. Controller fingers, contacts and colliery coal-cutter spares and renewals	Imeson & Finch, "Empress" Works, Stockton-on-Tees.
IGRANIC All types of electric motor starting and motor controlling apparatus and wireless components	Igranic Electric Co., Ltd., 149, Queen Victoria St., E.C.4.
IGRANIC-PACENT Radio components for wireless receiving sets	Igranic Electric Co., Ltd., 149, Queen Victoria St., E.C.4.
IMP Flat tumbler switches and switch plugs	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
IMPERIAL Conduit tubes and accessories ...	Isaac Griffiths & Sons, Imperial Works, Wednesbury, Staffs.
IMPERIAL Electric stage equipment	Imperial Lighting Co. (Implitico), Ltd., 2-6, Pocock St., S.E.1.
INGLEBY Electric motors	Electric Motor & Stove Hiring Co., Ltd., Sweet St., Leeds.
INKWELL Recording instruments	Everett, Edgcumbe & Co., Ltd., 117, Victoria St., S.W.1.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
INSULAC Insulating acid-proof varnish ...	W. W. Hill, Son & Wallace, Ltd., Broughton, Manchester.
INSULOIL Oil insulating varnish (stoving or air drying)	W. W. Hill, Son & Wallace, Ltd., Broughton, Manchester.
INTERMEDIATE Tumbler switch for control of lamps from more than two positions	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
INTERNALITE Signs	K.F.M. Engineering Co., Ltd., 29-31, Portugal St., Kingsway, W.C.2.
INTERNATIONAL ELECTRIC CO., LTD. Automatic telephones, intercommunicating telephones, loudspeakers, &c.	International Electric Co., Ltd., 161a-166, Strand, W.C.2.
INTERZONE Reflectors and lighting system ...	Marryat & Place, 28, Hatton Garden, E.C.1.
INVENTUM Electric fires and domestic appliances, hot-water taps	W. E. Beardsall & Co., Ltd., 5, Victoria Bridge, Manchester.
INVENTUM Fires, cookers, water heating and domestic electric appliances	Alan Wright, 124, Chancery Lane, W.C.2.
INVENTUM Electric fires, electric water taps, electric cisterns	W. C. Yuille & Co., Ltd., 155a, St. Vincent St., Glasgow, C.2.
INVENTUM Electric fires, water heating and cooking appliances	Inventum Electrical Appliances, Sales Dept., 124, Chancery Lane, W.C.2.
IRONSAFE Switchboards	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
ISCO House service cutouts	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
IVANHOE Lighting glassware	L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.
JACKSON Electric cookers, fires, kettles, breakfast cookers, &c	Jackson Electric Stove Co., Ltd., 143, Sloane St., S.W.1.
J.K.W. Solid-contact lampholders	J.K.W. Manufacturing Co., Ltd., 1 & 2, Bridge St., Middlesbrough.
J. & P. Wiring system	Johnson & Phillips, Ltd., Charlton, S.E.
JUBILEE Worm-drive earthing clips	L. Robinson & Co., "London Chambers," Gillingham, Kent.
K Adhesive insulating tape	F. R. Hunt, Crowther Avenue, Calverley, Nr. Leeds.
KALANITE Insulating material	Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.
KALANOID Plastic waterproof compound ...	Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.
KALBITUM Anti-corrosive paint	Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.
KALEECO Electric wiring system	Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.
KANGAROO Electric radiator	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
KANTARK Fuses, cut-outs and distribution boards	Midland Electric Mfg. Co., Ltd., Stafford Works, Barford St., Birmingham.
KARETNJA Non-hygroscopic insulating material for low and high tension cables	Maatschappij Tot Vervaardiging van Homogene Kabel (Homogeneous Cables, Ltd.), 43, Stadhoudersplein, The Hague, Holland.
KATHANODE Storage batteries	The D.P. Battery Co., Ltd., Bakewell, Derbyshire.
KAYBEE Wash boiler	Armature Winding Co., Ltd., Castle Grounds, Bury, Lancs.
KDAG Wires and cables	S. G. Leach & Co., Ltd., 26-30, Artillery Lane, E.1.
KELVEDON Hand-decorated and tinted glass and M.P. vellum shades (produced in England)	Electric Art Shades, Kelvedon, Essex.
KEY FIBRE CONDUIT Conduit and bird guards	Key Engineering Co., Ltd., 4, Queen Victoria St., E.C.4.
KILARC Positive action quick make and break tumbler switches	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
KINARKO Carbons for cinematograph work, &c.	The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.
KINGOLITE Electric candles	Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
KINGSWAY Combined switch and plug	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
KLYMAX Single and two-way narrow-panel tumbler switches	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
KOMET Electric heating appliances	Electric Heating & Hardware, Ltd., Crown Works, Berkley St., Birmingham.
KONE Loud speaker	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
KONFORM Switch plug	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
KYE Electric lamps	Kye, Ltd., 1-3, Brixton Rd., S.W.9.
LANCASHIRE Generators and motors, synchronous motors, turbo-alternators, &c.	Lancashire Dynamo & Motor Co., Ltd., Trafford Park, Manchester, associated with The Crypto Electrical Co., Ltd., Acton Lane, Willesden, N.W.10.
LATASCALE Indicating instruments	Elliott Bros. (London), Ltd., Century Works, Lewisham, S.E.13.
LEATHEROID Insulating materials	Mosses & Mitchell, Ltd., 122-124, Golden Lane, E.C.1.
LEATHEROID Insulating materials	Attwater & Sons, Hopwood St. Mills, Preston.
LECITE Insulated cables	Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Liverpool.
LECTROFLATOR Tire pump, electric	Gerrard & Co., Ltd., 15-19, Gt. Tichfield St., W.1.
LEKTRIK Switches, plug connectors and kindred accessories	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
LIBERTY Super-heterodyne receiver and units	Radi-Arc Electrical Co., Ltd., Bennett St., W.4.
LIBERTY Permanent crystal detector	Radi-Arc Electrical Co., Ltd., Bennett St., W.4.
LINAPEX Varnished cloths, silks and tapes ...	Ioco Rubber & Waterproofing Co., Ltd., Netherton Works, Anniesland, Glasgow.
LINK Clips	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
LINOLITE Reflector fittings for shop-window and cornice lighting	Beuttell, Ltd., Christopher Place, Chalton St., Euston Rd., N.W.1.
LISTER Electric lighting and power plant ...	R. A. Lister & Co., Ltd., Dursley, Gloucestershire.
LISTER-BRUSTON Generating set	R. A. Lister & Co., Ltd., Dursley, Glos.
LITHOLITE Moulded insulators	Litholite Insulators, Ltd., 55-57, Hackney Grove, London, E.8.
LITTLE GIANT Electric and pneumatic portable hand drills	The Consolidated Pneumatic Tool Co., Ltd., Egyptian House, 170, Piccadilly, W.1.
LIVERPOOL CABLES Wires and cables	Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Liverpool.
LOHYS Electrical sheets and stampings ...	Joseph Sankey & Sons, Ltd., Bilston, Staffs.
LORIVAL Insulating material	Lorival Mfg. Co. (1921), Ltd., Norwood Works, Southall, Middlesex.
L.P. Lamplock	G. S. Peckham & Co., 4-5, New Compton St., Charing Cross Rd., W.C.2.
L.P.S. Insulated varnished silk cambric, paper, tapes and sleevings, bakelite, &c.	L.P.S. Electrical Co., Ltd., Avenue Rd., Acton, W.3.
L.P.S. Magnet and resistance wires, cords and tungsten contacts	L.P.S. Electrical Co., Ltd., Avenue Rd., Acton, W.3.
L.P.S.-DUDLO Enamelled wire	L.P.S. Electrical Co., Ltd., Avenue Rd., Acton, W.3.
LUNAX Dustproof glassware lighting units...	Engineering & Lighting Equipment Co., Sphere Works, St. Albans, Herts.
LUNDBERG Switches, plug connectors and kindred accessories	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
LUX Storage batteries	Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.
LUX (LIQUID CO_2) Fire extinguishing without damage	Walter Kidde & Co. (Inc.), 2, Victoria St., S.W.1.
LYRIC Flexible cord	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
MACADIE Automatic coil-winding machine ...	Automatic Coil Winder & Electrical Equipment Co., Welling ton House, Buckingham Gate, S.W.1.
MACONITE Insulated cables	Macintosh Cable Co., Ltd., Ashbourne Road Mills, Derby.
MACRORY Service box	Standard Telephones & Cables, Ltd., Connaught House, Ald wych, W.C.2.
MAGICLOG Electric log fires	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
MAGICOAL Electric fires	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
MAGNA V.i.r. cables and lead covered cables, &c.	Magna Wire & Cable Co., Ltd., 4, Gt. Smith St., Victori St., S.W.1.
MAGNASTART High starting torque S.C. motors ...	The Harland Engineering Co., "B.E.P." Works, Alloa Scotland.
MAGNET Electric fans of every description ...	The General Electric Co., Ltd., Magnet House, Kingsway London, W.C.2.
MAGNET Household electric appliances for heating, cooking, washing, cleaning, ironing, &c.	The General Electric Co., Ltd., Magnet House, Kingsway London, W.C.2.
MAGNET Wiring systems for general and industrial purposes	The General Electric Co., Ltd., Magnet House, Kingsway London, W.C.2.
MAGNUM Two-pin plug connectors	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradis Passage, Sheringham Rd., N.7.
MAHOGANITE Insulating material	American Hard Rubber Co. (Britain), Ltd., 13a, Fore St. E.C.2.
MANSON Adhesive protecting tape	Wm. Geipel & Co., Vulcan Works, St. Thomas St., S.E.1.
MARCONI Various types of valves for reception and transmission, bright and dull emitter for both general and special purposes	M.O. Valve Co., Ltd., Osram Works, Brook Green, Hammer smith.
MARELLI Electric fans	Marelli & Co., Ltd., 19-20, Garlick Hill, E.C.
MARVEL Tumbler switches for variable control from two or more positions	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradis Passage, Sheringham Rd., N.7.
MASTA Ironclad fuse-switches	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1
THE MASTER VALVE Wireless receiving, transmitting, rectifying and modulating valves	Mullard Radio Valve Co., Ltd., Nightingale Works, Nightingale Lane, S.W.2 (Manufacturers). Mullard Wireless Service Co., Ltd., Mullard House, Denmark St., W.C.2 (Distributors).
MAXIM Lamps	Poynter, Griffiths & Co., Ltd., Maxim Lamp Works, 75, Canonbury Rd., N.1.
MAXLUME Industrial and commercial lighting fittings and heating apparatus	Veritys, Ltd., Plume Works, Aston, Birmingham.
MAXTORQ Squirrel-cage type induction motors	Lancashire Dynamo & Motor Co., Ltd., Trafford Park, Manchester, associated with The Crypto Electrical Co., Ltd., Acton Lane, Willesden, London, N.W.10.
MAYTAG Electric clothes washing	Hotpoint Electric Appliance Co., Ltd., 24, Newman St., Oxford St., W.1.
M.C.L. & REPETITION Motor-car electrical equipment and automatic screw machine products	M.C.L. & Repetition, Ltd., Pool Lane, Langley, Birmingham.
M.E. Battery-charging switchboards ...	Mann, Egerton & Co., Ltd., Major's Corner, Ipswich.
M.E.C. Small electric motors, a.c. and d.c.	The Medical Engineering Co., Ltd., Englefield Rd., N.1.
MECVENT Organ-blowing equipments, forge blower, industrial fans, &c.	Millns Electrical Co., 17, Whitefriars St., E.C.4.
MEDIUM RESISTANCE Special high-quality dynamo sheets and stampings	Joseph Sankey & Sons, Ltd., Bilston, Staffs.
MEGOHMOID Cable materials	Lindsay & Williams, Ltd., Bennett St. Works, Ardwick, Manchester.
MEMETTE Ironclad switches	Midland Electric Mfg. Co., Ltd., Stafford Works, Barford St., Birmingham.
MEMREX Ironclad switches	Midland Electric Mfg. Co., Ltd., Stafford Works, Barford St., Birmingham.
MEPIC Shop-window heater and car radiator heater	Midland Electric Power Installation Co., Old Mill St., Wolverhampton.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
MERIDIAN "Z" wires and cables and everything electrical	Meridian Electric Co., Baltic Chambers, 50, Wellington St., Glasgow.
MERSEY Dynamos and motors	McClure & Whitfield, Stockport.
MERSEY Motors	City Electrical Co., 1, Emerald St., W.C.1.
METROHM Insulation tester	Everett, Edgcumbe & Co., Ltd., 117, Victoria St., S.W.1.
MICANITE Insulating material	Mica & Micanite Supplies, Ltd., Offord St., N.1.
MIDGET MASTA Fuse switch	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
MILL Circuit breakers	Geo. Ellison, Perry Barr, Birmingham.
MILLER Lamps and lighting fixtures	L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.
MILLERETTE Bathroom unit	L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.
M.I.P. Combined 3-plate ceiling rose and two-pin plug	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
MONEL Nickel alloy, anti-corrosive metal ...	G. & J. Weir, Ltd., Cathcart, Glasgow.
MOONSTONE Glassware	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.2.
MORGANITE Brushes	Morgan Crucible Co., Ltd., Battersea Wks., Church Rd., S.W.11.
MORTISE Single-way small narrow-panel tumbler switches	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
MOSAIC Fires and paint removers	Girlings, Ltd., Electricity Works, Maldon, Essex.
MOULDENSITE Moulding powders and impregnating varnishes	Mouldensite, Ltd., Darley Dale, Derbyshire.
MUELLER Universal test clips	L.P.S. Electrical Co., Ltd., Avenue Rd., Acton, W.3.
MULPARVO A utility heater	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
N Insulating waterproof and weather-resisting tape	St. Helens Cable & Rubber Co., Ltd., Slough.
NALDER Electric measuring instruments of all types	Nalder Bros. & Thompson, Ltd., 97a, Dalston Lane, E.8.
NARROW OBLONG Two-pin panel plug connectors ...	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
N.B.D. Electrical plant	Newton Bros. (Derby), Ltd., Alfreton Rd., Derby.
N.C.S. Electrical measuring instruments of all types	Nalder Bros. & Thompson, Ltd., 97a, Dalston Lane, E.8.
NERON Electric lamps	Neron Lamps, Ltd., 1-3, Brixton Rd., S.W.9.
NESDRUM W.T. boilers	Richardsons, Westgarth & Co., Ltd., Hartlepool.
NEWBERRY Magicoal fires	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
NEWBRIDGE Time switches	Horstmann Gear Co., Ltd., Newbridge Works, Bath.
NEWTONS Dynamos, motors and train-lighting equipment	Newtons of Taunton, Taunton.
NICO Fittings and accessories	Nico Light Co., Ltd., 19, Farringdon Avenue, E.C.
NIPHAN Couplings and plugs for cables ...	Simmonds & Stokes, Ltd., 4, Vernon Place, Southampton Row, W.C.1.
NO-LAG Induction motors	British Thomson-Houston Co., Ltd., Rugby.
NOMAG Non-magnetic cast iron ...	Ferranti, Ltd., Hollinwood, Lancs.
NOVEL Switch	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
OHMALINE Insulating varnish	Griffiths Bros. & Co. London, Ltd., Macks Rd., S.E.16.
OHMER Insulating testing sets	Nalder Bros. & Thompson, Ltd., 97a, Dalston Lane, E.8.
OKONITE Insulating tape	Wm, Geipel & Co., Vulcan Works, St. Thomas St., S.E.1.
OMEGA Electric lamps of all kinds	Omega Lampworks, Ltd., 83, Merton Rd., Wimbledon, S.W.19.
ORB Switchgear, ironclad	Geo. M'Cartney & Co., Burnside Works, Cumnock, N.B.
ORBIT Traversing desk bracket or cabin fan, for commercial or marine use	Veritys, Ltd., Plume Works, Aston, Birmingham.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
OSRAM Various types of valves for reception and transmission, bright and dull emitter for both general and special purposes	M.O. Valve Co., Ltd., Osram Works, Brook Green, Hammersmith.
OSRAM Electric lamps for all conditions of lighting	General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
OSRAM Wireless valves of all types for general and special requirements	General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
OWL Porcelain	Geo. Wade & Son, Ltd., Manchester Pottery, High St., Burslem, Staffs.
OXFORD Receiving sets, special transformers	Oxford Wireless Telephony Co., Ltd., Titmouse Lane, Oxford.
OZONAIR Ozone apparatus, pure air ventilation	Ozonair, Ltd., 96, Victoria St., S.W.1.
PAKYDERM Finishing varnish	Griffiths Bros. & Co., London, Ltd., Macks Rd., S.E.16.
PARAGON Air pump	G. & J. Weir, Ltd., Cathcart, Glasgow.
PARAGON Terminals	Clarkes, "Sinnew" Works, Redditch.
PEEBLES Electrical machinery and transformers	Bruce Peebles & Co., Ltd., East Pilton, Edinburgh.
PEEL-CONNER Telephones for domestic, commercial and industrial uses	General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
PEERLESS Insulator and fibre	Attwater & Sons, Hopwood Street Mills, Preston.
PEERLESS Single-phase repulsion induction motors, generators and fans	S. G. Leach & Co., Ltd., 26-30, Artillery Lane, E.1.
PEERLESS Insulation paper	J. Burns, Ltd., Wangye Works, Chadwell Heath, Essex.
P.E.H. Heating apparatus	Premier Electric Heaters, Ltd., Keeley St., Watery Lane, Birmingham.
PELAPONE Country-house electric lighting plants	New Pelapone Engine Co., Ltd., 41, Baker St., W.
PERCO-WASH Electric clothes-washing device and washboiler	Jackson Electric Stove Co., Ltd., 143, Sloane St., S.W.1.
PERNAX Insulated cables, mining cables, bird guards for h.t. transmission lines	Greenwich Cable Works, Ltd., 97-99, Dashwood House, Old Broad St., E.C.2.
PERTINAX Special bakelite insulators, tubes, sheets and paper	Geo. L. Scott & Co., 69, Fleet St., E.C.4.
PETER THE HEATER Motor-car engine heater	L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.
PETROLEX Fire extinguishers for electrical equipment	Read & Campbell, Ltd., 75, Victoria St., Westminster, S.W.1.
PHENOLITE Laminated bakelite	J. Burns, Ltd., Wangye Works, Chadwell Heath, Essex.
PHILATTA Switches	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
PHONOPHORE Railway signalling telephone ...	Sterling Telephone & Electric Co., Ltd., Dagenham, Essex.
PINNACLE Switch fuses, enclosed fuses, &c. ...	Pinnacle Switchgear, Ltd., Weybridge, Surrey.
PIONEER Turn-type switches and switch plugs	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
PIRELLI-GENERAL Wires, cables and flexibles	The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
PIVOT Single and two-way tumbler switches	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
PIVOT COMBINATION Tumbler switch and two-pin connector	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
PIVOT INTERMEDIATE Tumbler switches for control of lamps from more than two positions	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
PIXY Bell pushes with straight-line movement	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
PLANIA Arc lamp carbons, carbon brushes, carbon battery plates, &c.	Wm. Geipel & Co., Vulcan Works, St. Thomas St., S.E.1.
PLASTOL Plastic insulating compound ...	Geo. Ellison, Perry Barr, Birmingham.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
P.M. VALVES Dull filament receiving valves ...	Mullard Wireless Service Co., Ltd., Mullard House, Denmark Street, W.C.2 (Distributors). Mullard Radio Valve Co., Ltd., Nightingale Works, Nightingale Lane, S.W.12 (Manufacturers).
POLIFLOR Electric floor polisher, for medium-sized rooms	C.C.A. (Vacuum Cleaners), Ltd., "Swinton House," 322-6, Gray's Inn Rd., W.C.1.
PRACHE Foundations for preventing vibrations	Fred. J. Down, 90-93, Fenchurch St., E.C.3.
PREMIER Fires	Premier Electric Heaters, Ltd., Keeley St., Watery Lane, Birmingham.
PREMIER Accumulators	Premier Accumulator Co. (1921), Ltd., Cattle Market Rd., Northampton.
PREMIER Electric vacuum cleaner	Hotpoint Electric Appliance Co., Ltd., 24, Newman St., Oxford St., W.1.
PREMIER DUPLEX Electric vacuum cleaner	Hotpoint Electric Appliance Co., Ltd., 24, Newman St., Oxford St., W.1.
PRESCOT Box compounds	British Insulated Cables, Ltd., Prescot, Lancs.
PRESCOT Feeder pillars	British Insulated Cables, Ltd., Prescot, Lancs.
PRESCOT Joint boxes	British Insulated Cables, Ltd., Prescot, Lancs.
PRESCOT Overhead equipment for electric railways and tramways	British Insulated Cables, Ltd., Prescot, Lancs.
PRESCOT Paper-insulated cables	British Insulated Cables, Ltd., Prescot, Lancs.
PRISMATIC Bulkhead fitting	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
PROMETHEUS Electric irons, radiators, water heaters, &c.	Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3, and 91-3, Baker St., W.1.
PROTOS Electric vacuum cleaner	Charlesworth, Peebles & Co., 5, Eden St., Hampstead Rd., N.W.1.
PUL-SYN-ETIC Electric impulse clocks	Gent & Co., Ltd., Faraday Works, Leicester.
QUASI-ARC Electric welding	Quasi-Arc Co., Ltd., 15, Grosvenor Gardens, S.W.1.
QUEAD Electric fires and cookers	Wm. Geipel & Co., Vulcan Works, St. Thomas St., S.E.1.
QUICKFIX Patent gallery	Charlesworth, Peebles & Co., 5, Eden St., Hampstead Rd., N.W.1.
QUICKWAY Coil-winding machines	Midland Dynamo Co., Ltd., Volta Works, Leicester.
RADIODESCENT Appliances for radiant heat treatment	Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3, and 91-3, Baker St., W.1.
RADIOLUX Loud speakers	Graham Amplion, Ltd., 25-26, Savile Row, London, W.1.
RADIOMATIC Broadcast receivers	Gent & Co., Ltd., Faraday Works, Leicester.
RADION Insulating material	American Hard Rubber Co. (Britain), Ltd., 13a, Fore St., E.C.2.
RECORD Insulation testers, battery cut-outs, circuit breakers	Record Electrical Co., Ltd., Broadheath, Altrincham, Cheshire.
RECORD Electric vacuum cleaner with fixed brush	C.C.A. (Vacuum Cleaners), Ltd., "Swinton House," 322-6, Gray's Inn Rd., W.C.1.
REDRAY Nickel-chrome resistance material ...	Henry Wiggin & Co., Ltd., Wiggin Street, Birmingham.
REESILEO Oils, insulating and lubricating ...	Reesoils, Ltd., 1, Eldon Sq., Newcastle-on-Tyne.
REFLEX Control of the pendulums and unification of existing workman's registers	Gent & Co., Ltd., Faraday Works, Leicester.
REGAL Ebonite	Spicers, Ltd., 19, New Bridge St., E.C.4.
RELIANCE Circuit breakers	Whipp & Bourne, Castleton, Manchester.
REMY Permanent tungsten steel magnet and magnet steel	W. F. Dennis & Co., 70, Queen Victoria St., E.C.4.
REPELLITE Insulating sheets	Spicers, Ltd., 19, New Bridge St., E.C.4.
RESISTON Insulating material	American Hard Rubber Co. (Britain), Ltd., 13a, Fore St., E.C.2.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
RESTFULITE Electric standards	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
REVERSING Tumbler switch, with or without "off" position	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
REX A.c. meters	Thompson & Co., 1 & 8, Old Swan Lane, E.C.4.
R.L.M. Reflector fitting	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
RODALUX Street-lighting reflector fitting ...	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
ROTAX Electrical equipment, motor accessories, wireless receivers, &c.	Rotax (Motor Accessories), Ltd., Willesden Junction, N.W.10
ROYAL Vibrators and hair dryers	L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.
ROYAL EDISWAN Lamps	Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
ROYAL EDISWAN Fullolite lamps	Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
RUPTOR Switch	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
RUTTER Patent wood pole for overhead transmission	Richard Wade, Sons & Co., Ltd., Hull.
SADIA Automatic water heater	Sadia Electrical Apparatus, 30, Ely Place, E.C.1.
SAFETEE Switches	L. Weekes (Luton), Ltd., Langley St., Luton, Beds.
SAFUSE Fuses and combined switch fuse ...	Donovan & Co., 47, Cornwall St., Birmingham.
ST. HELENS Cab tyre sheathed (C.T.S.) cables, dialite cables	St. Helens Cable & Rubber Co., Ltd., Slough.
ST. HELENS Ebonite, corrosion-proof fittings ...	St. Helens Cable & Rubber Co., Ltd., Slough.
ST. HELENS Insulating matting, insulating gloves, insulating shoes	St. Helens Cable & Rubber Co., Ltd., Slough.
SALFORD Circuit breakers	General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.
SANGAMO-EDISWAN Meters	Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
SANTON Switching plugs, geysers, wash boilers, &c.	Santon, Ltd., Dock St., Newport, Mon.
SAUTER Time switches, thermostats	Nathan & Allen, Ltd., 25, Victoria St., London, S.W.1.
SAVELITE A.c. incandescent lamp	Philips Lamps, Ltd., 145, Charing Cross Rd., W.C.2.
S Ironclad switchgear	T. M. Johns & Co., Ltd., Station Rd., Plymouth.
S & C Brass and steel repetition productions, turned from bar on capstan and automatic lathes and also pressings from sheet	Spears & Co., Capstan Repetition Works, 68, Park Rd., Hockley, Birmingham.
SAX Electric bells, indicators and accessories	Julius Sax & Co., Ltd., 24a, High St., Bloomsbury, W.C.2.
SAX Wall plugs and electric light accessories	Julius Sax & Co., Ltd., 24a, High St., Bloomsbury, W.C.2.
SAXONOR Switch plug (interlocking)	Julius Sax & Co., Ltd., 24a, High St., Bloomsbury, W.C.2.
SCHERBIUS Phase advancers and a.c. motor speed regulators	British Brown Boveri, Ltd., Trafalgar House, Waterloo Place, S.W.1.
SCRULIX Guy anchors for staying poles, &c.	F. J. Down, 90-3, Fenchurch St., E.C.3.
SECURA Insulating sleevings	Brasse, Ltd., Manor Works, High St., Hornsey, N.
SEECOL Modern stage lighting equipment ...	Strand Electric & Engineering Co., Ltd., 24, Floral St., W.C.2.
SELCO Syrens, motors, fans	S. G. Leach & Co., Ltd., 26-30, Artillery Lane, E.1.
SELZ Lamp shades	Charles Selz, 47, New Cavendish St., W.1.
SEMAPHITE Cables	Johnson & Phillips, Ltd., Charlton, S.E.
SERIES-PARALLEL Tumbler switch with or without "off" position	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
SERVICE Unbreakable, non-rusting and rigid grid resistances	The Rheostatic Co., Ltd., Mackenzie St., Slough, Bucks.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
SERVICE Electric domestic appliances	The Rheostatic Co., Ltd., Mackenzie St., Slough, Bucks.
SHAYDOLITE Lamp lacquer	Griffiths Bros. & Co., London, Ltd., Macks Rd., S.E.16.
SHIPTON Automatic telephone systems ...	Shipton Automatic Telephone System, Ltd., 37, Tothill St., S.W.1.
SIEMENS Electric lamps	Siemens & English Elec. Lamp Co., Ltd., 38 & 39, Upper Thames St., E.C.4.
SIFAM Electrical measuring instruments and instrument transformers	Sifam Electric Instrument Co., Ltd., 10a, Page St., Westminster, S.W.1.
SIFTRON Filter circuits	Graham Amplion, Ltd., 25-26, Savile Row, London, W.1.
SILOLUXE Quiet, closed-bag type, electric vacuum cleaner	C.C.A. (Vacuum Cleaners), Ltd., "Swinton House," 322-6, Gray's Inn Rd., W.C.1.
SILOVAC Silent electric vacuum cleaner ...	C.C.A. (Vacuum Cleaners), Ltd., "Swinton House," 322-6, Gray's Inn Rd., W.C.1.
SILUMINITE Switchboards, mouldings	Siluminite Insulator Co., Ltd., The Green, Southall, Middlesex.
SILVALUX Electric lamps (opal)	Siemens & English Electric Lamp Co., Ltd., 38 & 39, Upper Thames St., E.C.4.
SILVARAY One-piece glassware fittings	Siemens & English Electric Lamp Co., Ltd., 38 & 39, Upper Thames St., E.C.4.
SILVERLITE Frink shop window reflector ...	L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.
SILVERSTONE Glassware	Metro-Vick Supplies, Ltd., 155, Charing Cross Rd., W.C.2.
SILVERTOWN Cables, instruments, &c.	India Rubber, Gutta Percha & Telegraph Works Co., Ltd., 106, Cannon St., E.C.4.
SIMBAKE Switches, holders and accessories ..	Simpson, Baker & Co., 2-5, Nelson St., Bristol.
SIMPLEX Jacks	Equipment & Engineering Co., 2 & 3, Norfolk St., W.C.2.
SIMPLEX Conduits and all electric installation equipment	Simplex Conduits, Ltd., Garrison Lane, Birmingham.
SIMPLEX "Ordinary" and "reverse" door contacts	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
SINDANYO Insulating and arc-resisting boards	Turner Bros. Asbestos Co., Ltd., Rochdale.
SINEW Wireless connections	Clarkes, "Sinnew" Works, Redditch.
SISSON Enclosed self-lubricating engines ...	W. Sisson & Co., Ltd., Elmbridge Rd., Gloucester.
SISTOFLEX Insulating sleeving, fibre and leatheroid	Spicers, Ltd., 19, New Bridge St., E.C.4.
SISTOFLEX Varnished cloth, paper, tapes, &c.	Spicers, Ltd., 19, New Bridge St., E.C.4.
SKROO-ZON Handles for files	Tyer & Co., Ltd., Ashwin St., Dalston, E.8.
SLEKTUN Inductance coils	Automatic Coil Winder & Electrical Equipment Co., Wellington House, Buckingham Gate, S.W.1.
SLOTTED STEEL Pierced mild steel angles, channels, flats, &c.	Constructors, Ltd., Imperial House, Charlotte St., Birmingham.
S.L.R. Industrial reflector fittings	Engineering & Lighting Equipment Co., Sphere Works, St. Albans, Herts.
SMOOTHWELL Irons	Premier Electric Heaters, Ltd., Keeley St., Watery Lane, Birmingham.
SOLARIUM Electric sun baths	Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3, and 91-3, Baker St., W.1.
SOLBIT Solid bitumen mining cables ...	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
SOVEREIGN Dry cells	Atlas Carbon & Battery Co., Ltd., 56, Southwark Bridge Rd., S.E.1.
SPARTON Motor horns	Graham Amplion, Ltd., 25-26, Savile Row, London, W.1.
SPECIAL LOHYS Electrical sheets and stampings ...	Joseph Sankey & Sons, Ltd., Bilston, Staffs.
SPIROGLIDE Turbine pump	Harland Engineering Co., Ltd., B.E.P. Works, Alloa, Scotland.
SPLENDOR Electric lamp manufacturers ...	M.S.L., Ltd., Splendor House, 67, Hammersmith Rd., W.14.
SPRING HAMMER For drilling stone, brickwork, &c. ...	Fred. J. Down, 90-93, Fenchurch St., E.C.3.

NAME AND DESCRIPTION.	MANUFACTURED BY OR OBTAINABLE FROM.
STALLOY Transformer sheets, stampings of all shapes, telephone and loud-speaker diaphragms	Joseph Sankey & Sons, Ltd., Bilston, Staffs.
STANDARD Vacuum sweepers, washing and ironing machines	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
STANDARD Cables of all types	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
STANDARD Public address systems	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
STANDARD Telephones for all purposes, manual and automatic	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
STANDARD Traffic control system	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
STANDARD Wireless transmitting and receiving apparatus	Standard Telephones & Cables, Ltd., Connaught House, Aldwych, W.C.2.
STECHFORD Dynamos and motors, motor-generator sets, epicyclic geared motors	J. S. Plumtree, 90-91, High Holborn, W.C.1.
STELLA Conduits and conduit fittings ...	Stella Conduit Co., Ltd., Highfield Works, Bilston, Staffs.
STERLING Insulating varnishes, solid impregnating compounds, wire enamels	The Sterling Varnish Co., 196, Deansgate, Manchester.
STERNOL Turbine, transformer and diesel oils	Sterns, Ltd., Royal London House, Finsbury Sq., E.C.2.
STROWGER Automatic telephones and exchange equipment	Automatic Telephone Manufacturing Co., Ltd., Strowger Works, Milton Road, Edge Lane, Liverpool.
STUDDEUTSCHE Cable and flexible	"Z" Electric Lamp & Supplies Co., Ltd., 73, Newman St. W.1.
SUNBEAM Magicoal fire	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
SUNBLAZE Magicoal fire	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
SUNRAY Radiators	British Electric Transformer Co., Ltd., The Tricity House, 50 Oxford St., W.1.
SUPASTONE Illuminating lighting glassware ..	Wholesale Fittings Co., Ltd., 23-27, Commercial St., E.1.
SUPER-BOX House-wiring joint box	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
SUPER DREADNOUGHT Fuse switch	Berry's Electric, Ltd., 85-6, Newman St., Oxford St., W.1.
SUPERLUX Glassware	The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.
SUPERSCALE Indicating instruments	Everett Edgcumbe & Co., Ltd., 117, Victoria St., S.W.1.
SUPER SEASONED Vulcanised fibre	J. Burns, Ltd., Wangye Works, Chadwell Heath, Essex.
SUPREME Electric fan	L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.
SUPRONIC Cupro nickel high resistance wire ...	L.P.S. Electrical Co., Ltd., Avenue Rd., Acton, W.3.
SURE-A-LITE Batteries, pocket and wireless ...	The Battery Co., Ltd., 94-6, Hurst St., Birmingham.
SWANLITE Industrial lighting fittings	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
SYNCHRONOME Electric clocks	Synchronome Co., Ltd., 32-4, Clerkenwell Rd., E.C.1.
TANGENT Sound signals, ironclad and wood-cased, and radio apparatus	Gent & Co., Ltd., Faraday Works, Leicester.
TATE Electric stop motion (safety device for engines)	James Tate & Co., Victory Works, Bradford.
TAWBURY Electric washer	Armature Winding Co., Ltd., Castle Grounds, Bury, Lancs.
TAYLOR-SCOTSON Pressure regulator	Cox-Walker & Partners, Darlington.
T.C.C. Mansbridge condensers, mica condensers, power factor improvement condensers	Telegraph Condenser Co., Ltd., Wales Farm Rd., North Acton, W.3.
TELAC Tumbler switches, accessories, switchgear	J. H. Tucker & Co., Ltd., King's Rd., Tyseley, Birmingham.

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LEVOX Loud speakers	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
RRA-GRIP Continuity wiring system	Simplex Conduits, Ltd., Garrison Lane, Birmingham.
RRAPIN Two-pin and "earth" plug connectors	A. P. Lundberg & Sons, Pioneer Electrical Works, Paradise Passage, Sheringham Rd., N.7.
ST SHEATH Test conductor for underground electric cables	W. T. Glover & Co., Ltd., Trafford Park, Manchester.
ERMOID Flexible cord	W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.
ISTLE Conduit tubes and fittings	James McDougall, Ltd., Wednesbury, Staffs.
OR Miners' electric safety lamps ...	Thor Lamps & Supplies, Ltd., 11, Windsor Place, Cardiff.
REE STAR Accumulators	Three Star Accumulators, Ltd., Rosebery Avenue, N.17.
?-TOP Push-button switch for motor horns	Benjamin Electric, Ltd., Brantwood Works, Tariff Rd., N.17.
RRILL Automatic voltage regulators ...	British Thomson-Houston Co., Ltd., Rugby.
OVEE 2-valve set	The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria St., E.C.4.
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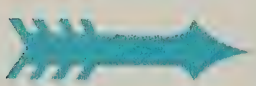
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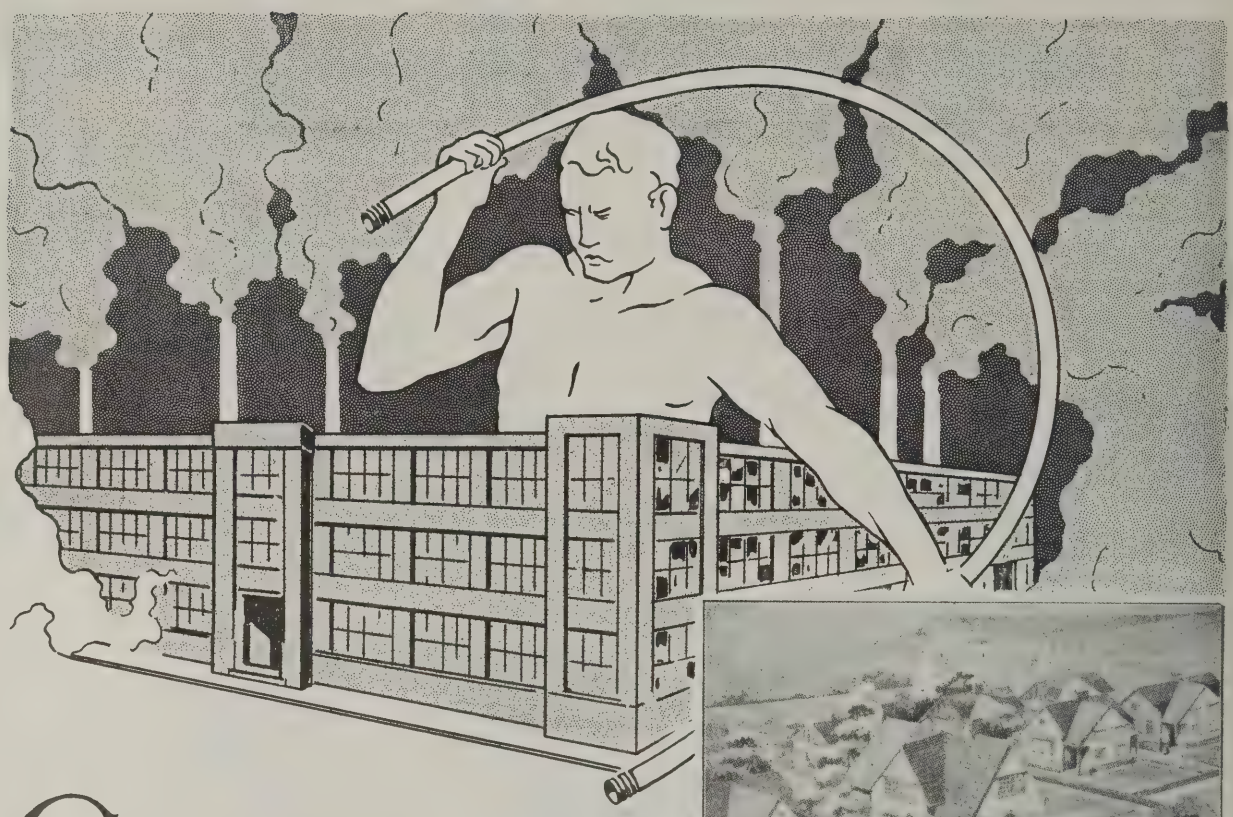
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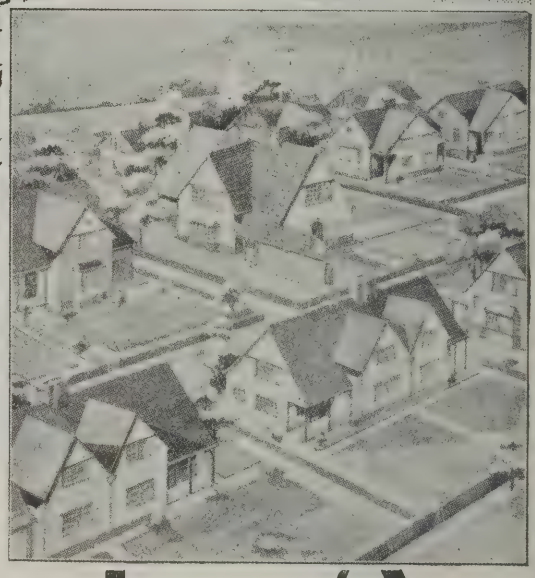
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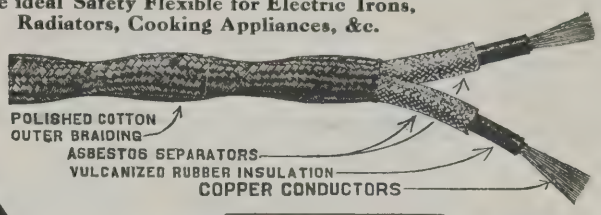
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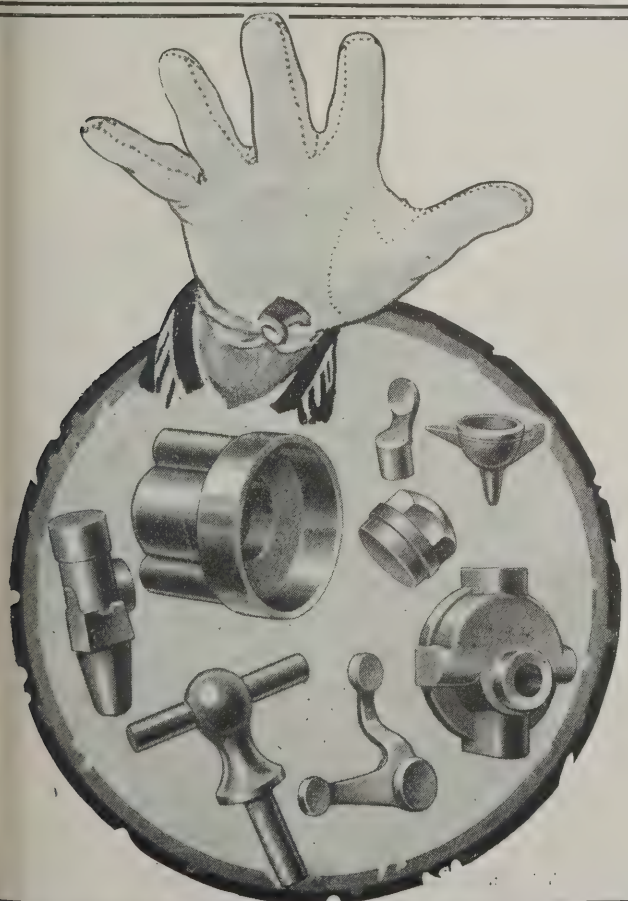
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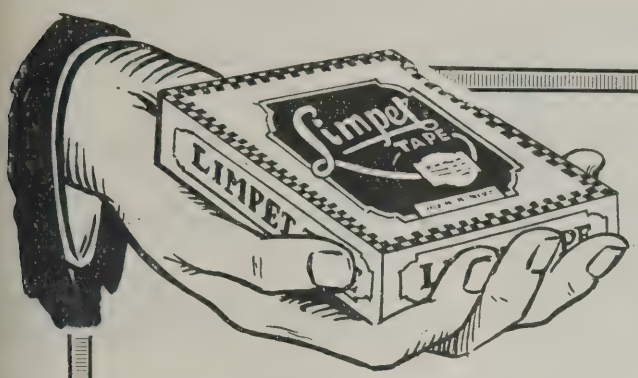
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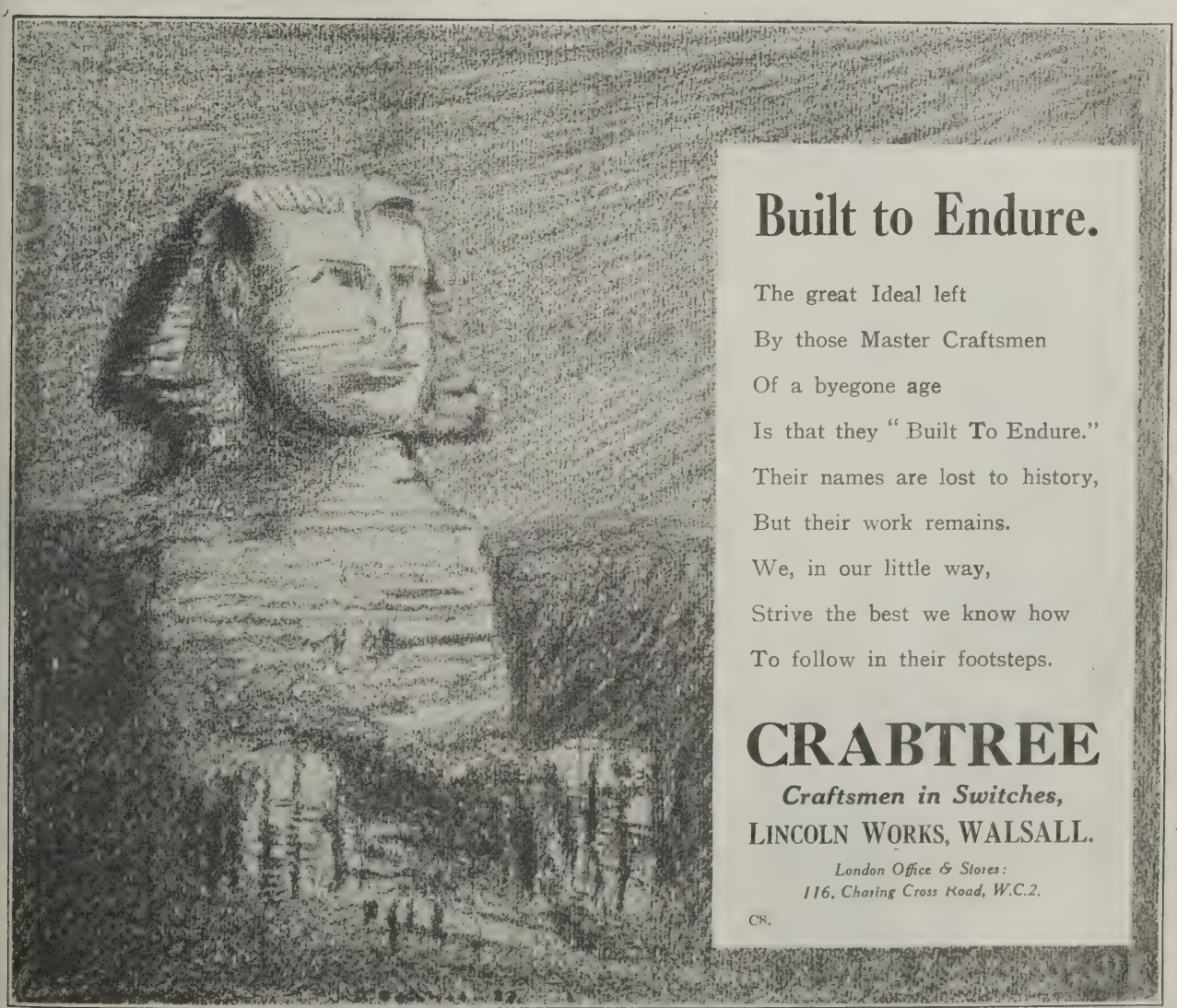
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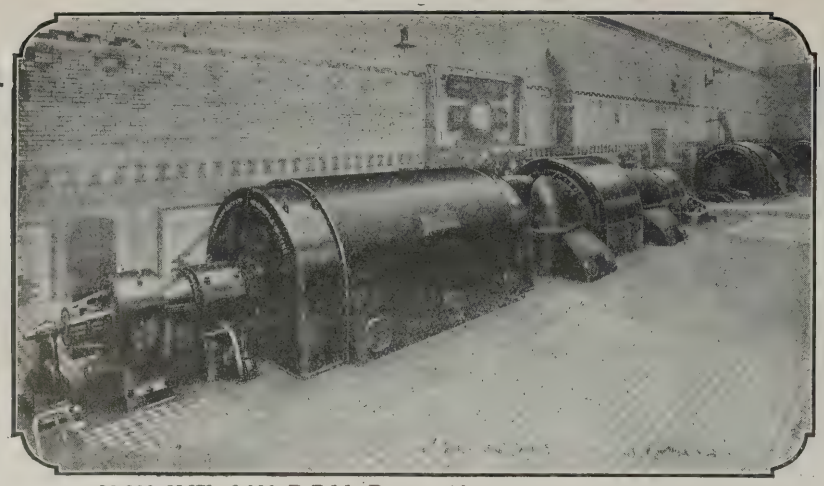
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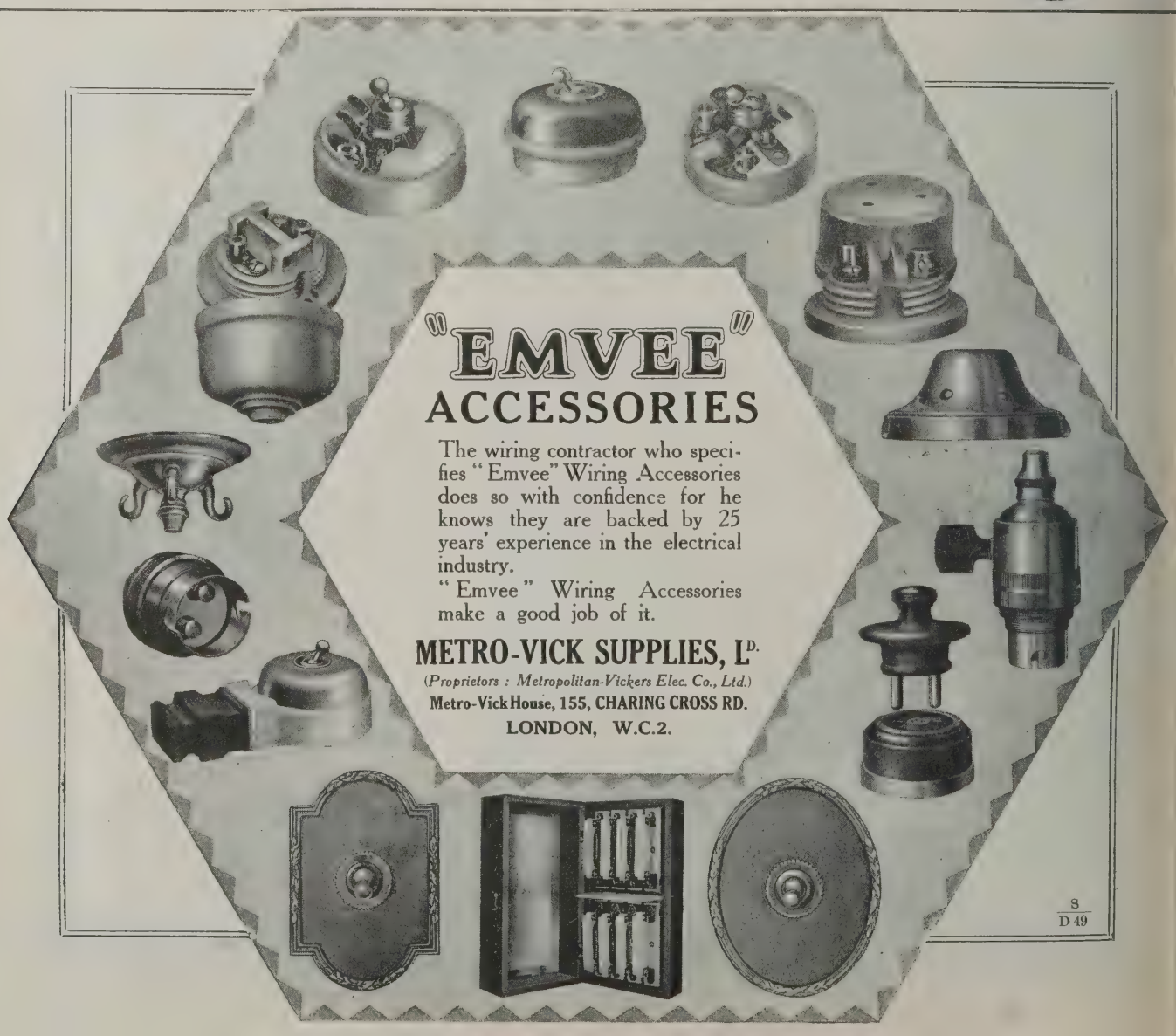
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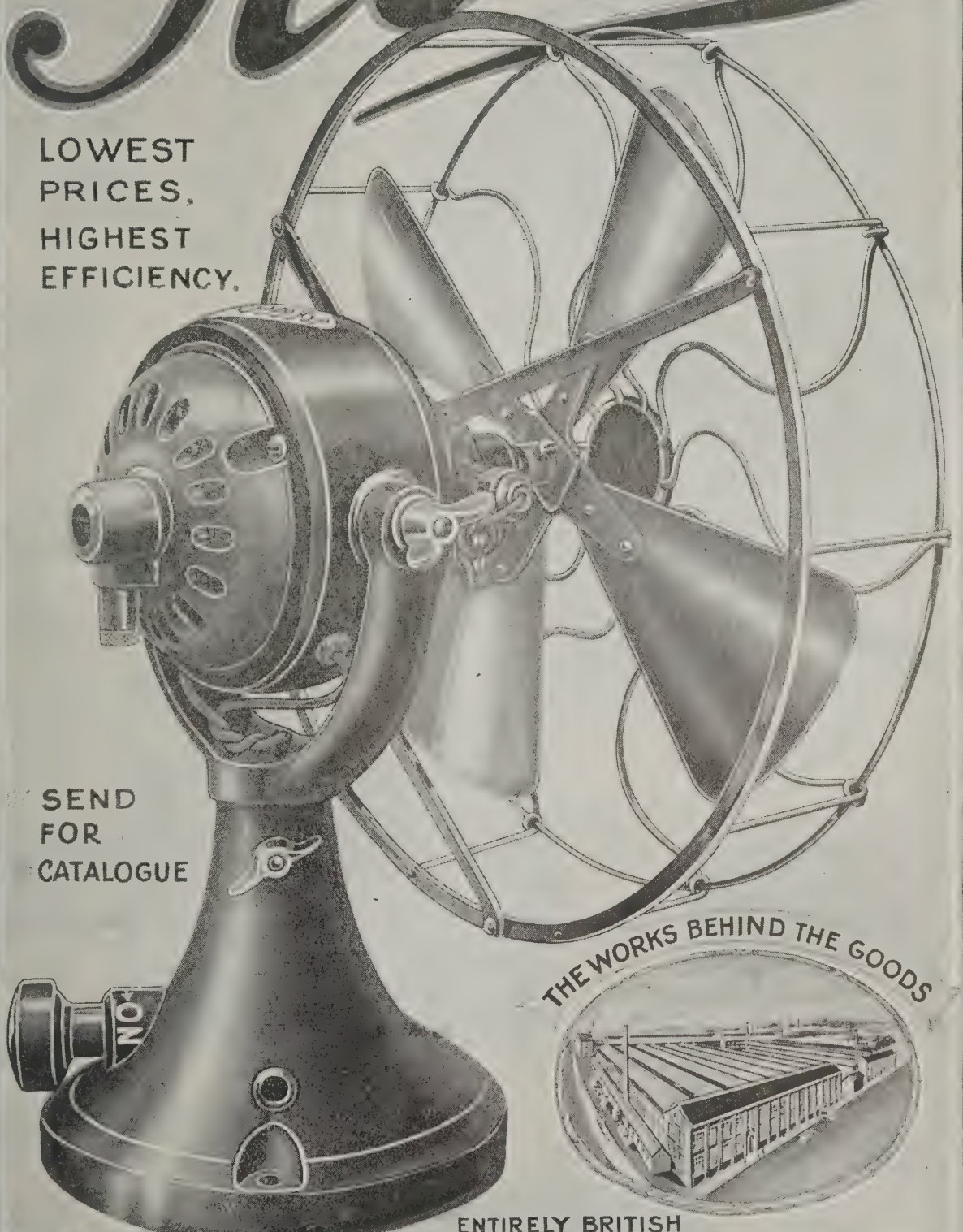
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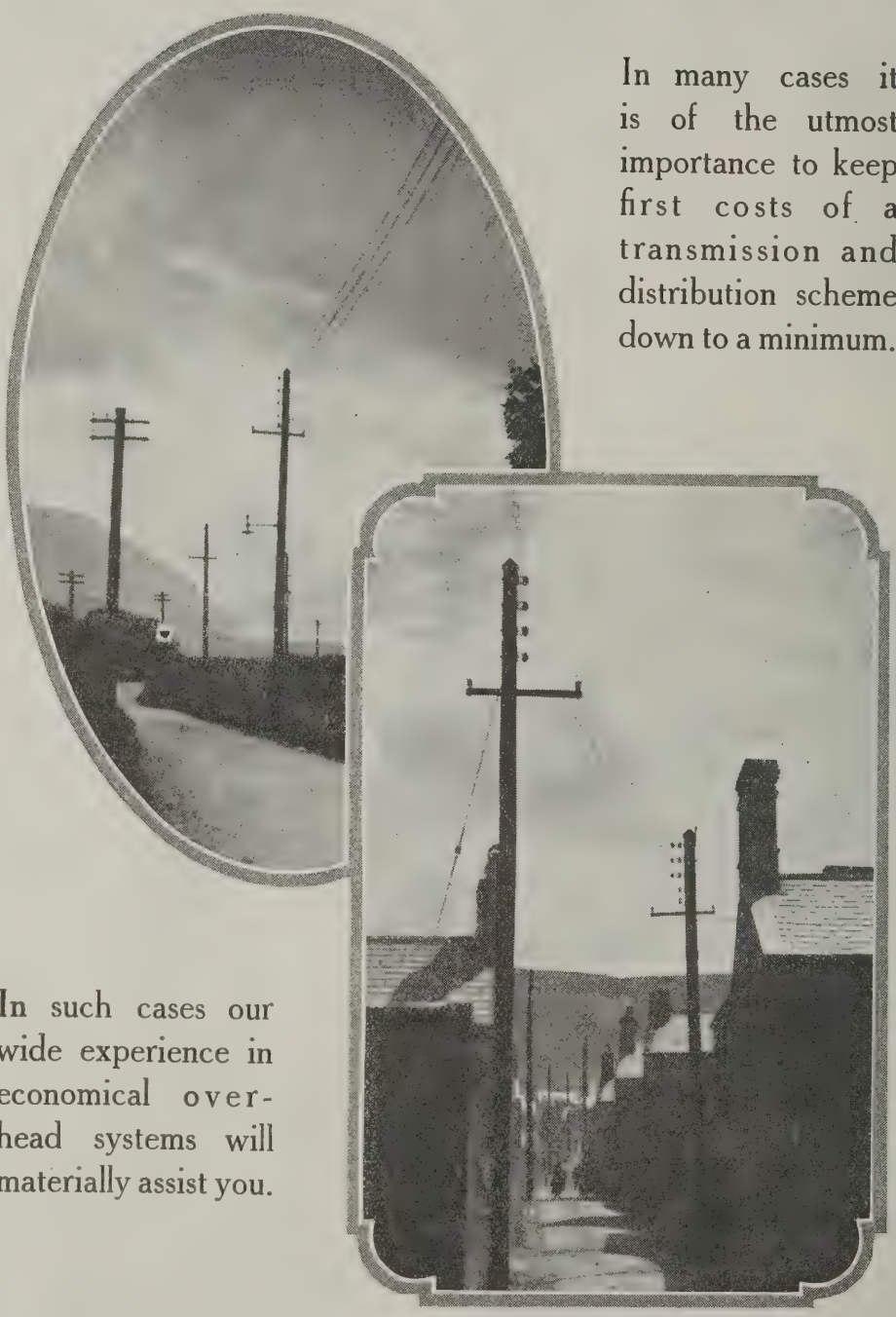
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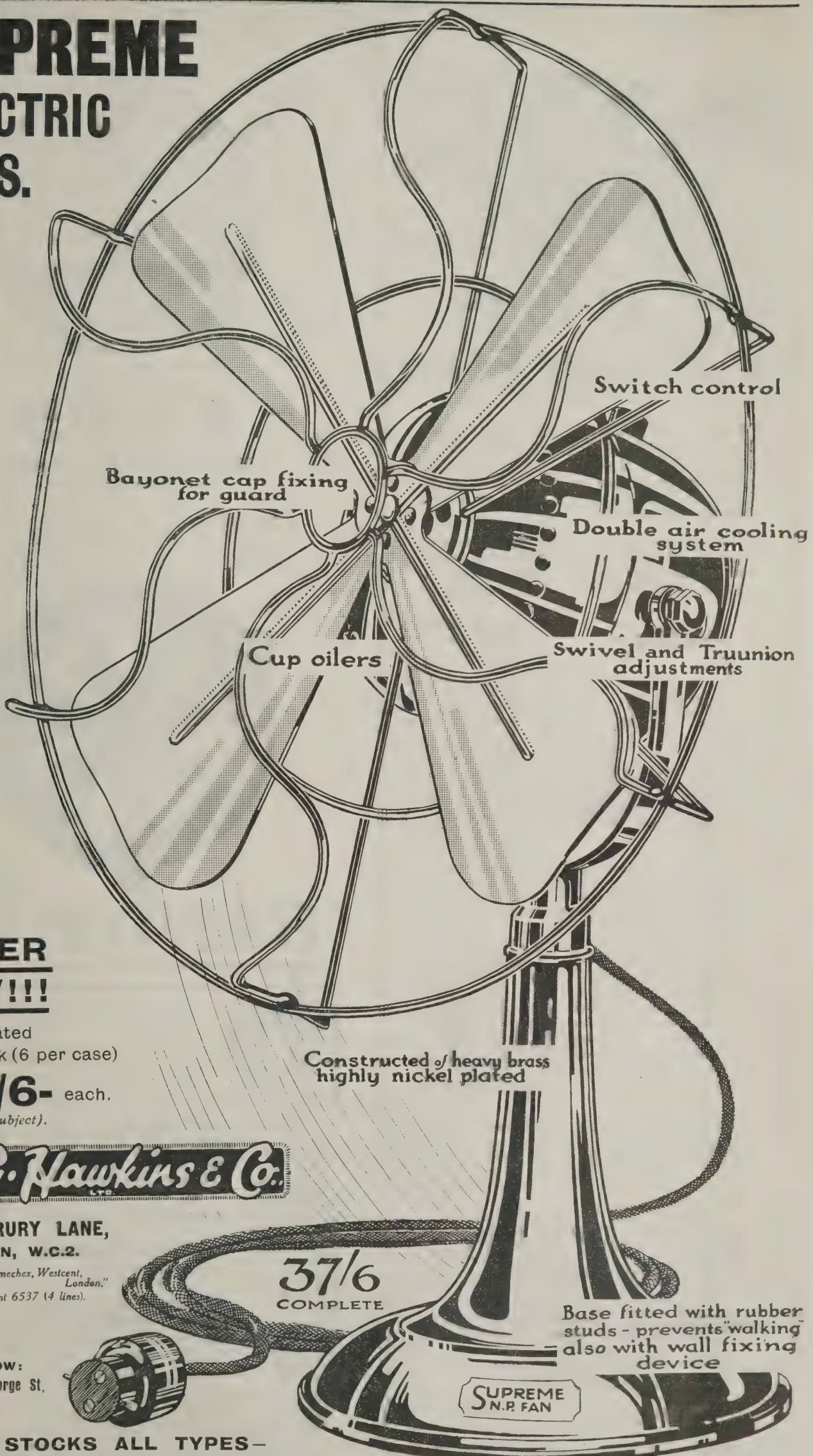
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CABLE WORKS, Ltd., SOUTHAMPTON.

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Proprietors: PIRELLI, LTD., and THE GENERAL ELECTRIC CO., LTD.

SUPREME ELECTRIC FANS.



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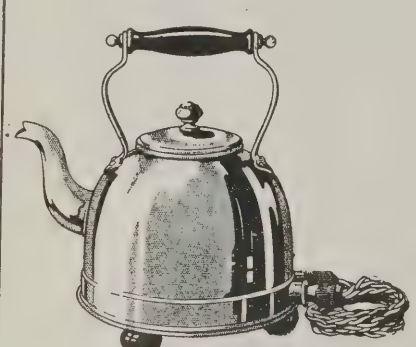
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The First L.C.C. Housing Scheme

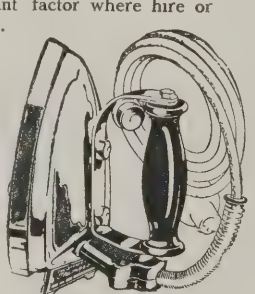
We are pleased to record the fact that in the first London County Council Housing Scheme (Castlenau Housing Estate, Barnes) to be equipped with electric heating and cooking appliances, PREMIER "Accident-Proof" Electric Kettles, and PREMIER "Smoothwell" Irons were chosen.

We have always urged the fact that implicit faith may be placed in the after-service of PREMIER apparatus, and this latest instance is representative of a growing appreciation of the truth of our claim.



The PREMIER Electric Kettle here illustrated is provided with the patent Accident-proof device by which no harm can come to the kettle in the event of it boiling dry. The considerable saving in maintenance and renewal thus effected will be readily appreciated. The finish is in the best PREMIER style and embodies the best accepted principles of design.

Wherever and in whatever circumstances, within reason, PREMIER Appliances are used, they will give such service as reduces maintenance and renewal costs to an absolute minimum—an all-important factor where hire or hire-purchase operation is involved.



The PREMIER "SMOOTHWELL" Iron embodies all the PREMIER principles of artistic design, utmost serviceability, efficiency and low current consumption. It is finished in double weight nickel plating, provided with Thumb Rest, solid terminals, and neat back stand.

Large stocks of PREMIER Electric Kettles, Irons, Saucepans, Urns, Fires, etc., are kept by the principal Electrical Wholesalers. Illustrated list giving full details will be gladly sent on request.

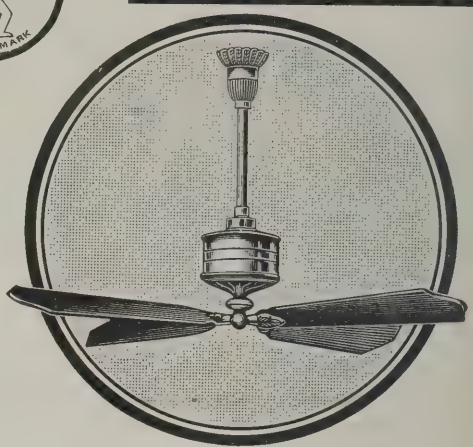
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PREMIER ELECTRIC HEATERS
LIMITED,
Electric Heating Engineers & Specialists,
BIRMINGHAM.

Telephone: Victoria { 821 / 822 } (Private Branch Exchange).
Telegrams: "Fahrenheit, Birmingham."

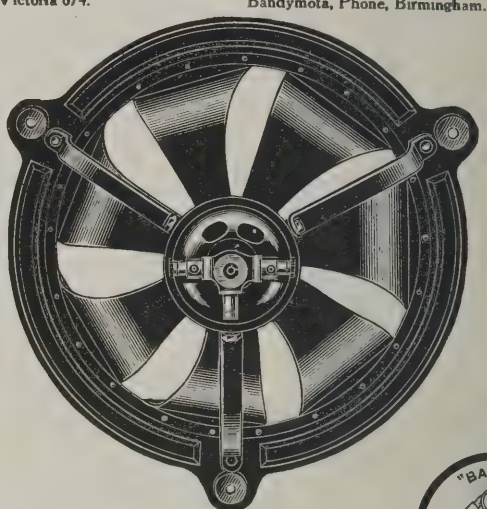
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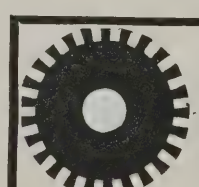
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OF UNIQUE DESIGN.
AS SUPPLIED TO ALL LEADING S.S. LINES.

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Armature, Dynamo and Transformer Stampings, Plain and Slotted—to customer's drawings or prints. Dynamo and Transformer Sheets, Swedish Iron Wire, Rods and Bars, black and bright drawn.
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The
PUREST & BEST ACCUMULATOR ACID

Specially prepared from **NATURAL BRIMSTONE &** *distilled water. Specially tested*
Medal awarded. St Louis 1904
F.W. BERK & Co LTD
Makers of Acids since 1870
106 Fenchurch St. London. EC3
WORKS: STRATFORD, E. & MORRISTON, Glam.

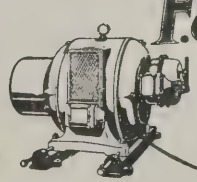
TAS.
ba.142.

Buy value and forget the price

The price of a Parkinson machine will mislead you, forget it for the moment. And then on merit compare it with the most expensive A.C. motor you know. Go over it point by point: machining, windings, insulation and finish. At the worst you'll find Parkinson equal on every count, we believe that you will find it better.

Now come back to price for a moment. You know the important part that production plays in the cost of any article. We are using production methods that collectively are not duplicated in an Electric Motor Works in the world. The labour operating on Parkinson machines is scientifically applied. There is no waste action. We have never attempted to economise on material—nothing but the best is good enough, but on labour we have saved enormously—one piece of machining we reduced from 5/- to 5d. and machined it BETTER.

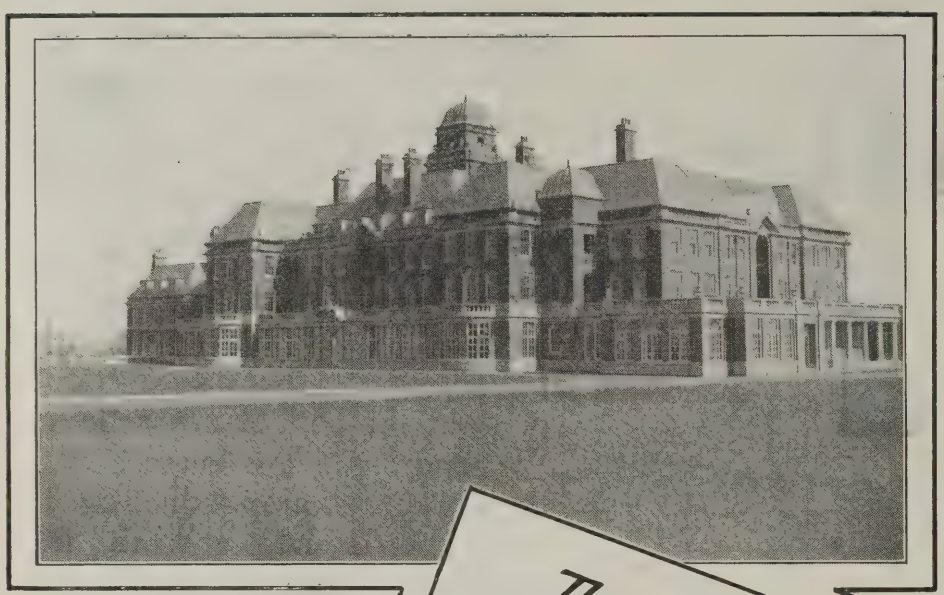
We pay higher wages than is usual, well above trades union rates—we get our pick of workmen—and we make a better motor at a lower price.



F. & A. PARKINSON LTD
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The Miner's dream of home

A DREAM which will come true when H.R.H. The Prince of Wales opens, on June 28th, the building illustrated. It is the Lancashire and Cheshire Miners' Convalescent Home at Blackpool, and the cost of the seven-acre site and of the building and equipment, amounting to more than £160,000, has been met by weekly subscriptions by the miners and by contributions from colliery managements.

It is fitting that electricity, the clean form of the energy latent in coal, should contribute towards the comfort of convalescent coal-getters. The lighting points alone number 800, and electricity is also used for heating and ventilating the 100 rooms, and for cooking for as many as 150 patients.

The Architects for this fine building were Messrs. Bradshaw, Gass and Hope, and the whole of the electrical installation was carried out by Mr. G. Morrison, of Blackpool. The bulk of the wiring consists of 2,500 megohm grade Association Cable drawn into galvanized conduit, the main feeder cable being paper insulated and lead covered.

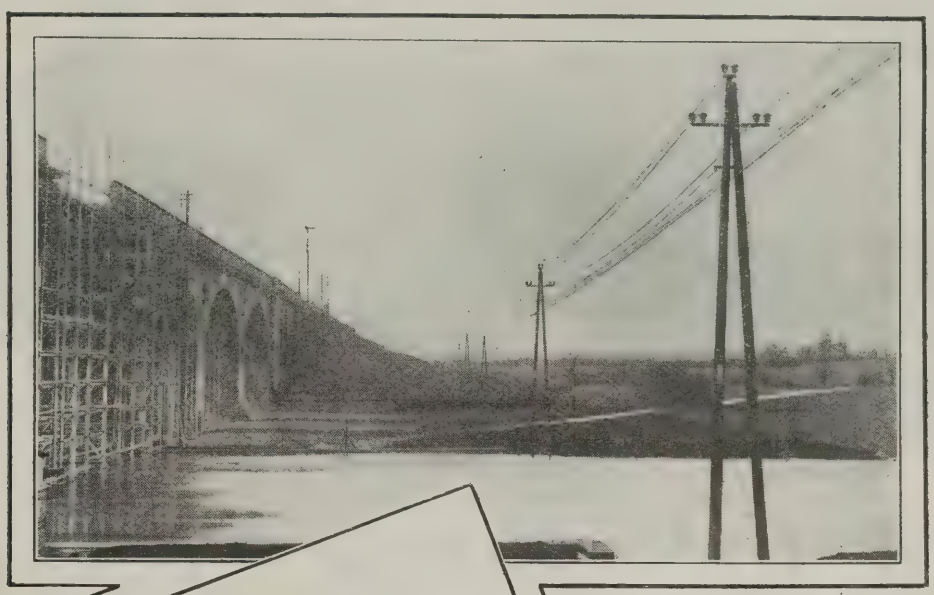
The Miners' Home is the first building of its kind, and was wired throughout with cables which rank, in point of quality, with the first of their kind; in short, with J. & P. Cables.

Johnson & Phillips, Ltd.

Head Office and Factory: Charlton, London, S.E.7. City Office and Stores: 12, Union Court, Old Broad St., E.C.2. Branches in Birmingham, Bristol, Cardiff, Derby, Glasgow, Liverpool, Manchester, Newcastle-on-Tyne, Portsmouth, Southampton & Belfast.

the mark that means that "little more" in quality

one of the J P paaes



Main Lines

OVER the bridge and along the embankment run trains from London to Liverpool and Holyhead, to Manchester, Glasgow, and Aberdeen. Passengers in these trains travel secure in the unique reputation for safety which our railways possess. This is the L.M.S. Main Line at Wolverton—a line which is claimed to be "the finest permanent way in the world."

Parallel to the railway runs a line of another kind; a 33,000 volt, 3-phase line transmitting power from Wolverhampton to Wolverton. An ordinary example of J. & P. overhead line construction, but ordinary only because in electrical and mechanical design and construction it ranks with every other J. & P. line, and with the best lines of the kind in the world.

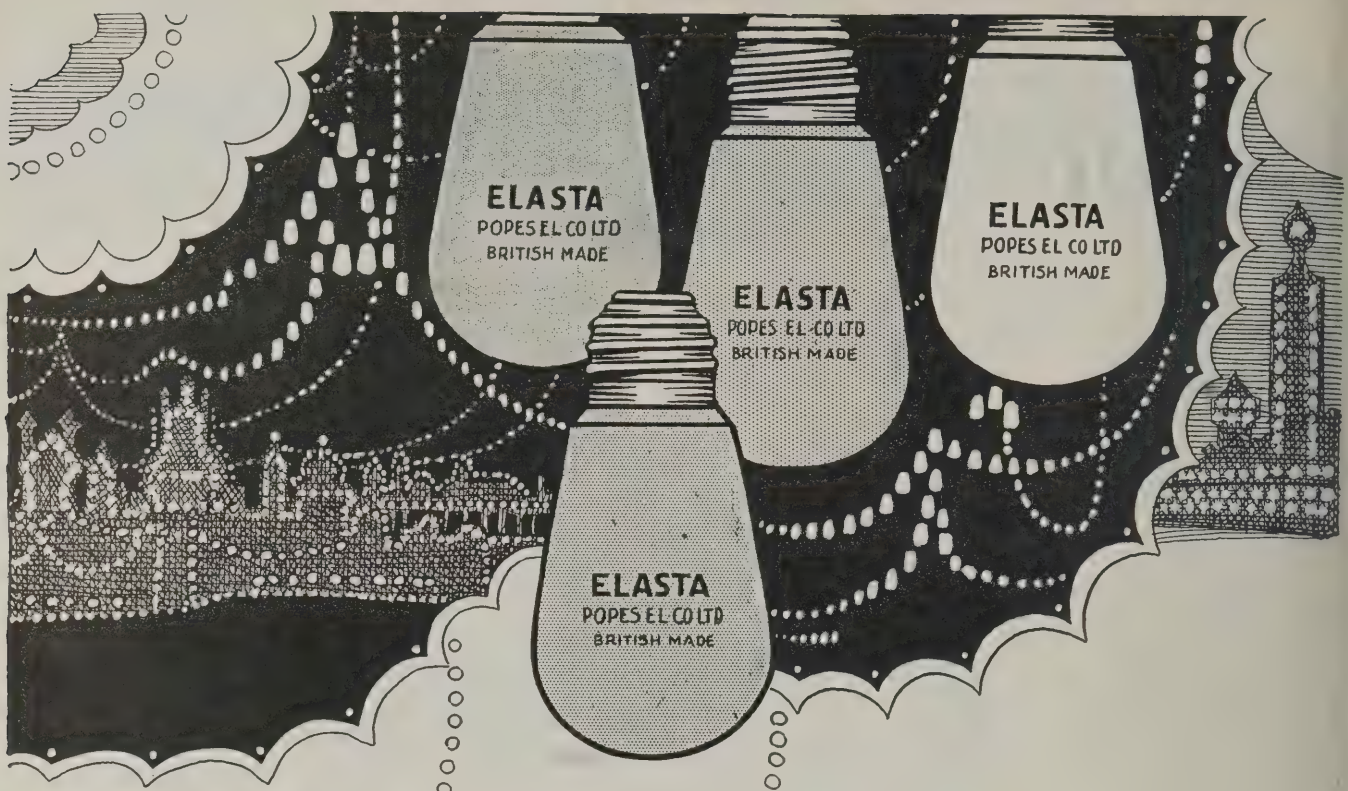
The river at this point is used as a bathing pool. The bathers, if they think about the matter at all, are probably as confident that the electric power line will not fall on them as they are that the bridge will not collapse, because engineers are expected to take every precaution necessary to prevent such happenings. The engineers who placed the contract for the line, and who certainly did think about the matter, were confident that in entrusting the work to J. & P. they were taking the only precaution necessary to obtain complete satisfaction.

You can take the same simple precaution by placing orders for Overhead Lines, or for Cables, Switchgear and Transformers with—

Johnson & Phillips, Ltd.

Head Office and Factory: Charlton London, S.E.7. Overseas Branches and Agencies in Australia (Sydney and Melbourne), New Zealand, South and East Africa, India, Ceylon, Malay States, Brazil and Spain.

the mark that means that "little more" in quality



For Colour-Sprayed Lamps

Go to POPE'S

When colour-sprayed lamps are wanted urgently for the summer demand—GO TO POPE'S. Write, wire or telephone to Pope's nearest branch office and you can be sure of the lamps reaching you in the shortest possible time.

STANDARD COLOURS
ELASTA
Colour-Sprayed Lamps.

Red, Orange, Yellow, Green, Blue and Flame Tint. Also White Sprayed.

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(Made in accordance with B.E.S.A. Specification No. 161.)

Obtainable from your usual supplier, or direct from :—

Pope's Electric Lamp Co., Ltd.

Head Office : **5, ARTHUR STREET, NEW OXFORD STREET, LONDON, W.C. 2.**

Telephone : Gerrard 6074/5. Telegrams : "Duramentum, Westcent, London."

Branches holding stocks from whom supplies can be obtained :—

LIVERPOOL : **21, Manesty's Lane.** *Tel. : Royal 427.* *'Grams : "Duramentum."*

MANCHESTER : **18, Pool Street, Market Street.** *Tel. : City 7087.* *'Grams: 'Pope's, City 7087.'*

LEEDS : **20/20a, Russell St.** *Tel. : Leeds 22119.* *'Grams : "Pope's 22119."*

LEICESTER : **89, London Road.** *Tel. : Leicester 128.* *'Grams : "Adroit."*

BIRMINGHAM : **72, Moor St.** *Tel. : Central 3268.* *'Grams : "Pope's, Central 3268."*

BRISTOL : **73, Victoria Street.** *Tel. : Bristol 5239.* *'Grams : "Pope's, 5239 Bristol."*

BELFAST : (Managers : Campbell, Gardner & Co.), 79, King Street. *Tel. : Belfast 4401.* *'Grams : "Camergard, Belfast."*

In all corners of the earth



No traveller landing in an out-of-the-way corner of the earth need be surprised to stumble across a packing case with the familiar ORMOND stamped upon it. For wherever there is progress and machinery, there Ormond screws may be expected. European and Continental engineers recognise the reliability of Ormond screws and constantly specify them for jobs that must be mechanically perfect. Power plants, electrical and engineering installations, in almost every country under the sun have Ormond screws built into them. Even the ships and trains that carry them to these countries rely on Ormond screws.

If ever you have to specify metal screws, get quotations and samples from Ormond. You will find their quality well over standard and their prices below those of foreign competitors because of their mass production.

ENGINEERING "ORMOND" COMPANY LTD.
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Specialists in turning Brass and Steel Metal Screws, Machined Parts and Accessories of every description. Send for our 1927 Catalogue.

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BAKELITE MOULDINGS

We are now in a position to quote for Bakelite Mouldings of every description, for which enquiries —large and small—are invited.

EVERYTHING The G.E.C. your guarantee ELECTRICAL

'Miss Magnet' is telling them to come to you!

Whenever Miss Magnet receives an enquiry from interested housewives, she says "Buy from your electrical dealer." That is why you will find it so profitable to handle



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REGISTERED TRADE MARK.

ELECTRIC CLEANERS

Not only have you a genuine British Product of proved efficiency to sell, but it is one backed by intensive publicity of the right kind.

Miss Magnet's talks to housewives hit the nail on the head, and create the desire to buy. It is for you, by showroom and window display, and by continuous demonstrating, to clinch the deal every time.

Write for "Miss Magnet" Sales Aids to-day and secure your share of the business.



YOUR FULL DISCOUNT GUARANTEED ON EVERY SALE.

Manufacturers:

THE GENERAL ELECTRIC CO., LTD.,

Head Office: **Magnet House, Kingsway, London, W.C.2.**

Branches throughout Great Britain and in all the principal markets of the world.

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of

Electrical Works, Plant & Stock.

WHEATLEY KIRK, PRICE & CO.

PARTNERSHIPS NEGOTIATED.

(Established 1850.)

46, Watling Street, London, E.C.4. — **16, Albert Square, Manchester.**

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By Order of a large Shipping Firm.

SALE BY AUCTION, WITHOUT RESERVE,

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On THURSDAY, JUNE 23rd, at 1.30 sharp.

3,500 COILS OF NEW AND PERFECT CABLES,

Sizes range from 1/·044 to 7/·064,

In V.I.R., SINGLE AND TWIN LEAD COVERED,

and

2,000 COILS OF TWIN FLEX AND WORKSHOP FLEX.

WILL BE OFFERED IN LOTS TO SUIT LARGE AND SMALL BUYERS.

The whole of the above goods will be on view on the premises the day previous and morning of sale.

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'Phone: Chancery 8136.

Telegrams: Loudsigs, Holb., London. 3776

TO ELECTRICAL ENGINEERS.

By Order of the Barking Town Urban District Council, who have arranged to purchase their Electric Power instead of generating same.

Messrs.

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Will offer for Sale by Auction in Lots, at the MERCHANTS' HALL, BALTIC EXCHANGE, E.C., on THURSDAY, JULY 14th, at 3 o'clock precisely,

ELECTRICAL POWER PLANT,

including a Brush-Ljungstrom, 1,000-kW Turbo-Alternator, 6,600 volts, 3-phase, 50 periods, with condensing plant, air filter, &c.

A 400-kW, 460/550-volt, d.c. Set, with Davey-Paxman triple-expansion Engine, Johnson & Phillips Generator.

A Vertical Compound Engine, by Allen, coupled to a Siemens 250-kW, 480/550-volt d.c. Generator and a Crompton 250-kW, 3-phase Alternator, 6,600 volts, 50 periods.

Two 100-kW, 460/520-volt d.c. Sets, with Allen vertical compound Engine and Thames Electrical Co.'s Generators.

Allen Condensing Set. Four Babcock & Wilcox Boilers, 165 lb. W.P. Two Green's Economisers. Motor-driven and steam Pumps, Lea Recorder, &c.

May be viewed on production of catalogue, which may be obtained on application to Messrs. Fuller, Horsey & Co., Mechanical Auctioneers and Valuers, 11, Billiter Square, E.C.3. 3939

THE ENGINEERS' CLUB

39, COVENTRY STREET, W.1

Annual Subscriptions:—Town Members -	£10	10	0
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72 BEDROOMS

Application for membership should be sent to "The Secretary" at the above address.

SITUATIONS VACANT.

Latest time for receiving, 5 p.m. Tuesday.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

Original Testimonials should never be sent.

ELECTRICAL ENGINEER.

THE GOVERNMENT of BIHAR and ORISSA require the services of an

Electrical Engineer for the Public Works Department.

Candidates must be Corporate Members by examination of the Institution of Electrical Engineers (London), or hold an equivalent Electrical Engineer's degree of a recognised University. At least seven years' practical experience in electrical engineering is essential. Age between 31 and 36 years.

The appointment is pensionable, subject to one year's probation. Pay in accordance with an age-scale, *e.g.*, age 31, Rs. 775 a month, plus overseas pay £25 a month; age 35, Rs. 975 a month, plus overseas pay £30 a month. (Overseas pay admissible only to an officer of non-Asiatic domicile). Free first-class passage to India. Strict medical examination.

Further particulars and forms of application may be obtained (upon request by post-card) from the Secretary to the High Commissioner for India, 42, Grosvenor Gardens, London, S.W.1. Last date for receipt of applications, July 7th, 1927. 3860

SHANGHAI.

TELEPHONE Maintenance Inspectors are required by the Shanghai Mutual Telephone Co., Ltd., Shanghai. Candidates must have good knowledge and experience of manual exchange switchboards and apparatus. Preference will be given to applicants having experience with the rotary automatic system. Age not over 25 years, and preferably unmarried. Commencing salary 250 taels per month (present rate of exchange 2s. 6d.) for first year, with probable increases to 275 taels and 300 taels per month for second and third years. Contract for three years, with second-class passage out and home. Six months' home leave after second term of three years if re-engaged.

Applications in writing only, giving age and full particulars of experience, with copies of three recent testimonials and names of references as to character, to be sent to Messrs. Preece, Cardew & Rider, 8, Queen Anne's Gate, Westminster, S.W.1, not later than the 11th July, 1927. Envelopes to be marked on top left-hand corner "Maintenance Inspectors." 3908

GLOUCESTER CORPORATION.

Electricity Department.

JUNIOR Charge Engineer, with experience of d.c., 3-wire, and preferably also of 3-phase supply. Appointment conditional upon medical fitness, and contribution to the Corporation Superannuation Scheme. Salary, Grade 9, Class "C," E.P.E.A., Schedule.

Application, with references, to Chief Engineer, Electricity Works, Commercial Road, Gloucester, not later than noon, July 7th, 1927. 3909

BHATPARA POWER COMPANY, LIMITED, BENGAL.

Assistant Engineer.

AN Assistant Engineer, aged 25 to 30, is required for the Bhatpara Power House (20,600 kW). Must be single, have served a regular apprenticeship (mechanical), and have had good electrical experience in the operation of large turbo-generator plant, W/T boilers, and e.h.t. switchgear. Starting salary, Rs.550/- per mensem, with free furnished quarters, &c.

Apply by letter to Z.R.551, care Deacon's Advertising Agency, Fenchurch Avenue, E.C.3. 3930

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.

Box Number and ELECTRICAL REVIEW address count as seven words.

ASSISTANT Switchboard Attendant required in a London power house; some previous experience essential. Knowledge of a.c. working a recommendation. Age about 18.—Send full particulars to 8594, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN wanted, good capable man, able to carry out complete mechanical designs for d.c. motors and generators; must be quick and accurate.—State age and present salary to 3914, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN wanted by Midland electrical firm (Aston district). Thoroughly experienced in the mechanical design of modern induction motors and d.c. machines, 1-200 b.h.p. State age, experience, and salary required. Preference given to ex-service pensioner Class I, II, or III.—8559, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

DRAUGHTSMAN, Senior, with first-class experience of power or instrument transformer work.—Apply, stating age, experience, and salary required, to 3935, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Meter Tester required for Tees-side. Experience single and polyphase W.H. meters, also switchboard instruments.—Reply, stating age, experience, and when available, to 3881, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Draughtsman wanted, with experience in switch and control gear design.—State age, experience and salary required, to 3888, Electrical Review, 4, Ludgate Hill, London.

ENGINEER wanted for North-East Coast Works, with experience in operation large gas engine, high tension, generating station and general blast furnace works maintenance.—Full details of experience, age, salary required, and when at liberty, to be stated, together with copies of three recent testimonials, to 3846, Electrical Review, 4, Ludgate Hill, London.

EXCELLENT opportunity for trustworthy men as Spare Time Representatives for well-known wireless manufacturers. Good commission paid. Applicants must have knowledge of wireless installation and be able to furnish good references.—Write 948, Electrical Review, 4, Ludgate Hill, London.

EXPERIENCED Electrician, thoroughly capable of taking full control of small department manufacturing electrical accessories and wireless components in Manchester district. Must be an efficient organiser with first-class credentials.—3835, Electrical Review, 4, Ludgate Hill, London.

FOREMAN Electrical Millwright required for large mills in Yorkshire. Must be thoroughly experienced in the maintenance of motors, shafting, drives and cable work.—Apply, stating age, wage, and experience, to 3916, Electrical Review, 4, Ludgate Hill, London.

FOREMAN wanted for Electrical Repair Works. Must be good timekeeper and disciplinarian, and accustomed to handling all kinds of a.c. and d.c. repairs, both in works and on site. Age not over 35.—State age, experience and salary required, to 3913, Electrical Review, 4, Ludgate Hill, London.

IMPROVER required to act as Switchboard Attendant (relief) and other duties in 15,000-kW power station in the Midlands. Wages 40s. to 45s. per week to commence.—State full particulars of experience to 3883, Electrical Review, 4, Ludgate Hill, London.

JOINTER for 3-wire l.t. system, overhead work, and meter repairs.—Apply, stating age, wage and experience, to Electricity Works, Carnarvon. 3884

JUNIOR Switchboard Draughtsman, with knowledge of layout work, h. and l. tension.—State experience, age and salary required, to Johnson & Phillips, Ltd., Charlton, S.E.7. 3915

MATERIAL List Writer for electrical engineers' drawing office. Must have an intimate knowledge of motors, control gear, and shop practice.—Apply, stating age, experience, and salary required, to 3934, Electrical Review, 4, Ludgate Hill, London.

SALES Engineer required immediately, age 25-27. Must have had some experience in transmission line design and preferably some construction experience; preference will be given to applicant who has had experience with overhead line contractors and who has had some sales experience. Write fully and in confidence, stating salary required and when disengaged.—3922, Electrical Review, 4, Ludgate Hill, London.

SALES Representatives.—Industrial and Commercial Lighting Fittings and Electric Radiators for Manchester and Birmingham areas, must be conversant with these sections of the trade, have sound connection, know districts thoroughly.—State age, districts worked, salary expected, to Veritys, Aston, Birmingham. 3894

SPLENDID opportunity for live commission men with good connections amongst Wireless Dealers, as Representatives for well-known British Loud Speaker. State ground covered.—Box 60, "Parrs," Craven House, Kingsway, London, W.C.2. 3889

TECHNICAL Assistant required in test room of cable factory. One having experience of super-tension cable testing preferred.—Applicants must give full details of technical training and practical experience, and state salary required, to 3933, Electrical Review, 4, Ludgate Hill, London.

TECHNICAL Representative required by London firm specialising in country house lighting work. Must be good salesman, capable of estimating for and supervising contracts.—Reply, stating experience and salary required, to 3918, Electrical Review, 4, Ludgate Hill, London.

TRAVELLER required by one of the oldest wholesale houses in the Midlands. Must be energetic and real salesman of all kinds of electrical supplies. Replies, in confidence, stating age, experience, and salary, to 3937, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

TRAVELLERS wanted, with good connection in Wireless, for the following districts:—Lancashire, Yorkshire, Wales, and the Midlands. Car essential. None other than live, reliable men need apply.—3886, Electrical Review, 4, Ludgate Hill, London.

WANTED, Assistant Electrician for cable steamer; previous sea-going experience essential, also good knowledge of testing and working of recorder and morse instruments, willing to assist in factory testing room.—Apply, stating qualification, age and salary required, to 3581, Electrical Review, 4, Ludgate Hill, London.

WANTED, Young Single Man with electrical experience, as permanent Assistant, private generating station, country estate, North Wales.—Apply, giving full details, how qualifications gained, wages required, with copies of three references which will not be returned, to 8484, Electrical Review, 4, Ludgate Hill, London.

YOUNG Lady required to take charge of electrical showrooms shortly opening in West London. Must be artistic, tactful, and have sales experience. Progressive position.—Write, stating salary, experience, copies of references, and date free, Medas, 47, Silverdale, S.E.26. 8544

APPOINTMENTS FILLED.

Dissatisfaction having been so often expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision. We will then insert a notice free of charge under this heading.

COUNTY Borough of Great Yarmouth (Junior Assistant); Eccles Corporation Electricity Works (Temporary Shift Engineer); South Wales Electrical Power Distribution Co. (Test Room Assistant); Box 3683 (Temporary Draughtsman); Box 2843 (Electrical Engineer); Box 8420 (Meter Repairer); Sheffield Corporation Tramways and Motors (Tramways Mechanical Superintendent).

SITUATIONS WANTED.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A CAPABLE young Engineer seeks progressive situation in mains department. H.t. and l.t., a.c., and d.c. 3-wire systems, underground and overhead, service and installation experience. Rural work preferred. Wages as secondary consideration.—8510, Electrical Review, 4, Ludgate Hill, London.

A YOUNG Engineer (21) seeks position offering scope for advancement; London area preferred. Salary of secondary importance to above, but must have facilities for continuing evening classes. Good references.—8509, Electrical Review, 4, Ludgate Hill, London.

ABLE Electrician (24), requires post, town or country; maintenance or installation.—59, Dangan Road, Wanstead. 8498

ACCUMULATORS, starter, 'bus, radio, &c.; works, service station, and commercial experience; could take charge; age 26; London preferred.—8522, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER, Shift Engineer, modern practice; disengaged; central or sub-station; in or near London desired.—8542, Electrical Review 4, Ludgate Hill, London.

ADVERTISER, capable Mains Engineer, seeks change. First-class experience construction and maintenance, e.h.t. and l.t., overhead and underground transmission and distribution, sub-stations, transformers, and consumers' work, &c. Present holding position with large Corporation authority.—Write 8578, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER, fourteen years' experience laying of e.h.t. and l.t. mains, is open to accept contracts anywhere in country, for laying of mains, jointing if required; also pole erection work.—Write 8579, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER, Sub-station Shift Engineer, desires similar employment; anywhere.—8543, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER, London, experience: manufacturing works, charge engineer, station superintendent, resident engineer, stations up to 25,000 kW, all systems. Disengaged. Seeks suitable employment, anywhere. Moderate salary.—8541, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER, Supervising Foreman, seeks re-engagement in similar position; competent large lay-outs, lighting, power, a.c., d.c. Good references. London preferred.—8463, Electrical Review, 4, Ludgate Hill, London.

AN Electrical Engineer, B.Sc., seven years' experience large electrical firm, including workshops, D.O., estimating, design, sales, desires post in London, technical or commercial.—8501, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

AN Electrician, charge of plant, all repairs; 25 years' experience.—Ireland, 71, Kenthouse Road, Sydenham. 'Phone: 1372. 8548

AN Engineer with 25 years' experience as general, works, and commercial manager of important companies, will shortly be disengaged, and would be pleased to communicate with firms having an opening. Entirely reliable.—8012, Electrical Review, 4, Ludgate Hill, London.

AN Engineer (38), requires permanent position in charge of plant; large experience steam, petrol, paraffin, and oil engines for generating purposes; knowledge of transport.—BM/MBDC, London. 8566

ARMATURE Winder, a.c., d.c. transformer. First-class man. Single. Twelve years' experience, repairs or otherwise. Any district.—8588, Electrical Review, 4, Ludgate Hill, London.

ARMATURE Winder, a.c. and d.c., also motor-car work.—W.W., 172, Highbury Hill, N.5. 8530

ARMATURE Winder, sound, practical all-round experience, old and new work.—8519, Electrical Review, 4, Ludgate Hill, London

BRAINS for Sale or Hire.—19 years' varied experience all branches electrical trade. Entire charge if necessary; interviewing, estimating, supervision, &c.; sound organiser.—8582, Electrical Review, 4, Ludgate Hill, London.

CAPABLE and energetic Organiser desires position as Sales Manager or similar post; expert knowledge wires and cables; also radio development; over 15 years with C.M.A. firm.—8453, Electrical Review, 4, Ludgate Hill, London.

CLERK-Bookkeeper, experienced contractors' and electricity supply accounts, costs and stores.—8555, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer, College, workshop and general experience (7 years), desires appointment, maintenance or inspection work. Excellent testimonials.—8569, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer (27), public school, ex-serviceman, Higher National Certificate, desires responsible progressive post; 5 years indentured with well-known firm; 7 years' experimental testing, all kinds motors, a.c. and d.c.—8575, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer, disengaged, requires post; 11 years' experience; modern engineering works and contractors; home or abroad.—39, Holden Street, London, S.W.11. 8443

ELECTRICAL Engineer (36), at present complete charge electrical department Port Authority, seeks change; 20 years' experience all branches, including cranes, overhead transmission lay-out, &c.; costs reduction speciality; present employers recommend.—8447, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer (a real one), 27, B.Sc., disengaged; 12 years' practical experience; seeks position; excellent references.—8466, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer (33) desires situation, home or abroad; 18 years' experience; installing, overhauling, motors, generators, oil, petrol plants, telephones, &c.—8465, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Instrument Maker (Graduate I.E.E.), requires position as Foreman or Works Manager. Sound knowledge of costing, production, &c.—8449, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Improver, apprenticed installation, 15 months' maintenance.—Read, 59, Ivy Crescent, W.4. 8485

ELECTRICIAN (23), tropical experience, desires contract abroad; speaks French.—8444, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN seeks situation in London. Good experience with Henley conduit; good at finding faults. Rate, 1s. 6½d.—8554, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer, disengaged, practical, technical, 25 years' experience all branches, 6½ years works manager, desires appointment.—Address "Technical," Wm. Porteous & Co., Glasgow. 8560

ELECTRICIAN desires part time work, preferably small house jobs. London.—8500, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN, all branches, jobbing or contract; anywhere. Experienced.—113, Albert Street, N.W.1. 8584

ELECTRICIAN, all-round, lighting, power, lifts, cranes, shafting, works maintenance; disengaged.—James, 70, Standen Road, S.W.18. 8568

SITUATIONS WANTED.—*Continued.*

ELECTRICIAN, good all-round, capable of taking charge.—Hooper, 7, Barnsdale Road, W.9. 8565

ELECTRICIAN wants work, town or country; 20 years' experience.—Long, 49, Alexander Road, N.19. 8583

ELECTRICIAN, screwed, slip, all systems. Capable workman; experienced. Excellent references.—Weston, 33, Grosvenor Park, Camberwell. 8581

ELECTRICIAN, 15 years' varied experience; power, lighting, bells, &c. Age 32.—Croser, 4, Cobham Road, N.22. 8511

ELECTRICIAN, good experience, all branches; day work or contract.—S., 30, Ringmer Avenue, Fulham. 8521

ELECTRICIAN and Fitter; plant and machinery, erection or maintenance; last situations 11 years and 5 years; maintenance preferred.—Cross, 40, Crossley Street, London, N.7. 8535

ELECTRICIAN, Wireman, 1st class; lighting, power, 'phones; town or country. Full district rate.—8531, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN, good all-round, a.c. or d.c., wants job. Go anywhere.—8525, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN seeks job, all-round experience; town or country.—Durtnall, 138, Sydney Road, N.10. 8524

ELECTRICIAN (32), long experience of shop and house installations; also staff maintenance.—B.W., 39, Gladstone Street, S.E.1. 8540

ELECTRICIAN, charge or otherwise; power, light, heat, maintenance, plant work; good refs.—"Electrician," 389, High Street, North, Manor Park, E.12. 8534

ELECTRICIAN, charge or otherwise; lighting, power installations, motors, wiring, all systems; testing, maintenance, or contracting.—"Electrician," 12, Pine Grove, Maidstone. 8488

ELECTRICIAN wants work; used to all systems; can take charge or estimate. Willing to fill in time at anything.—8490, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN, plant, maintenance, wiring, screwed barrel, oil engines, batteries, &c.; town or country.—C., 9, Ripplevale Grove, N.1. 8464

ELECTRICIAN (young) requires situation with electrical firm; previous experience in lighting and power installation, maintenance and wireless work.—Mitchell, 35, Stonehill Road, Chiswick, W.4. 8460

ELECTRICIAN Improver, age 22, reliable and energetic, desires berth; maintenance preferred.—8459, Electrical Review, 4, Ludgate Hill, London.

ENGINEER-Electrician, plant maintenance, wiring, steam, gas or oil engines; batteries.—Brunt, Brookmans, Hatfield. 8585

ENGINEER-in-Charge, 17 years' experience, desires position in works, public building, or generating station; accustomed to steam and i.c. plants, electric and hydraulic lifts, refrigeration, &c.; excellent references.—8576, Electrical Review, 4, Ludgate Hill, London.

EXPERIENCED Stoker requires situation; hand or mechanical.—8570, Electrical Review, 4, Ludgate Hill, London.

EX-WIRELESS Operator requires position ashore; good knowledge electrical work; thoroughly reliable; good references.—8505, Electrical Review, 4, Ludgate Hill, London

FIRST-Class Construction and Maintenance Telephone Engineer requires permanent position at home or abroad.—8504, Electrical Review, 4, Ludgate Hill, London.

FOREMAN Inspector, motors, wiring, &c.; supply company experience; good estimator; capable; take charge; private plant; good references.—8445, Electrical Review, 4, Ludgate Hill, London.

FOREMAN, Production, a.c., d.c. motors, stampings, assembling, tools, machining operations (otherwise firms wishing to start making stampings). Wide experience.—8552, Electrical Review, 4, Ludgate Hill, London.

INSTRUMENT Maker (1st class) requires situation; 24 years' experience; capable of taking charge.—T.B., 52, Hazeldean Road, Harlesden, N.W.10. 8595

SITUATIONS WANTED.—*Continued.*

MANAGER of Electrical Business desires similar position abroad. Fully acquainted with advertising, sales, and general supervision of installation and plant work.—8558, Electrical Review, 4, Ludgate Hill, London.

REPRESENTATION of good firm required by qualified Electrical and Mechanical Engineer, with connection in S.W. London area, Surrey and part Hampshire.—Salary and or expenses and commission.—8241, Electrical Review, 4, Ludgate Hill, London.

SALES Engineer, A.M.I.E.E., with large and valuable personal connection with Government offices, supply engineers, and leading firms. Heavy records of turnover. Wants Managership or to represent manufacturers in London and Home Counties. Highest credentials, wide practical, technical, and commercial experience.—8455, Electrical Review, 4, Ludgate Hill, London.

STOREKEEPER, Counter Salesman, fully conversant wholesale electrical and wireless trade packing and despatching; excellent references; salary, 50s.—James, 58, Fortess Road, N.W.5. 8586

TO Cable Makers, Wire Manufacturers, &c.—Position required by advertiser, having expert knowledge and practice of wiredrawing and preparation for same, including the layout and erection of plant, in all details, for modern methods of production.—8315, Electrical Review, 4, Ludgate Hill, London.

WANTED, position as Mains or Assistant Mains Engineer, or Clerk of Works; experienced high and low tension, overhead and underground transmission, distribution, and substation work; ability, tact, initiative. Present employed municipal body.—Write 8580, Electrical Review, 4, Ludgate Hill, London.

WIREMAN, good hand, thoroughly reliable.—Hearn, 19, Bryantwood Road, London, N.7. 8452

WIREMAN, good all-round, now disengaged; references.—"Electrician," 28, Sheen Grove, N.1. 8533

WORKING Engineer requires post, small supply undertaking or factory, conversant with generating plant, switchboards, batteries, overhead and underground distribution, wiring installations.—8573, Electrical Review, 4, Ludgate Hill, London.

YOUNG Man (23), with examinations in mechanical and electrical engineering and mechanical technology, desires post as Junior Draughtsman; willing to accept small salary to start.—A. Wickham, 106a, Broughton Road, Fulham. 8557

YOUNG Man (17) desires change of occupation, requires work with engines generating electricity; no experience.—Hayles, Rossway, Berkhamsted, Herts. 8518

YOUNG Man (23), Fitter Turner Improver, used to plant construction, machine shop, electric knowledge; references.—Write Brass, West View, Evenwood, near Bishop Auckland, Co. Durham. 8483

FOR SALE.

Advertisements are inserted under this heading at 14s. per inch.

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T. W. THOMPSON & CO.,

39, London Street, Greenwich, S.E.10, 'Phone Greenwich 1259,

INVITE enquiries for guaranteed Dynamos, Motors, Switchboards, Regulators, and Starters by leading makers, all sizes, large selection, cheap summer rates, quotations per return.

Write or 'phone for list post free.

Bargain Charging Resistance.

100 volt, 0-10 amp. and 0-6 Slate Panels, stud tapped. £1 each.

Charging Switchboards, Slate Panels, Voltmeter and Ampmeter, Moving Coil, Main and Battery Switch, Fuses, new, meter readings as required. Price £3 10s. each. 3902

BABCOCK BOILERS FOR SALE.

WE hold a big stock of almost new Boilers up to 30,000 lbs. evap., 200 lbs. w.p. Enquire our prices before ordering new.

BURFORD, TAYLOR & CO., Middlesbrough. 3405

FOR SALE.—*Continued.*

Best British Makes. New and Equal to New at Rock Bottom Prices. In our own Stock.

TRANSFORMERS.

600-KVA Westinghouse, 6,600/415 volts, 3-phase, 50 periods.
75-kVA Metro-Vickers, 5,000/220 volts, 3-phase, 25 periods.
75-kVA Hackbridge, 5,000/440 volts, 3-phase, 25 periods.
30-kVA Brush, 5,000/220 volts, 3-phase, 25 periods.
8-kVA Westinghouse, 415/110 volts, 3-phase, 50 periods.

D.C. MOTORS, 440/480 VOLTS.

200 h.p., 50, 40, 38, 35, 30, 28, 25, 20, 18, 17, 15, 10, 8, 5, 3, 2, 1.

D.C. MOTORS, 500/550 VOLTS.

58 h.p., 50, 20, and 10 h.p.

D.C. MOTORS AND DYNAMOS, 200/250 VOLTS.

50 h.p., 30, 27, 25, 20, 12, 10, 7, 5, 3, and 2 h.p.

D.C. MOTORS AND DYNAMOS, 110 VOLTS.

52 kW, 18 kW, and 8-volt, 300-amp. Plating. Dynamos 4.9 kW. Cinema M.G., 440/70 volts, 70 amps.

A.C. MOTORS, 400/440 VOLTS, 3-PH., 50 PERIODS.

200 h.p., 60, 34, 25, 16, 15, 12, 10, 8, 7, 5, 4, 3, and 2 h.p.

A.C. MOTORS, 400/440 VOLTS, 3-PH., 25 PERIODS.

150 h.p., 60, 50, 35, 25, 20, 18, 10, 8, 7, 5, 4, 3, and 2 h.p.

A.C. MOTORS, 200 VOLTS, 2-PH., 50 PERIODS.

60 h.p., 55, 30, 25, 10, 7, 5, 3, and 1 h.p.

A.C. MOTORS, 200 VOLTS, 3-PH., 50 PERIODS.

10 h.p. and four 5-h.p.

GENERATING SETS.

250 kW B.T.-H., 220/250 volts, d.c., geared, steam turbo.
26 kW Parsons-B.T.H., 100/150 volts, d.c., petrol-paraffin.

Very large stock of Instruments, Switchgear, and general Electrical Material. All plant fully guaranteed. Inspection invited.

MIDLAND COUNTIES ELEC. ENG. CO., LTD.,
Grice Street, Spon Lane, West Bromwich.
Telegrams: "Rheostat-West Bromwich." 1077

ELECTRIC CABLES AND ACCESSORIES.

Large Quantities at Bargain Prices.

NEW 1/.044 V.I.R. Taped and Braided Cable, red or black, 6s. 9d. per 100 yd.; 3/.029 ditto, 9s. 3d.; 3/.036, 10s. 6d.; 7/.029, 13s. 6d.; 7/.036, 17s. 6d.; 7/.044, 22s. 6d. per 100 yd.; large stocks in sizes up to 37/.103. Best makes, including B.I. & Helsbys, Johnson & Phillips, Glovers, &c.; also C.T.S. and Armoured Cables.

New guaranteed quality 1/.044 Flat Twin Lead-covered Cable, 14s. 9d. coil; 3/.029, 18s. 6d. coil. All sizes single and twin up to 7/.044 in stock.

C.T.S. and Solid Rubber Flexes and Cables. Large quantities at low prices.

Special Lines in Ceiling Roses, 2s. 3d. doz.; Lamp Holders, 4s. 6d. doz.; Switches, Cut-outs, Cleats, Insulators and Arms, Conduit and Fittings, Bells, Shades, Industrial Lighting Fittings, Ironclad Fittings, Floodlamps, Wood Blocks, Immersion Heaters, Carbons, Electric Motors.

Osram, Mazda, Ediswan, and Wotan Electric Lamps. Also Coloured Lamps and Striplite.

Send for Price Lists.

EDWARDES BROS.,
(Chief Depôt), 20, Blackfriars Road, London, S.E.1.
Tele.: Hop 2115. 8589

MOTORS, &c., FOR SALE.

20 D.C. Motors, 460 and 230 V.
One 460-V Motor-Generator for battery charging, 75 h.p.
One Balancer for 460 V, 3-wire, 250 amps., 230 V, either side.
One Mains Booster 90-h.p. Motor, 460 V, with two series wound generators.
One 300-kW Browett-Lindley Steam Balancer, 160 lb. pressure compound, 465 revs., direct-coupled to 2 × 230/260-V, 600-amp. generator.

Further particulars may be had from the undersigned.

A. R. DOWLING,
Clerk and Steward.
County Mental Hospital,
Prestwich, Manchester.
20th June, 1927. 3917

FOR SALE.

WIRELESS Valves (spec. offer till August 1st), 0.06 A for 4 or for 2 V, £1. Postpaid your factory. Prepayment.

OOSTERHUIS BROS., ARNHEM (Holland). 3921

MYLAN & SMITH (ENGINEERS), LTD.
KELVIN HOUSE,
St. James' Street, Sheffield.

Every Item in our own Stock.
All Guaranteed for Six Months.

Thoroughly overhauled and tested before despatch.

THREE-PHASE, 50 PERIODS, 400/440 VOLTS.

Stock.	H.P.	Speed.	Winding.	Maker.
One	15	960	slip-ring	Phœnix
Three	20	480	,,	Westinghouse.
One	45	975	,,	B.T.H.
Five	45	940	,,	Fuller
One	50	960	,,	,,
One	50	955	,,	Newton Bros.
One	50	590	,,	Fuller
One	70	485	,,	Mather & Platt
One	100	583	,,	E.C.C.
One	100	575	,,	L. D. & M.
Two	125	485	,,	Brush
One	160	365	,,	Fuller
Two	200	733	,,	Newton Bros.
One	330	575	,,	Westinghouse
One	440	490	,,	E.C.C.
Two	10	950	squirrel cage	Brook
Two	20	1420	,,	L. D. & M.
One	20	940	,,	,,
Three	50	964	,,	Newtons
One	50	480	,,	L. D. & M.
Three	60	965	,,	Newtons
Two	60	720	,,	L. D. & M.
One	75	970	,,	Newton

DIRECT CURRENT, 110 VOLTS.

Stock.	H.P.	Speed.	Winding.	Maker.
Twenty-two	2¼	410/475	shunt	G.E.C.
Sixty-five	3¾	375	,,	,,
One	6	1000	,,	Cutting Bros.
One	10	500	,,	A.E.G.
One	10	375	,,	G.E.C.
One	18	450	compound	Westinghouse
One	20	375	shunt	Verity
One	21½	275/400	,,	,,
One	24	260	,,	Greenwood & B.

DIRECT CURRENT, 220/230 VOLTS.

Stock.	H.P.	Speed.	Winding.	Maker.
Forty	4½	825/950	shunt	G.E.C.
Forty-seven	7½	750	,,	,,
One	12	295	,,	L. D. & M.
One	15	435	,,	Mawdsley
One	19¼	420	,,	E.C.C.
One	20	1000	,,	A.E.G.
One	20	750	,,	G.E.C.
One	20	610	,,	Newtons, T.
One	20	500	,,	Crompton
Two	20	300	,,	Vickers
Two	20½	370	,,	Laurence, Scott.
One	28	220/330	compound	Electromotors
One	32	260	,,	Phœnix
One	36	900	,,	Westinghouse
One	40	750	shunt	Verity
One	43	550/800	,,	,,
One	47½	580	,,	Greenwood & B.
Two	48	270	,,	Phœnix
One	65	157/175	,,	G.E.C.
One	300	490	,,	E.C.C.

DIRECT CURRENT, 440/500 VOLTS.

Stock.	H.P.	Speed.	Winding.	Maker.
One	9	1050	shunt	Phœnix
One	10	1000	,,	Rhodes
One	12	1025	,,	Newton
One	16	1000	,,	Crompton
One	25	830	,,	Siemens
One	25	585	,,	L. D. & M.
One	30	875	,,	Mawdsley
One	40	950	,,	Crompton
One	40	880	,,	E.C.C.
Two	40	600	,,	Vickers
One	40	350	compound	Met.-Vick.
Two	45	800	shunt	Laurence, Scott
One	45	685	,,	L. D. & M.
One	56	440/660	compound	Electromotors
One	70	550	,,	Phœnix
One	80	900	shunt	E.C.C.
One	130	331/375	,,	G.E.C.
One	180	250	,,	E.E.C.

A Selection from the Miscellaneous Section of our Stock.

STEAM ENGINE SETS.

150/150 lb. Compound Non-condensing.

ONE Belliss 85 kW, 220 volts, d.c., 520 r.p.m.
One Howden 120 kW, 220 volts, d.c., 355 r.p.m.

PETROL-PARAFFIN GENERATING SETS.

Large number of sets from 10 kW to 50 kW, all voltages from 80 to 500.

A.C. SWITCHGEAR.

One B.T.-H. 8-panel, black enamelled slate, 3-phase, 50 per., 440-volt board, six 3-pole, 200 amps., and two 3-pole, 500 amps., oil-immersed breakers (ammeter, power factor indicator and integrating wattmeter each panel), busbars, &c., complete.

Two B.T.-H. ironclad, drawout, truck type H.T. (3,300 volts) cubicles, each with 200-amp. O.I. circuit breaker, isolating switches, &c.

Five B.T.-H. type O.D.I. 60-amp. circuit breakers.

Two Ellison triple-pole ironclad, oil-immersed circuit breakers, 300 amp. capacity, floor mounting, complete with three overload releases, time lags and no-volt release.

D.C. BROOKHIRST PILLARS.

A large range of pillar type d.c. motor control panels for all voltages and any size up to 100 h.p.

SWITCHBOARD FITTINGS.

Circuit breakers, knife switches, instruments, &c., &c., in large quantities and new condition.

MAGNET.

One 36-in. diameter circular lifting magnet, reconstructed by Allen West & Co., Ltd., 220 volts, 25 amperes, complete with chain and lifting shackle.

TRANSFORMERS, 3-PH., 50 PERIODS, OIL IMMERSED, SELF-COOLING.

One 1,000 kVA, 3,300/440 volts, B.E.T. Co.

Two 1,000 kVA, 6,600/440 volts, Ferranti.

PUMPS.

One British Electric Plant, 200 g.p.m., 150-ft. head pump, with direct-coupled 16-h.p. d.c. motor.

One Mather & Platt, 115 g.p.m., 450-ft. head turbo pump, direct-coupled to 25/30-h.p., 220-volt d.c. motor.

REDUCTION GEARS.

Fifteen reduction gears for electric motor drives, worm and spur wheel type, all oil-immersed, for powers from 1 h.p. to 100 h.p., reductions up to 30 to 1.

STEAM, GAS AND WATER VALVES.

Several hundred brand new Hopkinson Valves at less than half makers' price. Priced catalogue on request.

ALTERNATOR.

One 200-kVA, 3-phase, 50-period, 500-volt rotating field Bruce Peebles alternator, with three pedestal bearings, bedplate, rope pulley, and direct-coupled exciter.

HIGH TENSION MOTORS.

One 65-h.p., 1,450-rev., 3-phase, 50-period, 2,750-volt slip ring English Electric motor.

One 430-h.p., 500-rev., 3-phase, 50-period, 3,300-volt slip ring G.E.C. motor.

The above represents only a small selection of our stock.
Please send us your enquiries.

MYLAN & SMITH (ENGINEERS), LTD.,
Kelvin House, St. James Street, Sheffield.
'Phone: 21371, 21372 Sheffield.
'Grams: Topical, Sheffield.

3

FOR SALE.—*Continued.*

FOR SALE.

ONE Marine Type Cylindrical Boiler, 13 ft. dia. by 11 ft. long, 3 in. tubes, 1,800 sq. ft. heating surface, 220 lb. w.p., 2 furnaces, complete with steam mountings.

Two Brush-Ljungstrom Turbo-Alternators, each of 625-kW capacity, 3,600 r.p.m., 650 volts, 60 cycles, suitable for 180 lb. per sq. in. steam pressure, complete with under-slung Condensers, each of 1,150 sq. ft. cooling surface. Generators fitted with self-contained exciters, lubricating oil fittings, and usual equipment.

Two Induction, 3-phase, 650-volt Motors, each of 785 b.h.p., 714 r.p.m., built by Brush Electrical Engineering Co., Loughboro'.

One Helical Reduction Gear, comprising 1 wheel and 2 pinions, capable of transmitting 1,570 b.h.p. total with reduction ratio of 714-76 r.p.m., complete with casing and usual fittings. Gearing manufactured by Power Plant Company.

Above plant, together with miscellaneous starters, pumps, &c., removed from S.S. *Wulsty Castle*, can be inspected at Naval Construction Works, Dalmuir, and offers for same should be sent to Messrs. William Beardmore & Co., Limited, Engine Department, Dalmuir. 3826

COUNTY BOROUGH OF PRESTON.

Electricity Department.

THE Electricity Committee invites tenders for the purchase and removal of the following Surplus Plant now lying at the Ribble Power Station and the Crown Street Sub-station, Preston.

ROTARY CONVERTORS.

One 500-kW Rotary Convertor by Metropolitan Vickers Co., Ltd., 6-phase, 50 periods, 450/480 volts, 1,100/1040 amperes, 750 r.p.m., complete with a.c. Booster, Exciter, and Starting Motor, also Exciter Rheostats.

TRANSFORMERS.

One 1,250-kVA, 3-phase, 50 periods, 6,600/280 volts, delta star Transformer group of 3 single-phase Transformers, h.t. tappings for 6,400 and 6,200 volts, complete with oil. Makers, Metropolitan Vickers Co.

The plant is in good order and has been replaced by larger units.

Tenders to be addressed to the Borough Electrical Engineer, 118, Fishergate, Preston. 3845

FOR SALE.

TWO Carels 320-h.p., 4-cylinder Diesel Engines, 175 r.p.m., coupled to—

Two Dick, Kerr 200-kW, 500/550-V, d.c. Generators, also switchboard, instruments, cooling water and fuel oil tanks, and Premier wooden natural draught open type water cooler.

One Reversible Booster, by Lancashire Dynamo Company, 0/150 V, 220/460 amp., 770 r.p.m., with switchboard.

One 10-ton Overhead Travelling Crane, by Herbert Morris and Bastard, Ltd.

Above plant all in good condition, comprising the complete equipment of a small 500-V, d.c. generating station, may be inspected by arrangement.

Apply Yorkshire (West Riding) Electric Tramways Co., Ltd., Belle Isle, Wakefield. 3309

LAMPS! LAMPS!! LAMPS!!!

Metal-filament, Half-Watt Type, Ferro Watt, Gas-filled Clear and Opal, Traction, Motor Car, Carbon and Candle Lamps.

DELIVERIES PROMISED AND MADE.

All Voltages and Wattages Stocked. Our Prices will Surprise You.

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Telephone: 5512-3 Clerkenwell. 13

FOR SALE.—*Continued.*

UNIQUE OFFER OF LIGHTING AND POWER PLANT,

All in first-class condition and ready for immediate service.

THE Plant consists of the following Machinery, which has only recently been taken out of commission.

PLANT NO. 1.

One Water-cooled, 125-h.p. Fielding & Platt Suction Gas Engine, fitted with graduated governor, water-cooled exhaust valve, magneto ignition, complete with gas cocks, exhaust pipes, air pipes, silencers, circulating pump, gas bag for town's gas, three 1,000-gall. circular cooling tanks, one 5-ft. driving pulley, and complete set of spares, comprising piston rings, springs, valves, cam shaft, gears, &c.

One 100-h.p. Fielding & Platt Suction Gas Governor Plant, complete with coke and wood-wool scrubbers, pipe work, and water seal.

One 100-h.p., 460-volt, 540 revs., d.c. Crompton Generator, complete with slide rails, open type, shunt wound, 4 main poles, 4 interpoles. Oil ring bearings with overhung pulley for belt drive. Diameter of pulley 20 in. Width 20 in. Main driving belt for the above set, 60 ft. by 1 ft. 6 in.

One Wells Oil Separator.

One 10-in. belt-driven Fan for blowing fire.

PLANT NO. 2.

One Water-cooled, 230-h.p. National Twin Cylinder Suction Gas Engine, fitted with hit and miss governor, magneto ignition, complete with gas cocks, exhaust pipes, air pipes, silencers, circulating pumps, gas bag, and complete set of spares, comprising piston rings, valves, &c.

One Smith's Patent Water Cooler.

One 200-h.p. Dowson & Mason Suction Gas Plant, complete with coke and wood-wool scrubbers, pipe work, and water seal.

One 134 kilowatt, 460 volt, 450 revs. Crompton Generating Set, complete with slide rails, open type, shunt wound, 6 main poles, 6 interpoles, with three oil ring bearings. Diameter of pulley 33 in. Width 26 in.

One main Driving Belt, 65 ft. by 20 in.

One Wells Oil Separator.

One Sturtevant Belt-driven Blower.

ADDITIONAL PLANT.

One 4-in. Kennedy Water Meter.

Two Herbert Morris 5-ton Lifting Blocks.

Two 36-in. Belt-driven Exhaust Fans.

One Tubular Steam Boiler, approx. 9 ft. long by 4 ft. diameter, by the National Gas Engine Co.

Three Oil Tanks.

The whole plant is being offered for sale by Private Treaty at very reasonable prices. It is situated a short distance out of London and can be viewed at any time by appointment. In the first instance apply 3876, Electrical Review, 4, Ludgate Hill, London.

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500 KW, 3,000/3/50, Belliss-E.C.C.
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150 kW, 440 volt, Ashworth-Siemens.
50 kW, 110 volt, Belliss-Siemens.
26 kW Sets, various makers. 3850
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Ring City Electrical Co., Emerald Street, Theobald's Road, W.C. 'Phones: Museum 5540, 5541, 5539. 2

MOTORS AND DYNAMOS.

400 IN STOCK.

Guaranteed and on approval.

GREENHALGH BROS., ATHERTON.

864

FOR SALE.—*Continued.*

FOR SALE.

GENERATOR, Crompton, 220 V, 150 A., 650 r.p.m., shunt, rails and pulley, unused; £55. 1 h.p., 400 V, 3-phase, 50 periods, 930 r.p.m., Parkinson, with no-volt starter, new; £6. 4½ h.p., 1,300 r.p.m., shunt, 460 V, Higgs, with rails and pulley, perfect; £9 5s. 7½ h.p., 1,000 r.p.m., shunt, Dick, Kerr, double automatic starter, 500 V; £9. 3 h.p., 230 V, shunt, 1,550 r.p.m., Higgs, with starter, as new; £9. 2 h.p., 460 V, shunt, 1,300 r.p.m., G.E.C., with starter; £7. 6 h.p., 230 V, shunt, 2,800 r.p.m., Phœnix; £9. Westinghouse Oil-immersed Star-delta Starters, with no-volt releases up to 20 h.p., 400 V, 50 periods; £7.—Foxton, 9, Scarisbrick Avenue, Litherland, Liverpool. 8572

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ELECTRIC Turbine Pump, Holden & Brook-Phœnix, 4-in. delivery, 150-ft. head, 300 g.p.m., 220 volts, d.c. Sulzer-Phœnix low lift Turbine Pump, 220 volts, d.c., 8-in. delivery, 70-ft. head.—Harry H. Gardam & Co., Ltd., Staines. 'Phone 98. 3735

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GARDNER Paraffin Set, 14 kW, 110 volts; seen running. £75 cash.—3926, Electrical Review, 4, Ludgate Hill, London.

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MOTOR and Worm Gear Set, 50 b.h.p., 460 volts, 825/985 r.p.m., compound, interpole, Electromotors make, 19 to 1 reduction, on c.i. base, and complete with control panel.—Oldfield Engineering Co., Ltd., Hampson Street, Salford. 3911

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NEARLY new 500-kW Browett, Lindley Steam Generating Set, direct-coupled to 3-phase alternator, 440 volts, 50 periods, with exciter. Low price.—Williams, 37, Queen Victoria Street, London. 3928

NEARLY new 40-kW Motor-Generator, d.c. motor, 400 volts, 120 amps., direct-coupled to d.c. generator, 200 volts, 200 amps.; immediate delivery.—Williams, 37, Queen Victoria Street, London. 3929

NEW 37/.103 V.I.R. Braided Cable; also .093, .083, and .072. Extra cheap. Best English makes.—Edwardes Bros., 20, Blackfriars Road, London. 8592

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THREE Weir Boiler Feed Pumps, 14 in. by 10 in. by 18 in., 12 in. by 9 in. by 21 in.; 8 in. by 6 in. by 12 in.—Harry H. Gardam & Co., Limited, Staines. 'Phone 98. 3017

THREE New "Delco" Automatic Lighting Plants (32 volts), complete with 160 amp. storage batteries. £55 each.—Inspect, Burleigh, 45, Hornsey Road, London, N.7. 3820

TWO 300-yard lengths, .23, three-core, e.h.t., paper-insulated, lead-covered, wire Armoured Cable, ex Wembley Exhibition. Price 15s. per yard.—R. F. Winder, Ltd., Belgrave Electrical Works, Leeds. Telegrams: "Contact Leeds." 'Phone: 20461 (2 lines). 3871

TWO E.C.C., 35-h.p. Motors, 200 volts, single-phase, 100 period, 1,460 r.p.m., slip ring, perfect condition.—Thompson, 39-43, London Street, Greenwich, S.E.10. 3899

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WATTS, Hardy & Company (1920), Ltd., Clarendon House, Newcastle-on-Tyne, have for Sale the following Second-hand Cable in excellent condition:—200 yards .25 sq. in., 37/.093 class, 702 single core, double wire Armoured Electric Cable; 600 yards .10 sq. in., 19/.083 class, 713 two core, single wire Armoured Electric Cable; 1,200 yards jute covered, S.W.A., two core, 3/20 Telephone Cable.—For price apply as above. 3800

WORM Gears, Wallwork, 20 h.p., 20:1 and 13½:1.—Greenhalgh Bros., Atherton. 3729

3-BEARING Crompton Dynamo, 75 kW, 480 volts, d.c., 950 r.p.m., belt pulley, 3 slide rails, with slip rings and transformer for 16 amp., 230-volt lighting circuit if required.—Oldfield Engineering Co., Ltd., Hampson Street, Salford. 3912

28-H.P. Siemens Slip-ring Motor for Sale, 730 revs., suitable for 3-phase, 50 cycles, 400/440 volts, with Ellison starter and circuit breaker.—Thomas Mitchell & Sons, Ltd., Bolton. 3811

FOR SALE.—*Continued.*

35-H.P., 440-volt, d.c., 760 r.p.m. Motor, with slide rails, pulley, starter, and main switch.—Harry H. Gardam and Co., Limited, Staines. 'Phone 98. 3632

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500-H.P., 3,000/3,500-V, 3-ph., 50-per., 291-rev., slip ring, B.T.-H. Motor.—Greenhalgh Bros., Atherton. 892

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MESSRS. Edwardes Bros. wish to announce that they are open to purchase Surplus Stocks for net spot cash. Full particulars with samples will receive immediate attention.—Edwardes Bros., 20, Blackfriars Road, London, S.E. 'Phone: 2115 Hop. 8590

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ABSOLUTELY top market prices paid for Platinum Scrap (£24 10s.), large or small quantities. Be convinced. Call or post.—A. Short, Bullion Depot, 47, Charing Cross Road, London. 8395

ACCUMULATOR and other Metal Scrap bought for immediate cash. Top prices paid. Complete batteries bought on site.—Bentley, Brown & Co., 59, Gracechurch Street, London. Telephones: Royal 4818 and 4819. 1457

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WANTED, one 40/50-kW Motor-Generator, 110 volts, d.c., 400 volts a.c., 3-phase, 50 periods.—State price and particulars to 3877, Electrical Review, 4, Ludgate Hill, London.

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175-KVA Transformer wanted, 2,750/625, Periodicity 40, oil cooled, tapping 5 per cent. above or below. 4-Panel Switchboard, incoming feeder, 250-ampere, one volt Meter. One outgoing switch suitable 200 amps., two switches suitable 100 amps. Switches fitted three overload coils and isolators. Outgoing switches, fitted ammeters, voltage 625, 3-phase, 40 cycles.—3907, Electrical Review, 4, Ludgate Hill, London.

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ENGINEERING & Lighting Equipment Co., Ltd., Sphere Works, St. Albans, Herts., are desirous of appointing a Sole Agent for West Riding of Yorkshire, for their Industrial Lighting Fittings. Firm with representatives travelling the territory desired. 3892

ENGINEER with specialised knowledge of moulded insulation and established connection, is prepared to Represent two or three good Firms. Own car.—8577, Electrical Review, 4, Ludgate Hill, London.

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FUNDS available for Advance by way of Debentures, Mortgages, &c.—Particulars of sound business concerns requiring such finance should be sent to Leopold Farmer & Sons, Factory Specialists & Surveyors, 46, Gresham Street, E.C.2. 3890

(*Continued on page* 29.)

CORRECT
Illumination of Shop Windows.



Install

BENJAMIN
Shop Window Reflectors

¶ A well-lighted window really forms one of the most economical and effective advertisements and has been aptly described as a "silent salesman." Efficient window lighting depends entirely on the use of scientifically designed reflectors, selected according to the dimensions of the space to be illuminated.

We shall be pleased to make recommendations—without obligation—which will ensure efficient shop window lighting.

FULL DETAILS OF OUR SHOP WINDOW LIGHTING EQUIPMENT WILL BE SENT ON REQUEST.

The BENJAMIN ELECTRIC Ltd.

Makers of Better Lighting Equipment

BRANTWOOD WORKS :: TOTTENHAM :: LONDON, N. 17

At Home

HENLEY

UNIT PILLARS

and Overseas



Walmgate Bar, York.

Entrance to the City of York in mediæval times was gained by four chief and one less important bar. Walmgate Bar is the only one which still retains its barbican. This was badly damaged in the 1644 siege and was repaired with the stones of St. Nicholas Church which stood about half a mile away. The Distribution Pillar shown is, of course, a Henley Unit Pillar.

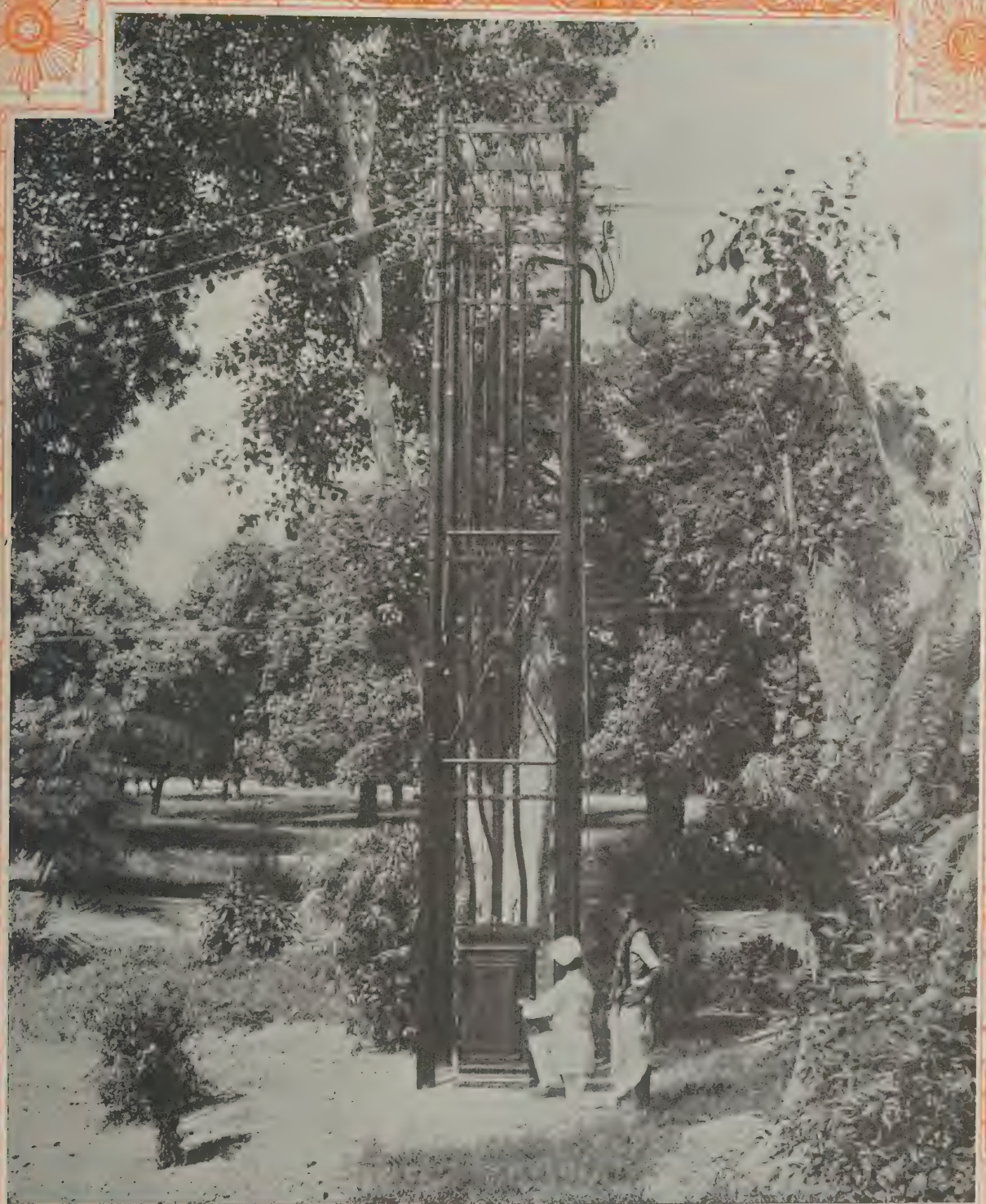
Advt. of W. T. Henley's Telegraph Works Company Ltd. Holborn Viaduct London E.C.1

At Home

HENLEY

UNIT PILLARS

and Overseas



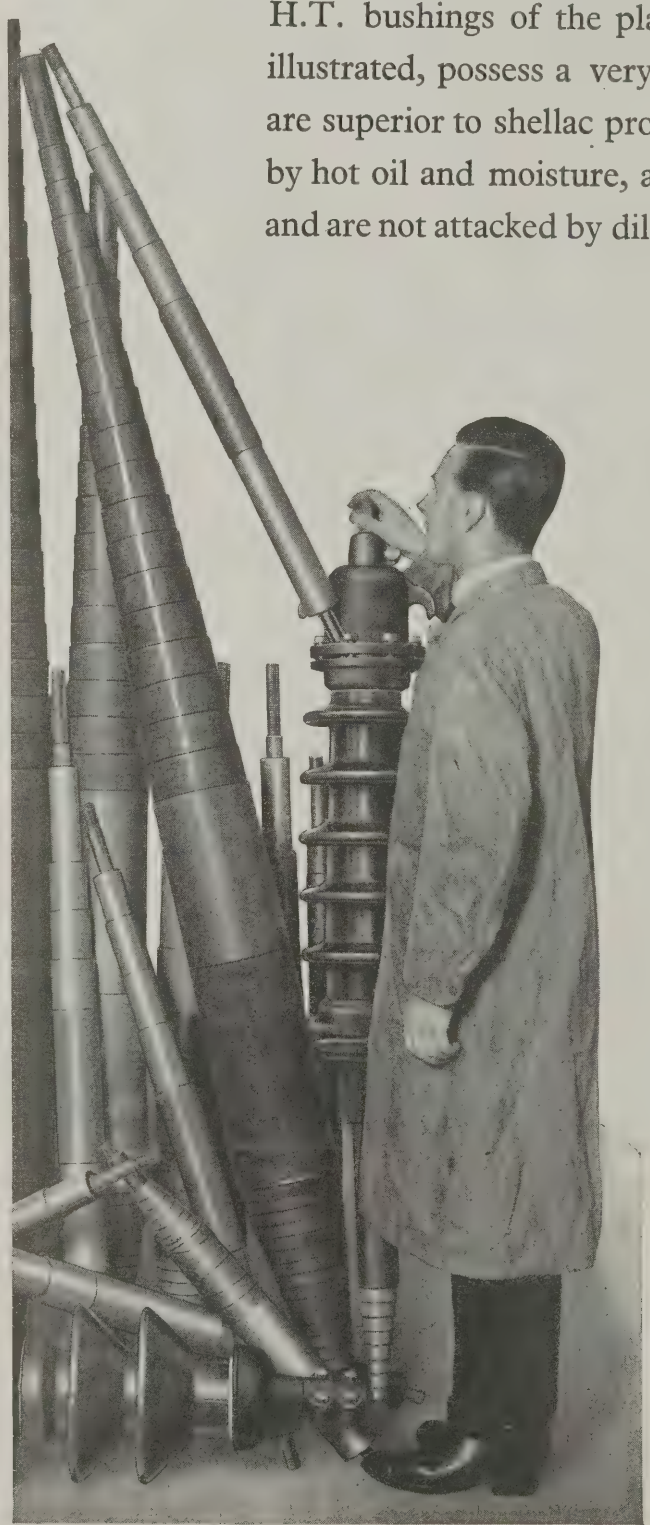
It's a far cry from York to Lucknow but Henley Unit Pillars can be found practically anywhere nowadays. The historical interest of Lucknow lies in the famous Siege of 1857. Lucknow was partially relieved by Havelock and Outram, but it was not until October, four months after the commencement of the Siege, that Sir Colin Campbell took possession of the place.
Our Contract for the supply and installation of a D.C. distributing network at Lucknow Cantonments included several Henley Unit Pillars.

Advt. of W. T. Henley's Telegraph Works Company Ltd. Holborn Viaduct, London E.C.1

HIGH TENSION INSULATION

The reliability of electrical apparatus designed for operating on modern high voltages, depends almost entirely upon the quality of the insulation used.

"Formapex" Synthetic resin treated papers, as used for H.T. bushings of the plain and condenser types such as illustrated, possess a very high electrical strength. They are superior to shellac products, in that they are unaffected by hot oil and moisture, are inert, insoluble, and infusible and are not attacked by dilute acids, petrol, naptha, or ozone.



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"FORMAPEX" IS ALSO SUPPLIED IN THE FORM OF VARNISH, OR AS POWDER FOR MOULDINGS.

IOCO

Insulating Products

THE IOCO RUBBER AND WATERPROOFING CO. LTD.,
Netherton Works, Anniesland,
Glasgow.

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THE DIRECT ELECTRIC LAMP CO.

BEG to announce that they are Removing to Larger Premises at 72, SHOE LANE, E.C.4, to which address all communications should be addressed on and after the 24th JUNE.

THE NEW TELEPHONE NUMBER WILL BE: CITY 7461.

We welcome your inquiries for all types of Lamps and should esteem a personal visit to our offices. 8563

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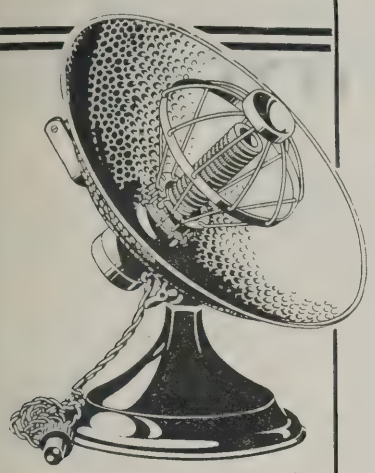
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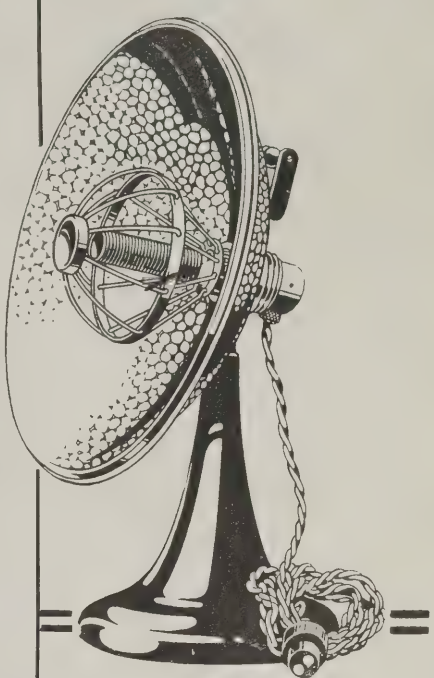
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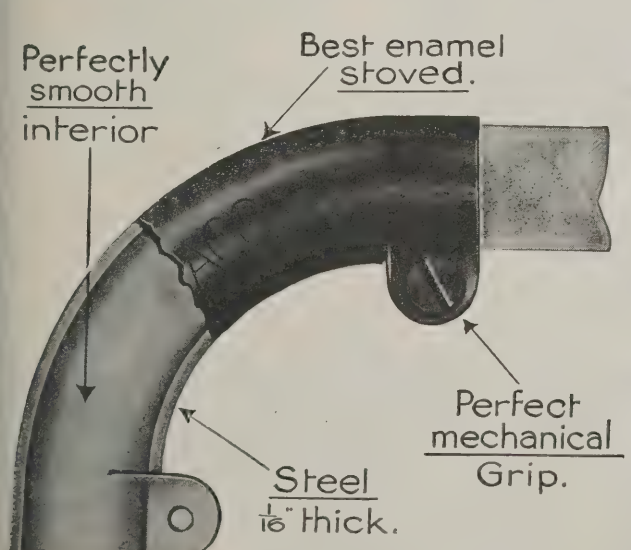
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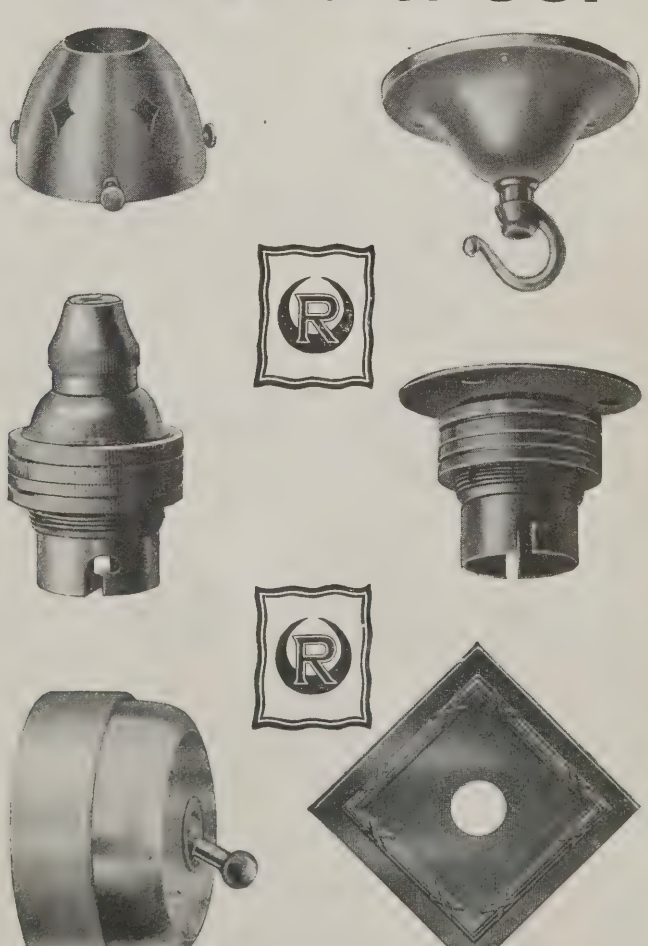
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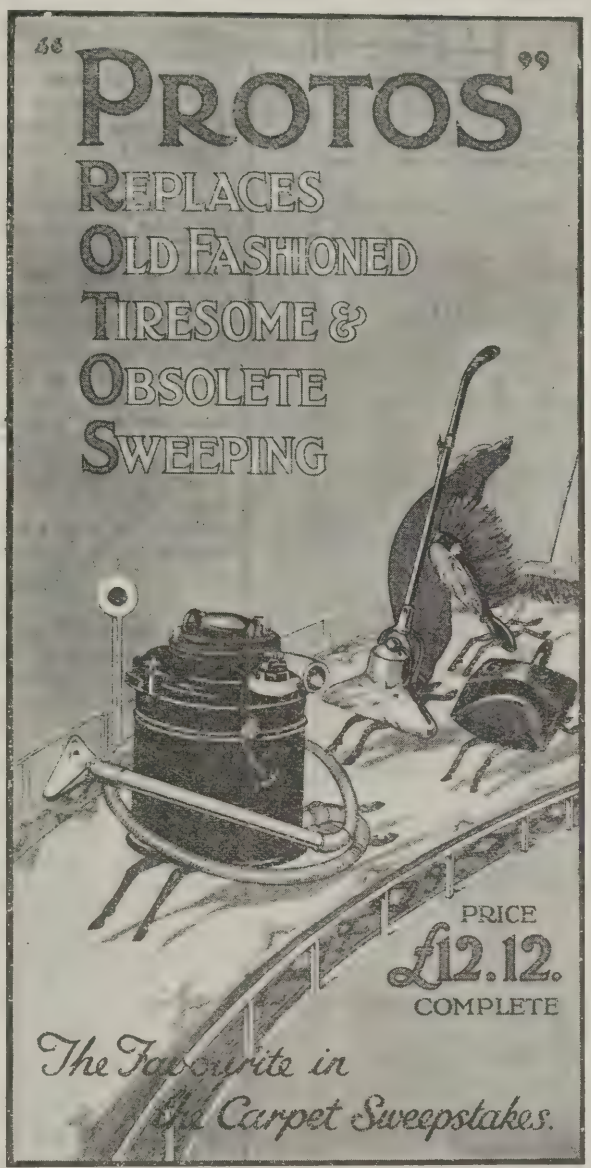
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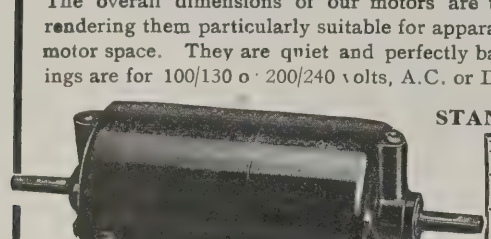
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As to the bonus scheme which had been very much before them recently, no change whatever was made with regard to the 6 per cent. cumulative participating preference stock, the ordinary stock now became an 8 per cent. non-cumulative preferred ordinary stock, and the new deferred ordinary stock about to be created and distributed would take all that was left. He had only come across one misapprehension with regard to the scheme, and that concerned the preference stock. It seemed to have got into the minds of some stockholders that, in future, they were going to receive 8 per cent. on that stock whatever happened. The true fact was that they would get the cumulative dividend of 6 per cent., the extra 2 per cent. remaining contingent, as it did before, upon the balance after 8 per cent. had been paid on the new preferred ordinary stock.

The main object which the directors had had in mind in formulating that scheme had been to recover the stockholders' lost capital. Perhaps he ought not to use that expression "lost capital," but rather capital which had been written off. When a company wrote down its capital, it was usually upon the ground that capital had been lost and was not represented by available assets. What in practice happened was that in the first place the directors persuaded themselves that some capital had been lost, and then persuaded the shareholders to the same effect, and finally, by means of affidavits, persuaded a Chancery Judge. Those affidavits were strictly true, as all they did was to say that upon a valuation the capital was not fully represented. What they did not say was that with a little luck and good management that capital might very likely be regained. His contention was that in many cases the capital had not been lost, but that there had merely been depreciation, often temporary, in value. He himself was a director of five companies, of which the British Electric Traction was one, which had written down their capital, and in the four other cases those companies had not only regained all that they had lost, or was considered to be lost, but a very great deal more, and he thought the British Electric Traction Co. was now well on the way towards doing the same.

He knew that some stockholders felt that they had lost capital, and, therefore, the directors wanted to give them something that would not only remove that feeling, but would actually make good any real loss which might have been sustained. The present bonus of deferred ordinary stock was, he hoped, only a first instalment, and, if at the end of the current year they were able to pay a dividend of 10 per cent. or more, he would himself like to see that dividend paid not in cash, but in stock. He did not want that to frighten the stockholders, for, if £100 stock was worth £150 in the market—and he would like to see it at £200—it did not take much arithmetic to show that £10 in stock that was worth £15 or £20 was better than £10 in cash. Of course, the decision would be in the stockholders' hands, and he thought that all except a few greedy stockholders, who wanted both, would be quite satisfied to take stock.

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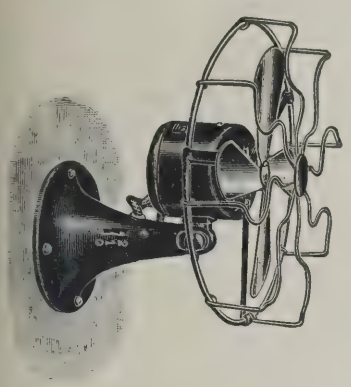
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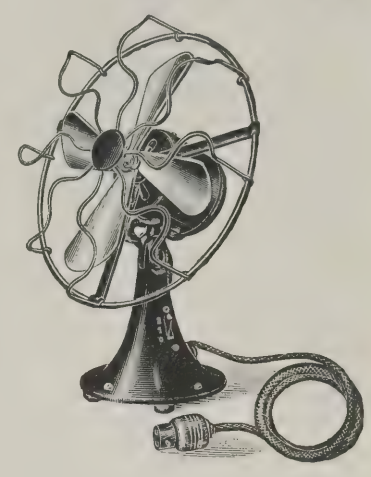
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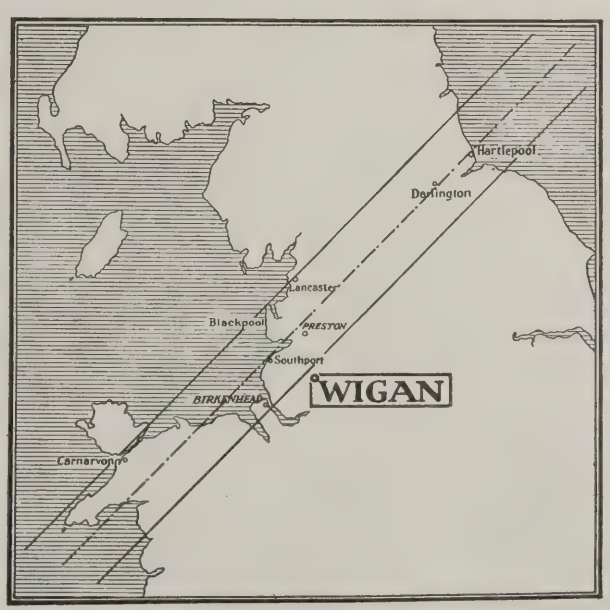
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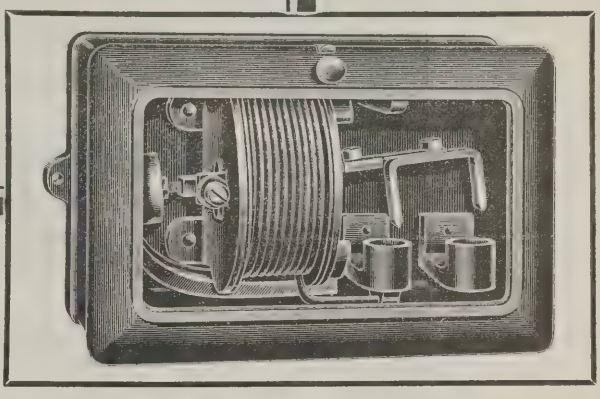
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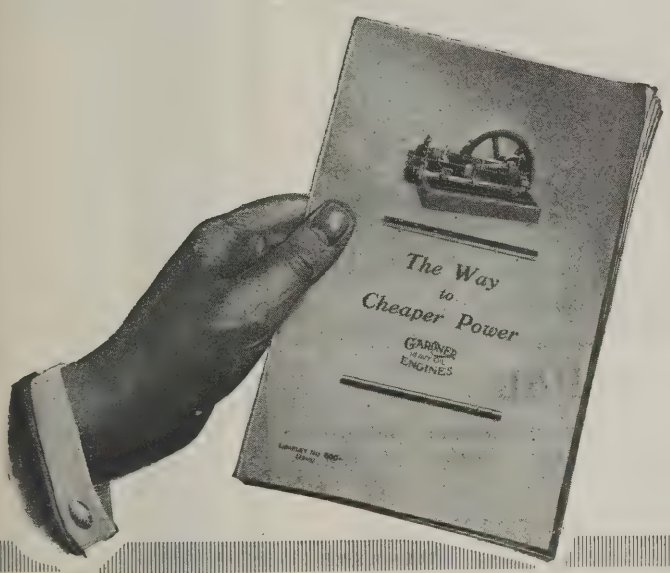
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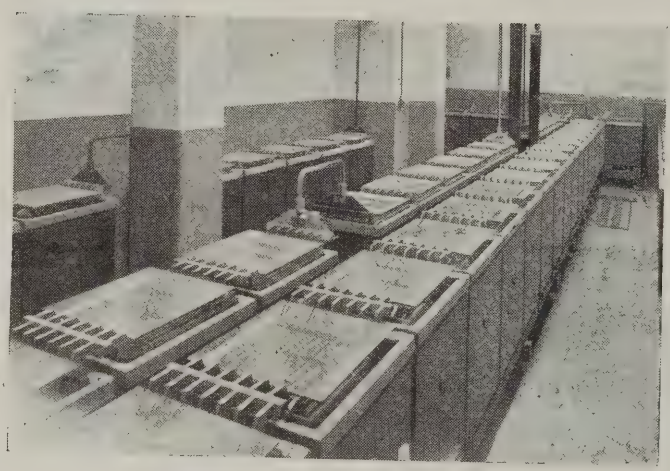
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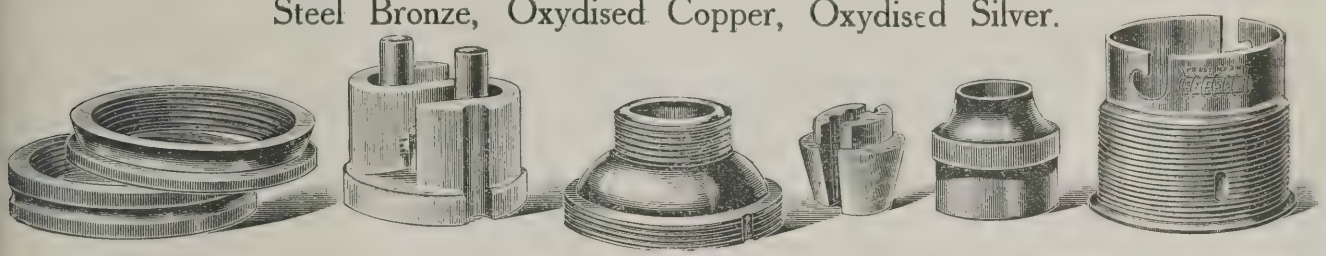
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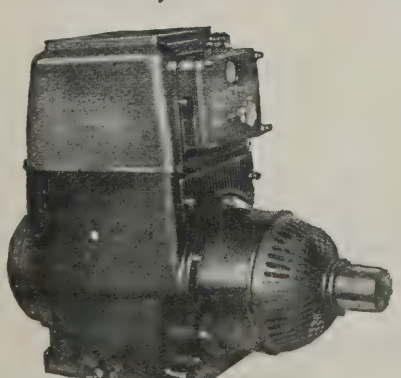
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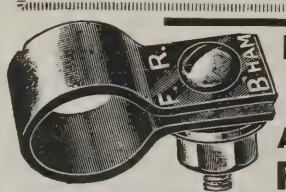
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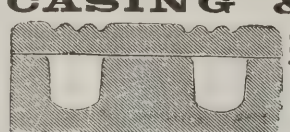
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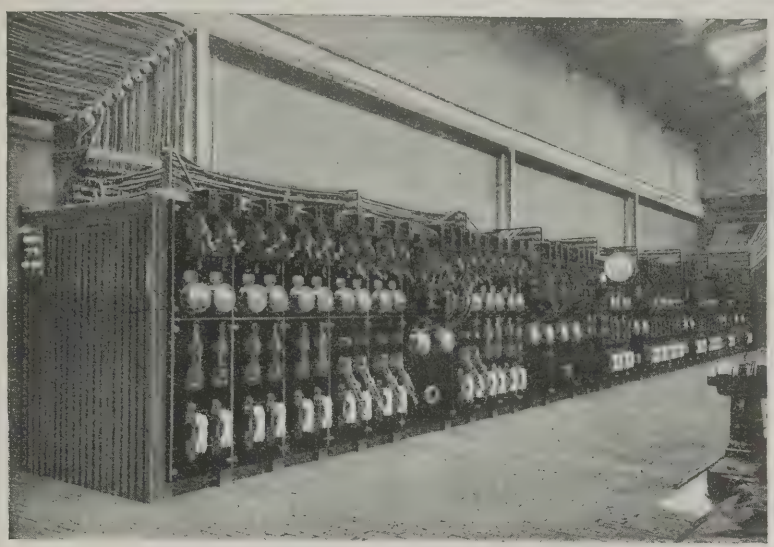
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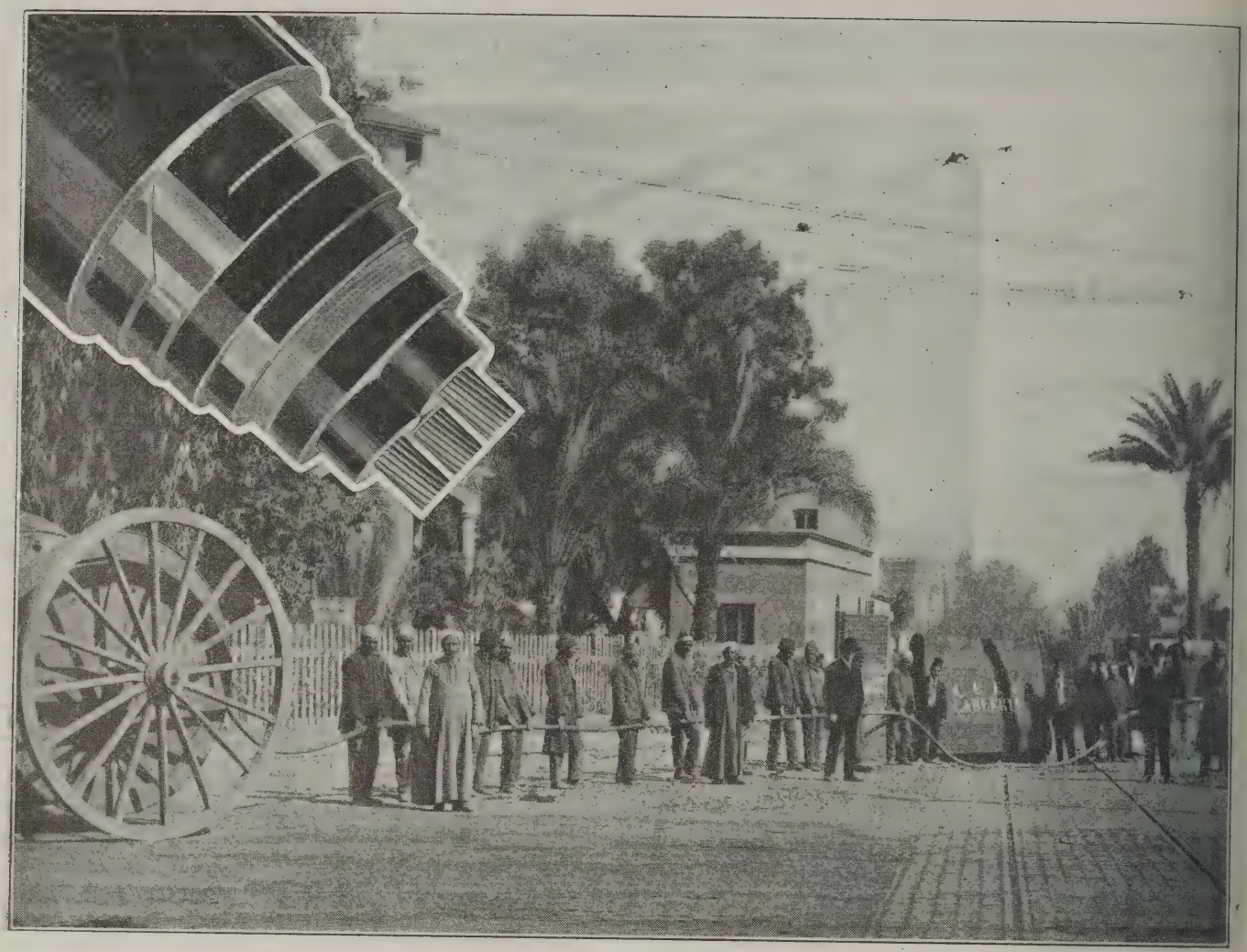
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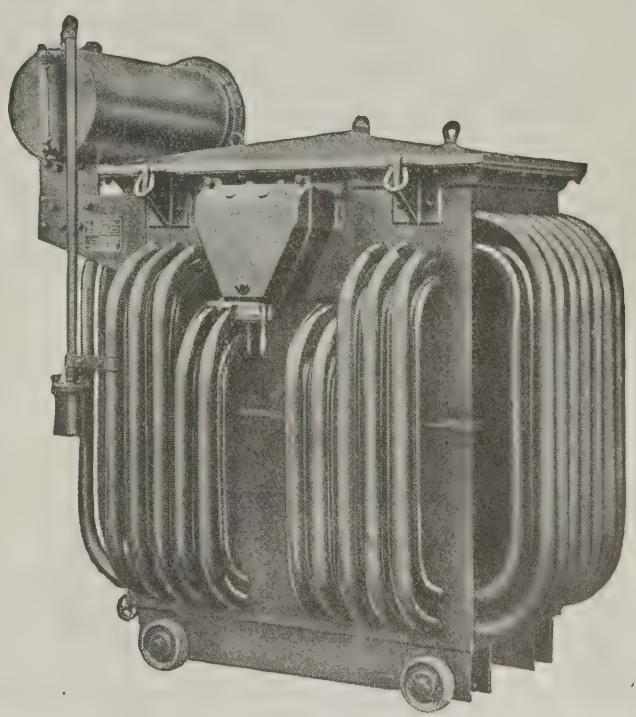
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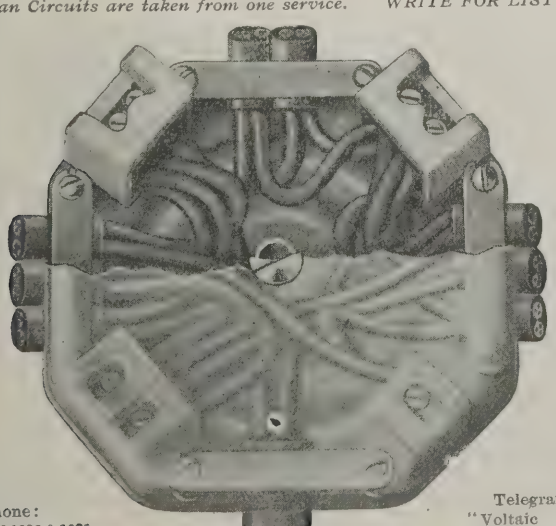
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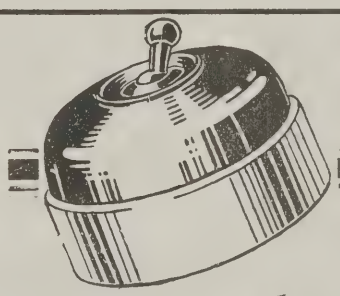
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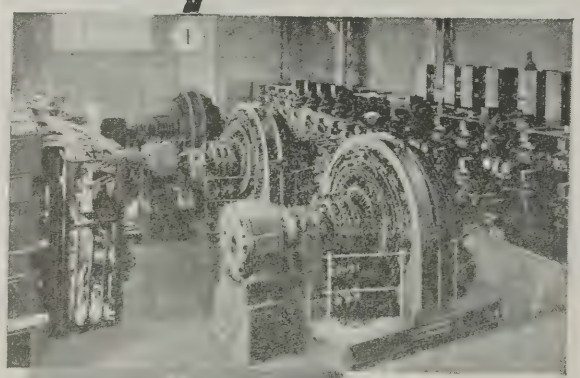


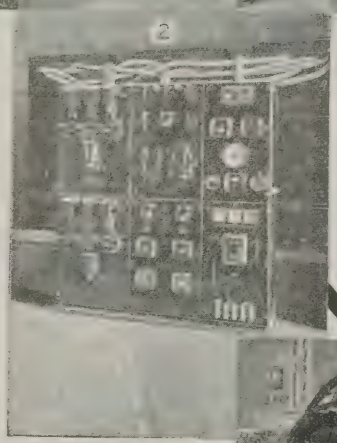
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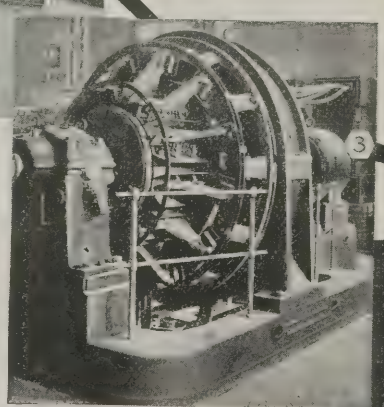
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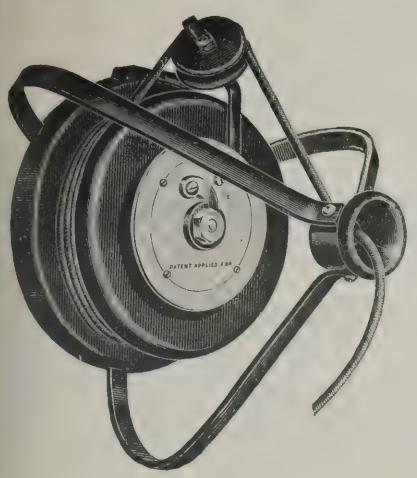
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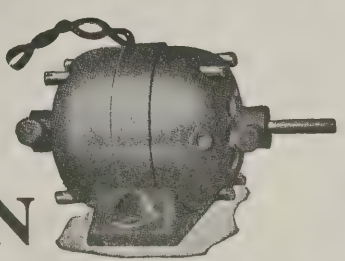
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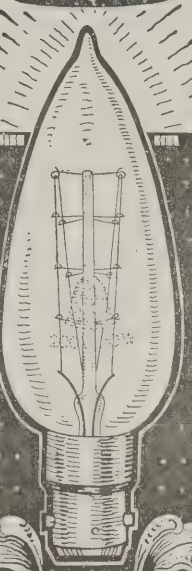
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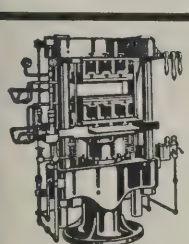
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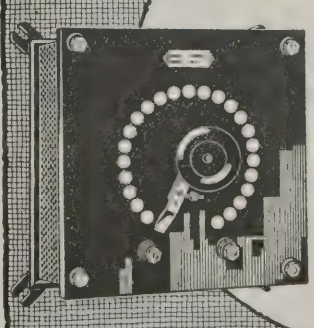
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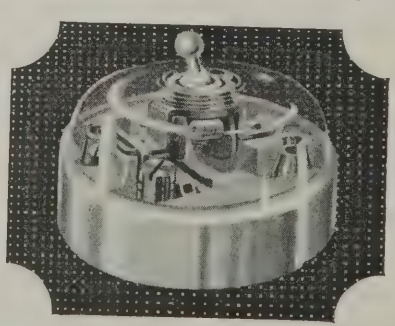
The Wolf and the Goat.

A Wolf caught sight of a Goat browsing above him on the scanty herbage that grew on the top of a steep rock, and being unable to get at her, tried to induce her to come lower down. "You are risking your life up there, Madame, indeed you are," he called out, "pray take my advice and come down here where you will find plenty of better food." The Goat turned a knowing eye upon him. "It's little you care where I get good grass or bad," said she: "What you want is to eat me."

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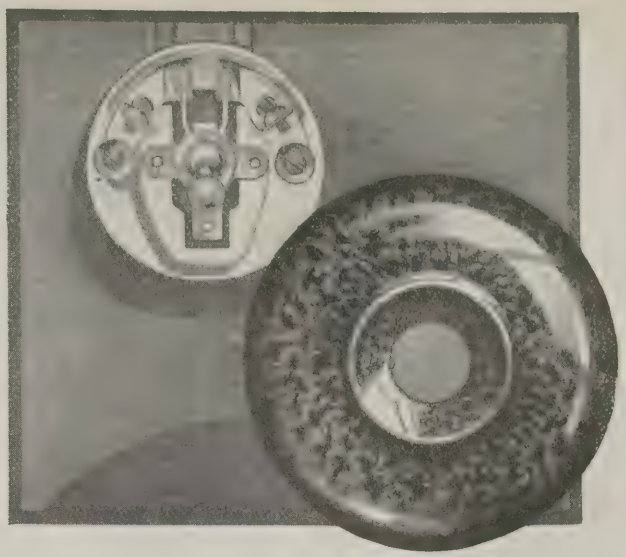
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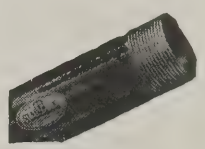
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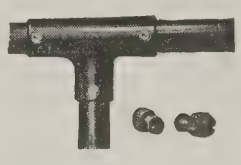
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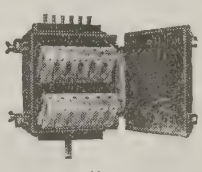
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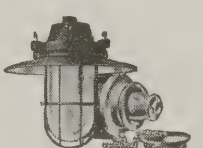
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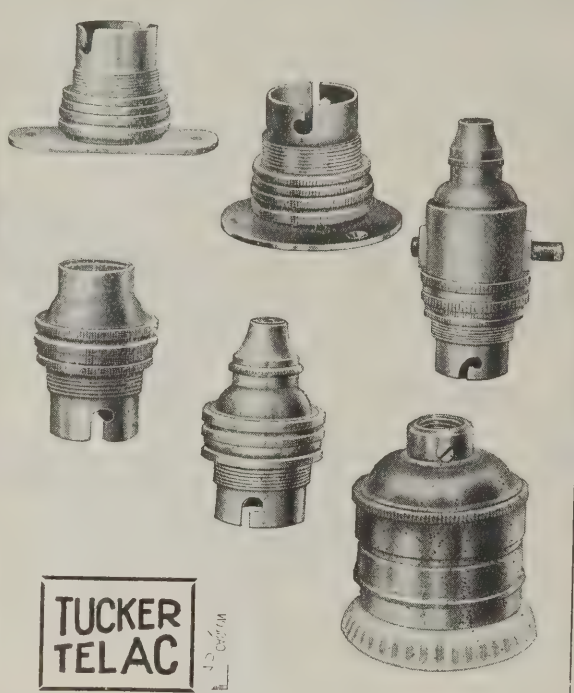
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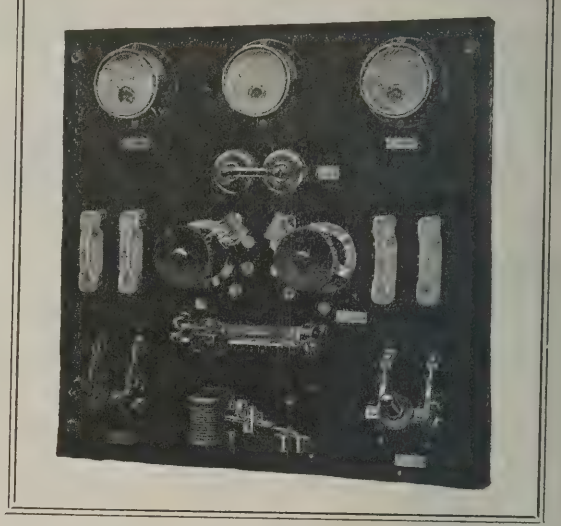
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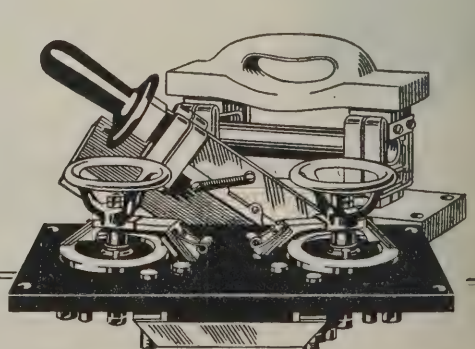


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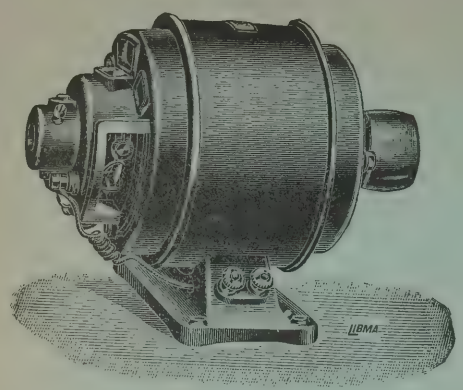
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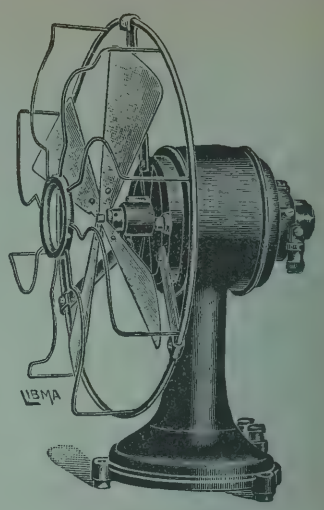
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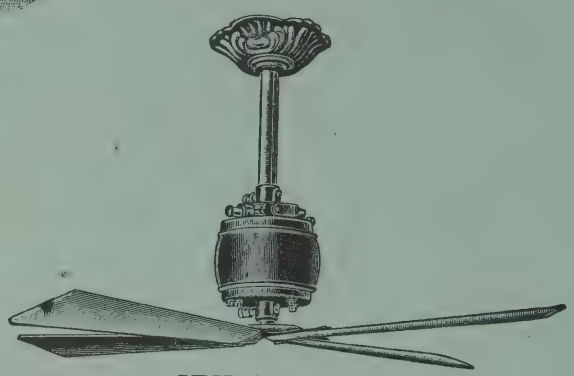
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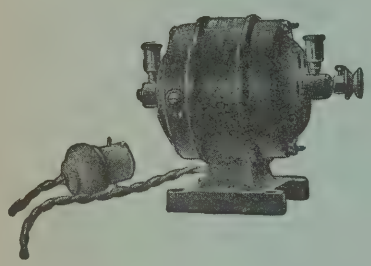
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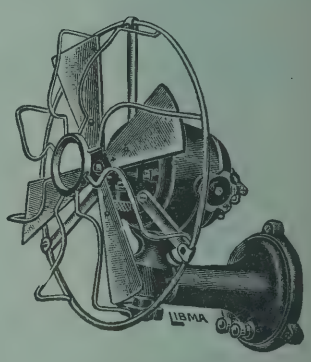
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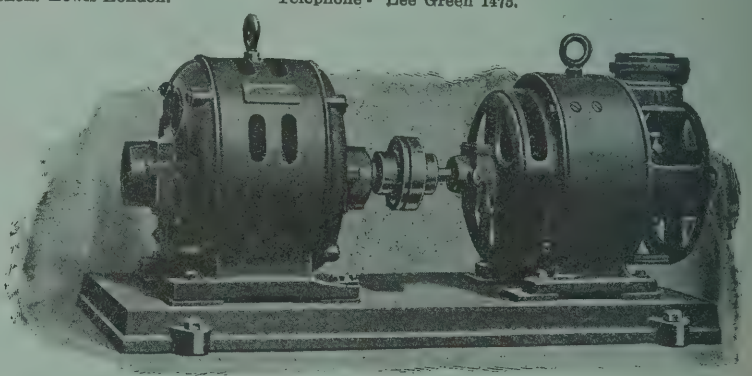
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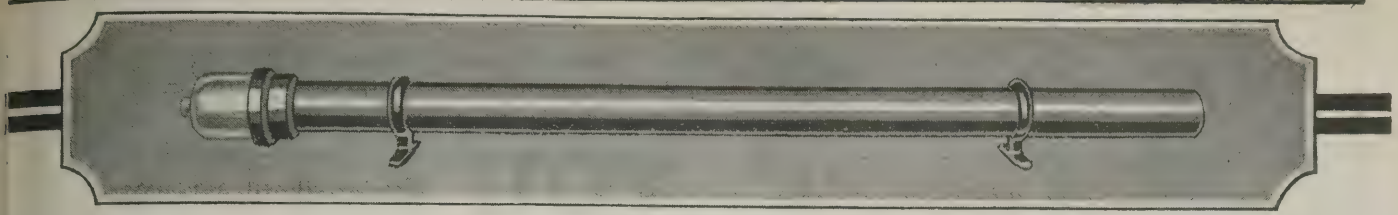
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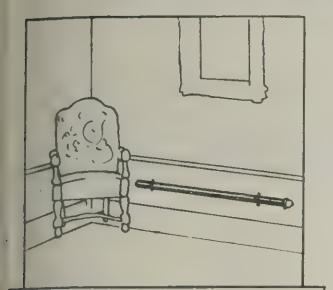
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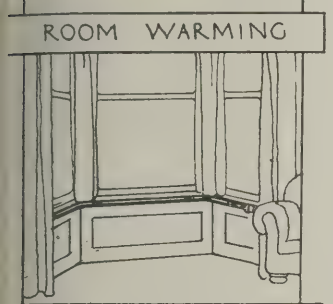
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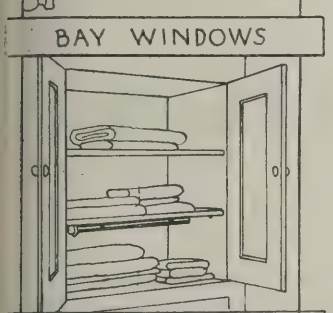
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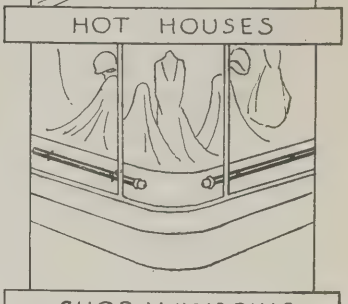
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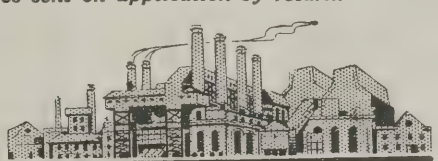

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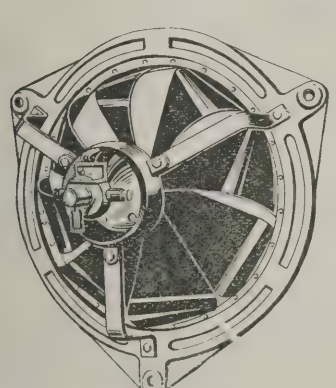
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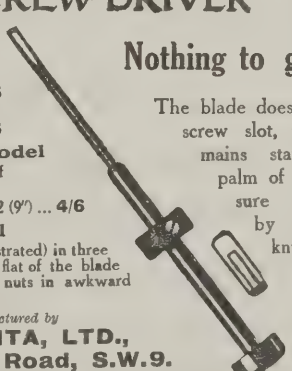
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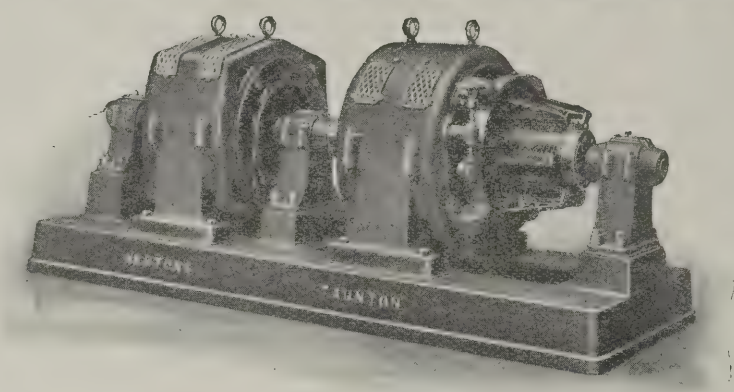
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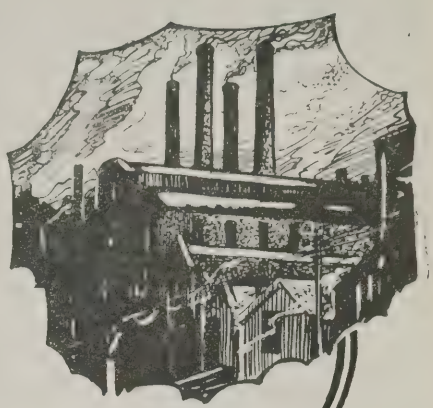
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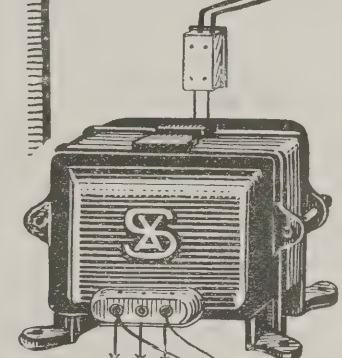
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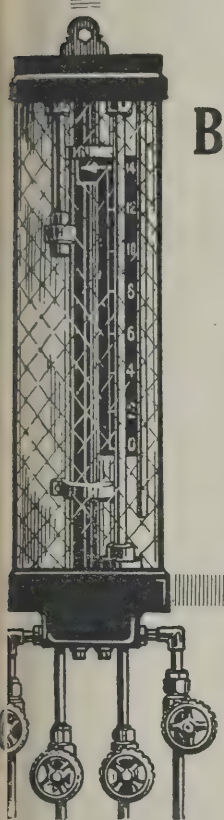
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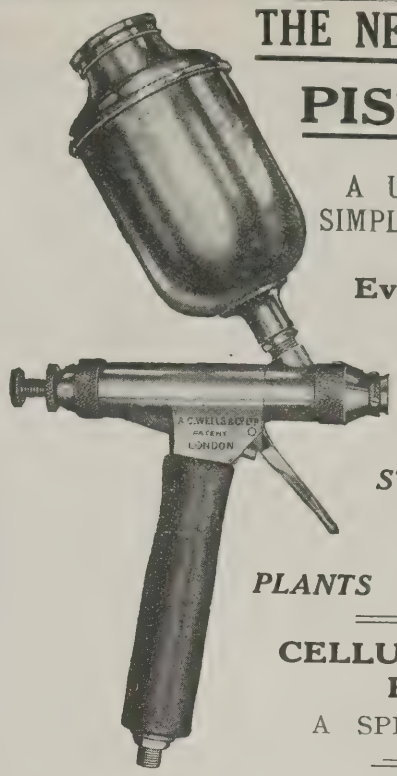
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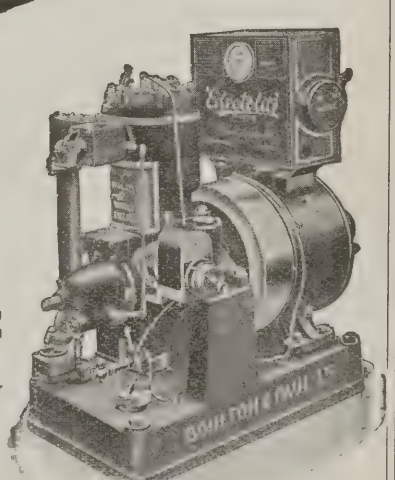
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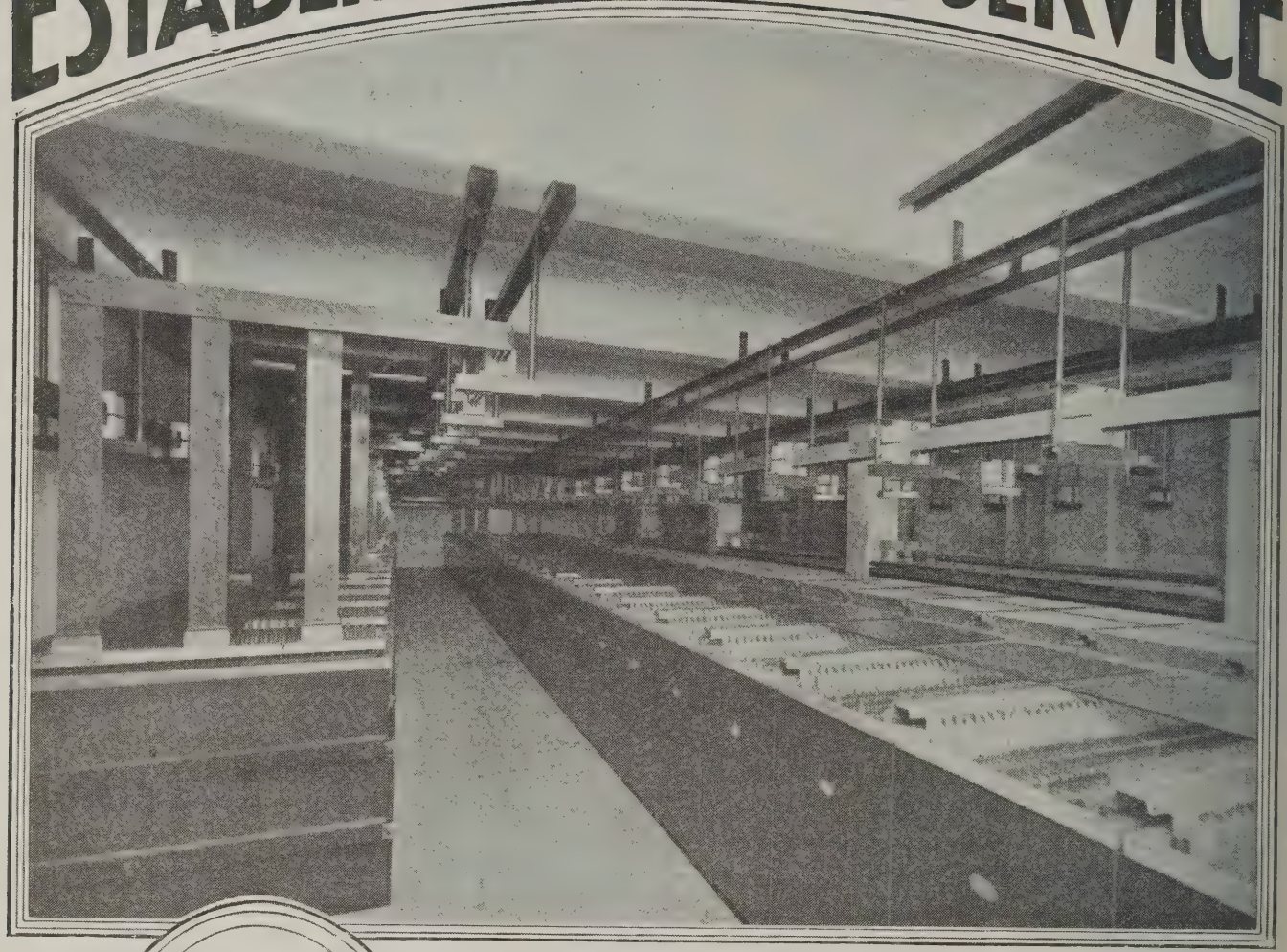


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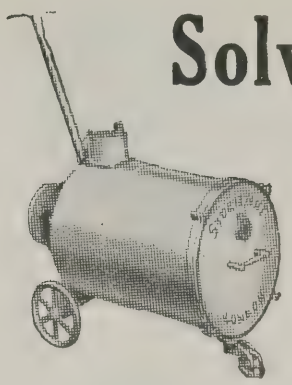
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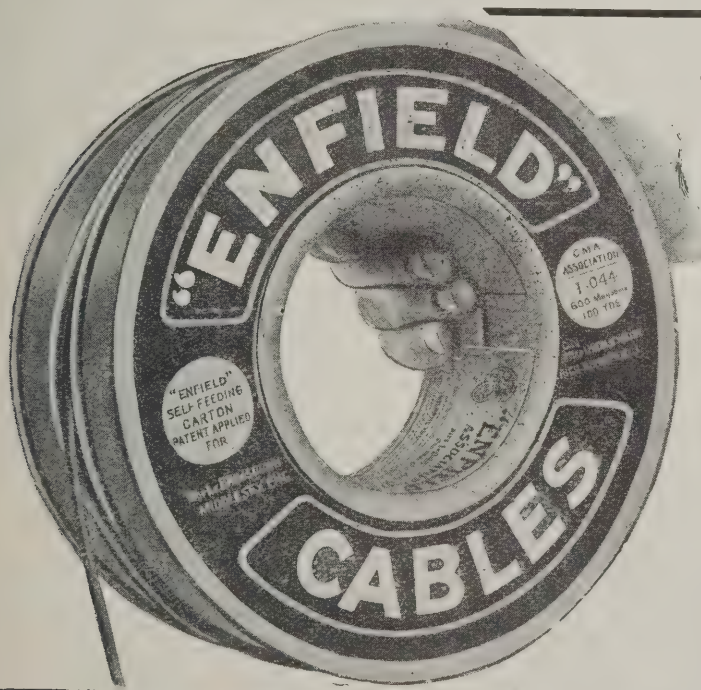
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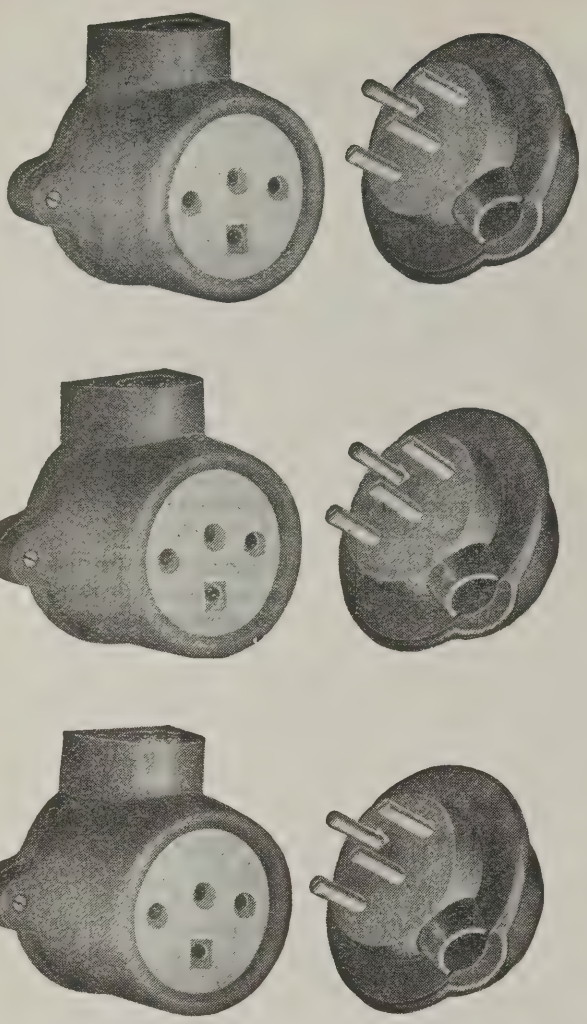
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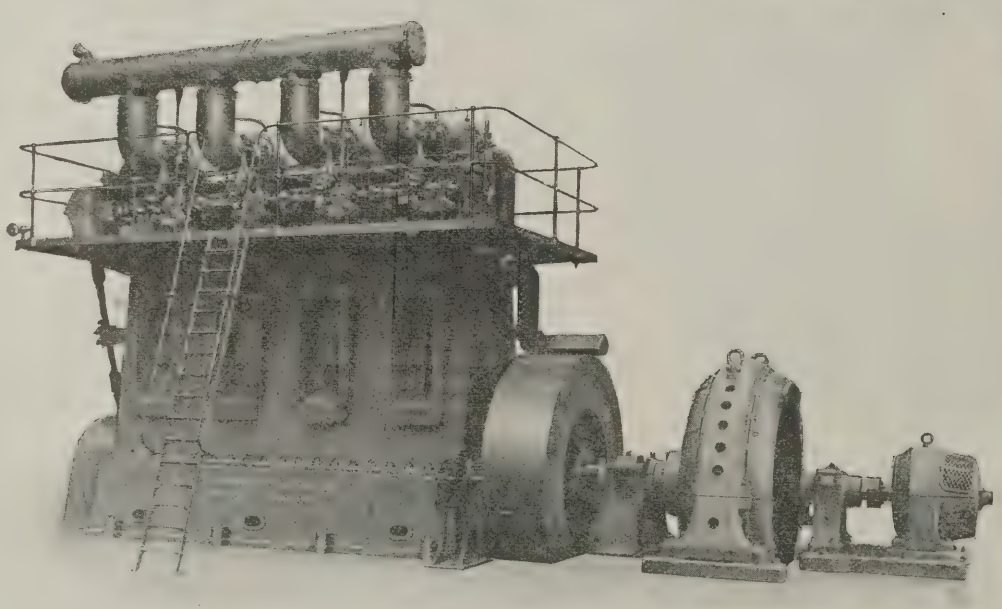
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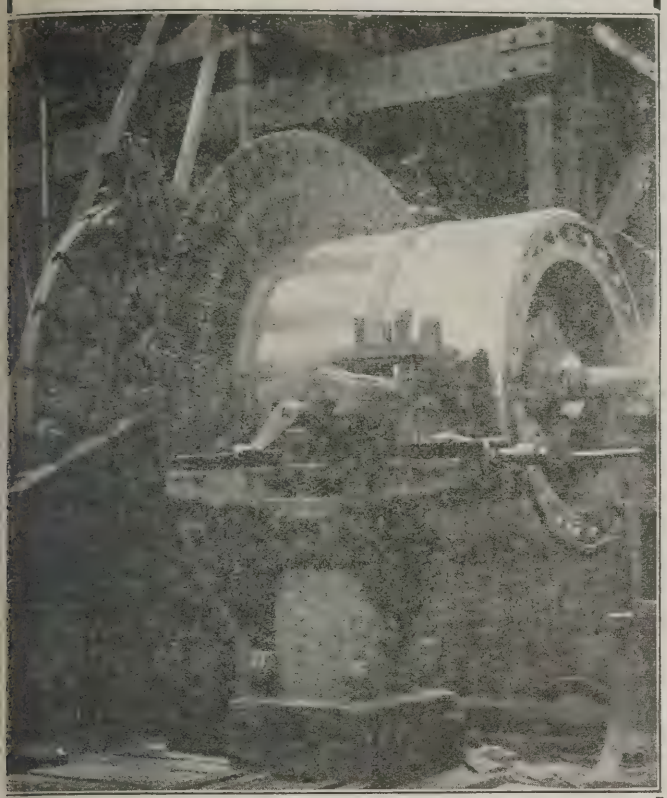
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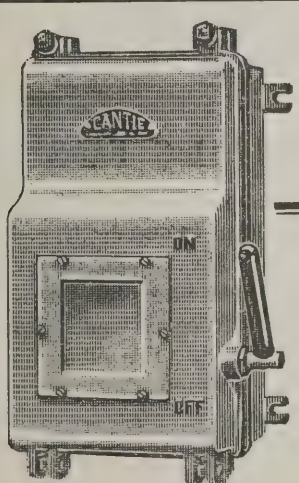
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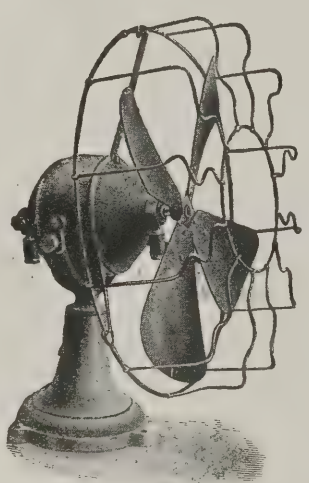
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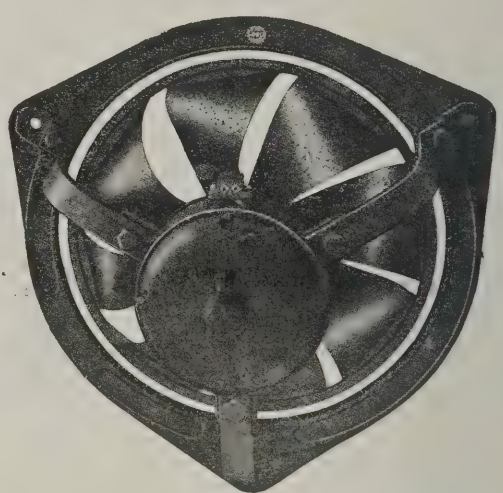
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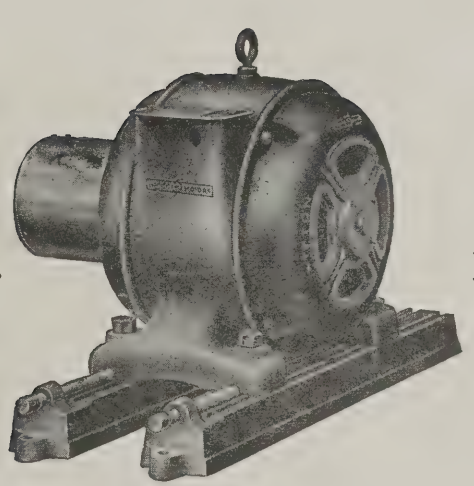
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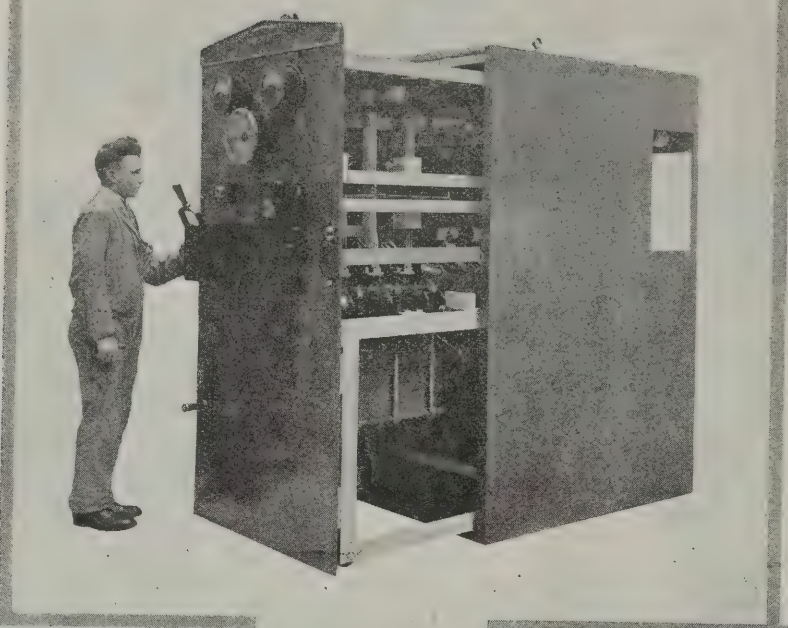


Fig. 1.

Fig. **1** above shows an equipment with the truck portion partially withdrawn. A side view of the truck is shown in Fig. **2**, and a rear view in Fig. **3**. In the latter, the two sets of isolating sockets in parallel are clearly shown, together with the air cooled synchronising potential transformer and oil tank raising and lowering mechanism.

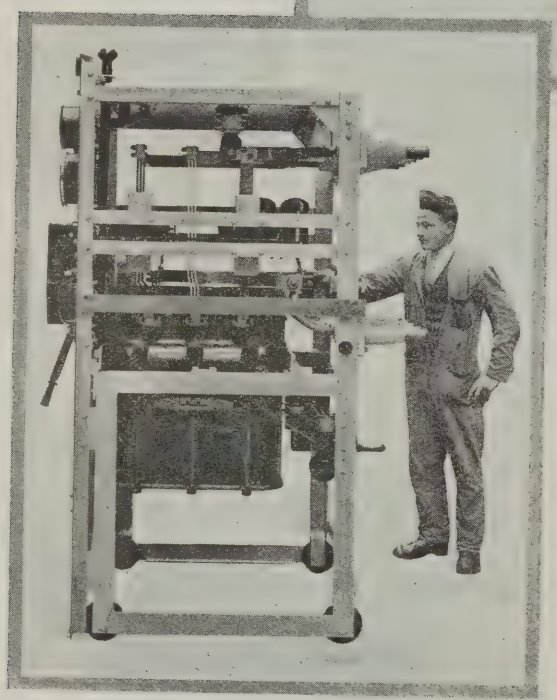


Fig. 2.



Fig. 3.

The use of truck type switchgear for heavy current low tension duty is increasing and a recent example is shown above.

Heavy section welded frames ensure rigidity and a mechanical rack out device enables one man to withdraw or plug in the truck portion.

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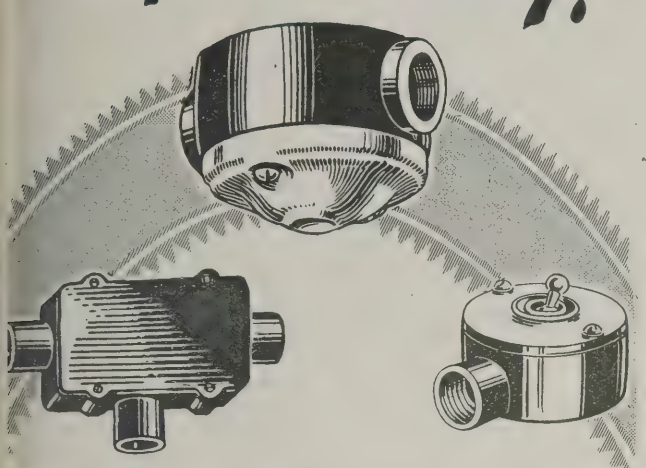
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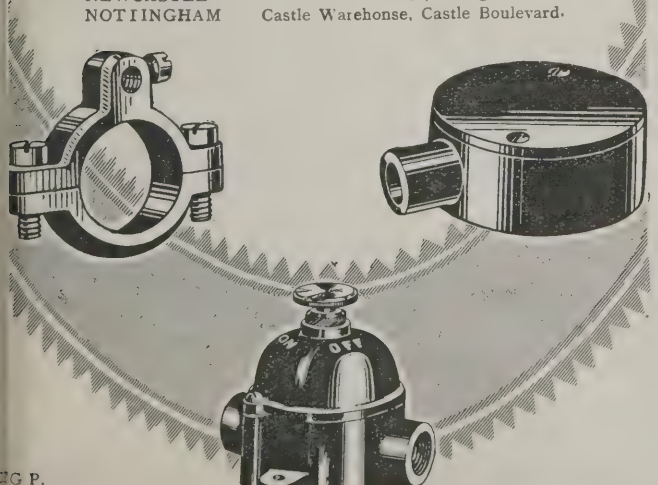
No matter what Fittings you may order from the range of "Walsall" Fittings, you can be quite sure in advance that the standard of quality in materials, workmanship and finish, will be of the very highest.

Every Fitting is so thoroughly examined and tested before despatch that the very name "Walsall" has become accepted as sufficient guarantee of satisfaction.

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Hardware Manufacturing Co., Ltd.,
Ablewell Street, Walsall.

London Office & Stores :
Addison Bridge, Kensington Road, W. 14.

LIVERPOOL	4, Preston Street.
GLASGOW	40, Broomielaw.
MANCHESTER	9, Watling Street, Shudehill.
LEEDS	York House, 21, York Place.
BELFAST	College Square North.
CARDIFF	West Canal Wharf.
LEICESTER	20, New Street.
COLCHESTER	T. A. Evans & Sons, 19/20, North Hill.
LANCASTER	D. Inman, Nile Street.
NEWCASTLE	61, Westgate Road.
NOTTINGHAM	Castle Warehonse, Castle Boulevard.



DON'T

instal an Electric Motor unless its windings have been thoroughly impregnated and carefully tested before leaving the works. We GUARANTEE all our machines to be absolutely perfect before despatching so that you can with safety instal any type of SCOTT machine and

FORGET

all about it. No petty troubles such as loose bearings developing after a few weeks in operation, windings breaking down to earth, or a short between phases letting both you and your customer down.

THE

following test results recently obtained on one of our stock motors in the presence of an eminent Consulting Engineer is conclusive proof of the only Quality we make.

SPECIFICATION :—
9 B.H.P., 3-Ph., 400 Volts, 50 cycles,
940 R.P.M., Squirrel Cage.
Efficiency, full load - 85·2%
Power Factor ,, - ·875
Temp. rise :- Core 69°F. Windings 65°F.
Pressure test 2,000 Volts A.C. for 1 minute.
Overloads :—25% 2 hours. 50% 1 minute.
100% 15 seconds,
thus complying in every respect with B.E.S.A. 168-1926
and the **Q.E.D.**

PRICE

£14 - 5 - 0
TRADE

also to same specification we offer

10 B.H.P. £15-5-0. 12 B.H.P. £18-0-0.

These serve to illustrate the value we can supply throughout the whole range of our Products.

A.C. ½ to 200 H.P. D.C.
300-3,000 R.P.M.

TO SUIT ALL INDUSTRIAL PURPOSES.

DELIVERY FREE GT. BRITAIN.

For terms write :—

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VOLT WORKS - RAVENHILL AVENUE - BELFAST.

— ESTABLISHED OVER 70 YEARS. —

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STOCK MACHINES DESPATCHED SAME DAY AS ORDER RECEIVED, SUBJECT TO PRIOR SALE.

LIST SENT BY RETURN POST.

FERRANTI

STANDARD SMALL A.C. METER, TYPE F.D.c. 10 AMPS

(made in one size only).



The illustration is half full size.

WEIGHT $4\frac{1}{4}$ LBS.

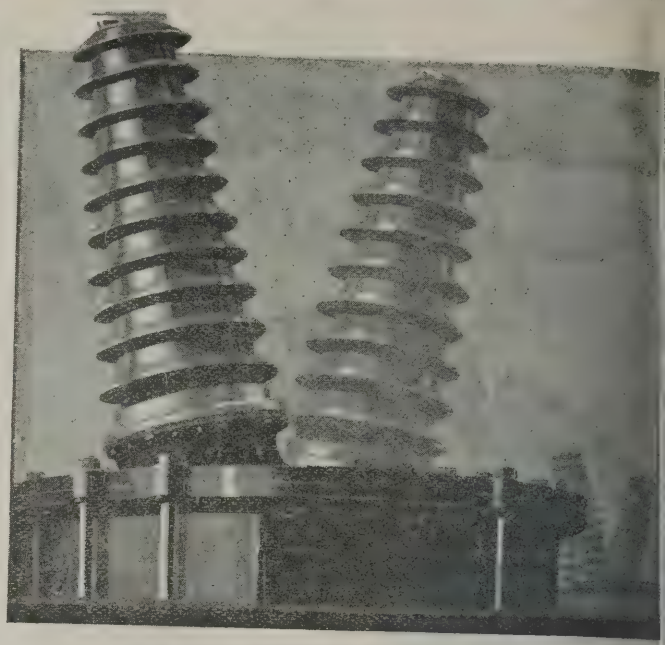
OVERALL DIMENSIONS
$7\frac{5}{16}$" x $3\frac{15}{16}$" x $3\frac{3}{16}$"

OVER HALF A MILLION IN USE.

Ferranti Ltd.
Hollinwood
Lancashire

Ferranti Electric
Limited
Toronto Canada.

Ferranti Inc.
130 West 42nd St.
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BUSHING INSULATORS

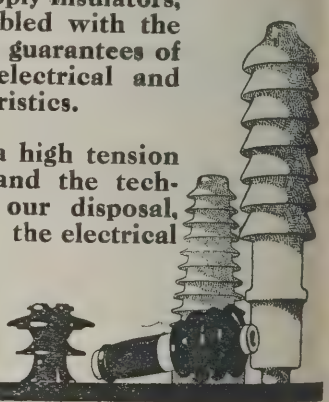
Size is a distinctive feature of extra high tension bushing insulators.

The question of how large, or rather how small, the body of porcelain used is a matter of scientific design. But only expert manufacture can produce the necessary vitrosity, strength and accuracy, and at the same time permit of the most economical supply.

This expert designing is an aspect of electrical porcelain development in which we specialise.

For the manufacture of insulators to customers' designs, we offer porcelain of unique quality. To those who prefer a complete standard we can supply insulators, designed and assembled with the metalwork, carrying guarantees of oil tightness, and electrical and mechanical characteristics.

Our works, our extra high tension testing equipment and the technical facilities at our disposal, are at the service of the electrical supply industry.



T.T.6.

TAYLOR TUNNICLIFF

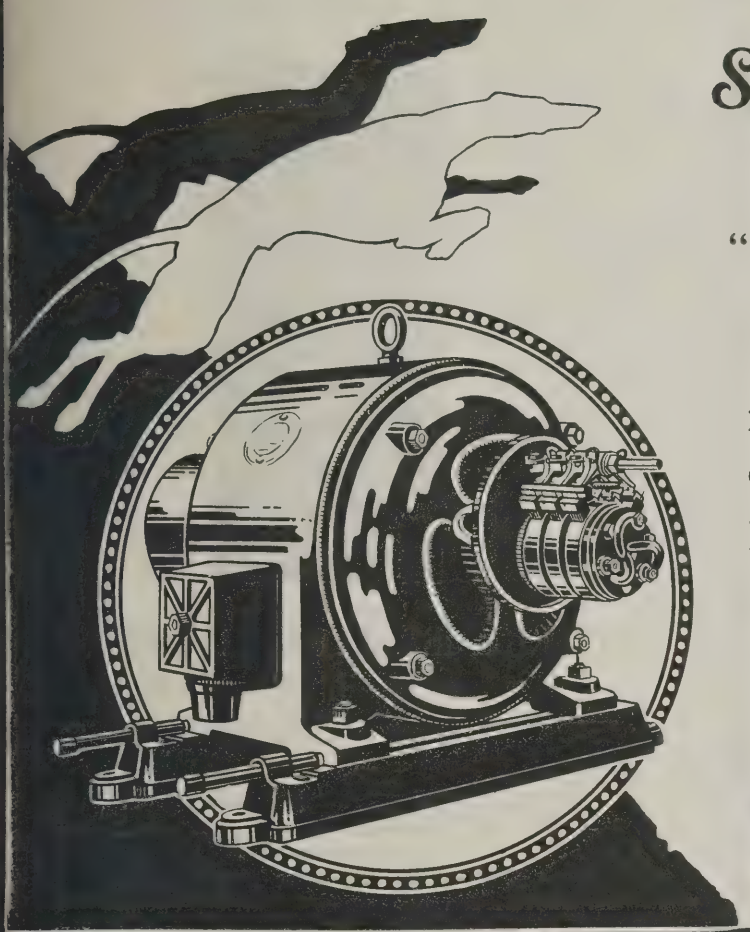
AND COMPANY, LIMITED.

Head Office: EASTWOOD, HANLEY, STAFFS.
Telephone: Hanley 2012.
Telegrams: Eastwood, Hanley.

London Office: 110, CANNON ST., E.C.4.
Telephone: City 6620.

T & C ENGLAND

Brook Motors for Smooth Running



"BROOK" specialist made Motors provide ample Power and Overloads without fuss or anxiety wherever required, making them forgetable parts of any installation,

AND YOU PAY NO MORE.

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President : The Right Hon. The Lord Mayor of B'ham (Ald. A. H. James, C.B.E.).

MIDLAND BUILDING AND ALLIED TRADES EXHIBITION

(including Public Works and Road Making Section),

BINGLEY HALL, BIRMINGHAM, SEPT. 5 to 17, 1927.

IN RESPONSE TO the general requests of Exhibitors at the first Exhibition two years ago, the Birmingham Chamber of Commerce (Inc.) has arranged to hold a similar display, on a still larger scale, in the coming autumn.

ALL ASPECTS OF Modern Building will be represented. The following is the Schedule of Exhibits :—

Building Materials.
Builders' Ironmongery and Hardware.
Architectural and Ornamental Work.
Constructional Steelwork.
Ferro-Concrete.
Sanitary Apparatus, Appliances & Fittings.
Contractors' Plant.
Shop, Bar and Restaurant Fittings.
Municipal Engineering and Equipment.
Road Making Plant and Materials.
Paints, Varnishes, Colours, Enamels, Stains, Polishes, Lacquers, Metal Powders, Wood Preservatives, Glues & Adhesives.
Mechanical and Hand Painting and Spraying Apparatus.
Decorating Materials, Wall-papers and Coverings.
Electrical, Gas, Oil and other Illuminating and Heating Plant and Fittings.

UNDER THE AUSPICES of the leading Architectural and Trades Associations.

Conferences on technical subjects and problems of the day will be held throughout the Exhibition in a Conference Pavilion specially erected for the purpose. Arrangements have also been made for the entertainment at Luncheon, day by day, of influential trade delegations.

THE greater part of available space having been booked in advance by Exhibitors in 1925

EARLY APPLICATION IS ESSENTIAL.

Full Particulars from :
The Exhibitions Director, The Chamber of Commerce, (Inc.), Birmingham.

FREDERICK SMITH AND COMPANY SALFORD

BARE COPPER STRAND

for

Power Transmission Lines

FREDERICK SMITH AND COMPANY

Incorporated in The London Electric Wire Co & Smiths, Ltd.,

Anaconda Works, Salford, Manchester.

JUDD

"F.I.L." INSULATORS



FABBRICA ISOLATORI LIVORNO, S.A.

***Works :* LEGHORN, ITALY.**

***Central Sales Office :* MILAN (3), Via Monte Napoleone, 39.**
Manager : E. VOLPATO.

SPECIALITY :

HIGH TENSION LINE INSULATORS.

Please address enquiries to our Sole Agents for the British Empire (except Canada) :

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POLISHING EQUIPMENT



We were established in 1785, and our experience is at your disposal.

Our manufactures cover the whole range of polishing machinery and materials for polishing the smallest piece of jewellery to the largest casting. Canning lathes, either belt driven or electric, have an unrivalled record for durability—and the use of our mobs, bobs, brushes and compos will prove their quality and economy.

W. CANNING & Co. LTD

GREAT HAMPTON STREET, BIRMINGHAM.



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We manufacture the exact equipment for your requirements.



ECONOMY

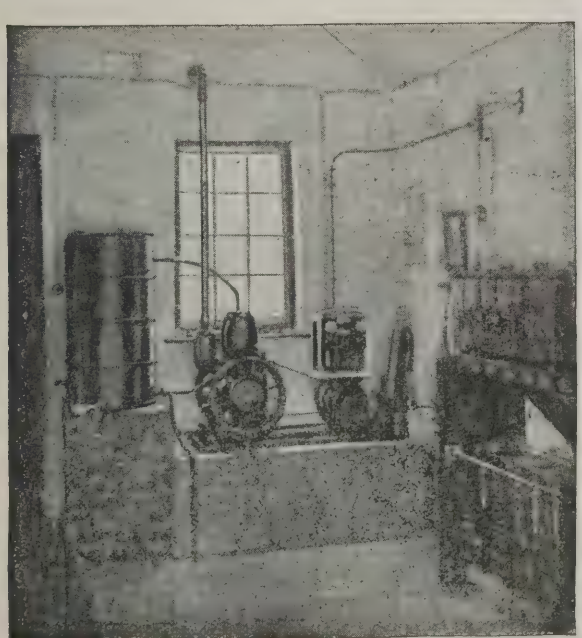
"The Gleaners," after J. F. Millet.

JUST as the Gleaners reap the benefit of the last grain of corn, so users of Petter Oil Engines gain that extra economy in power per unit which puts these engines in a class by themselves.

This economy proceeds largely from the simplicity of their construction which brings about decreased initial costs and considerably reduced upkeep costs. This is especially noticeable when one compares our engines, built on the 2-stroke cycle with 4-stroke cycle engines. The fuel and lubrication costs of Petter engines are remarkably low.

Such qualities bring sales and it is significant that Petter Agents are to be found in every important town in the world.

The range of our products has recently been increased so that we now manufacture engines and oil-power electric generating sets from 1½ to 2,000 Horse Power—a proof in itself of our growing expansion. Our star is in the ascendant and the Agent who hitches his wagon to this star will be well advised.



A Petter-Light Installation.

PETTER-LIGHT

Petter-Light Electric-Generating Sets are not excelled by any other small power lighting plants for use in Country Houses, Factories, Shops, etc.

They are made in sizes from ¾ to 3 K.W. and work on petrol/paraffin with magneto ignition.

Our prices have recently been reduced and these lighting sets are sold from £80 and upwards, with batteries complete.

There is also a range of direct-coupled Petter-Light Plants.

For full particulars of the Petter Agency write to:

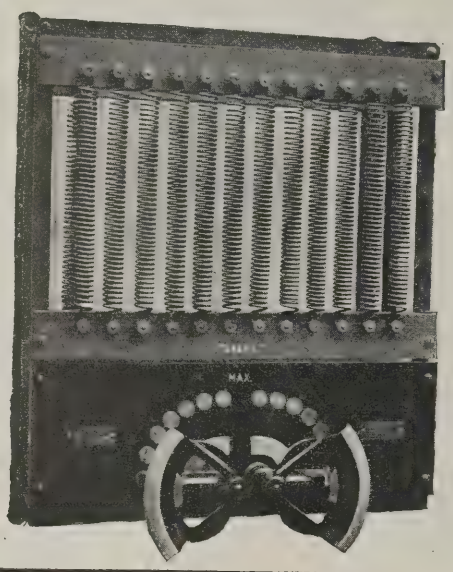
PETTERS LIMITED

Works: **YEOVIL and IPSWICH.**

Enquiries for engines up to 36 B.H.P. should be addressed to Yeovil; for larger sizes to Ipswich.

RESISTANCES
FOR
CINEMA ARCS.

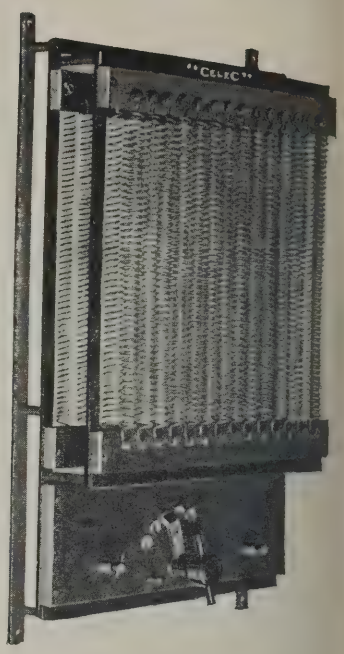
PATENT DUPLEX TYPE.
FOR TWO ARCS.



FOR
Ordinary Carbon - - - 48-50 v. Arc.
High Intensity Mirro Light 25-32 v. Arc.
Flaming Arc - - - - 50-68 v. Arc.

WE HAVE SUPPLIED
the RESISTANCES for the Three NEWEST LONDON THEATRES.

THIRTY YEARS' BRITISH
Manufacturing Experience,
During the last 16 years of which we have Specialized on the manufacture of over
40,000
RESISTANCES.



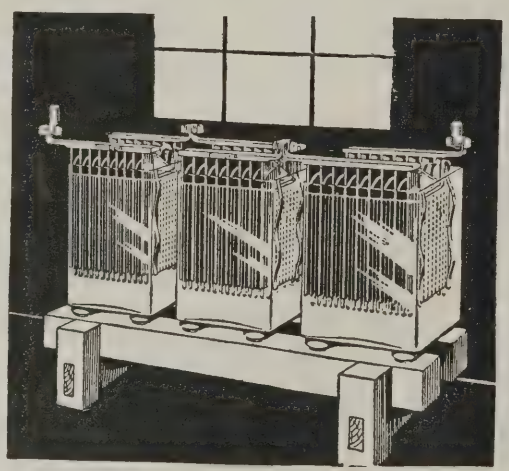
REGULATING RESISTANCE.
FOR ONE ARC.
(Guards if required.)

The Curtis Manufacturing Co., Ltd.
"MAKERS OF RESISTANCE APPARATUS,"
Conduit Place,
Paddington, W.2.

"CELEC"
REG. TRADE MARK.

'Phone: Paddington 4076.
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ESTABLISHED 1910.



Fuller
ALL BRITISH
HOUSE LIGHTING BATTERIES
"THE RECOGNISED STANDARD."

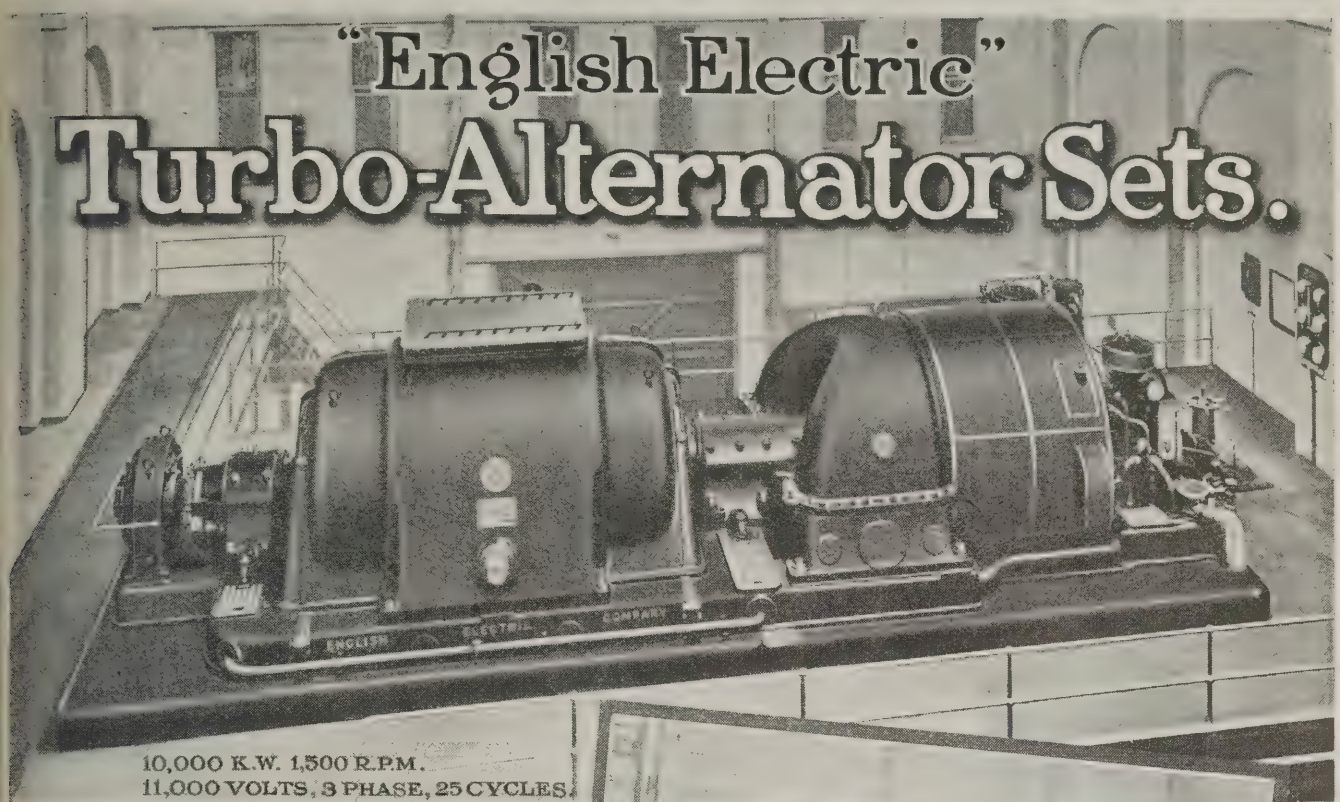
THE Battery which meets your requirements must be reliable, efficient, and capable of maintaining its capacity throughout its useful life.

Experience proves that the Fuller battery meets these requirements in every way. It sells on its merits as a highly-efficient dependable product.

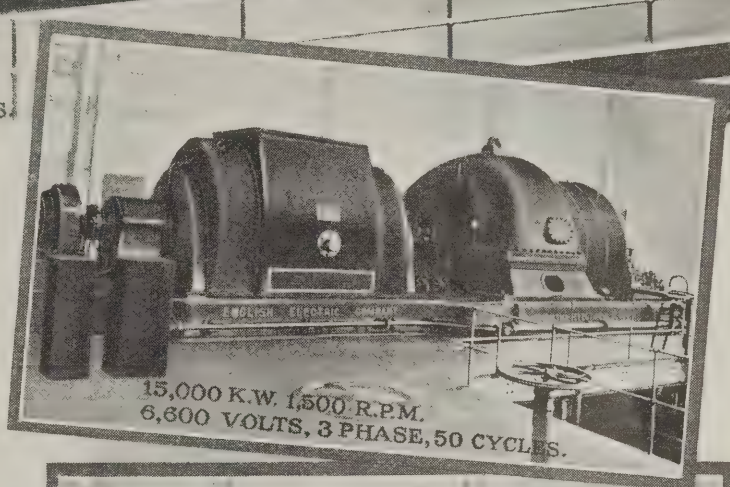
Standard House Lighting ratings up to 600 amp. hours' capacity, fitted with heavy Plante Positive and Box Type Negative Plates.

FULLER ACCUMULATOR
COMPANY (1926) LIMITED.
Manufacturers of Central Station, House Lighting, Train Lighting, Traction, Automobile, Radio, Ignition, Medical and other Batteries.
CHADWELL HEATH, ESSEX.
TELEGRAMS: "FULLER, CHADWELL HEATH."
TELEPHONE: SEVEN KINGS 1200.

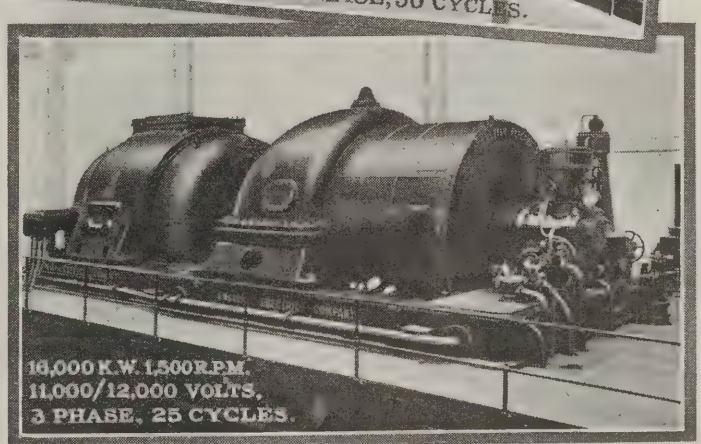
"English Electric" Turbo-Alternator Sets.



10,000 K.W. 1,500 R.P.M.
11,000 VOLTS, 3 PHASE, 25 CYCLES.



15,000 K.W. 1,500 R.P.M.
6,600 VOLTS, 3 PHASE, 50 CYCLES.



10,000 K.W. 1,500 R.P.M.
11,000/12,000 VOLTS.
3 PHASE, 25 CYCLES.

1,500 R.P.M. Turbo Sets of 10,000 K.W. and over

THE long and extensive experience of The English Electric Company in the design, manufacture and installation of Turbo Alternator Sets in all parts of the world, places them in an unique position, and enables the Company to undertake contracts for the largest Power Schemes at home and abroad.

Development of improved designs is maintained by research, and a careful study of results obtained in practical working, together with the adoption of improved manufacturing methods.

The illustration shows three "English Electric" Turbo Sets, each of 10,000 K.W. or over, supplied respectively to Adelaide, Calcutta and Treforest.

ENGLISH ELECTRIC

THE ENGLISH ELECTRIC COMPANY LIMITED

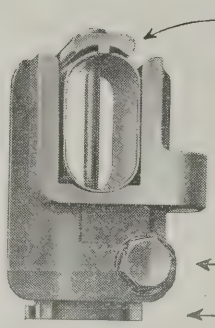
Head Office:—

Queen's House, Kingsway, London, W.C.2.

Works: BRADFORD, COVENTRY, PRESTON, RUGBY AND STAFFORD.

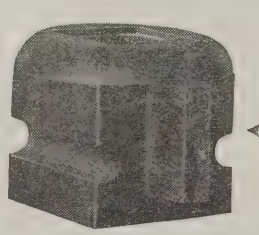
The CALLENDER-WATSON TYPE SPRING CONTACT

MANUFAGTURED UNDER PATENT No 157011.

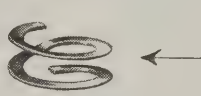


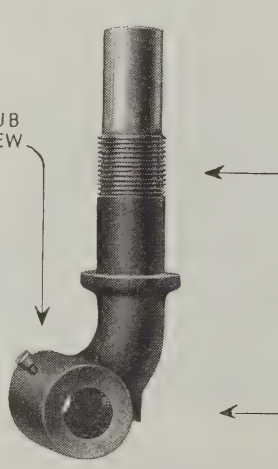




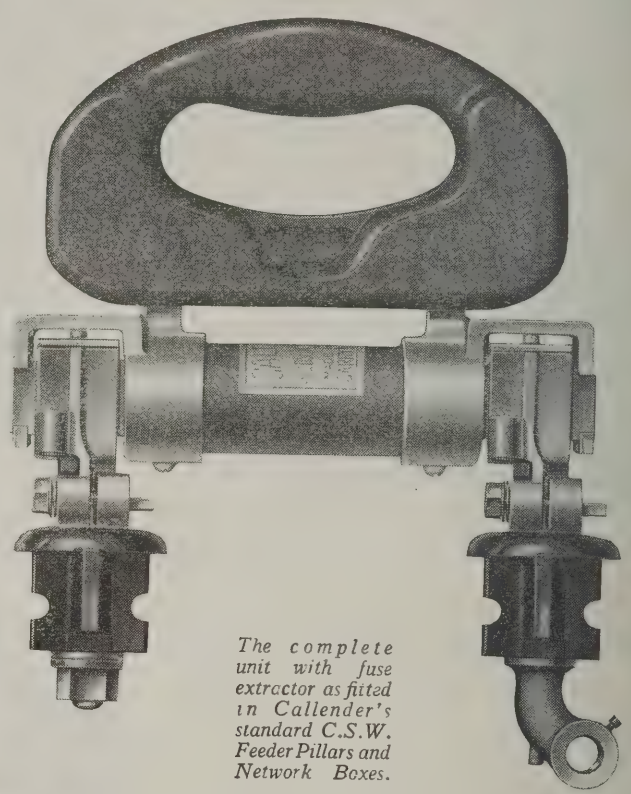






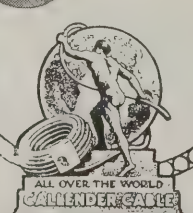






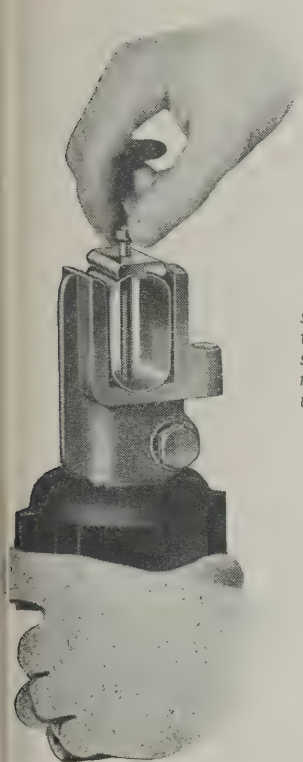
The complete unit with fuse extractor as fitted in Callender's standard C.S.W. Feeder Pillars and Network Boxes.

THE Callender Watson Type Spring Contact, evolved after months of experimenting, has now not only removed all the objections and prejudices engineers may hitherto have had against spring contacts, but provides considerable advantages over other types of disconnecting gear. With this type the ready disconnecting of links or fuses can be obtained without the delay and trouble of undoing nuts or screws. From the illustration showing the arrangement of the stalk and contact head it will be noted that the stalk is supported in the insulator by means of an internal nut, so that when the contact head is removed for any purpose there is no possibility of the stalk dropping out and making contact with the sides of the pillar body, or the bottom of the network Box.

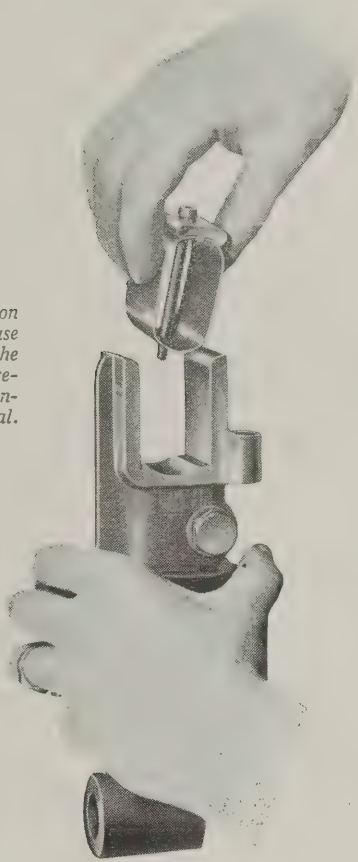


CALLENDER'S CABLE & CONSTRUCTION CO. LTD.
Hamilton House, Victoria Embankment, LONDON E.C.4
Telephone, 8903 Central. Telegrams "Callender" Ldn.

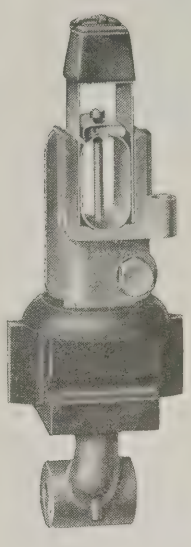
ILLUSTRATING ADVANTAGES OF THESE PATENT SPRING CONTACTS



This illustration shows the ease with which the spring clip is removed for cleaning or renewal.

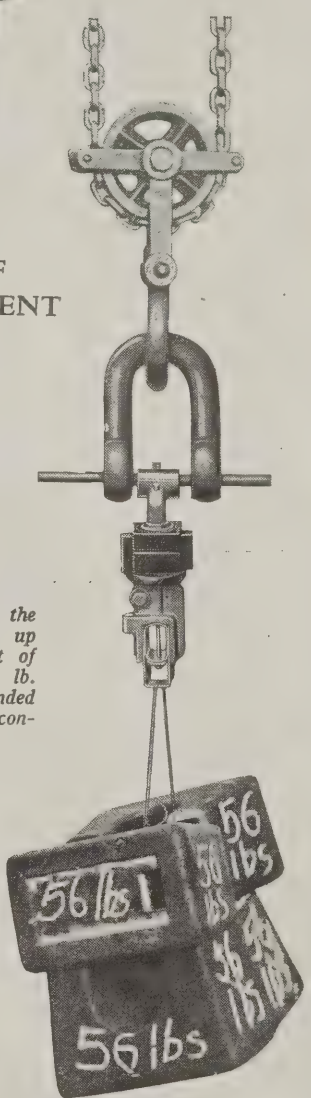


EASY REMOVAL



This photograph illustrates the slight pressure required to push home the fuse contact, whilst the one below,

SCOPE OF ADJUSTMENT



demonstrates the adjustability up to the point of holding 4-56 lb. weights suspended from the fuse contact.

The chief advantages of the Callender Watson Type Spring Contact are:—

(1) The springs are easily removable.

(2) The pressure on the contact surfaces is adjustable.

(3) The spring when removed leaves a wide space between the contact jaws, rendering cleaning easy.

(4) The spring itself is not relied upon to carry any current.

(5) The spring is in compression, thus minimising fatigue in the material.

(6) Each side of the contact will carry the current applicable to the cable for which it is used, continuously without overheating, whether links or fuses are adopted.



CALLENDER'S CABLE & CONSTRUCTION CO., LTD.
Hamilton House, Victoria Embankment, LONDON E.C.4
Telephone, 8903 Central. Telegrams "Callender" Ldn.



You can ring up

Mr. Hotpoint and get immediate attention to all requirements for Heating, Cooking, Washing & Cleaning Apparatus.

Mr. Hotpoint has also a special department for the repairing of any class of heating or cooking apparatus.

The Hotpoint Electric Appliance Co., Ltd.

Head Office—24 Newman Street, London, W.1

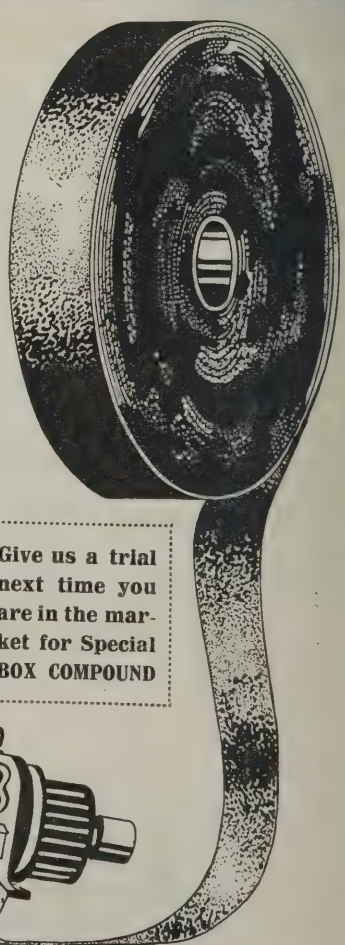
Museum 8327/8. **"Hotpoint, Wesdo, London."**

ALSO AT

18 Queen Street, Manchester (City 3703). **164 Howard Street, Glasgow (Central 798).**

18 Chester Street, Bradford ('Phone 5548).

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For reliable, long-wearing insulation, wherever a tape may be used, Clarke's "ATLAS" Black Adhesive Insulating Tape is the best for the purpose. Dynamo and Motor Manufacturers, Switchgear users, and all Electrical Engineers, who know the meaning of perfect insulation, will appreciate the value of "ATLAS"—the best Tape obtainable.

Easy handling, due to the fact that it is perfectly adhesive without being sticky. It is guaranteed not to dry out. The yardage is 125 feet to the lb. on a basis of ¾" wide.

SEND FOR SAMPLES AND PRICES, STATING QUANTITIES.

CLARKE'S "ATLAS"

BEST BLACK ADHESIVE INSULATING TAPE.

We have one of the largest stocks in the world. Specify Clarke's "ATLAS" and be sure of the best.

Also Manufacturers of:
Micanite — moulding commutator and flexible qualities, Pure Mica Tubes Synthetic Resin Tubes—known as Bakelite. Micafolium. Mica Cloth, etc.

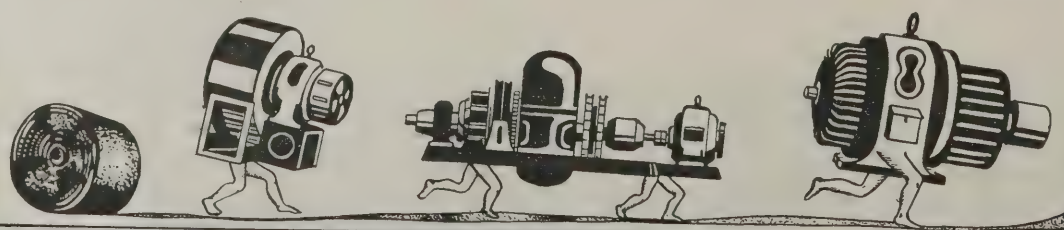
Large stocks always on hand of:
Leatheroid. Presspahn. Fibre. Indian and Egyptian Cotton Tapes and all classes of Electrical Insulation for the Trade.

Give us a trial next time you are in the market for Special BOX COMPOUND

H. CLARKE & CO. [M/CR.] LTD.,

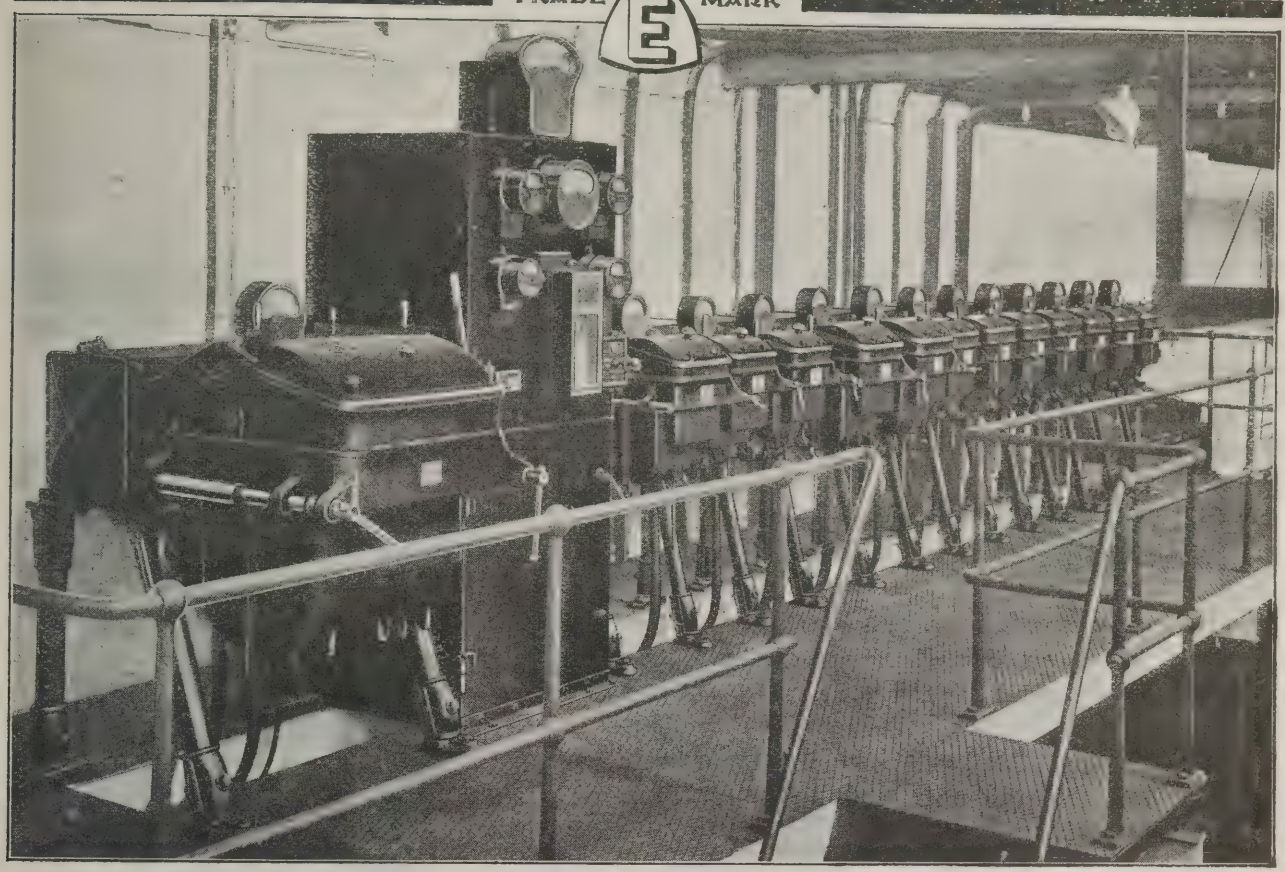
Electrical Insulating Material Manufacturers: ATLAS WORKS, OLD TRAFFORD.

Telephones: 683 and 793 Trafford Park. MANCHESTER. Telegrams: "Pirtoid, Manchester.



ELLISON SWITCHGEAR

TRADE MARK



Ellison Draw-out Unit Type Switchgear in the Albion Motor Car Co.'s Works.

Controlling the Workshops of Britain

Ellison Switchgear is distinctive in both design and construction. Old types are imitated as being good enough, but experience teaches, and new Ellison types have been evolved *which retain the old reliable characteristics with improvements that still further lower installation and maintenance costs.*

Note how the supporting members of the above switchboard straddle the trench and leave a clear way for the cables. This is only one of the considerations that lead Engineers to specify "Ellison make."

GEORGE ELLISON

Works: **PERRY BARR, BIRMINGHAM.** 118



ELLISON No. "O" CIRCUIT BREAKER

TUFNOL and PLASTOL

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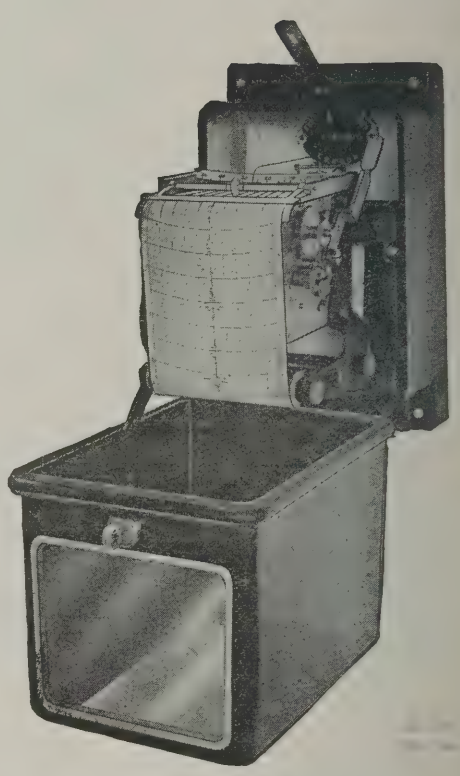
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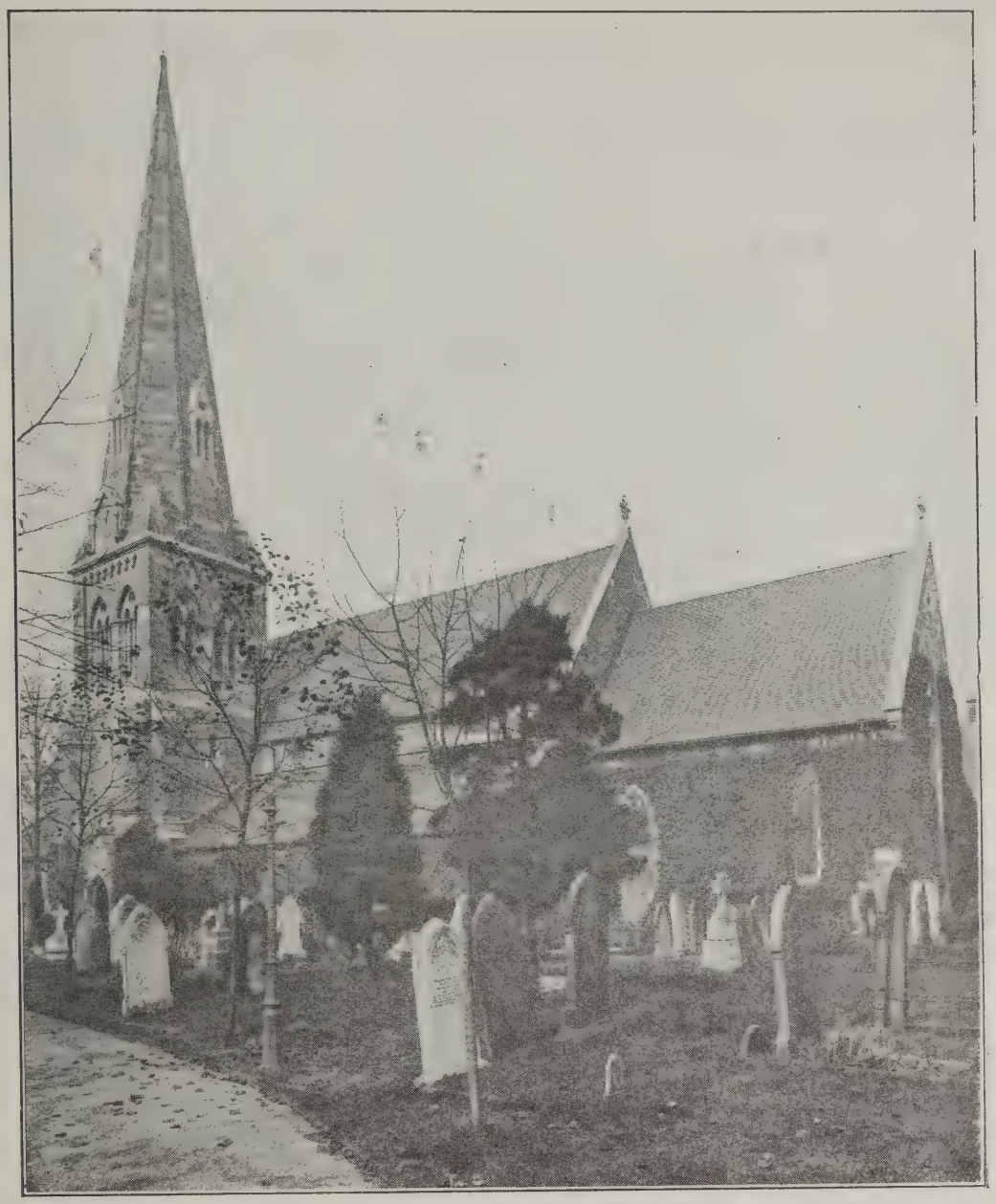
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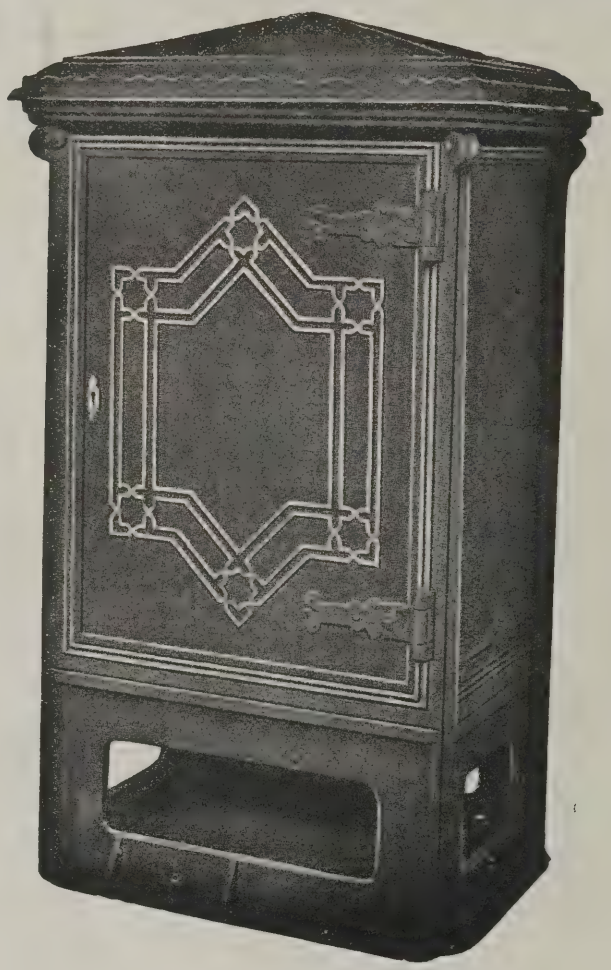
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,, 1b ...	21 × 12 ins. ...	33 × 17 ins.	45½ ins.
,, 2 ...	21 × 14 ins. ...	33 × 17 ins.	
,, 2a ...	21 × 16 ins. ...	33 × 17 ins.	
,, 2c ...	21 × 18 ins. ...	33 × 17 ins.	46½ ins.
,, 2b ...	25 × 14 ins. ...	36 × 21 ins.	
,, 3 ...	25 × 16 ins. ...	36 × 21 ins.	49 ins.
,, 3a ...	25 × 20 ins. ...	36 × 21 ins.	
,, 3b ...	31 × 16 ins. ...	36 × 27 ins.	
,, 4 ...	31 × 20 ins. ...	36 × 27 ins.	49½ ins.
,, 5 ...	36 × 24 ins. ...	42 × 33 ins.	55½ ins.
,, 6 ...	42 × 24 ins. ...	61 × 38 ins.	74½ ins.
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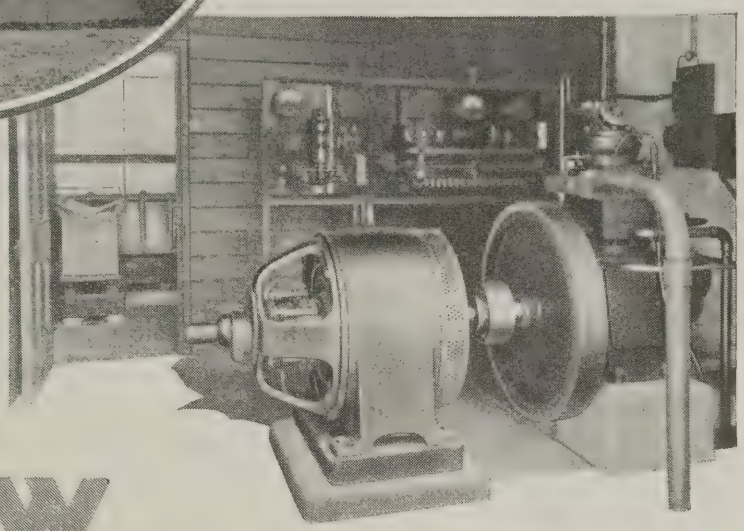
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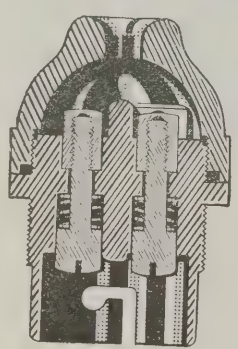
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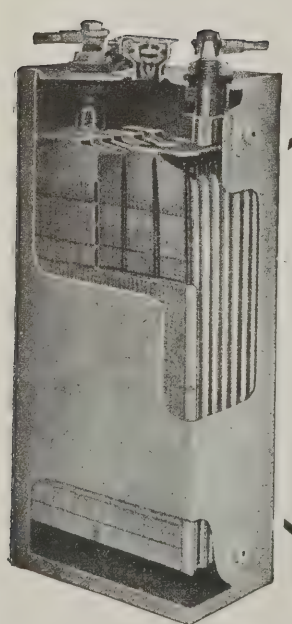
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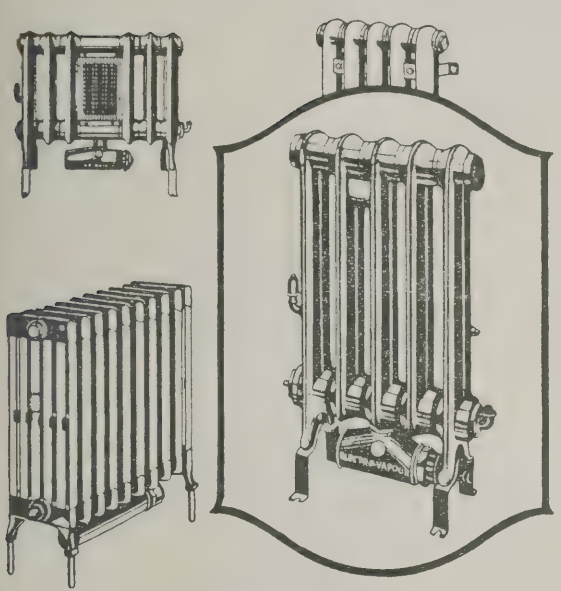
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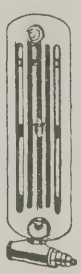
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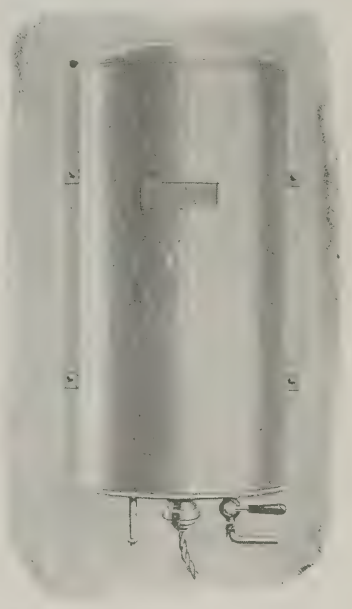


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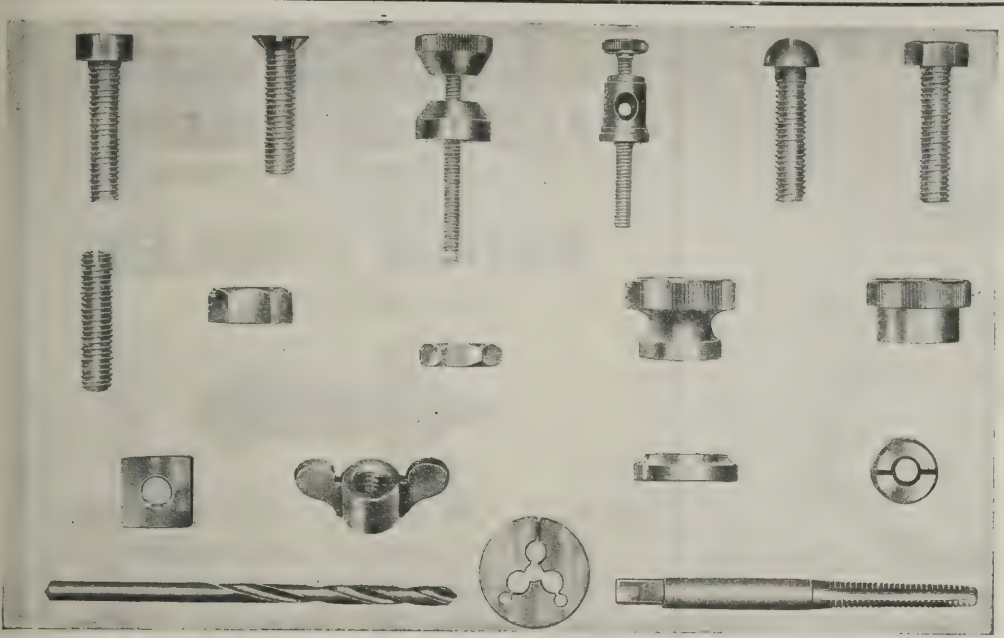
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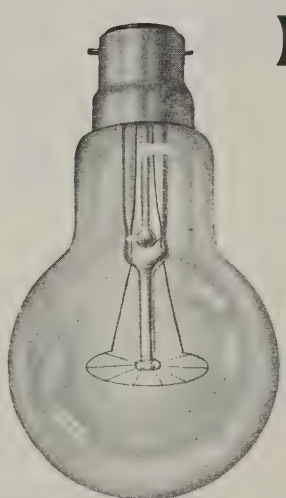
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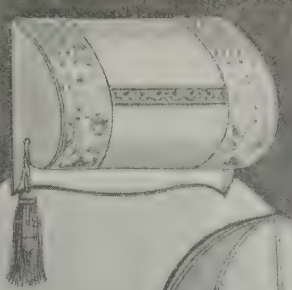
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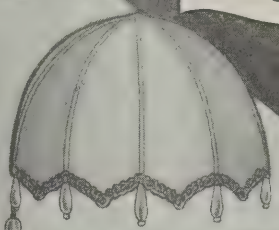
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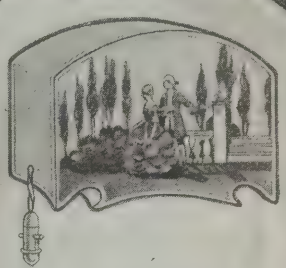


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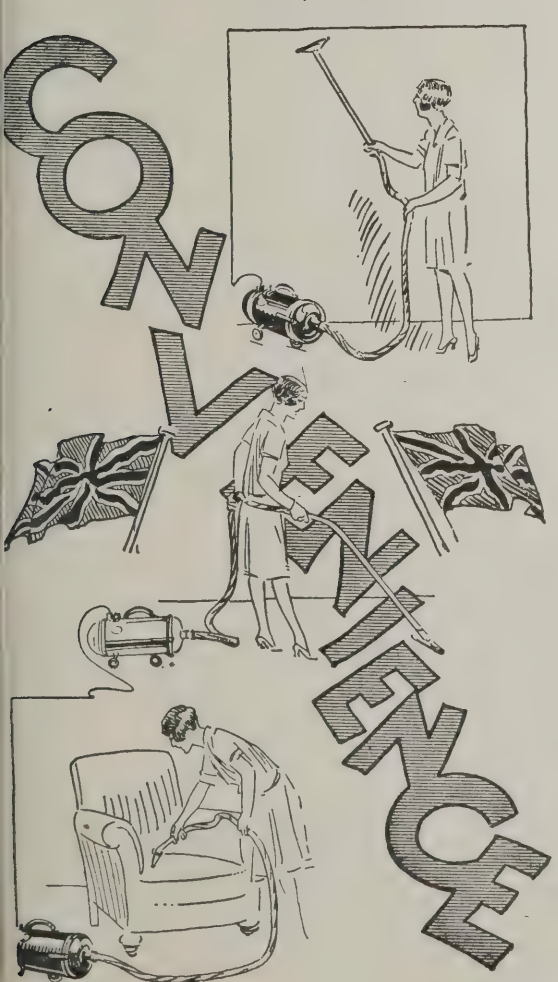
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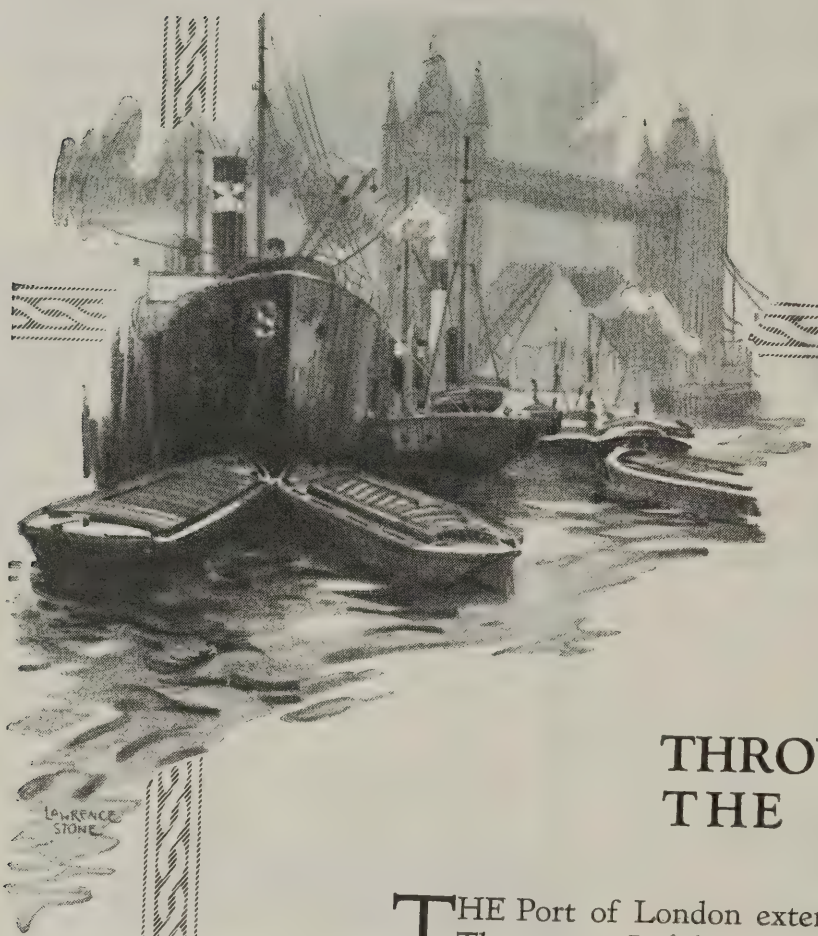
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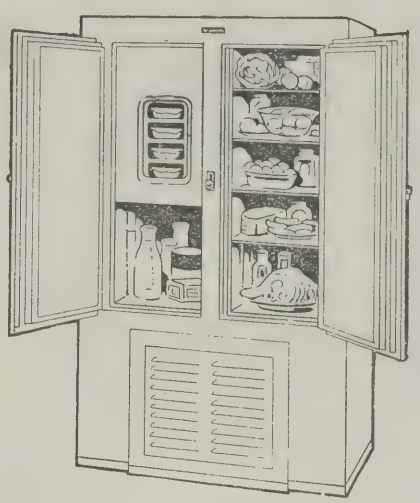
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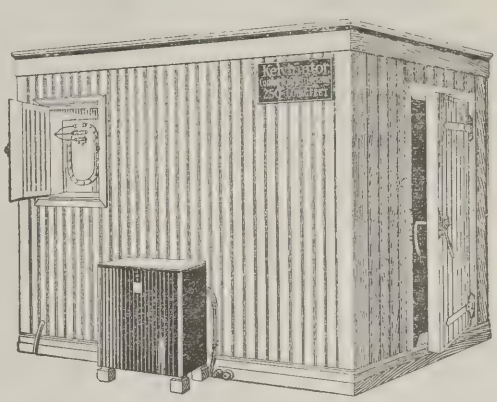
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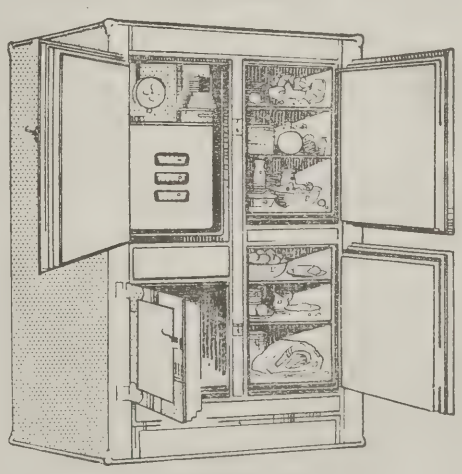
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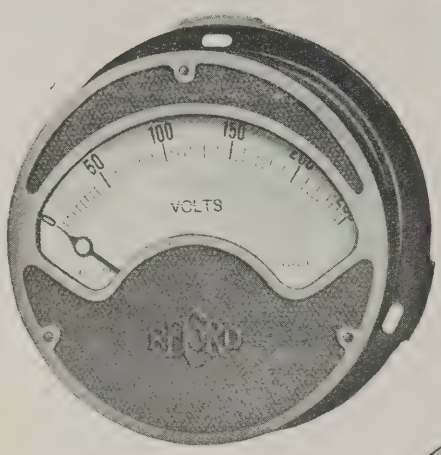
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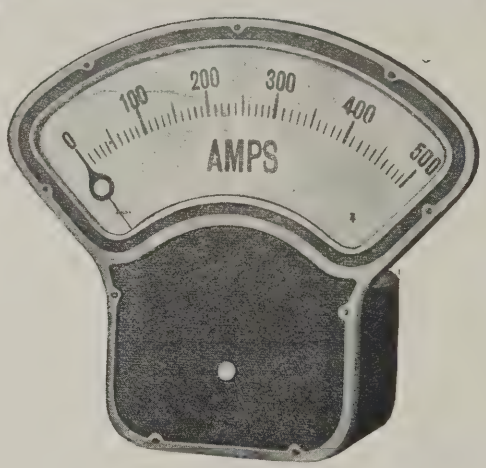


Protected Dial Pattern.

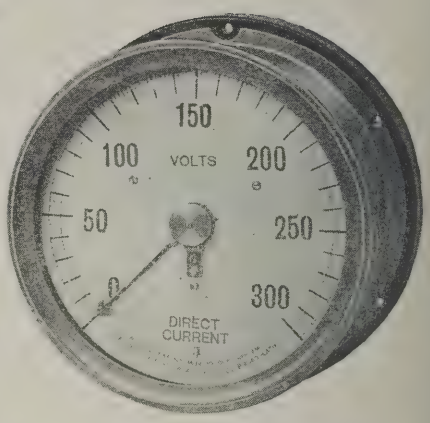
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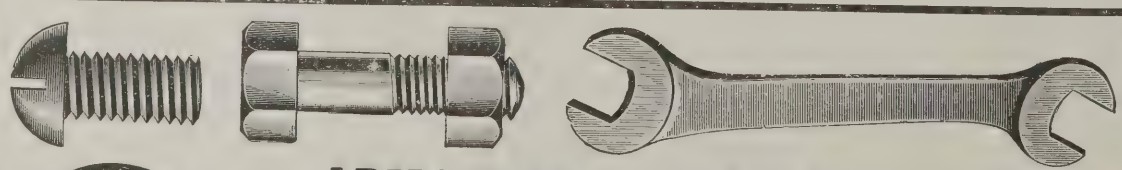
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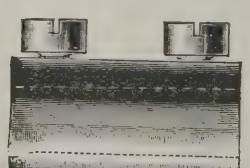




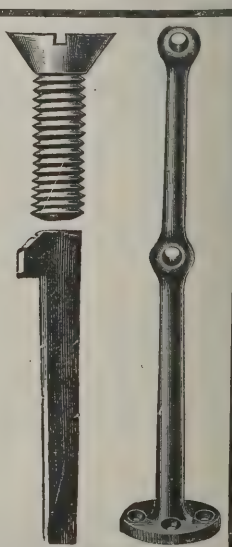
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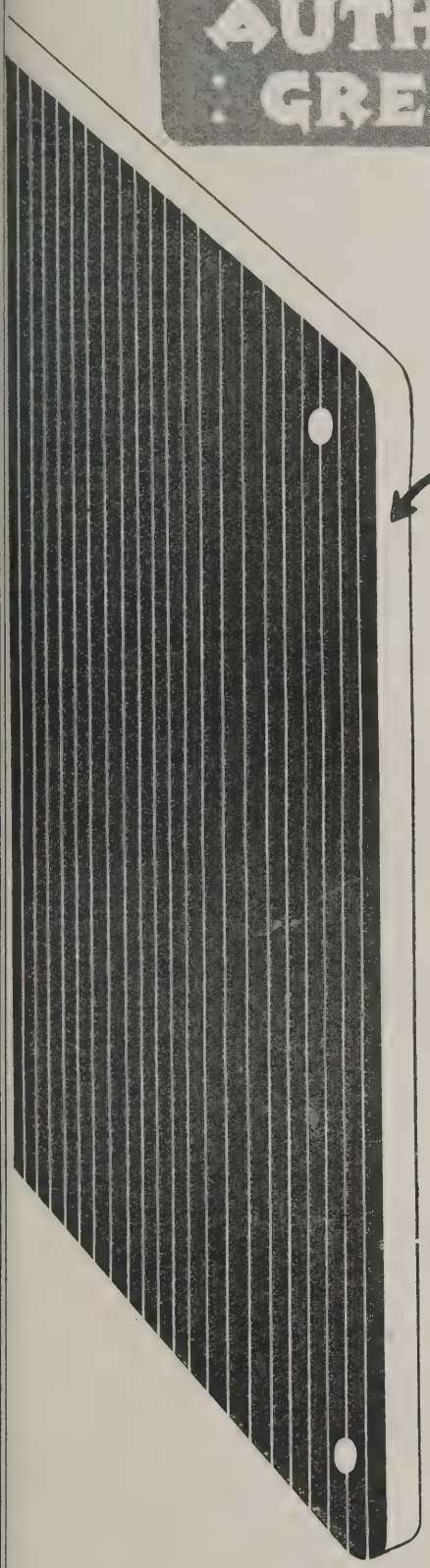
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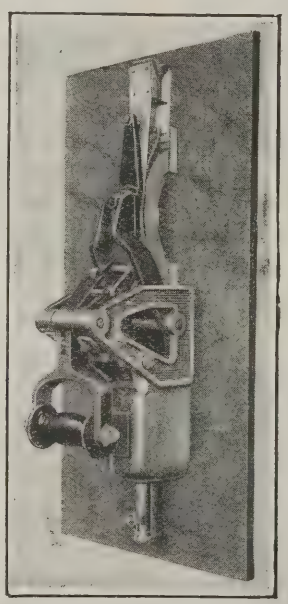
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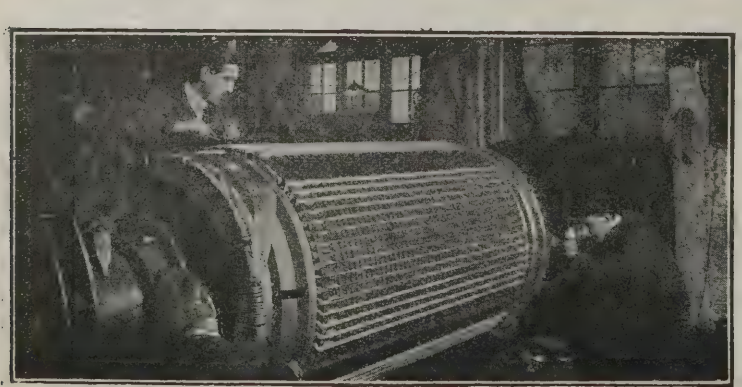
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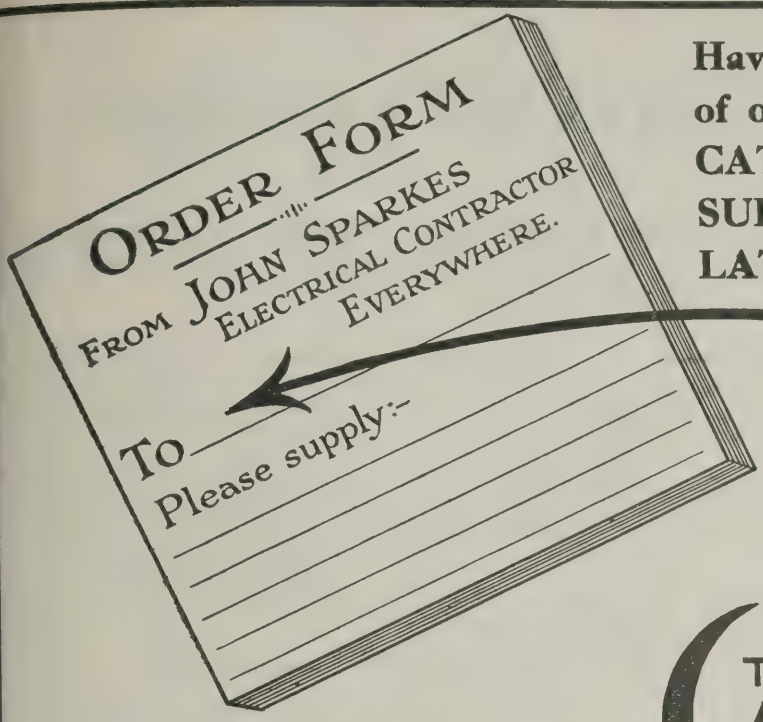
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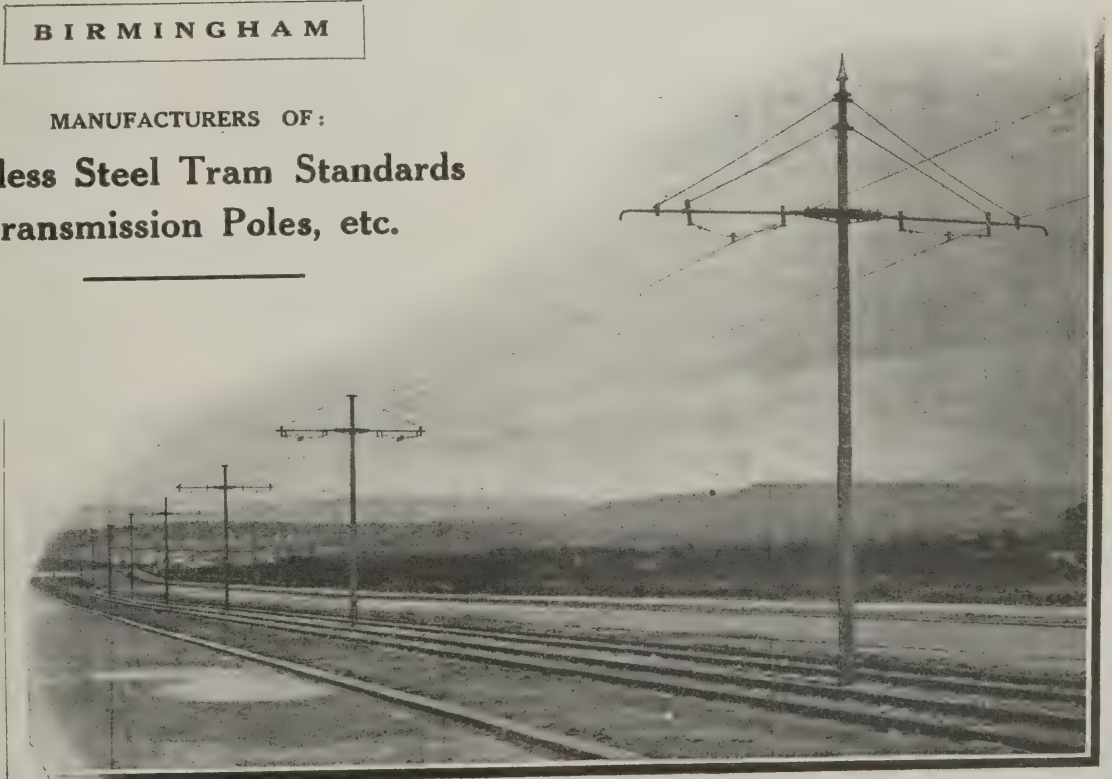
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INDEX TO ADVERTISERS.

Advertisers will please note that New Copy and Alterations to Existing Advertisements (with Blocks) should reach this Office not later than THURSDAY MORNING of the week previous to issue.

PAGE

Accles & Pollock, Ltd. ... ...
Accumulator Makers' Assoc. ...
A.C.E.C. (Ateliers de Constructions Electriques de Charleroi) Sup. 44
Adamson, D., & Co., Ltd. ...
Airedale Electrical Manufacturing Co., Ltd.... ... ...
Ajax, Ltd. ... ... Sup. 42
Allen, West & Co., Ltd.... ...
Armstrong, Addison & Co. ...
Armstrong, Sir W. G., Whitworth & Co. ... ...
Armstrong, Stevens & Son ... xl
Arora Co. ... ... Sup. 42
Ashdown, H. E. (B'ham), Ltd. xxxii & Sup. 47
Ashford, Dunn & Co. Ltd. Sup. 42
Atalanta, Ltd. iii
Austin Lighting Co., Ltd. ... xxxi
Automatic Rectifiers, Ltd ...

Bailey, Sir W. H. & Co., Ltd. Sup. 36
Balmford, W. ... ... Sup. 42
Barrett & Elers, Ltd. xxxvi
Batteries, Ltd. xxxii
Belling & Co. ... ...
Belling & Lee, Ltd. ... ...
B.E.N. Patents, Ltd. ... ...
Benham & Sons, Ltd. xxxiii
Benjamin Electric, Ltd. Sup. 25
Bennis, E., & Co., Ltd. ... ...
Berk F. W., & Co., Ltd. Sup. 10
Berk & Dundas Fox, Ltd. ...
Berkeley & Young, Ltd. Sup. 10
Berry, Wiggins & Co. ... ...
Berry's Electric, Ltd. ... ...
Bertram Thomas ... ...
Bill, S., & Co., Ltd. ... ...
Birkbys liv
Birmingham Mica Co. ... ...
Blackwell, F. C., & Co., Ltd. Sup. 31
Bolton, T., & Sons, Ltd. ...
Boulton & Paul, Ltd. vii
Boving & Co., Ltd. ... ...
British Aluminium Co., Ltd. ...
British Electric Co. i
British Electric Lamps, Ltd. Sup. 47
British Electric Transformer Co., Ltd. ... ...
British Elec. Develop. Assoc. ...
British Engine, Boiler, and Electrical Insurance Co., Ltd. xlv
British Insulated Cables, Ltd. Sup. 39
British Thomson-Houston Co., Ltd. ... ...
Brittain's Elec. Motor Co. ... ii
Broadbent, T. W., Ltd. i
Brook Motors, Ltd. xix
Brookhirst Switchgear, Ltd. ...
Bromford Tube Co., Ltd. ... xliii
Browett, Lindley & Co., Ltd. ...
Brownie Wireless Co. (G.B.), Ltd. ... ... Sup. 32
Browning's Electric Co. ...
Bruce Peebles & Co., Ltd. ...
Brush Electrical Eng. Co., Ltd.
Builders Exhibition xix
B . lers, Ltd. ... ...
Bu...ock, S. E., & Co., Ltd. ...
Burdette & Co., Ltd. ... ...
Burt Boulton & Haywood, Ltd.

Cable Accessories Co., Ltd. ...Sup. 7
Cable Makers' Association ... xlvii
Callender's Cable & Construction Co., Ltd. ... ... xxiv & xxv
Cambridge Instrument Co., Ld.
Campbell Gas Engine Co., Ltd. x
Campbell & Isherwood ... ...
Canadian Porcelain Co. (British) Ltd. liv
Canning, W., & Co., Ltd. ... xx
Cantie Switches, Ltd. xi
Carbic Ltd.... ... ...
Carron Company ... ...
Carson, F. M. i
Castle, T. L. xxxv
Caxton Wood Turnery Co. ...
Century Electric Co. ... ...
Chamberlain & Hookham, Ltd.
Charlesworth Peebles & Co. Sup. 33
Chloride Elec. Storage Co., Ld. Sup. 38
Churchill, C., & Co., Ltd. ...
Churton, T., Harding & Co., Ld. i
City Electrical Co., Ltd. ...
Clarke, Chapman & Co., Ltd. ...
Clarke, H., & Co. (M/cr.), Ltd.... xxvi
Clifford (Charles) & Son, Ltd....
Concrete Utilities, Ltd.... ...
Connolly (Blackley), Ltd. ...Sup. 5
Consolidated Pneumatic Tool Co., Ltd., The ... ...
Contract Journal ... ...
Cox-Cavendish Electrical Co. (1924), Ltd. ... ...
Crabtree, J. A., & Co., Ltd. ...Sup. 5
Crane, F., Chemical Co., Ltd. ...

PAGE

Credenda Conduits Co., Ltd.
Cressall Manufacturing Co. i & Sup. 47
Crewe, Allen & Co. ... Sup. 42
Crompton & Co., Ltd. ... ...
Crossley Bros., Ltd. ... .
Crypto Electrical Co., Ltd. Sup. 49
Cryselco, Ltd. ... . Sup. 4
Curtis Manufac. Co., Ld., The... xxii
Cutting Bros., Ltd. i

Dacier, Ltd. ... ...
Davidson & Co., Ltd. ... ...
Davis & Timmins, Ltd. ... ...
Dawson, E., & Co.... ... ...
De la Rue (Thomas) & Co., Ld. i
Dermatine Co., Ltd. i
Dernier & Hamlyn, Ltd. xxxvii
Dexine, Ltd. ... ...
Diamond Fibre Co., Ltd. ...
Dikkers, G., & Co., (England), Ltd. ... ... Sup. 42
Donovan & Co. ... ...
Dorman & Smith, Ltd. x
Downes & Davies .. ..
D.P. Battery Co., Ltd. ... ...
Drake & Gorham, Ltd. ... ...
Drake & Gorham, Wholesale, Ltd. ... ...
Duncan Watson & Co. ... ...

Earle, Bourne & Co., Ltd. ... v
Edison Swan Cables, Ltd. ... xlvi
Edison Swan Electric Co., Ld.
Electric and Ordnance Accessories Co., Ltd. ... ...
Electric Control, Ltd. i
Electric Fires, Ltd. iii
Electric Heating Co. ... ...
Electrical Contractors' Assoc. ..
Electrical Equipment & Carbon Co., Ltd. i
Electrical Power Engineering Co. (Birmingham), Ltd. ...
Electrical Utilities, Ltd. ...
Electro-Mech. Brake Co., Ltd.... ...
Elliott Bros. (London), Ltd. ...
Ellison, George xxvii
Enfield Cable Works, Ltd. ... ix
Engineers' Club (The) ... Sup. 17
Engineering and Lighting Equipment Co., Ltd. ... i
English Electric Co., Ltd. ... xxiii
Equipment and Eng. Co. ... xxxv
Erskine, Heap & Co., Ltd. Sup. 43
Everett, Edgcumbe & Co., Ltd. xxviii
Evershed & Vignoles, Ld. ...xxviii
Excelsior Shade Mfg. Co., The

Fabbrica Isolatori Livorna, S.A. xx
Fair W. D., & Co. ... Sup. 34
Fairbanks, Morse & Co., Ltd. Sup. 41
Falk, Stadelmann & Co., Ltd. Sup. 35 & 41
Ferguson, Pailin, Ltd. xvi
Ferranti, Ltd. xviii
Fluxite, Ltd. ... ...
Foamite Firefoam, Ltd. ...
Foster Eng. Co., Ltd. ... Sup. 45
Fraser & Chalmers Eng. Works
Fuller Accumulator Co. (1926), Ltd. xxii

Geipel, Wm., & Co. ... ...Sup. 3
General Accessories Co., Ltd., The ... ...
General Chemical and Pharmaceutical Co., Ltd. ...
General Electric Co., Ld. Sup. 16
Gent & Co., Ltd. ix
Gillett & Johnston ... ...
Gledhill Brook Time Recorders xi
Glover, W. T., & Co., Ltd. ...
Gordon, J., & Co., Ltd. ... ...
Green, E., & Sons, Ltd. ...
Greengate & Irwell Rubber Co., Ltd. xxxiii
Gridway Manufacturing Co. ...
Griffiths Bros. & Co., London, Ltd. ii

Hall, J. P., & Sons ... ...
Hann & Ingle ... ...
Hardy & Padmore, Ltd. xxx
Harland Engineering Co., Ld.,...
Harris, A. E., & Co. ... ...
Harris, J. F. & G., Ltd. .. Sup. 42
Hart Accumulator Co., Ltd. ...xxxiv
Hawkins, L. G., & Co., Ltd. ...Sup. 9
Heathman, J. H., & Co. ... ...
Henley's, W. T., Telegraph Works, Ltd. xxix Sup. 26 & 27
Heyes & Co., Ltd. ... ... Sup. 35
Hick, Hargreaves & Co., Ltd....
Higgs Motors xiii
Hildick & Hildick ... ...
Hogan & Wardrop iii

PAGE

Holder-Harriden, Ltd. i
Holophane, Ltd. ... ...
Hooper's Telegraph and India-Rubber Works, Ltd. ... ...
Hopkinsons, Ltd.... ... ...
Horstmann Gear Co., Ltd. ... xlv
Hotpoint Electric Appliance Co., Ltd. xxvi
Hunt, A. H., Ltd.... ... Sup. 42
Huntalite, Ltd ... ...

Igranic Electric Co., Ltd. ... liii
Importers & Distributors, Ltd.... vi
India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd. ... lvi
Ioco Rubber and Waterproofing Co., Ltd. ... ... Sup. 28
Isenthal & Co., Ltd. ... ...

Jackson Electric Stove Co. ...
Jenkins, W. J., & Co., Ltd. ...
Jenkins (Robert) xlvi
Johnson & Phillips, Ltd. i, Sup. 12 & 13
Johnson (Richard) & Nephew, Ltd. ... ...
Jones (Inigo) & Co. ... Sup. 42

Kaye (Joseph) & Sons, Ltd. ...
Kelvinator, Ltd. xxxix
Kelvin, Bottomley & Baird, Ltd. vii
Kent Bros. ... ...
Key Engineering Co., Ltd. ...
Klaxon, Ltd. ... ...
Kohler Co., Ltd. ... ...

Lacy-Hulbert & Co., Ltd. ...
Lancashire Dynamo and Motor Co., Ltd. ... ... Sup. 49
Lawton, J., & Sons ... ...
Leach, S. G., & Co., Ltd. ... li
Lister, R. A., & Co., Ltd. ... ...
Litholite Insulators, Ltd. ... i
Liverpool Elec. Cable Co., L. Sup. 43
London Electric Firm ... Sup. 42
London Electric Wire Co., Ld.
Low, A., & Sons, Ltd. ... ...
L.P.S. Electrical Co. ... ...

Macintosh Cable Co., Ltd. Sup. 40
Macintyre, J., & Co., Ltd. ...
Magnum Elect. Appliances xxxvii
Maldon Electric Works, Ltd. Sup. 47
Marconi Wireless Telegraph Co., Ltd. ... ...
Marelli & Co., Ltd. lii
Marryat & Place ... ...
Marryat & Scott, Ltd. ... ...
Mather & Platt, Ltd. ... ...
Matthews & Yates, Ltd. ...
Mavor & Coulson, Ltd. i
Maybrook Elect. Co. xxxvi
M.C.L. & Repetition, Ltd. ... lii
McClure & Whitfield ... ...
McGeoch, W., & Co., Ltd. ...
McGregor & Co., R. ... ...
McKechnie Bros., Ltd. ... ...Sup. 3
McMillan, J., & Co. liv
Measurement, Ltd. ... ...
Medical Supply Association, Ltd. ... ...
Medway's Safety Lift Co., Ltd. li
Metropolitan Electric Cable and Construction Co., Ltd. ...
Metro-Vick Supplies, Ltd. ... Sup. 6 & 31
Metropolitan - Vickers Electrical Co., Ltd ... Sup. 46
Mickelwright, Ltd. ... ...
Midland Elec. Mfg. Co., Ld. ... lv
Mills, W., Ltd. ... ... Sup. 32
Mosses & Mitchell iii
Moy, Ernest F., Ltd. i

Nalder Bros. & Thompson, Ld. Sup. 37
Nathan & Allen xlii
Newton Bros. (Derby), Ltd. ...
Newtons' Dynamo Works ... iv
Norris, Henty & Gardners, Ltd. Sup. 37

Oldas Metals Co., Ltd. ... Sup. 42
Ormiston, P., & Sons, Ltd. ...
Ormond Engineering Co., Ltd. Sup. 15
Osler & Faraday, Ltd. ... ...

Park Royal Eng. Co., Ltd. ... i
Parkinson, F. & A., Ltd. Sup. 11
Parmiter, Hope & Sugden, Ld.
Parsons, C. A., & Co., Ltd. ...Sup. 6

PAGE

Pass (Capper) & Son, Ltd. ...
Peebles (Bruce) & Co., Ltd. ...
Perrin, W. ... ...
Petters, Ltd. xxi
Pirelli-General Cable Works, Ltd. ... ...Sup. 8
Pope's Electric Lamp Co., Ld. Sup. 14
Power Equipment Co. xlii
Premier Accumulator Co. (1921), Ltd. ... ...
Premier Electric Heaters Sup. 10
Premier Gas Engine Co., Ltd.
Pulsometer Eng. Co., Ltd. ...
Pyrene Co., The ... ...

Quasi-Arc Co., Ltd. ... ...

Ransome & Marles Bearing Co., Ltd. ... ...
Ransomes, Sims & Jefferies, Ld.
Rawlplug Co. ... ...
Reason Mfg. Co., Ltd. ... ...
Reavell & Co., Ltd. xlv
Record Elec. Co., Ltd. ... i & xl
Redmanol, Ltd. i
Rees Roturbo Mfg. Co., Ltd. ...
Reeves & Co. ... ... Sup. 31
Relay Automatic Telephones ...
Rentell, S., & Co., Ltd. ... ...
Reyrolle, A., & Co., Ltd. ... xv
Richardsons, Westgarth & Co., Ltd. ... ...
Robinson (Lionel) & Co. ... i
Ross Courtney & Co., Ltd. Sup. 42
Royce, Ltd.... ... ...
Ruberoid Co., Ltd., The ...
Ruston & Hornsby, Ltd. ...
Ryman, F., & Co.... ... Sup. 42

Sanders, W., & Co. xi
Sankey, Joseph, & Sons, Ltd. ... xlvi
St. Helens Cable and Rubber Co., Ltd. ... ...
Sax (Julius) & Co., Ltd.... ... i & v
Saxonia Electrical Wire Co., Ld.
Scott & Hodgson, Ltd. ... ...
Scott, H. J., & Co. (Belfast) Ld. xvii
Sells, Ltd. xi
Siemens & English Electric Lamp Co., Ltd. ... ... Sup. 50
Siemens Bros. & Co., Ltd. ...
Siluminite Insulator Co., Ltd. ...
Simmonds & Stokes, Ltd. ...
Simon-Carves, Ltd. ... ...
Simplex Conduits, Ltd. ... Sup. 51
Sisson, W., & Co., Ltd. liv
Sloan Electrical Co., Ltd. ... xliii
Small Power Dynamo & Motor Co., Ltd. ... ...
Smith (Frederick) & Co., Ltd. ... xx
Solenoid Regulator Co. i
Solidite & Synthetic Mouldings, Ltd. ... ... Sup. 49
Spencer-Bonecourt, Ltd. ...
Spencers (Melksham), Ltd. ...
Sperryn & Co. ... ... Sup. 45
Spicers, Ltd. i
Spon, E. & F. N. ... ...
Standard Telephones & Cables, Ltd. xxxviii
Statter, J. G., & Co. ... ...
Stella Conduit Co., Ltd. Sup. 2
Sterling Telephone & Electric Co., Ltd. ... ...
Sterling Varnish Co. ... ...
Sterns, Ltd.... ... ...
Streetley Mfg. Co. ... Sup. 47
Stuart Turner, Ltd. ... ...
Sturge & Baker, Ltd. ... Sup. 47
Sturtevant Eng. Co., Ltd. ... ix
Sullivan, H. W., Ltd. ... ...
Sunday Pictorial ... ...
Sun Electrical Co., Ltd. ... xii
Sutcliffe Bros. & Bryce, Ltd. ...
Suter & Co. ... ...
Switchgear and Cowans, Ltd. ...

Tarmac, Ltd. ... ...
Taylor & Challen, Ltd. ... ...
Taylor & Petters, Ltd. ... ... i & ii
Taylor, Tunnicliff & Co., Ltd.... xviii
Telegraph Condenser Co., Ld....
Tourtel Manufacturing Co. ...
Tucker, J. H., & Co. ... i & Sup. 52
Tudor Accumulator Co., Ltd. ... viii
Tullis Russell & Co., Ltd. ...
Tungstone Accumulator Co. ...
Turner Bros. ... ... Sup. 10
Turner, F. ... ...
Turnock, G. ... ... Sup. 42

Underwood (Mcr.), Ltd. ... xlv
Union Cable Co., Ltd. xiv

CONTINUED ON PAGE XLVI

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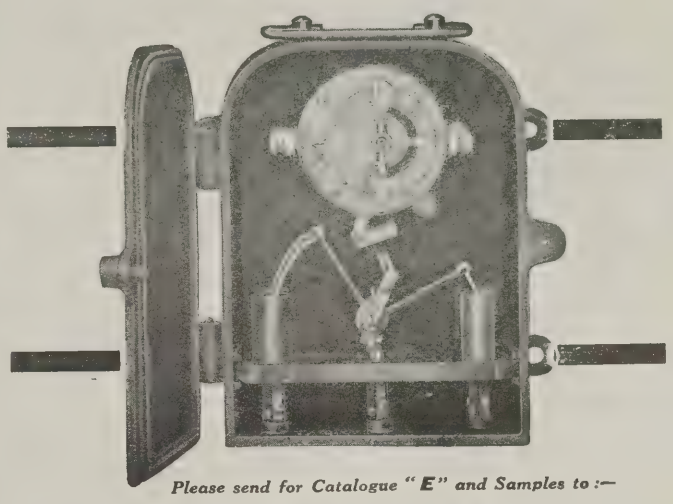
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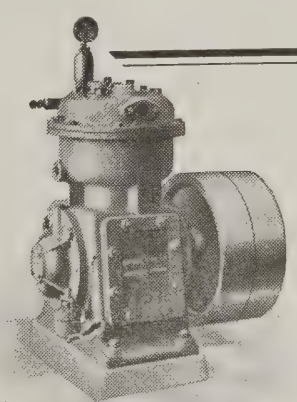
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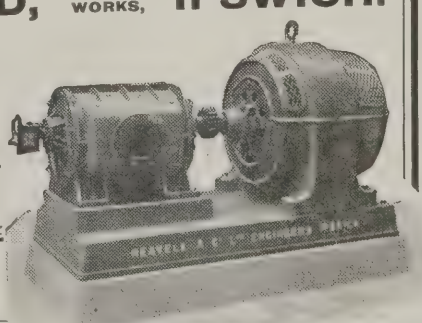
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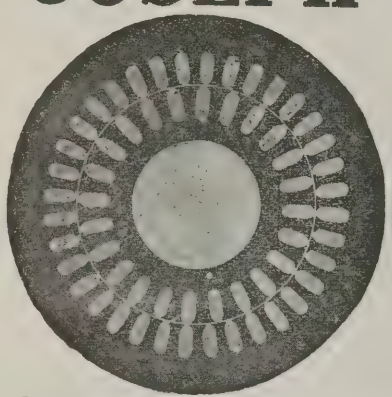
INDEX TO ADVERTISERS.—(*Continued from page xliv.*)

	PAGE
Vac Tric, Ltd.	xxxvii
Varley Magnet Co.	
Vandervelde, L.	Sup. 41
Veritys, Ltd.	Sup. 1
Venner Time Switches, Ltd.	xlix
Vickers Boiler Co., Ltd.	
Vickers, Ltd.	
Vincent Switchgear Mfg. Co.	
Volet, Rèné	ii
Visco Engineering Co., Ltd.	
Volta, Ltd.	xxxvi
Walsall Electrical Co., Ltd.	iv
Walsall Hardware Mfg.Co.,Ld.	xvii
Walters (Austin) & Son, Ltd.	
Wandsworth Electrical Manufacturing Co., Ltd.	Sup. 48
Ward & Goldstone, Ltd.	Sup. 3
Watliff Co.	lii
Weekes (Luton), Ltd.	
Weir, G. & J., Ltd.	
Wells, A. C., & Co., Ltd.	vii
Welsbach Light Co., Ltd.	
West London Timber and Moulding Co., Ltd.	
Westinghouse Electric International Co.	
Westinghouse Morse Chain Drives	i
Westminster Eng. Co.,Ltd.	vii & xi
Westminster Tool and Electric Co., Ltd.	
Weston Elec. Inst. Co., Ltd.	
Wheatley Kirk, Price & Co.	Sup. 17
White Elec. Instrument Co.	i
White, Jacoby & Co., Ltd.	xlii
White, J. C.	Sup. 45
Wiggins, F., & Sons	Sup. 36
Wootton & Co., Ltd.	xli
Yarrow & Co., Ltd.	
Yorkshire Copper Works, Ltd.	
Zenith Electric Co., Ltd.	li

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CLASSIFIED INDEX OF ADVERTISEMENTS.

The names of Advertisers whose Announcements are ordered for a series are entered under any one Heading in this Index Free of Charge, but if repeated under existing headings 1s. per week is charged for each additional entry.

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(See Wire Covered.)

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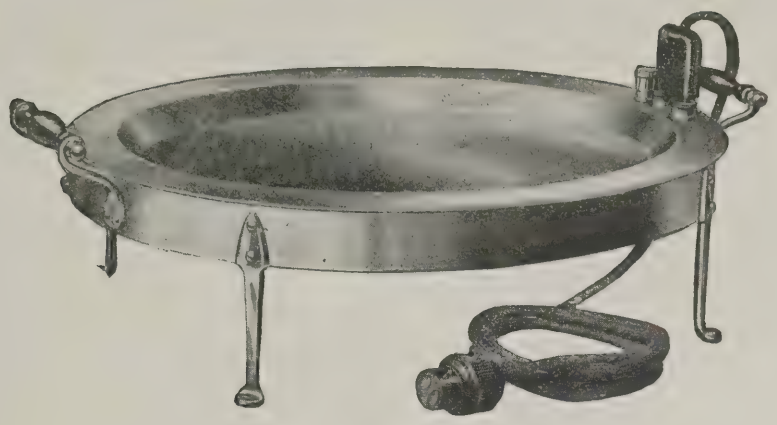
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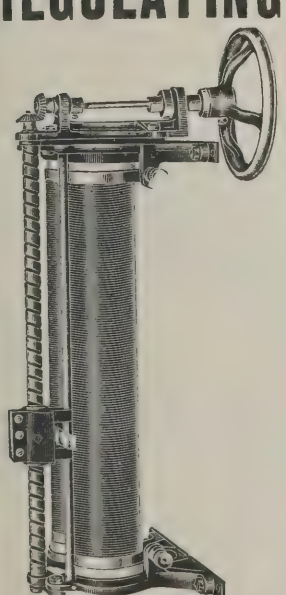
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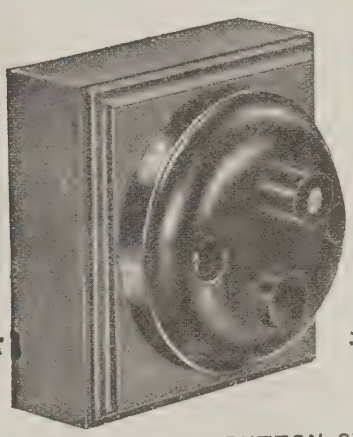
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64

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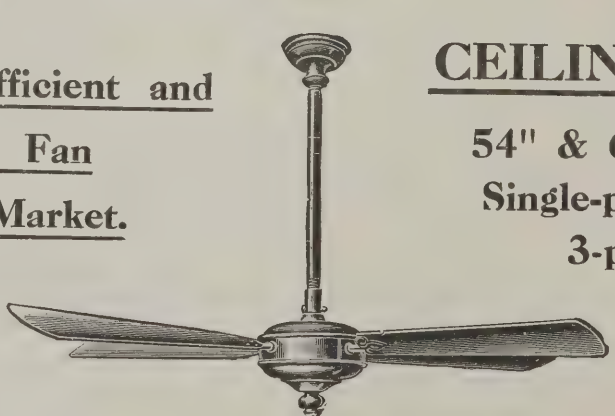
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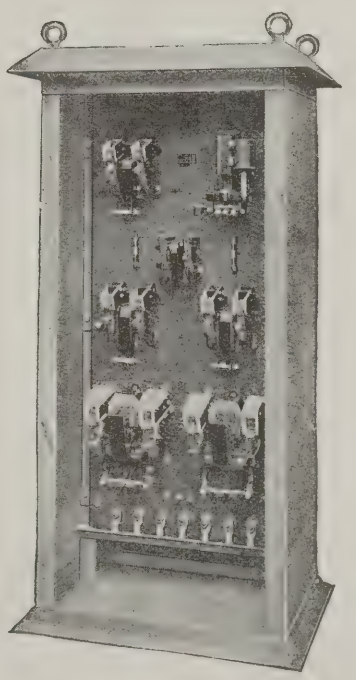
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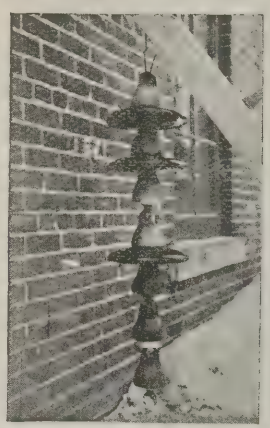
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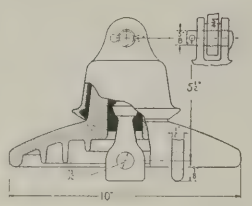
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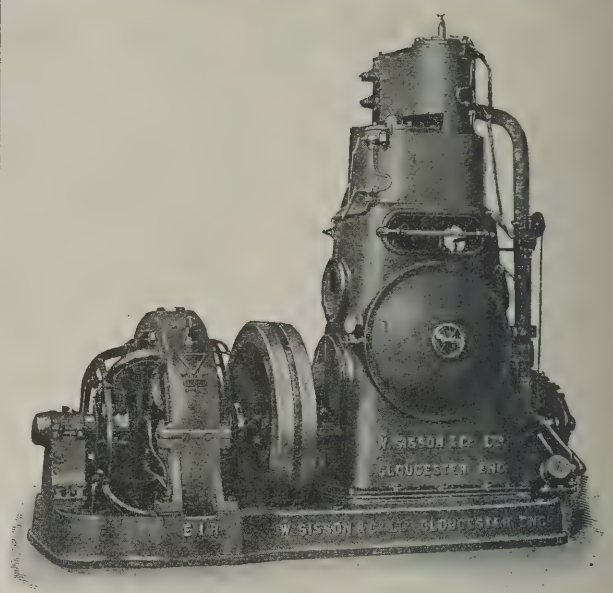
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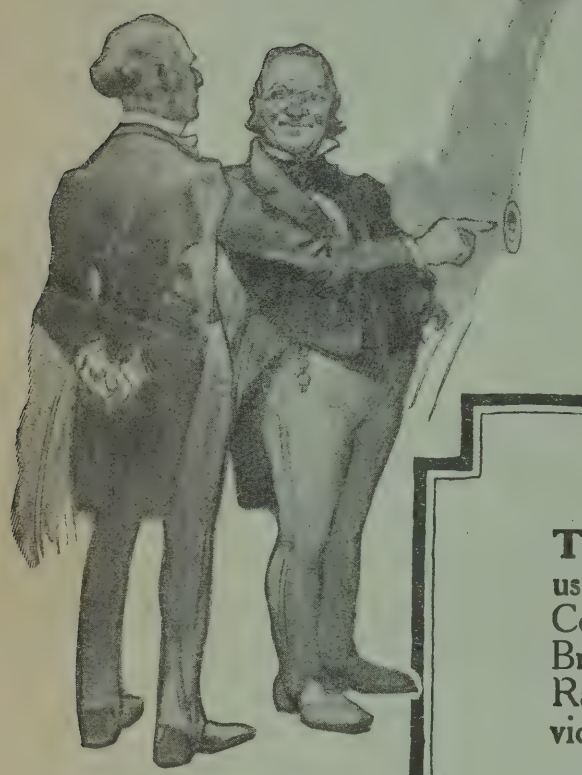
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